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Sustainable Digital Marketing: Factors of Adoption of M-Technologies by Older Adults in the Chinese Market

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Abstract: A rapidly graying population has coincided with the widespread use of information technology (IT) since the turn of the 20th century. As the elderly are less familiar with IT, paying attention to the acceptance of the rapidly evolving digital marketing ecosystem is essential. Engagement with consumers and M-technologies is one of the most significant aspects of the digital marketing environment. The technology acceptance model (TAM) and the theory of planned behavior (TPB) were used to develop the theoretical framework of this study. Using technological anxiety as a moderating variable, we tested the theoretical model linking perceived value, subjective norm, effort expectancy, performance expectancy, and self-efficacy to measure older adults' attitudes and intentions toward M-technology. Sample sizes of 251 respondents were selected with 95% confidence. To analyze the relationships between the variables proposed, structural equation modeling (SEM) was implemented. The results revealed that perceived value positively affects performance expectancy, effort expectancy, self-efficacy, subjective norm, attitude, and intention to adopt M-technology. Furthermore, technology anxiety moderated the effect of intention toward M-technology. The results explain that technology anxiety dampens the positive impact of the attitude of older adults on their intention to adopt M-technology. Managers must address this issue while developing marketing strategies for elderly consumers.

Keywords: perceived value; effort expectancy; performance expectancy; intention; M-technology; older Chinese adults

Citation: Zhang, B.; Ying, L.; Khan, M.A.; Ali, M.; Barykin, S.; Jahanzeb, A. Sustainable Digital Marketing: Factors of Adoption of M-Technologies by Older Adults in the Chinese Market. *Sustainability* **2023**, *15*, 1972. https://doi.org/10.3390/su15031972

Academic Editor: Jun (Justin) Li

Received: 11 December 2022
Revised: 11 January 2023
Accepted: 15 January 2023
Published: 19 January 2023

1. Introduction

Technology advancements bring rapid changes in human lifestyles and standards in all aspects. People interact daily with new Information and knowledge using internet search engines, features, and frequently new applications. The expanding power of technologies makes it possible to access information and understand sources and services. The boom of technology is also reaching out to the older generation. In China, the rate of the aging population is high compared to the rest of the world. According to [1], China faced the most significant level of older adult population among all countries in the world, with Chinese people over 60 years estimated to exceed 194 million, which is equivalent to 14.3% of the total population of China [2].

Given that China has a large proportion of the population in old age, there is a need to understand the benefits of active technology adoption among older people [3,4]. China is facing a challenge in meeting the needs of aging-related issues such as security, health, social, and community services. However, with the adoption of new technologies

among older adults, China's socioeconomic burden of dealing with families, communities, societies, and the country may be decreased considerably [5].

Recently, the world has been moving toward advancing information and communication technology (ICT), considered a valuable tool of life, helping to create an integrated society where people can interact and share knowledge and thoughts. Coincident with the advancement of ICT, there is a fast escalation in the world's aging population, with surveys indicating that China's older population is growing more quickly than all other countries [6,7]. The impacts of China's 36 year, one-child strategy, joined with unprecedented enhancements in health services, have increased life expectancy and brought about a decline in the birth rate in China. In China, life expectancy increased from 67 to 75 during the one-child policy's implementation, and the birth rate dropped from 2.8 to 1.7 [8,9]. The rapid increase in the aging population needs proper attention from administrative authorities, policymakers, and service providers because new technologies bring complications that increase the rejection rate among particular age groups. The previous literature states that, among ICT products, the smartphone is the most fantastic; however, in some age groups, the adoption rate is meager. Technology is an integral part of individuals' lives in China, and, if ICT is not adopted, there will be drastic impacts. The recognition of technology adoption has been echoed primarily in qualitative studies. The use of telehealth via the internet is already under investigation in the healthcare sector [10,11]. Technology with a bright future should be used by older adults, who are an important sector of society and could more easily access M-technology than any other technology.

ICT is a valuable tool that can integrate social and make it more productive by helping people to share knowledge and practical thoughts. The elderly has easy access to smartphones, contributing to their widespread adoption as the ICT device with the highest level of popularity among this demographic group. The mobile phone has been a critical source of communication, social networking, information, and knowledge in recent years. Researchers conclude that awareness and benefits of various technologies attract older adults to adopt the technology, especially M-technology, that can mobilize quickly. The 39th Statistical Report produced by China Internet Network Information Center (CNNIC) (Center, 2017) on Internet Development revealed that mobile phones are the primary source of Information for Chinese people [12]. The growth of internet users has entered a stable state. Continuous growth is encouraged by the development of innovative and improved wireless networks, the emergence of the popularity of 3G and 4G technology, and innovative smartphone applications. A CNNIC study showed that, in 2016, a 95.1% growth of mobile usage in the Chinese population was recorded, with an annual growth rate of 10% for three consecutive years. Furthermore, among the older adult age group (defined as age 45–64), 55% of the population is using smartphones [13,14].

In previous studies, researchers have focused on various places in China. Nevertheless, they have conducted limited research studies and surveys in cities of Anhui province, home to a large population of older adults. Anhui's society is significantly related to agriculture, but this province and its capital city, Hefei, are developing rapidly, reaching around eight million. There are two main reasons for the researchers choosing Hefei city: its convenience and locality for the researchers, and the homogeneity of the Chinese-aged population. Previous studies have not paid much attention to M-technology adoption among older adults [15].

