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International experience in promoting elderly labour supply in the context of digital transformation and its enlightenment to China

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Abstract. ***Relevance.*** In order to alleviate the problems of labour reduction and heavy financial burden caused by population aging, some developed countries have implemented policy reforms to develop the resources of the elderly, and provided educational measures to improve digital literacy for the elderly in combination with the fact of digital transformation. These positive measures have not only achieved certain results, but also provided a reference for China to deal with aging. ***Aim.*** To summarise the measures and experiences in developing geriatric resources in typical developed countries, and to gain insights from them, and then to make suggestions for China's response to population ageing. ***Methods.*** Based on the collection and collation of objective facts and statistical data, this paper summarises the current situation of aging in Japan, Germany and Singapore and the reform measures for the development of human resources for the elderly, and uses induction to analyse the internal logic of the successful experience of these countries in developing human resources for the elderly. ***Results.*** The author has summarized and analyzed the measures and experience of Japan, Germany and Singapore in developing geriatric resources in the dual context of ageing and digitalisation as well as logic of the positive results of developing geriatric resources. Combined with the current situation of the development of human resources for the elderly in China, some suggestions are put forward for the development of human resources for the elderly in China. ***Conclusions.*** The establishment of a sustainable pension system, the formulation of policies to promote the employment of the elderly, and the provision of a service system for the elderly, such as old-age security, education and training, are the necessary prerequisites for the development of the elderly's human resources. The construction of a digitally inclusive social environment of positive aging, and the enhancement of the elderly's digital literacy through a variety of ways have better benefits for the elderly's confidence in the labour supply and the increase in the rate of labour force participation. Constructing a synergistic mechanism based on stakeholders such as the government, enterprises, families as well as the elderly stimulates the elderly labour supply and other social activities.

Keywords: digital transformation, aging, elderly labour supply, digital literacy, delayed retirement

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Международный опыт стимулирования предложения труда пожилых людей в контексте цифровой трансформации и его ценность для Китая

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Аннотация. ***Актуальность.*** Для того чтобы смягчить спроблемы сокращения рабочей силы и усиления финансового бремени, вызванного старением населения, некоторые развитые страны проводят политические реформы, направленные на развитие ресурсного потенциала пожилых людей, предоставляют им возможность участия в образовательных программах, нацеленных на повышение их цифровой грамотности в условиях цифровой трансформации современного общества. Эти позитивные национальные инициативы уже принесли определенные результаты, они являются примером для Китая в реагировании на старение населения. ***Цель:*** обобщить опыт повышения отдачи от ресурсного потенциала пожилых людей в экономически развитых странах, извлечь из него уроки и сформулировать предложения для Китая по реагированию на старение населения. ***Методы.*** Проанализированы статистические данные о реагировании Японии, Германии и Сингапура на старение населения, с помощью метода дедукции обобщена логика успеха этих стран по раскрытию трудового потенциала пожилых людей ***Результаты.*** Обобщен опыт действий Японии, Германии и Сингапура в развитии ресурсного потенциала пожилых людей в контексте старения общества и цифровизации экономики, выявлены основные факторы их успеха. Предложены рекомендации по интеграции описанного опыта в развития резусного потенциала пожилых людей в Китае. ***Выводы.*** Устойчивость пенсионной системы, политика содействия занятости пожилых людей, развитие системы образовательных услуг для пожилых людей являются необходимыми предпосылками для развития их резусного потенциала в стареющем социуме. Инклюзивная цифровая среда и цифровая грамотность пожилых людей создают условия для роста доверия пожилых людей к современному рынку труда и повышения уровня их участия в рабочей силе. Синергия усилий правительства, работодателей, семей, а также самих пожилые люди стимулирует предложение труда пожилых людей в стареющем социуме.

Ключевые слова: цифровая трансформация, старение, предложение труда пожилых людей, цифровая грамотность, отложенный выход на пенсию

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Introduction

China is the world's second most populous country, China's elderly population has been growing rapidly since 2000, and by the end of 2022 China will have 210 million people aged 65 years and older, accounting for 14.9% of the national population [1]. This means that China has entered a moderately aging society. The United Nations Population Division predicts that by 2050, China will have one of the highest proportions of the elderly in the world [2]. It is likely that China's aging population will cause a serious shrinkage of the labour force. This will in its turn affect China's future economic and social development. From a worldwide perspective, a series of geriatric resource development policies implemented in some developed countries have not only led to a significant increase in the motivation of the elderly to participate in society [3, 4], but also positively impacted the improvement of the elderly's economic situation, social circle, physical and mental health [5]. Therefore, this paper analyses the successful reform measures and experiences of Japan, Singapore and Germany in the development of human resources for the elderly, and explores the implications of these initiatives for China's response to population ageing, and finally puts forward recommendations with a certain degree of operability and feasibility in the context of China's national conditions.

