Original Research Article

How does Digital Trust Technology Make Up for the Digital Divide in Elderly Care Services

Abstract

Under the double impact of aging and the digital divide, China is facing a severe pension problem. Promoting smart pension services can help solve this problem. This paper mainly discusses how to promote the use intention of intelligent elderly care service through digital trust. In this study, 403 valid questionnaires were obtained through questionnaire survey. The results showed that respondents' perceived ease of use of digital tools and applications significantly affected their digital trust and willingness to use them. However, considering digital trust, digital risk has no significant effect on willingness to use. This study suggests that strengthening the digital knowledge and skills of the elderly and strengthening their trust in smart elderly care services can help improve their willingness to use, and resolve the dual impact of aging and the digital divide.

Key words: ~~willingness to use; d~~Digital trust; ~~e~~Elderly care service; ~~a~~Aging; ~~d~~Digital divide

1. Introduction

According to the World Health Organization's ~~L~~life ~~E~~expectancy rankings for 2022, Japan, Switzerland and Singapore have a life expectancy of more than 83 years. The global average life expectancy continues to increase, also represents the age of aging is coming. The so-called aging ratio refers to the proportion of people over 65 in the total population. The higher the ratio, the more elderly people are. Economically developed countries, such as Japan (27%), Italy (23%), Germany (21%), France (20%), the United Kingdom (19%), Canada (17%), Australia (16%) and the United States (15%), all have an aging population of more than 15%, highlighting that these countries are facing the problem of demand and supply of elderly care services.

In 2020, the seventh population census was conducted in China. Data showed that the population aged 65 or above reached 190 million, accounting for 13.50% of the total population. The aging degree is increasing and the aging speed is accelerating [1]. Like the advanced countries, ~~our~~ China ~~country~~ also faces the problem of aging supply and demand. In addition, the number of births and deaths in 2022 was 9.56 million and 10.41 million, indicating that China has entered a period of

population decline, and it is not easy to avoid high aging population through population growth [2]. In addition, data from the seventh census in 2020 showed that China's elderly dependency ratio (old-age dependency ratio; The ODR is increasing rapidly from 18.94% in 2010 to 29.53% in 2020. The old-age dependency ratio caused by the aging population is gradually testing our pension policy, pension system and financial planning [3].

In other words, the aging population is very likely to have more disability, marriage loss, widowhood, left-behind and other vulnerable elderly and pension service problems [4, 5]. These problems affect not only the old man himself, but also his family and the community where he lives, resulting in social problems [6, 7]. Moreover, the high number of elderly population also symbolizes the decrease of the number of employed people, which also has a negative impact on economic development [8]. In view of these problems arising from aging, studies also point out that it is one of the feasible directions to comprehensively improve the digital literacy of the elderly, promote the accurate matching of smart products and services, and integrate the new generation of information technology into the development of the elderly care industry [9]. Moreover, it is also one of the possible solutions to alleviate the high old-age dependency ratio by clarifying the elderly people's attitude and willingness towards old-age care services and constructing a smart old-age care platform [10].

However, in the age of digital divide, many elderly people are limited by physical and psychological factors, and they are not good at or are not accustomed to using digital tools such as smart phones to handle care for the elderly. The phenomenon of these elderly people's insufficient use and adaptation to intelligent tools is called digital divide [11]. If ~~we~~ one can build their confidence in digital tools and increase their willingness to use them, ~~we~~ it will facilitate the promotion of smart elderly care services. Therefore, it has become a very important research topic to discuss the influencing factors of elderly people's trust in smart tools (as digital trust is discussed in this paper) and the influence of trust on their willingness to use smart tools. Specifically, the research topic of this study is the use behavior of digital tools and applications by the elderly. Among them, the use behavior is affected by the use intention. Therefore, this study actually wanted to explore the willingness of older people to use digital tools and applications.

In view of elderly people's willingness to use digital tools and applications, this study defined as elderly people's willingness to use and adopt digital tools and applications for information access and acceptance. These digital tools include smart phone, notebook computer, general computer, tablet computer, smart TV, smart watch and smart bracelet. The apps cover various pension applications, medical

appointments, food ordering, travel, online shopping, leisure and entertainment videos, etc.