It has been repeatedly shown that older adults use modern technologies (such as computers, cell phones, and email) [16], and that they have good impressions of these devices that contradict stereotypes [17,18]. However, there is a lack of knowledge about the same innovative technologies that older adults are now adopting, as well as the causes and viewpoints that influence their use (or nonuse). Human–technology interaction research has concentrated chiefly on comprehending the variables that affect technology acceptability over the last few decades. The technology acceptance model (TAM; Davis et al. [19]) was created as a result of earlier work by Azjen [20] concerning their theory of reasoned action (TRA). The TRA asserts that the intention one has to carry out a specific activity is significantly

influenced by that intention, which in turn is influenced by attitudes toward the behavior and subjective norms, which are defined as a sense of social pressure to carry out the behavior or refrain from doing so [21]. When Davis et al. [22] modified the idea of behavioral intentions and applied it to using technology, they distinguished TAM from TRA by assuming that these intentions were impacted by one's attitude toward using technology and assessment of its utility. Because the subjective norm element of their model was the one that was least understood at the time [23], TAM added a contributing component known as perceived ease of use, which is defined as "the extent to which the prospective user anticipates the target system to be relatively straightforward to use", which would have a significant impact on future models of technology acceptance [22]. Therefore, it is urged to investigate smartphone technology adoption by the elderly. The current study investigated how the perceived value of M-technology influenced older people's attitude toward adoption, to what extent does the M-technology providing ease to older people influence their attitude towards adoption, and which factors are required to promote M-technology in older people. We integrate two theories, the technology acceptance model (TAM) and the theory of planned behavior (TPB), to create a framework tailored to the specific characteristics and requirements of the people living in Anhui. Most previous studies have been conducted to determine smartphone adoption differences among genders, financial statuses, and geographic locations. Nevertheless, only minimal studies have targeted older adults and their M-technology adoption. The rapid increase in the aging population in China and low adoption among older adults will create a vast generation gap in society, thus increasing complications and dependency among older adults.

Furthermore, in previous studies, TAM and TPB theories were incorporated separately to analyze user intention to adopt the technology; in contrast, our study carefully integrated TAM and TPB and selected constructs and variables that best fit the survey environment. We chose Hefei because of its locality and homogeneity in the Chinese-aged population, a small city by Chinese standards. We targeted specific local people to study and analyze the problem scientifically. For this purpose, a pilot study was conducted first, through which we observed the effectiveness of the selected constructs and variables to make the study more practical and honest.

The older population is increasing day by day. It represents a considerable opportunity for M-industries to target a sizeable market. However, there are challenges in producing and marketing new older, and adult-friendly products and services. This study can help manufacturers or designers of M-products and services in the design phase. M-industry providers can use our results to guide the practical design and deployment of M-products geared to older adults. A practical consequence of this research is data to help ICT firms plan, design, and implement e-government systems and services that effectively influence the willingness and intent of older adults to use such methods on the basis of user expectations, needs, perceptions, beliefs, and other aspects.

2. Literature Review

2.1. Theoretical Stances Technology Adoption

The technology acceptance model (TAM), which measures how quickly new technologies are adopted, is thought to be a reliable tool. Different studies have been undertaken to determine the positive and negative elements of older adults' use of information and communications technology (ICT) and the underlying motivations for their use. Numerous theories and models of technology acceptance and practical usage have been developed over the past few decades due to the research interest in this phenomenon [24]. The technology acceptance model (TAM) and its extension are widely used as measurement tools in academic research [25,26]. Fred Davis first presented TAM [22], founded on Fishbein and Ajzen's theory of reasonable action (TRA), as well as Ajzen's theory of planned behavior (TPB) [21]. It is a prevalent paradigm used to explain and foresee the consequences of technology acceptance for people [27]. Perceived usefulness and

perceived ease of usage are identified in the basic TAM as fundamental and unique characteristics that have an impact on decisions regarding the use of information technology [26] and function as a mediator in the complex link that exists between system attributes (external constructs) and prospective system utilization (attitude and behavioral intention) [28]. Since then, the extended variants of TAM have been suggested in some studies as a way to adjust to various study objectives. For example, by adding variables such as effort expectancy, learning difficulty perception, and social influence, these studies have found that the extended variants of TAM can better accommodate their respective research aims [29,30]. The different versions of TAM are combined with several technology models in the unified theory of acceptance and use of technology (UTAUT) (e.g., TAM2 and TAM3) [28,31,32]. The unified model, currently in its second version, states that seven main elements influence a person's behavioral intention to utilize technology (UTAUT2 [32]): performance expectations, effort expectations, social influence, conducive conditions, hedonistic drive, price value, and habit. As a result, behavioral intentions, facilitating factors, and habits impact actual usage behavior.

2.2. Theoretical Framework of the Study

The Davis [22] technology acceptance model (TAM) is the most widely used framework for making predictions about whether or not people will adopt a new technology and for quantifying their intentions to adopt the technology using the theory of planned behavior (TPB). It is common practice for academics to combine TPB and TAM when studying how technology impacts end-users' values and preferences. Studies have used TAM to ascertain users' motivations for adopting new technologies [33], thus supporting the argument that TAM highly influences the adoption and utilization of technology. According to a situation perspective in most developing countries, the modified TAM has been found most appropriate regarding user intention to adopt new technologies [34]. However, our investigation of the previous literature found that no research study has explored M-technology acceptance among older adults or used modified TAM to investigate their intention to adopt M-technology.

Based on Ajzen's [21] work, TAM stems from TRA and illustrates how people's actions change once they've come to terms with new technologies. TAM has two essential constructs to measure the behavior of an individual toward technology: effort expectancy and performance expectancy. In this study, modified TAM is used with a new construct: perceived value; it is an essential variable because it represents compelling, emotional, and practical features of using M-technology. Studies conducted by Moon [35] and Zulfiqar et al. [36] also utilized modified TAM. In this research, we examine how M-technology influences the formation of technological intention among older adults by using the perceived value of M-technology as an antecedent of expectation expectancy and effort expectancy. Earlier research incorporated TPB and TAM theories to evaluate user technology adoption intentions, with outcomes confirming robust backing for consolidated models [34,37]. TPB is used to understand individual actions and objectives using diverse technological relevance [21]. TPB depicts that individuals' actions significantly inflate their intentions [38]. Figure 1 demonstrates how we integrated modified TAM and TPB to evaluate older adult preferences toward M-technology.

