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THE EFFECT MECHANISM OF IDENTITY CHANGE ON LABOR PARTICIPATION OF CHINESE ELDERLY IN THE DIGITAL AGE

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Abstract. Actively developing human resources for the elderly is an important way to alleviate the labor shortage. However, in the digital society, most elderly people become ' digital refugees ' due to the digital access divide, the use divide, and the inequality divide. On the surface, the ' digital divide of the elderly ' is caused by the low digital literacy of the elderly. Internally, it is mainly the impact of the lifestyle of the elderly on psychological digital exclusion. Therefore, it is helpful to further reveal the mystery of restricting the labor participation of the elderly by analyzing the mechanism of the change of the digital identity of the elderly on their labor participation from the internal level. Therefore, this paper first summarizes the research results of digital identity-related literature; secondly, taking the Chinese elderly (women over 55 years old and men over 60 years old) as the research object, the statistical analysis method is used to analyze the current situation of the digital identity, evolution, and reconstruction of the Chinese elderly. Finally, the mechanism of digital identity change on the labor participation of the elderly is clarified from three perspectives: labor stock, internal driving force, and labor way.

Keywords: identity; digital identity; digital divide; digital integration; the elderly's labor participation.

JEL codes: E20; G50; J01.

Introduction

In recent years, the world population pattern has undergone dramatic changes, and population aging has become an important issue in the world. According to the data released by the United Nations Population Division in 2022, by the end of 2021, the dependency ratio of the elderly in high-income countries such as Europe, North America, Oceania, and East Asia was relatively high and showed a significant increase (Figure 1), which significantly increased the pension burden of relevant countries (UN, 2022) [1]. At the same time, the new generation of Internet information technology represented by new media technology, artificial intelligence, and mobile communication is rapidly updated and iterated. It not only realizes the transformation of intelligent production mode, digital industrial form, and platform of the industrial organization but also creates new employment forms and new jobs, which has a great impact on the labor market. It has also promoted the digital transformation of residents' social activities such as smart transportation, smart healthcare, digital learning, and smart home. Based on the deep aging of the population and the development of Internet information technology, the social activities of the elderly in most countries around the world have also undergone dramatic changes. In particular, the "digital integration" of the elderly caused by the "digital divide" has become an important problem in social governance. The digital divide between the elderly is not only significant between developed and developing countries, but also very prominent among different regions and groups within developing countries.

**Fig. 1: Trends in old-age dependency ratios by continent[1]**

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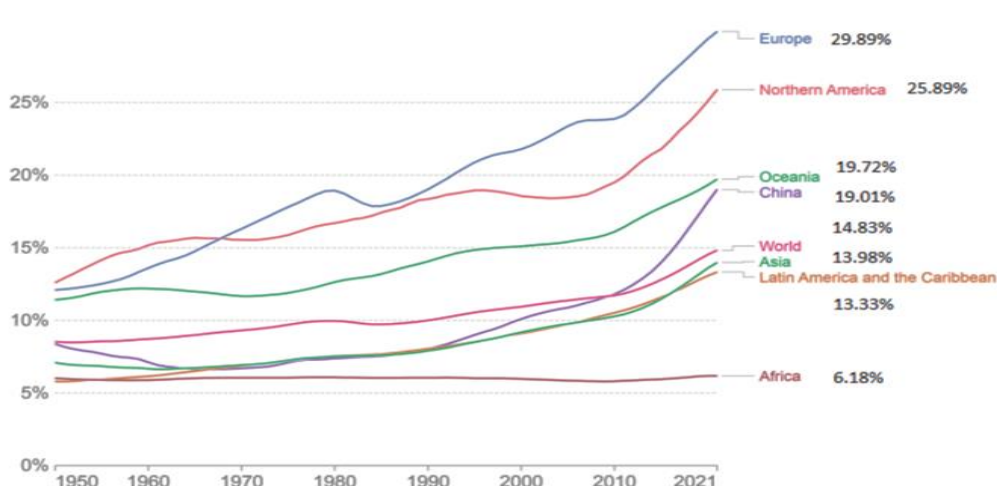
[1] Source: World Population Prospects 2022. https://population.un.org/wpp/

As a representative of developing countries, China's social production and lifestyle have been rapidly transformed into digitalization in recent years with the help of Internet information technology. According to the 49th 'China Internet Development Statistics Report' released by China Internet Network Information Center (CNNIC), as of December 2021, the number of Chinese netizens reached 1.032 billion, and the Internet penetration rate reached 73.0%. Among them, the number of elderly netizens aged 60 and over was 119 million, and the Internet penetration rate reached 43.2 % (CNNIC, 2022) [2]. However, the elderly group is restricted by technology, system, culture, and their factors. Compared with other groups, there are great differences in the degree of information technology ownership and application, which eventually leads to a huge digital divide and then becomes a "digital refugee" (Attewell, 2001; van Dijk, 2006) [3], [4]. From the age point of view, the elderly group aged 60 and above is the main group of non-Internet users. As of December 2021, the proportion of non-netizens aged 60 and above in China accounted for 40.8% of the total non-netizens, 21.4% higher than that of the national population aged 60 and above (CNNIC, 2022).