International experience in the development of human resources for the elderly: the examples of Japan, Singapore and Germany

The experience of human resource development for the elderly in Japan under the digital background

Japan is the latest among the industrialised countries to enter into an ageing society; in 1969, the proportion of the elderly aged 65 years and above was 7%, which was the beginning of a mildly ageing society, but the speed of population ageing in Japan after it became an ageing country is the fastest among the developed countries. In 2022, the total number of elderly people aged 65 and over in Japan was 393.4 million, accounting for 29.4% of the total population of Japan [2]. According to the data released by the World Bank in 2022, the life expectancy of the Japanese population is 84.5 years old, and the life expectancy of the Japanese population ranks first in the world [6]. Although the population aging situation in Japan is very serious, the Japanese government has taken many measures to promote the active employment of the elderly, and the labour force participation rate of the elderly aged 55–64 and 65 and over is currently ranked firstly in the world [7]. Population aging has not stopped Japan's economic development, according to the International Monetary Fund (IMF), in 2022 Japan's total economic output of 5.30 trillion U.S. dollars, ranked third in the world, and the scale of the development of the digital economy ranked fourth in the world [8].

In order to solve the problem of labour shortage caused by serious population ageing, Japan has taken a series of reform measures at the policy level.

(1) ***The implementation of delayed retirement policy.*** In 1971, Japan enacted the Act on the Stabilisation of Employment for the Elderly, which explicitly raised the labour retirement age from 55 to 60. In 1986, the "stability law" was enacted and the 60-year-old retirement system was introduced. In 2004, Japan amended and improved the law, requiring enterprises to raise the retirement age in phases, and ultimately raising it to 65. In 2013, Japan amended and implemented the new "stability law" here, stipulating that enterprises must remove the restrictions on continuing employment, so that employees who want to work can work until they are 65 years old. As the implementation of the new law stipulates the obligation of enterprise employment, the system is also called "65-year-old retirement system". In 2021, Japan passed the amendment of the "Employment Stability Law for the Elderly", requiring enterprises to fulfill their obligations to hire the elderly and hire the elderly who want to continue to work until the age of 70. The implementation of this policy extended once again the time of economic activities for the elderly, further increased the economic

value of the elderly, reduced the downward trend of the working-age population in Japan to a certain extent, increased taxes, reduced the financial burden of old-age care, and eased intergenerational conflicts. It is conducive to the formation of a positive aging social atmosphere [9].

(2) ***Reform of the pension system.*** Japan's pensions are mainly divided into national pensions, thick life pensions, communal pensions and corporate pensions. Since its establishment, the national pension set the age of receipt at 65 years old. As it is a basic pension, the government has not postponed the age of receipt. While the thick life pension is related to personal income, in recent years the government has gradually delayed the receipt of the thick life pension by level and gender, and the incentive for delaying the receipt of the thick life pension is that the later the person receives the thick life pension, the more he or she receives; in 2022, the upper limit for delaying the receipt of the thick life pension in Japan was raised from 70 to 75 years of age. This Japanese government policy of encouraging the elderly to delay receiving their pensions not only reduces the government's financial burden, but also promotes the elderly to continue to work after retirement, which in its turn improves the problem of labour force shortage brought about by the reduction of the number of children [10].

(3) ***Provide legal protection for the employment of the elderly*****.** In order to provide good employment opportunities, environment and treatment for elderly workers, the Japanese government enacted laws and regulations to promote the re-employment of the elderly, such as the implementation of a series of legal amendments to the Employment Insurance Law (1975), the Basic Law for Countermeasures against the Elderly (1995), etc., as a way to improve the treatment of non-regular employees, including elderly workers, and to protect the re-employment of the elderly by the rule of law, explicitly prohibiting age discrimination in hiring by employers, and obliging employers to continue hiring older workers through legal means [11, 12].

(4) ***Establishment of online and offline talent service markets.*** Japan established online and offline markets for elderly talent services, including the Ginga Talent Centre, the Tokyo Work Centre and the Public Employment Security Office, with the aim of assisting the elderly to find employment. The Silver Hair Talent Centre provides a wide range of job opportunities matching the elderly according to their physical fitness, work experience and willingness to work, and so on. The Tokyo Work Centre provides employment opportunities for the elderly and helps to solve problems encountered by the elderly at work. The Public Employment Security Office set up a special service window for job introduction and employment training for the elderly [13].

(5) ***Formulate measures to encourage enterprises to employ the elderly and promote flexible employment for the elderly.*** The Japanese government encourages enterprises to employ the elderly through sound laws, tax incentives, financial loans and other means. The Japanese government enacted the "Elderly Employment Stability Act (2013)", which stipulates that enterprises are obliged to ensure the employment of the elderly and abolish the age limit for recruitment. The government rewards enterprises that actively create jobs for the elderly by formulating the system of "increasing the retirement age bonus" and "setting up" special funds for the elderly to hire", and gives certain subsidies or tax incentives to enterprises [14]. At the same time, policies have been introduced to guide the elderly into flexible employment. For the elderly who want to extend their working years and have special needs (such as being weak or needing more time to take care of their families), the ideal employment model is a flexible employment model. In 1993, Japan enacted the first flexible employment law "Employment Management Law for Short-Term Workers". In 2012, the "Labor Contract Law" was amended to strengthen the protection of flexible employment for the elderly. At the same time, many local governments in Japan provide short-term, temporary flexible employment opportunities for the elderly through "senior talent centers" [15–17]. These measures not only improve the employment rate of the elderly, but also help enterprises solve the problem of labor shortage.