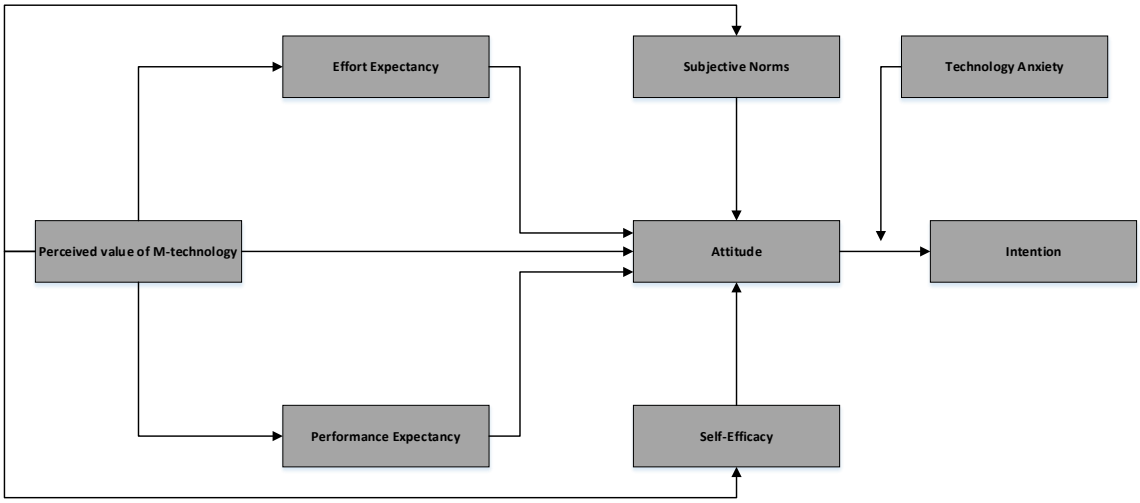

Figure 1. Proposed Model.

2.3. Benefits of M-Technology

From the name "mobile technology", it can be predicted that M-technology refers to portable devices and activities the user can carry out anywhere, including various tasks. M-technology allows users to perform their jobs and tasks using mobile devices such as smartphones, PDAs, and tablets. M-technology is no longer used only to make telephone calls and text messages. With the advancement of technology, it provides users with facilities to engage them in different social and private activities with the help of web searches and other mobile applications [39]. For older adults, smartphones are beneficial in many aspects, such as being a source of happiness, reducing loneliness in the retired community, promoting social associations, and allowing convenient interaction through which they can exchange information and knowledge. Mobility among older adults is often limited; thus, smartphones can help them overcome loneliness and connect to the world [30,40]. In the ICT environment, it is essential to keep learning, gain the same capabilities as young people, and stay productive. The ability of older individuals to stay connected with others at all times and locations, regardless of where they are physically located, is a significant benefit of mobile technologies [41]. M-technology increasingly plays a fundamental part in older adults' healthcare and security. In Chinese society, older adults stay at home; hence, mobile technology provides a sense of security for older adults since they can be connected anytime when they are alone. Many administrative services and government-level M-health service programs are being initiated, increasing the importance of M-technology among older adults. The new situation provides opportunities for older adults to fully exploit M-technology's benefits and improve their quality of life regarding security, health, communication, and wellbeing [42].

2.4. Perceived Value (PV)

Perceived value explain by monetary benefit, social psychology, and quality [43,44]. Previous studies also defined it as the exchange between the practical benefits and the expenses that individuals incur. Perceived value impacts individual thinking regardless of the money and time spent on the activity. As previously mentioned, four sub-values make up perceived value: emotional value, functional value, monetary value, and social worth [45,46]. Dynamic values are then defined as the feelings and thoughts of individuals created by experience with products and services. Functional values are the practical benefits associated with products and services. M-technology's available value motivates individuals to adopt this latest user-friendly technology to understand the environment better. Social value is defined as the benefits individuals feel from M-technology by considering that they could be connected with social sharing and thoughts. Money, time, and

effort invested in goods and services that provide enjoyment are referred to as having monetary value [47,48]. Economic value is vital in the case of M-technology because users spend money, time, and effort to purchase and learn its use. M-technology is no longer just a choice; it has become a necessity of the modern era [49,50]. Currently, M-technology is becoming an essential component of Chinese society, not only because it is used to communicate, educate, and provide leisure but also because many organizations provide M-health services. M-technology allows users to communicate, exchange knowledge, and assist one another in learning and making decisions [51]. According to Janawade et al. [52] and Verhaegen et al. [53,54], one's perspective on the significance of M-technology depends on prior exposure to the technology and the advantages one hopes to reap from its utilization.

Hypothesis 1 (H1): *The perceived value of mobile technology has a direct and positive influence on older adult attitudes.*

Hypothesis 2 (H2): *The perceived value has a direct and positive influence on subjective norms.*

Hypothesis 3 (H3): *The perceived value has a direct and positive influence on self-efficacy.*

Hypothesis 4 (H4): *The perceived value has a direct and positive influence on effort expectancy.*

Hypothesis 5 (H5*): The perceived value has a direct and positive influence on performance-expectancy.*

2.5. Performance Expectancy (PRE)

The degree to which someone expects that the environment's design will help them carry out their everyday tasks successfully and profitably is modeled by their performance expectancy [28,55]. In the case of M-technology, performance expectancy is the usefulness of the technology [56,57]. It lets users access information by interacting with others at any time without location restrictions. Performance expectancy is the most influential determinant influencing the user's behavioral intention to accept M-technology [58]. According to Nyembezi [59], performance expectancy among older adults increases with M-technology adoption intention.