In terms of the antecedents of intelligent tool trust, considering the digital divide problem and research characteristics, this study chooses ease-of-use and digital risk as the pre-factors of trust, and analyzes how they directly affect the intention to use and indirectly affect the intention to use through digital trust. In summary, the purpose of this study is to:

- analyze the elderly's perceived ease of use of digital tools,
- perceived digital risks,
- digital trust and willingness to use them,
- to clarify the impact of ease of use and digital risk on digital trust, and
- verifying the effects of ease of use,
- number risk, and word trust on the intention to use; and make some suggestions.

2. Literature Review

2.1The concept of digital divide

The digital divide is the difference in how information is received, processed and used between those who have more and those who have less. In 2013, China Information Administration defined it as the gap between different social groups in owning and using modern information technology [8]. To be specific, digital divide is the difference in the distribution of information technology between different regions and different groups, which leads to certain gaps in the production and life process of different groups [11]. The gap between different generations in participating in public activities and obtaining and using information resources with the help of digital resources [12].

Secondly, iIf it is applied to the elderly population, it can be defined as an obstacle for the elderly to use digital tools [13]. In other words, the elderly are affected by physical, psychological, economic and knowledge barriers, as well as family, technology and network service barriers, which will affect their Internet use behavior [13,] 14]. Moreover, the barriers to access and use of such digital tools will also affect their willingness to use old-age service tools [14]. Accordingly, this study defines the digital divide for the elderly as the gap in access to and use of information resources through digital tools, which is caused by various factors.

In addition, some elderly people are not good at or refuse to use digital tools, which may affect their life after retirement. The influence of the digital divide of the elderly is shown in several aspects, such as the degradation of parts of the body organs (eyes and ears), the inconvenient use of digital tools, and the cash transaction when shopping by car, which limits the way of shopping in their retirement life [15].

~~Secondly~~Nevertheless, psychological factors such as engraving of digital tools and fear of being cheated affect the elderly~~'s~~ willingness to use intelligent software [13,~~,~~ 15]. They still feel high uncertainty about handling life affairs through digital tools, and have low confidence and trust in intelligent tools [14]. Therefore, they are less willing to accept network electronic products [16].

2.2 The concept of digital trust

In the process of transaction, trust is one of the two parties' confidence evaluation of the other party's reputation, product quality and price, professional knowledge and ability [17,~~,~~ 18,~~,~~ 19, ~~,~~20]. If the relationship between the two parties is applied to the use of digital tools, it can be called digital trust [8]. Taking this study as an example, digital trust refers to the elderly~~'s~~ confidence in the use of digital tools, including the brand reputation, quality and safety of digital tools.

In the context of digital divide, elderly people's confidence and trust evaluation on digital tools may affect their willingness to use them [13,~~,~~ 15]. When the elderly people assessed their confidence and trust in digital tools was high, it was called high digital trust. The opposite is called low level of digital trust. Moreover, the higher the digital trust perceived by the elderly, the higher their willingness to use it [8].

In other words, in the context of the digital divide, the more trust older people have in the credibility, quality and safety of digital tools, the more willing they are to use them. In other words, older people's digital trust may influence their willingness to use digital tools. Accordingly, the following hypotheses are proposed in this study:

Hypothesis 1: In the context of digital divide, elderly people's digital trust may affect their willingness to use digital tools.

2.3 The antecedents and Effects of digital trust

Digital trust is related to the use of digital tools. The perceived ease of use of digital tools and the perceived risk of using digital tools may be one of the important antecedents of digital trust. First of all, perceived ease of use comes from technology acceptance model (TAM), which is the antecedents of people's attitude and behavioral willingness to use specific tools [21]. Perceived usability is people's evaluation of the ease of using a particular tool [22]. TAM hypothesized that people~~'s~~ perceived ease of use of certain tools would affect their attitude and willingness to use them [22]. Moreover, attitude has been proven to be one of the more appropriate outcomes of technology acceptance [23,~~,~~ 24]. Many studies have confirmed that people's attitudes towards specific tools can affect their behavioral intentions [25,~~,~~ 26,~~,~~ 27]. In the context of digital divide, elderly people's perceived ease of use of digital tools may

affect their willingness and attitude to use them.

~~Secondly, t~~This study considers digital trust as one of the attitudes of the elderly towards digital tools. This is because digital trust is an overall assessment of older people's use of digital tools. The evaluation of digital tools is a subjective judgment. This subjective judgment conforms to the basic definition of attitude: the psychological tendency of people to like or dislike certain things [28]. Accordingly, this study regards such personal subjective judgment as an individual's attitude towards digital tools.