In the face of the wave of digitisation, the Japanese Government attaches importance to building a digitally inclusive society and helping the elderly to adapt to the digital environment.

Firstly, in 1990, Japan adopted the "Lifelong Learning Revitalization Act", which set a world precedent [18]. In 2018, Japan introduced the "Lifelong Learning Revitalization Act", which strengthened the integration of lifelong learning policies and resources. Lifelong learning centers were set up throughout Japan to promote the learning of the elderly, and public facilities were used to set up courses for the elderly [19].

Secondly, it is to make use of joint efforts to bridge the digital divide among the elderly. Through a variety of means, such as policy advocacy by the government, technical support by enterprises and product innovation by digital product providers, the digital divide among the elderly was bridged to a certain extent. In addition, the Japanese government has formulated a series of digital policies for the elderly to improve their digital literacy and social participation. For example, in 2016, the Society 5.0 vision mentioned in the fifth "Basic Plan for Science and Technology" was formulated to integrate the digitisation of the elderly into it, and to create a society, in which the elderly can easily use digital technology through measures such as smart cities, technological services for aging reform, and digital training. Through the "programmed production" project and other plans, digital, automated and intelligent production, the labour intensity and the skill threshold of traditional process technology are reduced, more employment opportunities and sustainable career development are provided for the elderly, and the elderly are better adapted to the digital employment environment [20].

The experience of human resource development for the elderly in Singapore under the digital background

Singapore is an internationally important trade transit point and world centre for electronics manufacturing as well as a financial centre and transport hub for Southeast Asia. Its digital economy is among the largest in the world. Its GDP per capita in 2022 reached US$82,800, ranking it 6th in the world [21]. However, with a population of about 5.64 million, Singapore is also facing the problem of an ageing population. In 2022, the proportion of Singaporeans aged 65 years and above is 18.4%, which is second only to Japan and South Korea in Asia in terms of the degree of ageing [22]. Therefore, Singapore attaches great importance to the development of elderly human resources. The data show that the employment rate of residents aged 65 and above in Singapore increased from 28.5% in June 2020 to 31.7% in June 2021 [23].

Singapore has implemented a series of policy reforms on the development of human resources for the elderly in order to address the worsening problem of population ageing.

(1) ***Establishing an institutional framework for the development of human resources for the elderly.***

Firstly, a multi-tiered service system for the elderly was set up. In order to better respond to the problem of population ageing, the Ministerial Committee on Population Ageing was established in 1998 to build a comprehensive coordination mechanism, and the Ministerial Committee on Ageing was restructured and established in 2007. In 2015, the "Action Plan for Successful Ageing" was implemented, which includes 12 aspects such as health and well-being, lifelong learning, volunteerism for the elderly, lifelong employability, social inclusion, and the development of ageing-related research, which builds a good institutional framework for the integrated development of human resources for the elderly [24–26].

Secondly, the implementation of delayed retirement policy. Singapore raised the statutory retirement age to 63 in July 2022 and the age of re-employment to 68 years. And Singapore plans to raise the statutory retirement and re-employment age to 65 and 70 by 2030 [27, 28].

Thirdly, the implementation of individual self-support initiatives. Singapore is a non-welfare state that emphasizes the concept of self-reliance in old age, and the government organised a man-

datory defined contribution personal accumulation fund system called the Central Provident Fund (CPF) since 1955. The CPF is a comprehensive social security savings scheme with four sub-accounts, namely: the Ordinary Account, the Medical Account, the Special Account and the Retirement Account. The Retirement Account is an account that is opened when a CPF member reaches the age of 55, when the savings in the Special Account and the Ordinary Account are transferred to this account. The funds in the Retirement Account are the main source of pension. Everyone has to support himself/herself. The government does not pay out pensions to individuals, and all an individual can spend the CPF money he/she saved when he/she was young, which depends entirely on his/her salary income. As a result, most elderly Singaporeans extend their personal labour supply for economic reasons [29].

(2) *Developing incentives for businesses to hire older labour.*

On the one hand, Singapore adopted a fair and merit-based approach to expanding the age range for employers to recruit employees. The "Tripartite Guidelines on Fair Employment Practices" issued in 2007 and revised in 2011, stipulates that employers should recruit and select employees based on factors such as skills, experience or ability to work, rather than age, race, gender, etc. as employment requirements. The 2014 "Fair Consideration Framework" also stipulates that employers should not discriminate against factors such as age and gender when recruiting.