Hypothesis 6 (H6): *The performance expectations directly and positively influence older Chinese adults' attitudes.*

2.6. Effort Expectancy (EE)

Effort expectancy, in theoretical terms, is the extent to which individuals consider that they benefit from the system with less substantial psychological effort [28,60]. According to Alraja et al. [61], effort expectancy is the sum of self-efficacy and user-friendliness. To exploit and consume technology, the user should be fully aware of its values and benefits and believe that this technology assists them in fulfilling their needs and wants [62,63]. According to Milošević et al. [64], self-efficacy and ease of use are powerful determinants that strongly influence the user's behavioral intention to accept or reject the system. Effort expectancy is necessary to determine individual attitudes toward technology adoption [65].

Hypothesis 7 (H7): *The effort expectations directly and positively influence older Chinese adults' attitudes.*

2.7. Attitude (ATD)

Attitude is the emotional tendency of an individual to be expressive after having experienced or evaluated a particular situation and acting to approve and disapprove of it [66,67].

Bombaes [68] concluded that an individual's attitude significantly affects their behavior, and they are expected to act positively or negatively in a specific situation. An individual's attitude further translates into intentional behavior toward the circumstances [69,70]. Information and knowledge about the benefits oftechnology are the crucial determinants that change the individual's attitude and result in changing their behavior [71]. According to Chi et al. [72], older adults in later life can be encouraged and motivated to have a good attitude about M-technology utilization if they are aware of the values incorporated in M-technology. Lee [73] discovered a clear link between an older person's mindset and M-technology use. Additionally, the user's subjective norms and attitude are evaluated as a consequence of the intention [74].

Hypothesis 8 (H8): *The attitudes directly and positively influence their intention to use M-technology.*

2.8. Subjective Norm (SN)

Subjective norm is the support or approval of specific behavior by people living in a society in a particular situation. It encourages or discourages individual behavior in a given case and in a specific manner [75]. Subjective norms are also social pressure from sources, including children, parents, friends, media, peers, and society [21,76]. Previous studies have found a substantial relationship between subjective norms and a person's propensity to adopt a technology [77,78]. In the case of M-technology, the views of children, friends, and society are essential because (1) individuals interact with others, share knowledge, information, and thoughts, and (2) individuals learn efficiently and effectively by communicating with others who are close and strongly affect their intention [79,80].

Hypothesis 9 (H9): *The subjective norms directly and positively influence older Chinese adults' attitudes.*

2.9. Self-Efficacy (SE)

A specific definition of self-efficacy includes the level individuals to which believe they can carry out a task positively and efficiently [81,82]. Self-efficacy is described in this study as an individual's confidence in their ability to employ cutting-edge M-technologies, which in turn affects their propensity to do so. Solvberg [83] observed that individuals' behavior toward technology adoption was significantly associated with knowledge about the usage and associated benefits and values. Similarly, Rønning [84] found three subjective norms that construct attitude and determined that self-efficacy significantly impacts the user's intention toadopt or pursue new technology.

Hypothesis 10 (H10): *Self-efficacy has a direct and positive influence on the attitudes of older Chinese adults.*

2.10. Moderating Role of Technology Anxiety (TA)

Technology anxiety is the term for users' uneasiness, anxiety, and fear when utilizing the most recent technology [85]. This anxiety is characterized by extreme apprehensiveness about using technology and negative comments about the latest technology, resulting in even avoiding that technology [86,87]. Studies show that M-technology anxiety is a fact and commonly occurs among older adults. It is assumed that elderly users have lower self-efficacy and technical skills than more youthful users [88,89]. It was also found that technology anxiety among older adults is caused by declining cognitive and physical abilities and capabilities, resulting in negative intention toward adopting new technology [90,91]. We offer the following hypotheses to assess the adoption of M-technology by older adults on the basis of the literature review mentioned above.

Hypothesis 11 (H11): *Technology anxiety moderates a direct and significant relationship between attitude and intention to use M-technology among older Chinese adults.*

3. Methodology

3.1. Research Instrument Design

To ensure content validity, the construct used in this survey was adapted from a previous study. The perceived value, subjective norms, and attitude items were taken from Wu et al. [80] and Zulfiqar et al. [30]. A five-point scale for effort and performance expectancy was adapted from Miloevi et al. [52], one for attitudes toward M-technology was taken from Ma et al. [81], and one for technology anxiety was obtained from Meuter [82]. A controlled variable was based on behavioral factors, including age, gender, and education. Table 1 shows demographic information on gender, age, education, and experience with M-technology. On a scale from one to seven, with one representing "strongly disagree", four representing "neutral", and seven representing "strongly agree", all of the responses for each construct-related item were scored. The questionnaire for the poll was first written in English, and responses were gathered from members of the Chinese community who use WeChat. To address the topic of instrumental validity and reliability, it was necessary to translate the instrument into the Chinese language, with a backtranslation being carried out as observed in [92]. The writers enlisted the help of three native Chinese speakers in their quest to find an answer to this predicament. The survey was initially created in English and was translated into Chinese by three people. Semantic ambiguities from the original Chinese survey were ironed out in the retranslation into English. To assess the content validity of the study, the authors approached two experts from the School of Management and the School of Psychology to review and evaluate the instrument.

Table 1. Demographic data.