In other words, the higher the perceived ease of use of digital tools, the more positive their attitude and willingness to use them may be. Here, the attitude can be interpreted as the elderly people's digital trust in digital tools. Accordingly, the following hypotheses are proposed in this study:

Hypothesis 2: In the context of digital divide, elderly people's perceived ease of use of digital tools may affect their digital trust.
Hypothesis 3: In the context of digital divide, elderly people's perceived ease of use of digital tools may affect their willingness to use them.

In addition, the perceived risk of using digital tools comes from the uncertainty faced by the use of digital tools (mobile phones, computers, smart bracelets, smart watches, etc.) [28]. When the uncertainty of using digital tools increases, the behavior of intelligent tool users will be affected. Accordingly, the perceived risk of using digital tools is referred to as digital risk in this study. In terms of the impact of digital risk, empirical studies have confirmed that digital risk is negatively correlated with digital trust [28], and various perceived risks will affect purchasing behavior [29]. Moreover, trust is a key factor when discussing the use of technology [30,~~,~~ 31,~~,~~ 32]. Therefore, digital risks may affect the digital trust and usage behavior of users of smart tools.

For example, in the age of smart services, more and more consumers are fulfilling their shopping needs through online transactions. However, in online shopping, because the seller and the real product are invisible and electronic payment is used, the purchase decision is often faced with higher risks than the traditional face-to-face transaction. Empirical studies have also confirmed that in the digital divide situation of the elderly, about 47.9% of the elderly have not adapted to online shopping and 53.8% have no information query ability [11], indicating that the elderly seem to face high digital risks, resulting in them not being able to enjoy the dividends of the digital economy [13]. Under such conditions, older people's digital trust and willingness to use digital tools may be affected. Accordingly, the following

hypotheses are proposed in this study:

Hypothesis 4: In the context of digital divide, an elderly person's digital risk to digital tools may affect his digital trust.
Hypothesis 5: In the context of digital divide, an elderly person's digital risk to digital tools may affect his willingness to use them.

3. Research Methods

3.1 Research Framework and Hypotheses

Based on the studies of Marikyan, Papagiannidis, Rana, Ranjan, and Morgan, Sembada, Koa and Yen, etc., Years??? and references numbers the research framework of this paper is shown in Figure 1. The following hypothesis is proposed in this study [33,][,] 34].

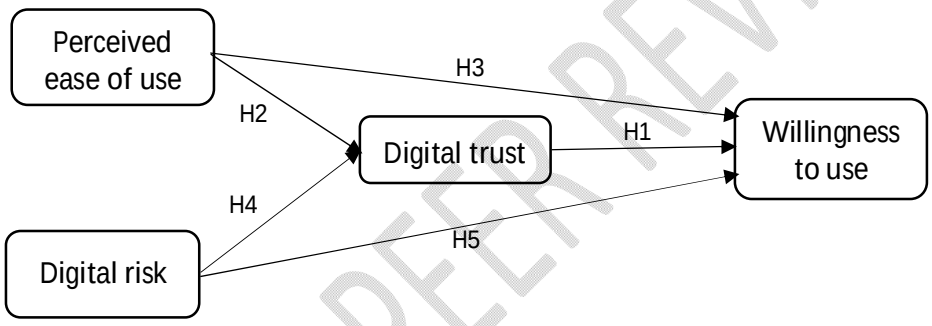

Fig. 1 Research Framework

H1: Hypothesis 1: In the context of digital divide, elderly people's digital trust may affect their willingness to use digital tools.
H2: Hypothesis 2: In the context of digital divide, elderly people's perceived ease of use of digital tools may affect their digital trust.
H3: Hypothesis 3: In the context of digital divide, elderly people's perceived ease of use of digital tools may affect their willingness to use them.
H4: Hypothesis 4: In the context of digital divide, an elderly person's digital risk to digital tools may affect his digital trust.
H5: Hypothesis 5: In the context of digital divide, an elderly person's digital risk to digital tools may affect his willingness to use them.