On the other hand, encouraging enterprises to hire the elderly labor. In 2001, Singapore introduced an incentive for employers of employees over 50 years of age to reduce the proportion of CPF contributions that should be borne by the employer. In 2011, a special employment subsidy scheme was launched, which stipulated that enterprises could obtain 8.5% of the monthly salary of Singaporean citizens over 50 years old with a monthly salary of no more than SGD $ 4,000. In 2015, the Singapore government introduced additional special employment subsidies to encourage enterprises to continue to employ people over 65 years old with a monthly salary of no more than SGD $ 4,000 [30].

The Singapore Government was early in paying attention to the issue of ageing in digital social transformation, and focused on building a digitally inclusive and friendly society for the elderly. To this end, the Singapore Government took three measures:

1. Developed systematic measures for a digitally inclusive active ageing society. Through strategies such as the "Smart Nation 2025 Plan" and the "Successful Ageing Plan", a top-level design for a digitally inclusive active ageing society was constructed, and a systematic organisational structure was set up that brings together multiple levels and sectors to safeguard the right of the elderly to digital inclusion. The "Silver Hair Programme" was launched successively. Multiple initiatives, such as the "Silver Hair Programme" and the "Digital Ageing" programme, were launched [31–33].
2. Improved digital infrastructure and expanded of digital access for the elderly. In the 1990s, Singapore took the lead in establishing nationwide broadband connectivity, with full deployment completed in 2000. In 2006, the Singaporean government put forward the "Smart Nation 2015 Programme", which makes full use of digital technology to build Singapore into a highly competitive smart nation. In 2017, Singapore set up the Smart Nation and Digital Government Working Group to enhance the quality of digital life and digital engagement of the elderly through a series of programmes covering all aspects of their daily lives to provide ease of access [34].
3. Focused on education to improve the digital literacy of the elderly. Singapore established the National Silver Academy (NSA) in 2015, as well as a number of online learning websites, to provide a wide range of vocational and digital education programmes for the elderly aged 50 years and above, covering different learning durations, learning styles and areas of study, and to improve the job skills of the elderly for re-entry into the workforce. The "Digital Ageing" project was launched as well. It provides tailor-made digital learning resources for the elderly. Launching the "Technology Connection" project leveraged the role of communities at all levels, setting

up community assistance stations for the elderly's digital transformation, and recruiting 1,000 "Digital Ambassadors" to assist the elderly in their digital transformation. At the same time, in order to support and encourage lifelong learning, the Singapore government introduced the "SGUnited Mid-Career Pathways Programme" and "SGUnited Skills" in 2015. These programmes subsidise up to 90% of course fees for middle-aged and older people aged 40 and above [35–37]. Singapore's series of measures have positive significance in promoting the digital transition and employment of the elderly, and helping them to better adapt to the digital society.

The experience of human resource development for the elderly in Germany under the digital background

Germany is one of the countries in Europe with the most serious population ageing. According to the statistics of the World Bank, for 2021, the proportion of the elderly aged 65 and above in the total population of Germany made up 22.17%, and the old-age dependency ratio will reach 34.66%, which indicates that the form of population ageing in Germany is extremely serious. But population aging did not stop the German economic development, Germany has taken a number of measures to actively promote the active labour participation of the elderly. In 2021, Germany's 55–64 years old labour force participation rate as high as 74.1%, ranked firstly in the European Union. In 2021, Germany's GDP per capita of 51,200 U.S. dollars, ranked fourth in the world. Meanwhile, Germany's digital economy in 2021 is $2,876.7 billion, ranking third in the world [38].

Germany has a series of measures in order to actively deal with the aging population and promote digital development.

(1) ***Reform of the social security system.***

On the one hand, in 1992, the German government changed from encouraging early retirement to restricting early retirement. Except for people who have been insured for more than 35 years or have lost their ability to work, they will no longer be given a full pension. In 1997, the statutory retirement age of German men was 63 years old, and that of women was 60 years old. In 2004, the retirement age of both men and women increased to 65 years old. In 2007, Germany adopted a program to raise the statutory retirement age from 65 to 67 by "gradual" starting from 2012 [39, 40].

On the other hand, the reform of the pension insurance system. Germany is the first country to establish a social security system in the world. In the 1880s, the Bismarck government adopted the "Disease Insurance Law", the "Industrial Accident Insurance Law" and the "Old Age and Disability Social Insurance Law". In 1911, these laws were merged into the "Imperial Insurance Law", which marked the initial establishment of the German social security system. In 1957, Germany began to implement the pay-as-you-go pension insurance system, that is, the pension paid by the current labour force pays the pension of the retiree. With the aging of the population, there are fewer and fewer laborers paying pensions to the national pension system, and more and more pensioners. In 2001, in order to make up the pension gap, caused by the reduction of the first pillar, Germany began to implement the "Liszt pension plan" and vigorously promoted the construction of the second and third pillars. In 2004, in order to solve the problems of insufficient pension coverage and unreasonable structure, the German government implemented the "Lurup pension insurance plan", which transformed the pension from the three-pillar model to the three-level model, and provided a pension plan for individual workers to enjoy the large amount and high proportion of government tax rebates. Germany's pension reform route not only guarantees the basic old-age security of the people, but also gives full play to the role of the market, alleviates the pressure of the government s pension responsibility, and promotes the development of pension finance through the coordinated use of fiscal and taxation policies [41, 42].