Demographic Information	Frequency	Percentage
Age		
45–50	91	36.4
50–55	98	39.2
55–60	54	21.6
60–onward	7	2.8
Gender		
Male	136	54
Female	115	46
Education		
Pre-primary	39	15.7
Primary school	19	7.80
Secondary	119	47.50
Post-secondary	74	29
Experience using M-technology		
2–7 months	15	5.76
8–13 months	50	20.15
14–18 months	89	35.5
At least 19 months	96	38.59

3.2. Data Collection

As part of the survey questionnaire, data from the Chinese population were collected in the third quarter of 2022 through Credamo (https://www.credamo.com). The site contains 1.5 million strictly censored users and may be able to assist researchers in reaching potential participants, as observed in the existing literature. Therefore, it allows researchers to gain potential participants through online forums or member recommendations and reward study participants. According to research conducted in China [93,94], it is regarded as one of the most valuable sources of participants in the survey who were asked

(1) if they had ever used a smart gadget in the past, and (2) whether they had experienced M-technology. We focused on China since it has a rapidly growing population of 1.4 billion, which is expected to account for 28% of the world's older people in 2040. Participants in the poll were assured of complete anonymity and told on the survey's front page that their participation was purely voluntary. We obtained 258 responses in all, and 251 of them were wide enough to be reviewed. Table 1 gives a better picture of the collected sample.

3.3. Common Method Based

As we collected cross-sectional data using only one instrument, common method bias (CMB) may be present in the responses. To avoid the effects of CMB, three quantitative approaches for behavioral modeling were used in the current study. Herman's single-factor biases approach was adopted as a first step, which is suggested in the existing literature [95], to measure the maximum variance among the proposed constructs. Interestingly, it is worth noting that the maximum variance in the overall model observed was 29.34% on the basis of a single factor only. In addition, Keren et al. (2021) conducted a common latent factor (CLF) test on the adapted instrument as a follow-up to the combinational analysis described above in terms of the standard regression score. There was no discernible difference between the mean regression scores of the models that did not include the CLF and those that did have the CLF. Thus, the quantified result of the study indicates no CMB. A variance inflation factor (VIF) score was recorded to identify multi-collinearity. Hair et al. [96] noted that this should be less than 3, which is acceptable for determining multicollinearity. As a result, the current study has no concerns about multicollinearity.

Moreover, the collected data should be verified for the reliability of the information. The nonresponse bias in the collected responses was also measured with the help of the chi-square test. This was achieved by comparing the beginning and ending portions of the collected responses both before and after the intervention period. In terms of the findings, neither of the data groups displayed a statistically significant divergence from one other. Due to the fact that the study was not affected by nonresponse biases, the results can be considered satisfactory.

3.4. Analysis and Results

SEM is an essential tool for analyzing the measurement model and structural model simultaneously through exploratory factor analysis (EFA), principal component analysis (CFA), and regression [97]. The structural equation modeling (SEM) approach was carried out with AMOS 24. Before factor loading was employed to assess the measurement, EFA was utilized to ascertain the convergent validity of the construct's composite reliability (CR), Cronbach's alpha, and average variance extracted (AVE). The ideal values for factor loadings, Cronbach's alpha, AVE, and CR, are 0.5, 0.6, 0.5, and 0.7, respectively [96]. All of the constructs have Cronbach's alpha values, factor loadings, AVE values greater than 0.5, and CR values greater than 0.7, as shown in Table 2. As a consequence of this, the measures included in our findings exhibit appropriate levels of convergent validity.

Table 2. Reliability and confirmatory analysis.

Constructs	Items	Loadings	Cronbach Alpha	CR	AVE
Attitude	ATD 1	0.856	0.885	0.886	0.722
	ATD 2	0.801			
	ATD 3	0.823			
Performance expectancy	PRE 1	0.844	0.789	0.796	0.568
	PRE 2	0.760			
	PRE 3	0.791			
Perceived value	PV1	0.900	0.932	0.933	0.776
	PV2	0.861			
	PV3	0.866			

	PV4	0.885			
Technology anxiety	TA1	0.815	0.794	0.795	0.565
	TA2	0.768			
	TA3	0.733			
Intention	IT1	0.805	0.823	0.825	0.612
	IT2	0.762			
	IT3	0.794			
Effort expectancy	EE1	0.761	0.804	0.807	0.512
	EE2	0.826			
	EE3	0.771			
	EE4	0.801			
Subjective norm	SN1	0.772	0.778	0.784	0.554
	SN2	0.827			
	SN3	0.720			
Self-efficacy	SF1	0.863	0.809	0.890	0.619
	SF2	0.828			
	SF3	0.832			
	SF4	0.821			

According to Fornell [98], a different method should be used to assess the discriminant validity (Table 3), which compares the square roots of AVE values for each concept and association. When the AVE square root was higher than the correlation between the constructs, discriminant validity is good. The discriminant validity of Table 3 is vital because all values are superior to the standard.

Table 3. Mean variance, correlation, and AVE square root.

Construct	M (SD.)	PRE	PV	EE	ATD	IT	TA	SN
Performance Expectancy	4.36 (1.22)	**0.751**						
Perceived value	4.62 (1.25)	0.181	**0.818**					
Effort expectancy	5.15 (1.49)	0.087	0.060	**0.792**				
Attitude	4.43 (1.01)	0.158	0.098	−0.004	**0.770**			
Intention	4.69 (1.29)	0.474	0.300	−0.023	0.300	**0.846**		
Technology anxiety	4.46 (1.20)	0.412	0.430	0.020	0.007	0.458	**0.771**	
Subjective norms	4.26 (1.45)	0.368	0.241	−0.011	0.146	0.500	0.471	**0.741**
Self-efficacy	4.79 (1.16)	0.389	0.435	0.082	0.150	0.430	0.420	0.531

PRE = performance expectancy; PV = perceived value; EE= effort expectancy; ATD = attitudes; IT = intentions; TA = technology anxiety; SN = subjective norms. Correlation values in Bold should be higher from the relevant correlational values below in the column.

Anderson and Gerbing [99] suggested that there are two systematic steps to assess the proposed model results (Figure 1). The measurement model was tested using CFA in the first stage, and the structural model was used in the second stage to evaluate the proposed model's overall design. SEM helps validate research results, and many researchers from various disciplines have adopted this technique. Researchers use fitness indices such as the chi-square test and the Tucker–Lewis (TLI) index to determine the model's fitness, NFI (normative fit index), CFI (comparative fit index), and RMS error of approximation (RMSEA). The approved chi-square rate should be between 2.0 and 5.0, depending on the sample size [100]. It is deemed to have good fitness indices if the RMSEA value is less than 0.08 CFI and TLI values should be above 0.90, while NFI values should be at least 0.95, according to Arbuckle [101].