In terms of specific manifestations, most of the elderly are in the three-tier digital divide (Figure 2). The first layer is the digital access divide (which refers to the difference in residents' Internet access), the second layer is the digital usage divide (which measures the difference in residents' Internet use), and the third layer is the digital inequality divide (which refers to the income inequality caused by the heterogeneity of residents' Internet use) (Friemel, 2014) [5]. Although the improvement of the Internet penetration rate of the elderly has bridged the digital access divide of the elderly to a certain extent.

Fig. 2: Onion diagram of three-layer Digital Divide [5]
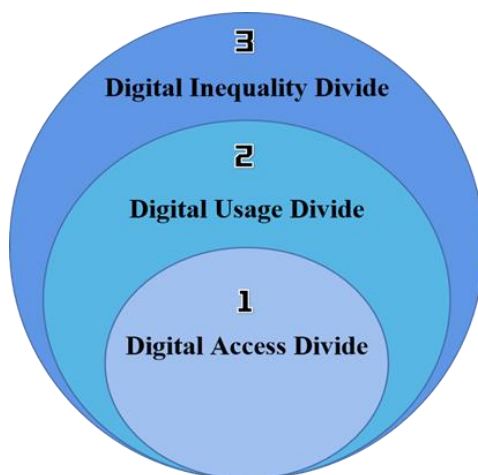
However, in the face of the rapid transfer of traditional manual services to online digital services, some elderly people are unable to provide digital health codes or digital payments,

resulting in a more prominent digital use gap in their travel, shopping, travel, visiting friends, and seeing a doctor. Moreover, the inequality gap in digital benefits caused by the significant differences in Internet use between the elderly and other groups is becoming more and more significant. In the end, the elderly group trapped in the three-tier digital divide is excluded from social activities dominated by Internet information technology in many areas of daily life. They more or less lose their rights and opportunities to participate in social activities, resulting in an objective and subjective sense of 'digital exclusion' (Seifert, 2018) [6].

From the experience of active aging in developed countries, the main way to bridge the digital divide is to enhance the digital literacy of the elderly, to continue their socialization in the digital age, and to enjoy the benefits of digital technology. In recent years, the Chinese government has implemented a series of activities, such as upgrading hardware facilities to bridge the 'access divide', aging software and hardware to bridge the 'usage divide', and cultivating digital literacy to bridge the 'inequality divide' (Scheerder et al., 2017) [7]. However, from the actual effect, the phenomenon of the digital gap in the elderly is still very serious, so it is necessary to clarify the reasons for the ' digital divide' in the elderly.

On the surface, the elderly is affected by objective factors such as physical decline, relatively low levels of education, reduced interest in receiving new things, digital exclusion (self-exclusion, financial exclusion, skill exclusion, and geographical exclusion), and lagging public digital literacy training mechanisms. As a result, they can only use digital devices. Many elderly people will only use simple health code displays and Internet social software, and will not or dare not try to use functions such as mobile payments, online meal ordering, vehicle appointments, medical registration, online bank transfer, and document production and transmission. From the internal point of view, in the digital age, the traditional lifestyle of the elderly is impacted and subverted. Many elderly people are passively integrated into the digital society, making it difficult for them to adapt to the changes in digital identity at the psychological level, which in turn leads to the exclusion of the digital society. Based on this, the author believes that analyzing the mechanism of the process of the elderly 's digital identity change on their labor participation from the internal level will help to further uncover the mystery of restricting the elderly 's labor participation and provide a way for further development of the elderly 's human resources.

1. Literature review

1.1 Related research on identity theory

The term "identity" is explained in the Oxford Dictionary as "who a person is, or the qualities of a person or group that make them different from others," which contains two meanings: one is

"who I am," which is the expression of an individual's self-identity; The other is "which group I belong to", which is the expression of characteristics shared between an individual and a group [8]. The research of identity, philosophy, sociology, psychology, communication, and other fields have different research perspectives.

(1) *In the field of philosophy.* The early research on identity focuses on the identity of the subject and consciousness. Descartes (1637) first proposed the famous saying" I think, therefore I am". He emphasizes the consistency and self-sufficiency of thinking and self, and firmly believes that the self of thinking is the inner core of self-identity (Dika, 2020) [9]. Locke's (1689) discussion of identity states that ' human identity is established because many material molecules that are constantly born and died have a living connection with the same organized body, and thus participate in the same continuing life [10]. Later, identity is mainly a social identity centered on society. For example, Hegel's Philosophy of Subjective Spirit believes that the development of self-consciousness depends on another self-consciousness. In the absolute mental state of the mind, consciousness overcomes the danger of alienation and unites with the world, so the relationship between self and the world is one for two and two for one (Petry, 1978) [11]. Giddens (1991) believed that in modern society, globalization and personalization have become two closely related extremes, which provides the possibility of shaping a new mechanism of self-identity. The construction and expression of the self are mainly achieved through consumption (things purchased and done), interpersonal relationships, and the development of physical skills [12]. Hall (1996) believed that identity is the recognition of some common origin or common origin of another person or group.