3.2 The development of measuring tools

This study discusses the variable relationship in digital marketing, which is a quantitative study in research design. It adopts the questionnaire method to collect

data. In terms of variable definition, referring to the research of Yen and Davis, Year?? Or reference number ?? perceived ease of use is defined as the expected difficulty perceived by elderly people before they operate and use digital tools and applications in their contact with and use relationship [8]. Referring to Yen's research and considering the research objectives and answers, three measurement items were used, including "easy to search with digital tools and applications", "easy to do things with digital tools and applications" and "easy to deal with problems with digital tools and applications" [8].

Moreover, referring to the study of Marikyan et al., year or reference number Yen, digital risk is defined as "the uncertainty of operation and use of digital tools and applications in the contact and use relationship between the elderly and digital tools and applications [8,] [33]". Referring to the research of Marikyan et al. year or reference number and Yen, and considering the research purpose and answers, two questions were selected, such as "it may take some time to do things through digital network" and "There may be some uncertainty in doing things through digital network" [8,] [33].

Furthermore, digital trust is defined as "the assessment of elderly people's confidence and trust in intelligent tools and applications under the background of digital divide" after referring to the study of Sembada and Koa. year or reference number Three measurement questions were used, such as "the digital network platform service is trustworthy", "I will pay attention to the prompts of the digital network platform system" and "I believe in the digital network platform system" [34].

Lastly, in terms of the willingness to use digital tools and applications, Yen's research is defined as "the degree to which the elderly are willing to use and recommend smart tools and applications in the context of digital divide" [8]. Three questions were used in the measurement, such as "I can do things through the mobile digital network", "I am happy to do things through the mobile digital network", "I would recommend to my relatives and friends to do things through the digital network", etc. All questions were measured by five-point Likert scale, Reference ?? with 1 indicating strong disagreement and 5 indicating strong agreement. The higher the total score of the dimension, the higher the degree of agreement. In addition, the questions used in the questionnaire have expert validity after expert discrimination and modification.

3.3 Questionnaire survey

In this study, offline questionnaires were used by interviewers to collect data during the Spring Festival. In terms of the number of samples, there are 11 questions

in this study, and it is generally suggested that the number of samples should be at least 10 times of the number of questions. In addition, considering the needs of subsequent structural pattern analysis, it is estimated that more than 300 valid samples will be collected in this study. The questionnaire was put on the questionnaire star in December 2021, and the interviewers visited the spring surface and filled out the answers in order. By the end of December 2021, a total of 429 questionnaires have been obtained, excluding 26 samples with single answers, and 403 valid questionnaires, with a valid questionnaire rate of 94%.

4. Results

4.1 Descriptive statistics, validity analysis and reliability analysis

In the aspect of data processing, statistical software SPSS22 Reference and year??? was used for descriptive statistics, validity analysis and reliability analysis of data. The results are shown in Table 1 below. ~~On the whole, t~~The average value ranges from 2.19 to 2.42, which belongs to the degree of slight disagreement to general, and the standard deviation ranges from 0.829 to 1.058, with little difference in respondents' views. In addition, the absolute value of skewness coefficient was less than 3 (0.246 to 0.657) and the absolute value of kurtosis coefficient was less than 10 (-0.840 to 0.196), indicating that the sample data did not violate the normality hypothesis.

~~Secondly, i~~In terms of validity, questions come from literature and thus have a theoretical basis. It has been tested by experts and has good expert validity. Factors with eigenvalue greater than 1 were extracted through principal component analysis (PCA) and initial eigenvalue exceed 1 by Varimax Method. The results of factor analysis showed that the KMO value of all construct surfaces was greater than 0.5, and the Bartlett sphericity test reached a significant level ($p<0.01$), indicating that all construct surfaces were suitable for factor analysis. After testing, the cumulative variation extracts were 57.9% for perceived ease of use, 72.6% for digital risk, 60.0% for digital trust and 59.4% for willingness to use with factor load greater than 0.7. On the whole, the scale used in this study had good construct validity.

Finally, in terms of reliability, Cronbach's Alpha values ranged from 0.621 to 0.664, indicating medium reliability, and the measurement tools had good internal consistency.