3.5. Measurement Model Analysis

The chi-square (1.803), TLI (0.946), IFI (0.955, CFI (0.954), NFI (0.904), and RMSEA (0.054) values all point to the goodness of fit of the model. In light of the benchmark values for the indices mentioned above, the findings support the legitimacy of further investigation into the structural model.

3.6. Structural Model Analysis

The structural model indices demonstrate that the model fits well, with the following values: chi-square (2.521), TLI (0.882), IFI (0.941), CFI (0.939), NFI (0.906), and RMSEA (0.065).

Our results show (see Figure 2) that the perceived value of M-technology is certainly linked with attitude ($\beta = 0.271$, t = 4.888, $p < 0.001$). The perceived value is significantly linked with effort expectancy ($\beta = 0.379$, t = 9.514, $p < 0.001$), performance expectancy ($\beta = 0.742$, t = 4.837, $p < 0.001$), subjective norm ($\beta = 0.230$, t = 1.99, $p < 0.05$), and self-efficacy ($\beta = 0.371$, t = 3.32, $p < 0.001$). Whereas effort expectancy significantly regressed attitude ($\beta = 0.427$, t = 9.31, $p < 0.001$), performance expectancy influenced attitude positively ($\beta = 0.289$, t = 4.99, $p < 0.001$). Subjective norms are positively associated with attitude ($\beta = 0.671$, t = 5.21, $p < 0.001$), and self-efficacy is linked with attitude but not significantly ($\beta = 0.161$, t = 0.035, $p > 0.01$). The attitude of the older adults toward M-technology is positively associated with their intention to use M-technology ($\beta = 0.535$, t = 11.29, $p < 0.001$).

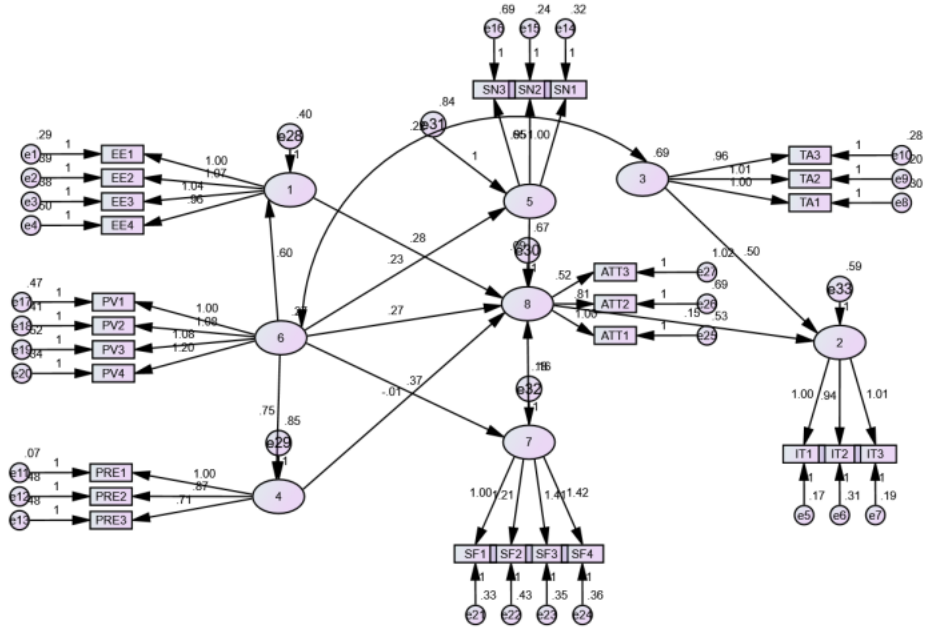

Figure 2. Results of structural modeling.

3.7. Hierarchical Multiple Regression Analysis

Table 4 summarizes the findings of hierarchical multiple regression. Figure 3 depicts a plot indicating that technology anxiety impacts the association between older persons' attitudes and their intention to use M-technology; the result shows that it dampens the relationship.

Table 4. Hierarchical multiple regression analysis.

Variables	Model 1	Model 2	Model 3
Age	0.548 ***	0.363 ***	0.323 ***
Gender	−0.062	−0.022	−0.020
Education	0.26	0.011	0.023
Attitude		0.105 ***	0.151 ***
Technology anxiety			0.501 ***
Attitude × technology anxiety			−0.162 ***
R^2	0.463	0.548	0.598
F	62.82 ***	61.07 ***	57.74 ***

*** Correlation is significant at the 0.01 level (two-tailed).

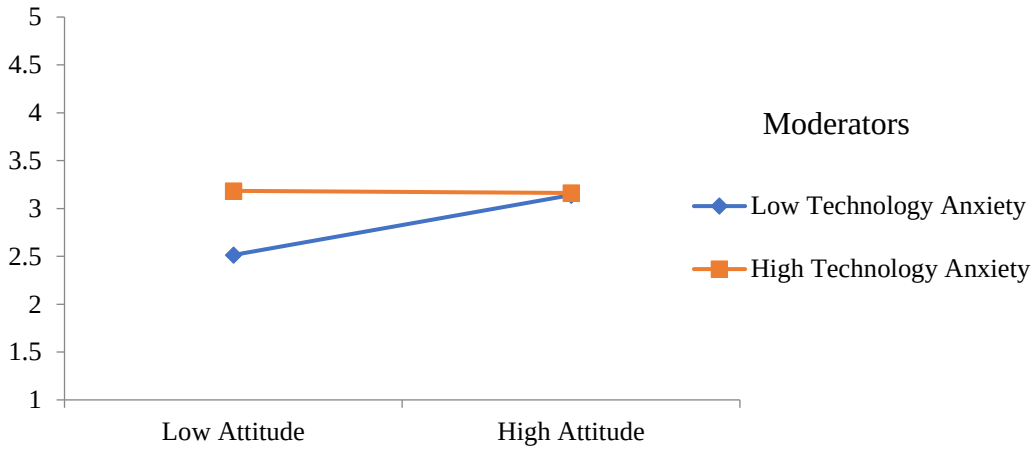

Figure 3. Moderating effect of technology anxiety on the relationship between older adults' attitude and intention toward M-technology.