(2) *In the field of sociology.* Identity is regarded as the subject's confirmation of the legitimacy of his identity or role, the consensus of identity or role, and the influence of this consensus on social relations. Researchers have focused on the positioning and construction of identity from the perspectives of institutional arrangements and social mobility. Mead's (1934) theory of symbolic interaction holds that the generation of self is the result of the interaction within the social group, and makes a distinction between the subject "I" and the object "me". Ashmore (2004) conceptualized the framework of collective identity and the dimensions of identity and pointed out that self-classification, evaluation, importance, attachment and interdependence, social embeddedness, and behavioral participation are the main elements of collective identity [15]. The identity theory founded by Stryker (2008) emphasizes the restrictive role of social structure and culture on individual role identity [16]. Breakwell (2015) believed that advances in science, technology, and medicine, political unrest, and changes in economic development will affect people's lifestyles, how they see themselves and each other, and how they communicate. This

requires us to constantly adjust our identity and behavior [17]. Syed (2015) proposed the concept of identity integration and discussed the concept and methodology of four forms of integration. He believes that contextual integration and temporal integration have been recognized by most people, while self-integration and human-society integration need to be further studied. Todd's (2018) research shows different aspects of individual identity change (synchronic identity innovation, diachronic direction change, and broader social outcomes), requiring different analysis and measurement methods [19]. According to Vignoles (2018), the formation, maintenance, and change of personal identity and social identity are constantly changing over time [20]. Scheepers (2019) argues that the strength and content of people's social identity depend on group characteristics and group norms, and have an impact on members ' emotions and behaviors [21].

(3) *In the field of social psychology.* The essence of identity is considered to be belonging in the sense of mind, and more attention is paid to the belonging of identity at the psychological level. The main theories are self-identity theory and social identity theory. In terms of self-identity, scholars mainly focus on the confirmation of individual identities, such as the self-development theory proposed by Allport (1961), and Erikson's (1963) 'self-identity theory [23]. In the aspect of social identity, scholars emphasize the attribute of social identity and explain the formation process from individual identity to group psychological identity. Tajfel (1978) proposed the concept of "social identity" and interpreted it as an individual's recognition of his or her belonging to a particular social group, as well as the emotional and value significance of being a member of that group. Scholars also studied social classification, group differentiation, inter-group conflict, and marginal social identity (Tajfel & Turner,1979; Turner et al., 1987; Hogg & Abrams, 1988; Hogg & Terry, 2000; Hogg, 2016) [25-29]. Other scholars have expanded their research scopes, such as Phinney's (1989) racial identity theory [30] and Burke's (2009) identity control theory [31]. In particular, Castells (2006) in "The Power of Identity" shows that the most important change in the online society is the transformation of social identity based on new media such as the Internet and mobile communication [32].

(4) *In the field of communication.* Mcluhan (1964) of the media environment school believes that any medium is nothing more than the expansion or extension of human senses and senses: text and print media are the extensions of human visual ability, radio is the extension of human auditory ability, and television is the comprehensive extension of human visual, auditory and tactile abilities; moreover, he also pointed out that each new media has created a new way of social life and social behavior. The media is the basic driving force for social development and a sign of distinguishing different social forms [33]. Meyrowitz (1985) argues that the new media have changed our

perceptions and behaviors of various social roles by altering the types of contexts in which various social groups come into contact [34].

(5) *In the field of economics.* Akerlof & Kranton (2000), the pioneer of " identity economics", believes that social environment can influence people's identity and preference, and then shape people's choice behavior. They introduced the concept of "identity" in social psychology into the framework of economic analysis [35]. The theoretical system holds that each person's identity is diverse, and each identity corresponds to different social norms, which determine the behavior of a certain identity [36]. Kranton (2016) established utility functions and game theory models to reveal how identity affects people's preferences, thereby changing individual behavior, and how identity affects economic activity [37].

To sum up, many scholars' research on identity and its construction explains the confusion of "who I am" and "which group I belong to" in people's minds and illustrates the significant influence of the social environment on identity and its behavior. At the same time, the study of surface identity cannot be separated from the theoretical issues such as subject, consciousness, and social relations, and social relations and subject consciousness are different in different historical and cultural contexts, that is, people's identity will change with the times.

However, since the 1990 s, with the rapid development of Internet information technology, the global economic and social environment has rapidly transitioned to digitization, and social life has achieved large-scale digital changes. People's communication has expanded into new fields, and the explosive growth of information has also broadened people's cognitive structure. We have reason to believe that the digital society will make people have a new identity, that is, digital identity. So, what is digital identity?

At present, there are two understandings of the concept of digital identity in academia. One is the sum of digital information formed by individuals participating in network activities that can represent their identity (Dong, 2018) [38]. The other is the Internet identity (or role) established by Internet users in the Internet community or website, also known as "Online identity" or "Internet identity" to represent (Turkle, 1999; Calvert, 2002; Bentley et al., 2020) [39], [40], [41]. Based on different research schools and theoretical ideas, this paper defines digital identity as the identity of individual netizens in the digital age to the digital role of themselves, and the digital social identity of individual netizens with common interests to belong to one (or more) Internet groups (communities). In essence, digital identity is the significant impact of Internet information technology on people's internal psychology and external behavior in the process of innovating social life and production methods. Moreover, with the continuous iterative update of Internet information technology, people's digital identities will also change further.