Develop a variety of active aging measures to promote the employment of the elderly.

Firstly, the implementation of flexible forms of employment. In 2007, in the revised contract law of Germany, it was clearly stipulated that enterprises can unconditionally sign limited-term con-

tracts with employees over the age of 52, which makes the employment situation of elderly workers more flexible and more attractive to employers.

Secondly, encourage the implementation of intergenerational cooperative human resource allocation within the enterprise. Many enterprises allocate the elderly labor force to positions such as vocational skills training or enterprise consultants, or adopt a mixed age group to work together to allow division of labour between young people and the elderly. This not only gives full play to the advantages of the elderly labour force in knowledge and experience, but also enables the successful experience accumulated within the enterprise to be inherited between generations and maintains the continuity of enterprise development [43].

Thirdly, launch a special plan to promote the employment of the elderly. In 2005, the German government launched a project called "Perspektive 50 Plus", which aims to promote the re-employment of the elderly workers over the age of 50. The project aims to help the long-term unemployed elderly to obtain economic and psychological assistance and re-employment through assistance in the three aspects of health, work flexibility and work ability of the elderly labour force. In addition, the German government's employment policy for the elderly tends to start with improving the employability of the elderly workers, rather than simply restricting the employment behaviour of enterprises through regulations. For example, enterprises are required not to allow age discrimination in the recruitment; in enterprises with more than 10 employees, the elderly workers enjoy the priority of being exempt from dismissal [44].

In the face of the wave of digitalisation, the German government is actively building a digitally inclusive active ageing society.

On the one hand, in 2016, the German government issued the "Digital Strategy 2025" and proposed 10 construction directions for digital transformation, including the construction of a Gigabit fiber network; supported the development of start-ups; promoted the construction of intelligent interconnection; promoted digital transformation of business models of small and medium-sized enterprises, handicraft industry and service industry; helped German enterprises to implement Industry 4.0; introduced digital education and training into various stages of life of citizens [45]. In August 2022, the German Federal Cabinet adopted a digital strategy presented by the Federal Ministry of Digital Affairs and Transport, which aims to advance the digitalisation of society, economy, and sciences. Under the slogan "Co-creating digital value", the strategy focuses on a networked and digitally sovereign society, an innovative economy, work, scientific research and a learning digital nation [46]. These measures provide more convenient and rich learning environments and resources to enhance the digital literacy of the elderly.

On the other hand, actively carry out education for the elderly. German academic universities and some universities of applied sciences have been regularly offering various courses for the elderly since 1979. Almost all specialisations at German universities, with the exception of a few restricted ones, are open to the elderly. At the same time, Germany actively promotes digital literacy integration into lifelong education. As early as the 1970s, the measures related to the cultivation of citizens' media literacy were incorporated into the basic system of compulsory education in Germany. In 2018, Germany issued the "High-tech Strategy 2025 Plan", promising to integrate media literacy education into all education fields, strive to improve citizens' digital literacy and transform the education system, so that this system is more compatible with digital survival, work, transaction and digital knowledge society. In terms of helping digital education for the elderly, build European Network "Learning in Later Life" for the elderly, encourage the elderly to learn and use digital technology independently, conduct digital skills training among the elderly, improve the ability of the elderly to use digital technology independently, and increase the autonomy and independence of the elderly. In addition, Germany promotes elderly active participation in digital communities and digital cultural activities, such as Internet learning classes for the elderly, screen readers and hearing aids to meet the needs of visually impaired groups of the elderly, and supports the promotion of mutual help groups for the elderly [47].

In summary, Japan, Germany and Singapore have adopted different institutional and policy reforms to promote the labor supply of the elderly, while also helping them adapt to the digitally transformed labour market. These measures have significantly increased the employment rate of the elderly in these countries, alleviated the plight of the country's labour shortage to a certain extent and reduced the social and financial pressure.

Implications for the development of human resources for the elderly in China

The experience of Japan, Singapore and Germany in the development of human resources for the elderly shows that increasing the labour participation rate of the elderly requires not only the establishment of a sustainable pension system, the development of a policy system to promote the employment of the elderly, a system of services for the elderly, and a system of education and training, it also requires the construction of a digitally inclusive social environment of positive ageing for them, and the enhancement of the digital literacy and digital employment skills of the elderly in a variety of ways. This is of great significance for the development of the entire national economy.

(1) The coordinated development of retirement and the social security system has actively promoted the employment of the elderly. The development of human resources for the elderly cannot rely solely on the single policy of delaying the retirement age. Attention should also be paid to the complementary support of other relevant policies. In particular, the social security system needs to be adjusted as a matter of priority in order to increase the willingness of individuals to delay retirement.