4. Discussion

In this study, the attitudes and intentions of older persons in China concerning M-technology are examined concerning perceived values. To conduct this study, a self-administered survey was conducted to avoid any discrepancies. This study explores a unique and new integrated model that integrates modified TAM and TPB to produce a good model fit. Other crucial variables were used in addition to perceived value, including expected expectancy, effort expectancy, self-efficacy, and the significance of subjective norms. This study investigated technology anxiety as a moderator that reduces the constructive association among attitude and intention toward M-technology by older adults in China. The data were collected from 251 with a 95% confidence interval and a 5% margin of error by Yamane [102] from the older adults living in Hefei, the capital of Anhui province. In the analysis, Amos-24 was used to examine the measurement and structural models. This paper considered 11 hypotheses; 10 were accepted, and one was rejected. Using M-technology is associated with perceived value, according to our findings, which also show that perceived value has a substantial beneficial impact on performance expectancy and effort expectancy.

Similarly, efforts and performance expectations greatly influence opinions regarding M-technology among older adults. The purpose of older adults is examined for the first time in this investigation by adjusting TAM and TPB to account for perceived value, performance expectations, and effort expectations. The perceived values were positively (and significantly) associated with self-efficacy and subjective norms. In contrast, self-efficacy is associated with attitude in a positive but insignificant way. Subjective criteria are positively associated with M-technology usage attitude. The intention and attitude of M-

technology usage by older adults are positively associated. When technology anxiety is considered, it is discovered that this moderator affects the positive relationship between attitude and intention to utilize M-technology. The values associated with M-technology are emotional, functional, and social; such ideals manipulate the communal customs and norms, self-efficacy, and personal mindset of older adults' intention toward M-technology. By examining the relationship between the perceived values connected with M-technology and intention toward it, this research contributes significantly to the literature on the subject. This is significant because M-technology is receiving much attention from researchers seeking to predict factors and reasons that impact the intention toward M-technology. Our study is one of the first to focus specifically on older adults in exploring this question.

Furthermore, as it approves or disapproves of an individual's behavior, the subjective standard is regarded as one of the most crucial components of intention [103]. This study indicates that subjective norms play an essential part in developing intentions among older adults. An individual can learn and gain knowledge through social interaction and encouragement from society [81]. Older adults will accept technology if they anticipate it will satisfy their needs and desires. The research findings show that older adults lack confidence while engaging with new M-technology; self-efficacy was defined as the user's self-confidence about their capabilities and abilities to use M-technology. At this stage, external and social support is necessary for older adults to have an attitude and intentions toward M-technology. Technology anxiety is an arbitrator that reduces the constructive association between attitude and intention to use M-technology. According to Czaja et al. [17] and Mitzner et al.[18], technology anxiety among older adults is high compared to young people. Older adults experience more anxiety while interacting with M-technology, and the stress causes their performance to decline.

5. Conclusions

As discussed in the literature, the older population is increasing daily. M-technologies have an opportunity to target this market and cope with the challenges by offering new products and services geared to older adults. Addressing the research question drawn in Section 1, this study produced two main findings. Firstly, this study can help manufacturers or designers of M- products and services in the design phase of such offerings. Such manufacturers should design products and services while considering older adults' needs, wants, and ease. Before mass production of the products, companies should perform pilot studies and give user orientation about the technology used. Only after a positive response from older adults should the companies move toward mass production. Secondly, technical and service support for older adults should be ensured after developing these productsand services. The support may include a suggestion to purchase appropriate M-technology products, with home delivery, and setup assistance, software installation, and hardware repair. Such support from industry and society can be a motivating and encouraging factor that helps older adults adopt M-technology and benefit from it. Technology is advancing and achieving breakthrough milestones as time passes. People preferred to interact physically in the past, but that has changed due to COVID-19. People used to avoid interaction with each other to minimize the risk of transmission. Older populations were more vulnerable to COVID-19. The older population did not intend to adopt technology before COVID-19, but COVID-19 compelled them to embrace it. Thus, the rate of technology adoption after COVID-19 increased in the world, particularly in China.

5.1. Implications

5.1.1. Theoretical Implications

The primary purpose of this study was to contribute to the literature of mobile technology by testing the proposed framework of M-technology determinants that directly and indirectly affect adoption behavior through emotional value. It is worth mentioning that past studies in this context were fragmented and exploratory in nature. Several

prominent studies [104] have recommended empirical testing to evaluate their effectiveness and applicability in the mobile technology domain. A second contribution of this study was to conceptualize medium-related factors associated with ensemble into the context of mobile technology in order to add to the existing literature. As a result of using the TAM, components related to M-technology were carefully selected and adapted in order to be applied to the present study. Due to its unique coherence within the context of technology adoption, credibility was prominently included in medium characteristics. Moreover, the characteristics of M-technology (i.e., perceived value for adopting M-technology, effort expectations, and performance expectations) were found to be pivotal factors in technological adoption. As a result, in conjunction with the TAM, it is recommended to include effort perceived value, effort expectation, and performance expectation as important indicators of adoption behavior among older adults. The third objective of this study is to advance existing research by investigating the indirect impact of emotional value on the association between M-technology characteristics (subjective norms, self-efficacy, and technology anxiety) and adoption behavior in the context of older adults adopting mobile technology. The study results indicate that emotional values do mediate this relationship to influence adoption behaviors. This research contributes to the technological context of consumer behavior literature by pointing out that emotional value may be one of the most important factors underlying the relationship between M-advertising characteristics and adoption patterns.