1.2 Research on the digital identity of the elderly

Starting from the extension of the concept of digital identity, the author believes that the concept of digital identity of the elderly can be defined as the self-identity of the elderly in the digital age for the digital role, and the digital social identity of the elderly with common interests for belonging to one (or more) Internet groups (communities). The changes in the digital identity of the Chinese elderly in the digital age are mainly analyzed from the perspectives of self-identity and social identity.

On the one hand, the rise of the digital society has brought more and more elderly people into the digital world, which provides an effective mechanism for the elderly to transcend their boundaries, and also provides a convenient way for their digital identity. From the perspective of self-identity, Internet use strengthens the frequency and intensity of physical exercise for the elderly, and has a positive impact on their physical health of the elderly (Wang, 2021; Hou, 2022), [42], [43]; it can reduce loneliness and depression of the elderly (Sum, 2008) [44], and improve the life satisfaction and mental health of the elderly (Shapira, 2007; Heo, 2015) [45], [46]. At the same time, Internet use provides opportunities for older people to learn, thereby improving their cognitive function (Kamin, 2020), [47]. It can be seen that the positive impact of Internet information technology on the physical and mental health and cognitive ability of the elderly makes the elderly continue to strengthen their self-identity of personal digital identity. From the perspective of social identity, digital society is both a new social form and a new social model (Castells, 1999) [48]. In the digital society, people are gradually liberated from traditional social relations and enter cyberspace that crosses the boundaries of time and space. With the large-scale network development of social life, digital media has gradually formed a new collective consciousness and then formed a common cognition. The digital society has gradually formed a new social identity (Cui, 1999) [49]. Moreover, various new information media in the digital society have had a profound impact on the traditional way of life and thinking. With the increase in the frequency, depth, and breadth of Internet use by the elderly, their identity in the digital society will continue to be strengthened. Studies have shown that the Internet has become an important tool for the continued socialization of the elderly (Chen, 2015) [50], which not only enhances the cognitive ability of the elderly (Kamin et al., 2022) [51], but also promotes the social participation of the elderly (Jin, 2019) [52], and also promotes the accumulation of social capital (Wu, 2013) [53]. At the same time, the mastery and application of Internet information technology have a positive effect on the labor participation of the elderly (Friedberg1,2003; Schleifer, 2006; Biagi et al., 2011; lv et al., 2020) [54-57]. It can be seen that the elderly group has continuously improved their social

participation ability with the help of Internet information technology, thus promoting the digital identity and transformation of the elderly.

On the other hand, the Internet technology revolution also has an impact on the traditional family power relationship, prompting the elderly to re-examine their self-worth and enhance their active awareness of continuing socialization. The Internet technology revolution has led to tremendous changes in the mode of production. The production function of the family has shifted to society. People choose to participate in the social division of labor according to opportunity cost, social needs, and skills. The economic sources of people engaged in non-agricultural industries are mostly wage income (Guo, 2016) [58]. The traditional extended family is gradually transformed into a core small family, and the parents gradually lose supreme authority and absolute dominance over the younger generation (Kang, 2011) [59]. On the contrary, under the influence of the concepts of equality, democracy, and freedom, the consciousness, and ability of independence of the offspring are increasing, and the economy and personalities are becoming more and more independent, which makes their dependence on their parents gradually weakened, and the status of the elders in the family power structure is decreasing (Hao, 2008) [60].In addition, with rich network language expression experience and interpretation ability, the offspring occupy the highland of meaning order in the network communication between generations, which makes the family relationship dependent on the network platform to maintain emotional communication, and gradually take children as the axis of emotional interaction and meaning expression (Wu, 2018) [61]. Under the dramatic changes in the technological revolution and family relations, the consciousness of the elderly to continue socialization through the Internet has also been awakened.

At the same time, the widespread dissemination of the concept of active aging also enables older persons to improve their quality of life by achieving health, participation, and security. The United Nations defines active aging as: "Improving the quality of life of older persons and creating the best opportunities for health, participation, and security" (WHO, 2012) [62]. Essentially, active aging is the process by which retired older persons maximize their health, social participation, and social security opportunities to improve their quality of life. Among them, "participation" is the core, because the active social participation of elderly individuals is an important way to maintain their health and obtain better quality assurance. The participation of the elderly in learning activities can improve life satisfaction and physical and mental health (Oliver et al., 2017; Tam & Chui, 2016) [63] [64], helping to build positive self-awareness and reduce loneliness in older adults (Hwang et al., 2020) [65]. Moreover, participation in learning helps to improve the knowledge, experience, and skills of older persons, enabling them to better participate in social activities and expand relevant social networks (Grosso, 2018) [66]. Finally, through participation in learning

activities, the elderly actively responds to various changes and challenges from within and outside the individual and then form an integrated and perfect self-concept, that is, identity reconstruction (Zhang, 2013) [67].