Firstly, gradual delay in retirement and the reform of the pension system. Currently, all men in China retire at 60 years of age, female workers at 50 years of age, and female cadres at 55–60 years of age. China's retirement time is significantly earlier than most countries with aging populations, and China's current retirees are increasing, and pensions in many places have become unsustainable. Reforming China's retirement system and pension system is imperative, and matching the time of receiving pensions with the age of retirement can effectively promote the prolongation of the working hours of the elderly workers. For example, for those who retire early, the proportion of the pension should be lowered appropriately; for those who delay retirement, the amount of the pension after retirement should be increased by an appropriate proportion, so as to stimulate the willingness of the elderly workers to delay retirement. The elderly who have reached the legal retirement age and wish to continue working can choose their retirement time flexibly according to their own situation and wishes.

Secondly, the reform of the medical insurance system should be accelerated. Physical fitness is the basic prerequisite for the elderly to prolong their economic activities. Japan, Germany and other aging countries established a perfect protection system in terms of medical security, while China still has problems such as the obvious urban-rural differences in the medical security system and the inadequacy of the medical security system. This system must be improved in order to alleviate the economic burden on the elderly, enhance the physical quality of elderly workers, and increase the enthusiasm of the elderly to participate in the labour market.

Thirdly, it is necessary to improve the power of re-employment protection for the elderly. Legislation on the prohibition of age discrimination in the labour market should be improved to protect the employment rights of the elderly workers. At the same time, we should also pay attention to the role of unemployment insurance and work-related injury insurance in safeguarding the rights and interests of the elderly workers, and give them appropriate preference.

(2) Actively building a digital and inclusive social environment for positive ageing and comprehensively improving social acceptance.

Firstly, to construct a positive view of ageing. It is necessary to replace the negative view of aging such as the "useless theory" of old age with a positive view of aging such as healthy aging and active aging, and to correctly understand the great value of the human resources of the elderly. It is

necessary to carry out comprehensive and in-depth education on the national situation of population ageing in enterprises and society, so that society as a whole will realise that the elderly group is a human resource with great potential. Through publicity and education, attention should be paid to eliminating age discrimination against the elderly in the labour market, and reversing the negative argument that "the employment of the elderly will take away the job opportunities of the young people".

Secondly, it is necessary to build a digitally inclusive active ageing society, strengthen digital education for the elderly, enhance their digital identity acceptance, lead the elderly to actively integrate into the digital society, and build an age-friendly employment and social environment.

Thirdly, to focus on national co-ordination and guidance, and cross-sectoral coordination. From the process of building a digitally inclusive active ageing society in Japan, Germany and Singapore, we can see that it is necessary to focus on a national strategy to coordinate the reasonable construction of an active ageing and digital nation. It is necessary to give full play to the complementary roles of functional departments at all levels up and down the hierarchy, and to give full play to the cooperation among enterprises, society and families, in order to comprehensively promote the effective construction of a digitally inclusive active ageing society.

(3) Guide enterprises to support the employment of the elderly through preferential policies.

On the one hand, flexible forms of employment for the elderly should be enriched. The experience of Japan and Germany shows that short-term flexible employment is more in line with the needs of the elderly for employment. The proportion of elderly people providing intergenerational care in China is relatively high, so this kind of employment is also more in line with the actual situation in China. It is possible to introduce short-term, part-time and other flexible and diverse forms of work that meet the needs of the elderly and create conditions for expanding employment opportunities for the elderly.

On the other hand, enterprises should be guided to voluntarily increase the number of jobs for the elderly by means of favourable policies, financial subsidies, tax concessions and other measures. At present, China's policies in these two areas still need to be improved.

(4) Combine lifelong education with digital literacy to improve the employability of the elderly.

Japan, Singapore and Germany have established a relatively complete lifelong education system in the deepening reform stage of promoting the employment of the elderly.

On the one hand, vocational skills training, digital skills upgrading and other courses that are conducive to improving the employability of the elderly are included.

On the other hand, in order to realize the convenience of education for the elderly, a diversified teaching model combining online and offline, as well as formal education and informal education was developed. For example, relying on the existing vocational education and higher education institutions to develop online courses suitable for the elderly and implement online and offline education and training for the elderly. In addition, it also uses the characteristics of community resources closer to the family to establish a community education and training base for the elderly.

Suggestions to promote the development of elderly human resources in China

This paper argues that based on the core concept of "participation, security, health" active aging proposed by the United Nations, we should give full play to the synergy of the government, enterprises, families and the elderly themselves, and build a digital inclusive active aging society from the aspects of system reform, perfecting laws and regulations, formulating preferential policies for enterprises to employ the elderly, building a digital service and education system, guiding the digital feedback of the whole society and the recognition of the digital identity of the elderly, so as to stimulate the enthusiasm of the Chinese elderly to participate in labour and other social activities.

1. Strengthen institutional reform and policy improvement at the government level.

(1) Establishment of a special management agency for employment of the elderly. Although China's Ministry of Human Resources and Social Security, Ministry of Civil Affairs and Commission on the Elderly all have the function of managing the elderly, there is a lack of co-ordination and communication between them, which has led to problems such as unclear powers and responsibilities and fragmentation in developing human resources for the elderly. Therefore, it is recommended that the government set up a professional department for the management of employment for the elderly, with the re-employment of the elderly as the centre of its work, integrating and coordinating resources and departments in various aspects, and promoting the development of re-employment for the elderly in an integrated manner.