5.1.2. Practical Implication

Researchers, educators, practitioners, and politicians in China interested in expanding elderly internet use can benefit in several ways from this study's findings. The findings of our study support the notion that perceptions of utility play a significant role in determining older individuals' intentions to use the internet and their actual adoption of the medium. Selwyn et al. [105], along with other studies, implied that older persons think computers and the internet are unimportant to their daily lives and do not provide any advantages. The findings show that performance expectancy significantly impacts older persons' attitudes toward utilizing technology. The higher the performance of the intelligent technology, the more appealing it is to older folks, who are more inclined to adopt it. The findings of this study may help tablet makers and technology developers improve their products, increasing the possibility that older persons will embrace and use mobile technology. It is essential to take into account a variety of intelligent devices with M-technology features. Parveen et al. [106] was also brought to light that there is a population known as "voluntary nonusers", which refers to older persons who do not feel the need to have access to the internet. The next generation of treatments should make it easier for older people to understand how the internet can improve their lives and provide a clear explanation of the platform's capabilities and benefits. The second most important finding from this research was that people's perceptions about the value of mobile technology can have a substantial impact on how quickly people adopt new technologies. Existing user interfaces, according to the opinions of a few senior citizens, are not warm and inviting. The software designers have not considered the participants' individual difficulties with vision, perception, movement, and cognition [107]. Due to this overt barrier, older adults cannot use mobile technologies. The stress on compromised functions that older persons may already be experiencing should be as little as possible when designing user interfaces and programs for mobile technology. Subjective norms, which have also been shown to be significant variables, impact older individuals' internet use. According to the literature on the spread of innovations, social interactions and norms are crucial in accepting new behaviors [108].

Influential people can help introduce and speed up the adoption of new techniques, as shown by Valente and Davis [109]. The local communities of elderly Chinese individuals interested in mobile technology should be studied as part of the project. These people should be recognized as influential members of these networks. Experts in a given field

can set examples for followers, which speeds up the diffusion of ideas. Last but not least, policymakers and practitioners should make better conditions to encourage older Chinese folks to adopt mobile technology.

5.2. Future Implications

Even though the findings from this study, which focused on older Chinese adults, may be generalizable to other populations, more research is required to confirm this. This study's limitations should be considered when interpreting the results. As China is a big country with regional and social diversity, the results may not represent all older adults in China or in another geographic location. The study was carried out in Hefei, and all the participants had an average level of education and economic condition. Furthermore, this region, especially Hefei, is rapidly growing (China, 2020) [110]. In China, there are also cultural diversities among the regions and provinces, differences which also affect technology usage [111]. Future research could concentrate on significant cultural aspects and their linkages since this study and sample do not fully represent the cultural diversity of older persons for the reasons mentioned above. For example, Holden et al. [112] examined the usage of a particular technological system by older adults from the perspectives of person-related obstacles, task-related obstacles, tool-related obstacles, and context-related obstacles. This methodology could provide a complete approach for a future study on the acceptance of smartphones. Lastly, since health and wellbeing are vital concerns as people age, future studies might concentrate on smartphone capabilities and features relevant to these areas.

5.3. Recommendations

This study found that various personal, technological, and environmental complications need to be addressed to promote the use of smartphones by older adults. Recommendations are presented here to encourage the usage of such technology by older adults in China. In China, the monthly cost of smartphone usage is often a financial problem for older adults; thus, smartphone manufacturing companies and telecommunication service providers should offer attractive data packages, perhaps with particular age-related discounts. In China, many older adults have limited-to-average education and learning abilities. This characteristic suggests introducing training, awareness, and further education of older adults by means acceptable to them, removing traditional obstacles such as their apprehension toward getting trained by youngsters.

Chinese older adults attach importance to positioning their image high in their social networks. The impact of their usage of technology and the treatment they get will strongly affect their use of smartphone services. Research by Yao et al. [113] discovered that older Chinese adults' fear of technology and poor smartphone performance are important factors. A generation gap in adopting a new fashion will be mocked in their social networks. In this rapidly evolving technology era, when the world is converging into a global village, society has a responsibility to promote and encourage older people to use new technologies to boost and safeguard their confidence. It is essential to push back against labels based on irrational concerns about new technologies. The media and public opinion can play a significant role in respecting the technical needs and rights of the elderly by promoting their adoption of new technologies and providing suitable means for their education and training.

Author Contributions: B.Z., conceptualization and writing—original draft; L.Y. M.A. and M.A.K., variable construction and methodology; S.B., supervision and funding acquisition; A.J., formal analysis and data handling; M.A. and S.B., writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Funding: The Russian Ministry of Science and Higher Education funded V.Y.'s research as part of the "Priority 2030" strategic academic leadership program (Agreement 075-15-2021-1333, dated 30 September 2021).

Institutional Review Board Statement: The Institutional Review Board at the School of Economics and Management, Ningxia University, Yinchuan, Ningxia, 750021, China, gave its clearance for the research.

Informed Consent Statement: Consent to participate voluntarily in this research project was acquired from all participants.

Data Availability Statement: The data supporting this study's conclusions can be obtained from the first author upon reasonable request.

Acknowledgments: This work was supported by a grant from the funding project of the Ministry of Science and Higher Education of the Russian Federation under the strategic academic leadership program "Priority 2030" (Agreement 075-15-2021-1333). The editor and the anonymous reviewers deserve a special thank you from the writers for their thoughtful feedback and recommendations that helped improve this article.

Conflicts of Interest: The authors declare no conflict of interest.

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