In summary, people's s identity has an important impact on social and personal development in all ages. Obviously, in the digital age, the digital identity of the elderly is also an important issue in modern social governance. Although some scholars have studied the negative and positive effects of computer use and Internet use on the participation of the elderly in social activities, the concept of digital identity for the elderly has not yet been concluded, and a comprehensive analysis of digital identity changes for the elderly. The literature on social participation activities is still very scarce. So, what is the status quo of the digital identity of the elderly? What is the mechanism of the elderly's digital identity change and participation in labor participation? To explore the answers to these questions, this paper will analyze the Chinese elderly group with the most significant change in digital identity in the digital age.

2. Status quo of identity change in China's elderly in the digital era

Digital society, as a specific form of social culture, social operation, and network digital life has a cross-domain connected and secure in state, independent operation, continuous interaction, data sharing, resource integration, efficient collaboration, intelligent control, and other significant characteristics of the industry development, public services and a wide range of influence in the fields of social life. In the digital era, the individual is like a node on the social network. The identity of the individual is bound to adapt to the new social norms emerging in the digital transformation of society, and then gradually determine their role positioning in this social and cultural order.

2.1 The rapid transformation of the economy and society to digitalization accelerates the identification of the digital identity of the elderly

According to statistics, by the end of December 2021, the number of Internet users aged 60 and over in China increased from 40 million in December 2017 to 119 million (Figure 3), with an Internet penetration rate of 43.2 % [68]. Obviously, with the rapid development of China's society to digital transformation, the social living environment of the elderly has been quickly overshadowed by the Internet, prompting a surge in the number of elderly Internet users and a significant change in the proportion of Internet penetration, which has led to the self-identity of the digital identity of the elderly. In addition, with the widespread application of Web 2.0 technology, rich, multi-dimensional, and frequent network interactions have further changed people's perceptions of digital identity (Wood, 2001) [69].

Fig. 3: Growth Trend of China's Elderly Internet Users (Unit: per 10,000 people)[2]
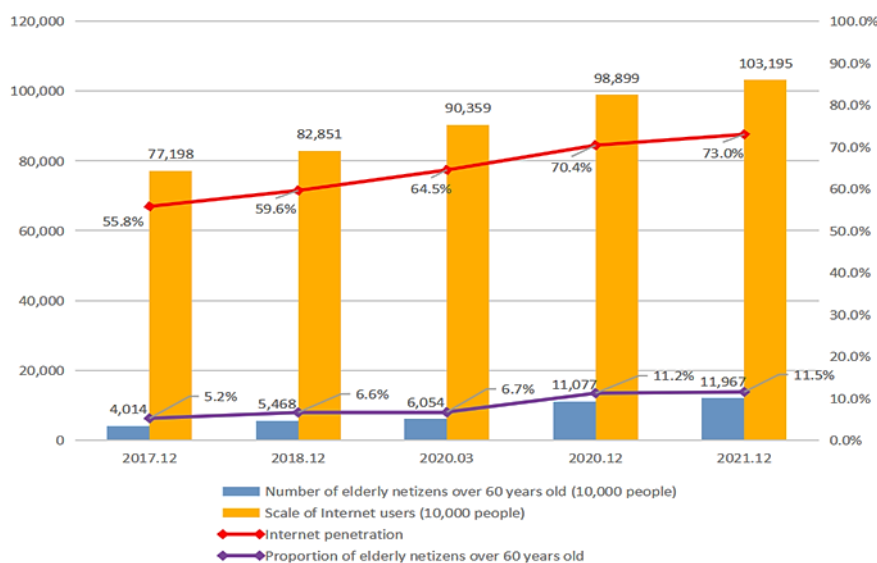
By the end of December 2021, the most commonly used Internet applications for Chinese elderly Internet users include instant messaging, online video, Internet government services, online news, and online payment. The number of users reached 107.4 million, 100.5 million, 0.968 million, 0.924 million, and 0.837 million, respectively, with usage rates of 90.6 %, 84.8 %, 80.8 %, 77.9 %, and 70.6 %, respectively (Figure 4) [68]. Data on the number of users and usage of these Internet applications indicate that the majority of older persons have rapidly integrated into the digital society and that there is a growing social acceptance of digital identities.

**Fig. 4: Proportion of Internet Applications among Chinese elderly Netizens, (Unit: per 10,000 people)[3]**
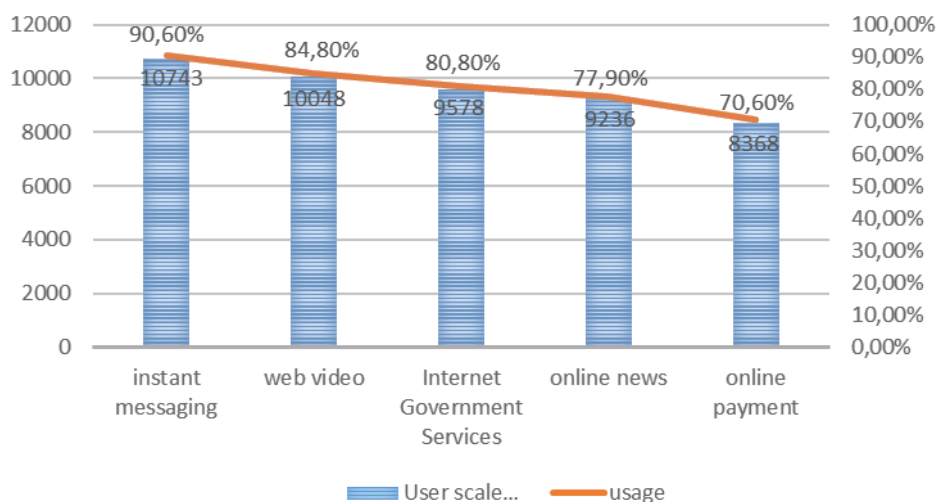
2.2 The change of power relations within the family promotes the evolution of the digital identity of the elderly