(2) Implementing a delayed retirement policy and a flexible retirement policy. At present, the retirement age of many countries with an aging population is 65 years old, but China has always followed the old retirement method formulated in the 1950s and 1970s. This retirement age system still divides the retirement age into 50 years old for women workers, 55 years old for women cadres and 60 years old for men. And with the extension of education years, the time for in-service workers to contribute human capital is obviously shortened. This existing retirement system obviously does not meet the development needs of the times. Moreover, with the improvement of the physical quality of the elderly and the level of education, a large number of the elderly who retired at the current age have a strong willingness to re-employment. Therefore, it is necessary to implement a delayed retirement policy in China. China can learn from the experience of Japan, Singapore and other countries, gradually implement the delayed retirement system, fully tap the potential of human resources for the young elderly aged 55–70, and alleviate labour shortage and financial pressure. At the same time, a flexible retirement system should be implemented in accordance with the health of the elderly and the characteristics of the industry, rather than a "one-size-fits-all" approach. While the overall retirement age is postponed, the elderly can decide whether or not to continue to delay retirement according to their own health, work adaptation status and other actual circumstances, which can meet the needs of different groups. At the same time, for the elderly who want to continue to work, it can reduce the cost of employment to look for a suitable job again.

(3) Reform the existing pension system. The current problem of China's pension system is that the first pillar of the basic pension insurance system is dominant; the second pillar of the enterprise annuities develops slowly and covers a small number of people; and the third pillar of the personal pension system is still in the pilot stage [48]. China should gradually promote the establishment of a multi-level pension security system, with the government-led first-pillar basic pension insurance as the main pillar, and the second-pillar and third-pillar pensions as the coordinated development of the pension system. Moreover, great importance should be attached to the role of enterprise annuities in the construction of a multi-level pension security system, and the rapid development of enterprise annuities should be vigorously promoted at a strategic level. In the face of population aging, the reform of China's pension system must take into account employment, enterprise competitiveness and the sustainable development of the national economy. The reform of the pension system must be carried out in tandem with individual employment, retirement, enterprise development, economic development and other public policies and measures. The elderly should be encouraged to prolong the duration of their personal economic activities through the reform of the pension system to continue to promote the development of the entire social economy.

(4) Enhance legal protection for the employment of the elderly. On the basis of the practice of existing labour laws and regulations, full consideration should be given to the conflicts between the employment protection for the elderly and the existing labour laws and regulations, so as to comprehensively clean up the unreasonable provisions that hinder the elderly from continuing to play their roles, remove the institutional barriers that hinder the employment of the elderly, and resolve the worries of the elderly about re-employment.

(5) Use policies to guide enterprises to employ the elderly.

On the one hand, enterprises should be guided to employ the elderly through preferential policies. The government should establish a mechanism for encouraging and rewarding the employment and entrepreneurship of the elderly, and give tax incentives, financial subsidies and other policies to enterprises that actively promote the employment of the elderly.

On the other hand, enterprises should be encouraged to provide flexible working hours for the elderly, and introduce short-time and part-time jobs that meet the needs of the elderly and create conditions for expanding employment opportunities for the elderly. In addition, digital economy platforms should be encouraged to accommodate the labour resources of the elderly and provide them with jobs that are within their reach.

2. Building a digital service system for the elderly.

(1) The Government has continued to promote the construction of Internet infrastructure. It is further improving the coverage of Internet infrastructure and services in remote rural areas, ensuring that urban and rural seniors share information technology equitably, and further bridging the digital access divide for the elderly.

(2) Promote society-wide digital ageing adaptation. In the face of serious population aging, the macro level should actively reform the productive forces and relations of production, the economic base and superstructure. The meso level should carry out ageing transformation of business, public facilities, transport, information technology and the entire infrastructure. The micro level should require families and communities to carry out ageing transformation in the elderly's life, health, social life and other dimensions.

(3) Protecting the physical and mental health of the elderly.

On the one hand, we should further strengthen the construction of medical security. For the low-income elderly in rural and urban areas, while establishing an inclusive medical insurance system, we should try our best to reduce the cost and economic burden of the elderly through finance, institutional standards, and medical security. Moreover, it is necessary to further carry out extensive health education for the elderly, guide the formation of healthy eating habits and health care habits, and build a healthy foundation for the elderly's labour participation.

On the other hand, we should care for the mental health of the elderly. It is necessary to give full play to the leading role of the government in the mental health work of the elderly, encourage the participation of community and social capital, build a multi-level online and offline mental health service platform for the elderly, carry out extensive publicity of mental health science, create a healthy and upward social atmosphere, and improve the ability and channels of the elderly to relieve psychological pressure.