Table 1. Descriptive statistics, validity, and reliability Table 1 orientation should be landscape

Construct	Items	M	SD	SK	KU	FL	Cronbach ‘s α
Perceived ease of use	1. Searching on the net is easy using digital tools and apps.	2.19	.986	.433	-.504	.797	.637

(VE=57.9 %)	2. It's easy to get things done using digital tools and apps.	2.23	.928	.497	.036	.734	
	3. It's easy to solve problems with digital tools and apps.	2.29	.989	.657	.196	.751	
Digital risk (VE=72.6 %)	1. Learning to do things digitally can take some time.	2.32	.995	.521	-.287	.852	.621
	2. Doing things on digital networks can be somewhat uncertain.	2.47	1.058	.341	-.452	.852	
Digital trust (VE=60.0 %)	1. Digital network platform services are trustworthy.	2.27	.829	.298	-.138	.797	.664
	2. I will pay attention to the prompts of the digital network platform system.	2.19	.918	.246	-.840	.739	
	3. I believe in digital network platform system.	2.30	.966	.444	-.179	.788	
Willingnes s to use (VE=59.4 %)	1. I do things digitally.	2.19	.856	.453	-.099	.770	.656
	2. I'm happy to do things through mobile digital networks.	2.19	.953	.574	-.086	.730	
	3. I would recommend digital networking to my friends and relatives.	2.23	.940	.553	-.051	.809	

M: Mean; SD: standard deviation; SK: skewness; KU: kurtosis; FL: factor loadings

4.2 Hypothesis testing

The research model of this paper has two dependent variables, so there are two regression equations. In this study, digital trust and usage intention were respectively taken as variables for stepwise regression, and the relationship between variables was observed. The hypothesis verification results were shown in Table 2.

First of all, in terms of the prediction of digital trust, the model fit between model 1 and model 2 is adequate (F=159 and 167), and the collinearity problem is not serious (VIF<10). The results showed that both perceived ease of use and digital risk had significant influence on digital trust, and the coefficient was 0.51 and 0.13, which could effectively predict 29.9% variation of digital trust. Secondly, in the prediction of digital trust, it is found that using ease of use as the prediction variable can predict the variability of digital trust by 28.5%, and adding digital risk can only increase the predictive power by 1.4%. This indicates that elderly people have a low degree of digital risk perception, and they will develop digital trust in digital tools as long as they are easy to use. Accordingly, hypotheses 2 and 5 are supported.

Secondly, in terms of prediction of intention to use digital tools, M3, M4 and M5 have an adequate model fit (F=159,164,284), and the collinearity problem is not

serious (VIF<10). The analysis results of model 3 showed that respondents' perceived ease of use (β=0.53, t=12.62) had a significant impact on their willingness to use with a predictive power of 28.3%. When digital risks were added to the model, they significantly affected its willingness to use, and the predictive power increased by 29.1%. In other words, adding digital risk increased the predictive power of willingness to use by 0.8%.

Finally, when digital trust was added to the model, perceived ease of use (β=0.27, t=6.09) and digital trust (β=0.48, t=10.95) significantly affected willingness to use. However, the influence of digital risk (β=0.04, t=1.09) on willingness to use was not significant. In terms of predictive power, the predictive power of model 5 is 45.3%, indicating that ease of use and digital trust can predict 45.3% variation of respondents' willingness to use. Since model 5 had 16.2% more explanatory power than model 3, this study confirmed that the addition of digital trust increased the predictive power of intention to use by 16.2%. Accordingly, hypothesis 1 and hypothesis 3 are supported. Hypothesis 4 is not supported.

Table 2. Regression analysis (n=403)

Independent Variable	Dependent variable				
	Trust (β,t)		Willingness to use (β,t)		
	M1	M2	M3	M4	M5
Perceived ease of use	0.53**(12.63)	0.51**(11.84)	0.53**(12.62)	0.51**(11.90)	0.27**(6.09)
Digital risk		0.13**(2.92)		0.10*(2.37)	0.04(1.09)
Digital trust					0.48**(10.95)
R^2	.285	.299	.283	.291	.453
ΔF	159.46	167.97	159.32	164.92	284.88
VIF	1	0.95	1	0.95	0.71-0.94

*p<0.05, **p<0.01

5. Discussion

The research purpose of this paper is to analyze and sort out the elderly people's perceived ease of use of digital tools, the impact of perceived digital risk on digital trust, and the impact of perceived ease of use, digital risk and digital trust on their willingness to use. The quantitative research method of questionnaire survey was used to explore the relationship between variables. The final study found that the perceived

ease of use of digital tools and the perceived risk of using digital tools are one of the important antecedents of digital trust, and the perceived ease of use and digital risk have a significant impact on digital trust, perceived ease of use and digital trust have a significant impact on the use of digital tools, the digital risk of the elderly has no significant impact on the use of digital tools.