Since the implementation of China's reform and opening-up policy in 1978, the modern industrial economy has gradually replaced the dominant position of the agricultural economy, which has led to the large-scale flow of labor force, which has led to great changes in family structure and internal relations. According to the Seventh Chinese Population Census released by the National Bureau of Statistics of China in 2020, on the one hand, the average family size in China decreased from 3.96 in 1990 to 2.62 in 2020, and it is still in a continuous decline. On the other hand, the number of Chinese family households increased from 277 million in 1990 to 494 million in 2020, an increase of 217 million in 30 years [70]. The reasons are as follows: first, the traditional family security system has been gradually replaced by the modern social security system. With the improvement of social productivity and the gradual improvement of social security systems such as medical care, old-age care, education, and public services by the state, most of the development resources originally allocated by the parents to the children in the family and family have been transferred to the burden and distribution of the state (Figure 5). This transformation has greatly impacted the traditional family norms and power structure with the vertical father-son relationship as the family axis (Li,2021) [71]. On the other hand, the labor utility of the father decreases, while the wealth-creation ability of the offspring increases. Due to the deterioration of the physiological function of the elderly year by year, their ability to participate in paid labor is also gradually declining. The old people have been reduced from the former "family economic pillar" and "dependent" to the current "caretakers" and "dependents". Children, on the other hand, with the aid of national compulsory education, public health, financial and other public services, and the resources of the social security system, in the economic income, level of education, social capital, and other aspects of the larger accumulation, gradually get rid of the parent resource constraints, and daughter relationship as the axis of modern family norms and power structure (Liang, 2022) [72]. Based on the above reasons, some elderly people are unable to inherit their original strong position from the traditional society, which weakens their family decision-making power and marginalizes their status, and leads to a decline in their independence and freedom of life, even affecting the repression and distortion of their independent personality. The world-famous writer and great thinker Spencer Johnson once said that "the only constant is change itself". In response to the crisis, many older people realize that only by adapting to the lifestyle of the digital society can they have a more colorful digital later life. Only by learning digital skills can the elderly realize their healthy development, cognitive development, value development, and role development, and further realize their self-worth. Combined with the above data on the digital integration of the

elderly into the digital age, we believe that the drastic change of power relations within the family makes the identification of the digital identity of the elderly change from "passive acceptance" to "active transmutation".

Fig. 5: Development Trend of China's social security system (2012-2021)[4]
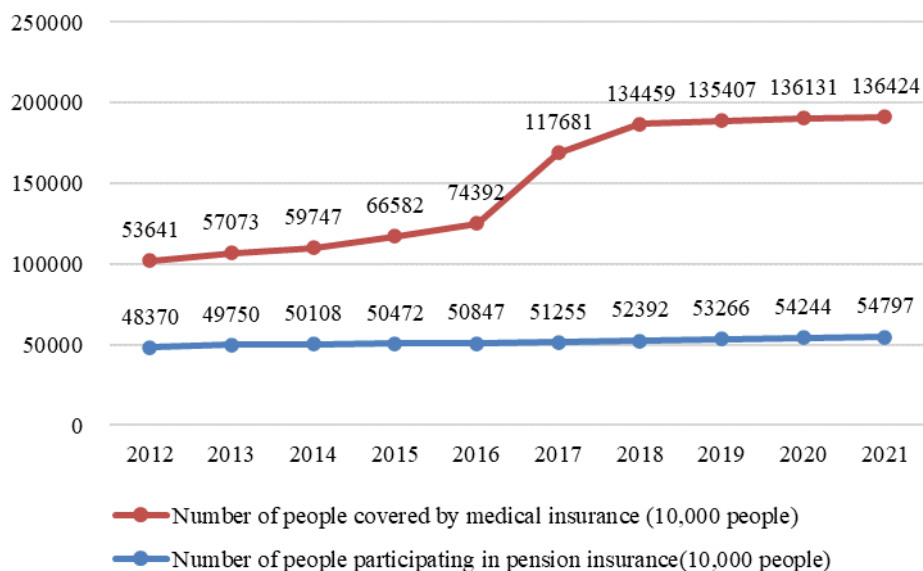
2.3 Family feedback and social education provide an effective path for the reconstruction of the digital identity of the elderly

It is an indisputable fact that there is a serious digital divide between the elderly and the young in China. In the face of the rapid iteration and update of Internet information technology, under the background that the traditional social lifestyle is gradually replaced by the digital and intelligent social lifestyle, the situation that the elderly is marginalized in the digital society is becoming more and more obvious. Family digital feedback and social digital education provide an effective way to realize the 'self-transcendence' of the elderly (Zhou, 2015) [73]. *On the one hand, family digital feedback improves the digital awareness of the elderly.* Family is the main place for the elderly to improve their digital literacy. As of December 2021, China had 485 million fixed Internet broadband access users with access rates of 100Mbps and above, accounting for 92.1 percent of the total number of users, and 99.5 percent of elderly Internet users use smartphones to access the Internet [74]. This makes it easy for the elderly to cross the first-tier digital access divide. Many elderly people through the child in the family and the guidance of self-study, grasp the present health code, online social networking, watching a short video, online reading, through friends, online payment, searching basic digital life skills, such as simple information so most

elderly netizens can under the digital feedback of family members across the second digital use divide. It can be seen that family digital feedback improves the digital awareness and skills of the elderly in China, effectively promotes the identification and evolution of the digital identity of the elderly, and lays a good foundation for the reconstruction of their digital identity and the crossing of the third layer of the digital knowledge divide. *On the other hand, government-led digital literacy social education activities have improved the digital skills of the elderly.* On the policy front, to effectively address the difficulties of digital inclusion of the elderly, the General Office of the State Council of China issued the "Implementation Plan on Effectively Addressing the Difficulties of the Elderly in Using Intelligent Technology" in November 2020. According to the seven types of high-frequency items and service scenarios involved in the daily life of the elderly, such as travel, medical treatment, consumption, entertainment, and service, 20 specific measures were proposed to bridge the digital divide among the elderly. Among them, it emphasized that the elderly's ability to use smart technology should be listed as a key content of education for the elderly and that online and offline methods should be adopted to help the elderly improve their ability and level of using smart technology through universities for the elderly, service institutions for the elderly and community educational institutions [75]. In practice, many of these professional, systematic, and sustainable digital literacy education models not only effectively stimulate the elderly's enthusiasm for digital learning, but also guide more elderly people to integrate into the digital environment through online learning communities. According to the Report on the Development of Education for the Elderly in China (2019-2020), there are about 76,000 universities for the elderly in China, with about 10.882 million students, with an average annual growth rate of 12.7%. More than 80 percent of the students are under 70 years old, with 60 to 69 years old accounting for about half of the total number of students [76]. It can be seen that the digital literacy education activities of family and society have become an effective way to reconstruct the digital identity of the elderly and to bridge the digital divide.

3. The mechanism of digital identity change on labor participation of the elderly

3.1 Digital identity increases the elderly human capital stock

Population aging and digitalization are important trends in global social development, as well as the basic national conditions of China for a long period in the future. Population aging will reduce the supply of the labor force, increase the burden of family pensions, and pressure on the supply of basic public services. Digitization, on the other hand, subverts the old people's original life skills and experiences, forces them to accept new identities and skills, and brings new experiences as well as pressure to the old people's participation in social activities. Currently,

among China's population aged 60 and above, the elderly aged 60-69 account for 55.83 percent, or about 146 million people [77]. These young elderly people have the advantages of knowledge, experience, and skills, and their physical condition is OK. Most of them can master the basic skills of digital life, such as online social interaction, shopping, ordering food, booking cars, and buying tickets, through simple training, and have good potential for human capital development. Along with the further extension of the aging population life and the improvement of health, if we can inspire from the inner face of digital life will and strengthen the identity of the old digital identity and social identity, the implementation of appropriate digital fu can plan (increased digital literacy education), giving full play to the advantages of digital information technology, is conducive to China from the population burden to longevity bonuses. In the digital age, the self-identity and social identity of the digital identity of elderly are the ideological keys to promoting the labor participation of the elderly. This will objectively accumulate a large number of young and elderly human capital who will volunteer to serve society again, and then alleviate the problem of labor shortage caused by population aging.

3.2 Digital Identity Evolution Stimulates Endogenous Motivation of Elderly Labor Participation

Under the dual effects of traditional prejudice and the axis shift of family intergenerational relations, many elderly people become marginalized in society and family. Maslow's hierarchy of needs theory believes that the realization of self-worth is a higher level of spiritual needs. As the elderly gradually identify with the digital identity, their spiritual needs to achieve self-worth are stimulated, which in turn produces a strong internal driving force for the realization of self-worth. *First, improve physical and mental health.* The elderly can learn a wealth of health-related knowledge from the Internet, improve health awareness and health literacy, develop healthy living habits, and focus on preventing various diseases, thereby improving physical and mental health, and building a healthy foundation for elderly labor participation. *Second, enhance the autonomy of the elderly life.* Some elderly people have realized shopping, entertainment, medical care, government affairs, finance, public payment, and other activities with the help of the Internet. The elderly enjoy the convenience and autonomy of digital social life, and also provide the possibility to realize labor participation through time and space constraints. *Third, it is convenient to obtain family emotional support.* Chatting with family and friends through Internet social software can maintain close relationships, relieve loneliness, relieve mood, obtain health help and emotional support, and effectively alleviate loneliness and depression. With the support of the family can better integrate into the digital society and participate in labor. *Fourth, awaken the elderly self-evolution consciousness.* In the digital age of 'The Internet of Everything', in the face of the crisis of digital