According to the research data, in the context of digital divide, the perceived ease of use of digital tools will significantly affect his digital trust, and the digital risks of digital tools will significantly affect his digital trust. Previous studies have confirmed that people's perceived ease of use affects their attitudes, and in the case of digital divide, perceived ease of use is positively correlated with digital trust. Older people's confidence in the use of digital tools is subjective. Therefore, the higher the perceived ease of use of digital tools by the elderly, they will think it easier to use digital tools, and they will be more confident to use it well, so the higher the digital trust.

Conversely, they rated digital tools negatively if they thought they were difficult to use. This may be due to the existence of the digital divide. Compared with other age groups, the elderly has relatively less information on the acquisition and use of digital resources. This information gap causes obstacles for the elderly to access and use digital tools. Therefore, in the absence of information, elderly people find it difficult to use digital tools, so they tend to dislike the use of digital tools, which is manifested as a lack of digital trust. In addition, the digital risk of the elderly on digital tools is negatively correlated with digital trust, which is consistent with previous studies [28, 29]. This is because the existence of the digital divide makes older people have a high degree of uncertainty about the use of digital tools, resulting in insecurity. For example, due to their limited knowledge of electronic products, they are likely to be deceived in the process of handling business once they make mistakes, which makes the elderly lack of trust in digital tools.

According to the research results, in the context of digital divide, the digital trust and perceived ease of use of the elderly will significantly affect their willingness to use digital tools. However, in the case of digital trust, the digital risk of digital tools had no significant effect on the willingness to use them. Perceived ease of use and digital trust were positively correlated with older people's willingness to use digital tools. Under the digital divide, the elderly has insufficient cognition of digital tools, and think that the use process is cumbersome, it is difficult to search for information, and they cannot communicate face to face when using digital network platforms. Therefore, compared with offline business, they lack trust in online digital platforms. Different from previous studies [14], under the influence of digital trust, digital risk has no significant impact on usage intention. Most likely the reason is that the elderly

lacks the concept of digital risk and lack of education in this area, so they do not talk about digital trust in the face of digital risk. It also suggests that digital trust has a stronger effect on willingness to use than digital risk. This finding clarified the influencing factors of intention to use and the degree of influence of each factor on intention to use.

The research on the concept of digital trust is relatively new. The findings of this paper enrich the connotation of this concept and provide a theoretical basis for further research. At the same time, the correlation between digital trust and its antecedents is verified, and the perceived ease of use and digital risk are the important antecedents affecting digital trust. This study also provides theoretical support and guidance for the government and enterprises to focus on in the future work. However, the limitation of this study is that the scope of the survey is limited in Shandong Province and the number of survey data is limited. Future studies can enrich the research data of other regions and further verify the conclusions of this study.

6. Conclusion and recommendation

In the age of digital divide, the aging of the elderly in China faces severe challenges. This study investigates the perceived ease of use, digital risk, digital trust and use intention of the elderly when facing digital tools by means of questionnaire. A total of 403 valid questionnaires were collected. The results showed that respondents' perceived ease of use of digital tools and applications significantly affected digital trust and willingness to use them, and digital risk affected digital trust. However, when considering digital trust, digital risk has no significant effect on willingness to use. This illustrates the importance of gaining the digital trust of older people.

According to the research results, some suggestions are put forward for government departments, which can focus on strengthening digital knowledge and skills education for the elderly, ~~so as~~ to strengthen their trust in intelligent pension services. For example, with the help of the window of community service, ~~we~~ one can carry out the teaching and guidance class of basic functions of smart phones. Mobile application manuals are issued to the elderly to make them more familiar with the digital system and reduce the sense of insecurity and uncertainty caused by strangers.

According to the analysis results of this study, it is suggested to add age-appropriate design and simplify operation mode for relevant enterprises. The intelligent elderly service platform should be designed with a simple operation interface to facilitate the elderly to learn and use. Apps should provide a simple version of the page for the elderly, with enlarged text or voice reading enabled instead of text reading, so that the elderly with poor vision can easily access information. Simplify the business process, extend the prompt information, increase the number of

prompts, use strong contrast color to make keys, convenient for the elderly to read and understand. Age-appropriate design and improvement measures will help to increase the willingness of older people to use, and address the twin impacts of ageing and the digital divide.

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