identity, many elderly people's awareness of digital identity has been awakened, and it is the general trend to learn the skills of using the Internet. Only by continuing to integrate into the colorful digital life through socialization can we regain confidence in life and work. *Fifth, stimulate the elderly desire to realize self-worth.* Internet use enhances the opportunities for social participation of the elderly, enabling them to participate in various aspects of social life in a variety of ways and to realize self-worth while realizing social value. It can be seen that the evolution of digital identity helps the elderly to re-establish a correct outlook on life and values, regain their dignity, value, and health as human beings, cross the inner "digital divide", stimulate the endogenous motivation of the elderly to participate in labor, and thus reduce the difficulty of developing human capital for the elderly.

3.3 Improving digital literacy is conducive to the reconstruction of the digital identity of the elderly

The reconstruction of digital identity is a process of further improving the digital literacy of the elderly through the cooperation of the elderly, family, and society, relying on family and social resources to cross the digital divide. Improving digital literacy is a process for the elderly to cross the digital divide and achieve "transformation", which is of great benefit to improving the quality of labor supply for the elderly. *First, family digital feedback gives the elderly basic digital life skills and subjective well-being.* On the one hand, the digital feedback behavior within the family helps the elderly to cross the digital divide between the first layer and the second layer based on the family Internet hardware and software resources and improves the digital life ability of the elderly. On the other hand, it can help improve the intergenerational family relationship, make up for the depression and other bad emotions of the elderly due to the loss of the axis position of the intergenerational relationship, promote harmony within the family, and enable the elderly to get family support through social participation. *Second, socialization professional training can improve the elderly's digital social participation ability.* The special series of training on digital literacy education for the elderly set up by universities and community service institutions for the elderly can make up for the shortcomings of the lack of family digital feedback specialty and system. It is of great benefit to the elderly to safely access the Internet, identify false information, prevent financial fraud, and psychological counseling. The elderly group can discuss with each other in collective learning, help each other, and improve together, but also can stimulate the elderly's sense of competition, and strengthen the learning effect. *The third is to broaden the information horizon of the elderly.* The vast amount of news, video, audio, books, and other content on the Internet has broadened the horizon of the elderly and also become their source of job information. *Fourth, accumulate knowledge capital.* With the wealth of knowledge and information available on the

Internet, the elderly can accumulate considerable knowledge, and find the joy of digital life and self-role positioning, so that they can maintain enthusiasm for social participation. *Fifth, we need to expand social capital.* The use of Internet social media can not only enhance interpersonal connections and maintain existing interpersonal relationships, but also contribute to the accumulation of online social capital, further enhance life satisfaction and happiness, and effectively alleviate the psychological pressure caused by individual degeneration and the evolution of intergenerational relationships. *Sixth, the Internet provides more opportunities for the elderly to realize their self-worth.* With the help of information resources and online communities on the Internet platform, some elderly people have returned to work and increased their personal and family income. Some serve the public as community volunteers. Some older people make short videos with the help of TikTok and other we-media platforms, become "Internet celebrities" with millions of fans, and continue to create wealth and value through live streaming and bringing goods.

To sum up, the technical logic of the network society is reshaping the digital identity of the elderly in the real world and the virtual world, opening the thinking key for elderly labor participation in the digital age. Various emerging digital media are accelerating the evolution of the elderly in the context of digital communication. Therefore, while facing unprecedented subversion, the elderly are also fully enjoying the evolution of digital self-identity and social identity brought about by technological evolution, which will lead to the behavioral logic of the middle-aged and elderly groups in the network society, which is different from that of the industrial society, and become an endogenous driving force to stimulate the elderly to participate in labor and realize their self-worth in the network era; to deal with the digital age and the technical logic behind it, modern society should actively reconstruct the cornerstone of the matching digital identity of the elderly, to promote the timely adaptation of the elderly to digital identity in the highly mobile technological evolution, thus continuously improving the digital literacy of the elderly and broadening the ways of labor participation of the elderly.

Conclusion

Through the analysis of the current situation and mechanism of the digital identity, evolution, and reconstruction of the elderly in China, this paper finds that Internet use is the process of the elderly's continued socialization and self-identity reconstruction in the digital society. This process not only stimulates the desire of the elderly to realize their self-worth but also improves the quantity and quality of their human capital, which reserves a large amount of human capital with certain digital literacy to make up for the decline of the age-appropriate labor force in China's aging society. Therefore, the government should clear obstacles for the elderly to cross the digital divide

from the perspectives of policy support, infrastructure improvement, and digital literacy education system construction. Enterprises should pay attention to the age-appropriate transformation of digital hardware and software to adapt to the user needs of the elderly. Meanwhile, the younger generation in the family should actively transfer digital thinking, digital skills, and network security awareness to the elderly, stimulate their confidence in using new media, and lead them to better adapt to digital life.

Acknowledgements

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