3. Building a service system for improving the digital literacy of the elderly.

(1) Build a multi-coordinated lifelong education system. The government should incorporate education for the elderly into the lifelong education system, with the education department taking the lead in researching and formulating policy initiatives for the development of education for the elderly, integrating the resources of education services carried out by China's existing universities, universities for the elderly, community organisations, and online and offline organisations, and coordinating with all parties to provide the elderly with training in digital life skills and vocational skills, so as to satisfy their individualised educational needs.

(2) Use digital information technology to enhance the human capital of the elderly. It is necessary to enrich the forms of education for the elderly, and develop "hybrid" teaching forms that combine online and offline, formal education and non-formal education.

(3) Expand the content of education for the elderly. We should change the previous mode of elderly education, which was mainly based on leisure and entertainment, and include courses on physical and mental health, life skills, vocational training and digital skills, which are conducive to the survival and development of the elderly, so as to promote the elderly to adapt to the digital lifestyle.

(4) Build a digital employment platform for the elderly.

On the one hand, government departments should make full use of the Internet and big data to establish a human resources database for the elderly in cooperation with relevant enterprises, and create a comprehensive online employment service platform that integrates human resources policies, talent information database, recruitment information, volunteer public welfare, education for the elderly, legal services, etc., so as to provide stronger employment support for the elderly group.

On the other hand, it relies on residential communities to establish offline employment service centres for the elderly, incorporating elderly employment and entrepreneurship into the education and training system for the elderly, and providing elderly people who have the will to work with services such as job introduction, vocational skills training, guidance on innovation and entrepreneurship, and legal aid, so as to promote the upgrading of the old people's human capital, and to let the elderly people's abilities and experience play a greater role.

(5) Provide the elderly with the necessary educational allowances. Based on the fact that the ability of the elderly employed to absorb and transform knowledge, information and technology becomes weaker as they grow older, and they are unable to meet the current employers' requirements for job skills in a timely manner and are worried about their future career prospects, through the provision of necessary education allowances and training programmes in cooperation with well-known companies, we can help middle-aged and elderly people to acquire industry-relevant skills and improve their competitiveness in employment, so as to facilitate their reintegration into the labour market.

4. Encourage family digital feedback.

Family digital backfeeding refers to the guidance and assistance provided by younger generations to older generations in modern families in terms of knowledge dissemination, selection, and use of digital technologies, as well as the popular culture and values associated with them [49]. In China's current situation, where ageing at home is the main mode of care, digital feedback within the family is a key aspect of the elderly's acquisition of digital education and skills.

Therefore, *on the one hand*, digital backfeeding within the family should be encouraged. In the family, the younger generation should fully respect and recognise the needs and aspirations of the older generation to improve their digital literacy, and actively pass on digital thinking, digital skills and cybersecurity awareness to them, so as to drive the elderly to better adapt to digital life and work.

On the other hand, a variety of social forces have been mobilized to provide digital support for the elderly. For example, relying on community cultural activity centres to carry out rich and varied educational activities on digital competence and literacy, and giving full play to the community's function of transmitting digital skills. In addition, social organisations, research institutes, community workers, volunteers and other social forces are encouraged to help more elderly people embrace the Internet and enjoy the dividends of the Internet by providing them with courses, either on a fee-paying basis or free of charge, on digital science, skills in the use of smart devices and software, cybersecurity, digital social participation, and fraud prevention.

Guiding the elderly towards digital identity acceptance.

Digital identity acceptance refers to an individual's acceptance with a digital social identity (or role) formed through online activities such as self-presentation (e.g., displaying one's interests and opinions on social media, blogs, forums, etc.), social interaction (e.g., communicating, commenting, liking, and sharing, etc.), online behaviours (e.g., searching, shopping, and reading, etc.), and community belonging (e.g., joining online interest groups and communities, etc.) in a digital society identity. It can reflect personal characteristics such as an individual's interests, values, social circles, etc., as well as an organisation's or group's brand image and value proposition. Moreover, with the continuous iterative updating of digital technology, people's digital identity acceptance is bound to undergo further changes [50]. In the digital era, in order to avoid the elderly becoming marginalised in the digital society, a variety of measures should be taken to help the elderly with their digital

identity acceptance. For example, the government should clear the obstacles for the elderly to cross the digital divide through the perspectives of policy support, improvement of infrastructure, and the construction of digital literacy education system; while enterprises should focus on the age-adapted modification of digital hardware and software to adapt to the needs of the elderly in using them. And the younger generation in the family should proactively transfer digital skills such as digital thinking, digital skills, digital security, digital innovation and entrepreneurship, digital employment and other digital skills, to the older generation to inspire the confidence of the elderly in using digital technology and drive them to better adapt to digital life [51].

Conclusions

At present, the digital wave is evolving in full swing around the world, and almost all areas of society are deeply infiltrated by digital technology. In the face of the challenges of "digital divide" "digital exclusion" and "digital income" brought about by the rapid digital transformation of the economy and society, the elderly must improve their personal digital literacy, so as to better realize their social participation in politics, economy, culture and other aspects. The successful experience of Japan, Singapore and Germany shows that the introduction of measures to promote the employment of the elderly and the improvement of their digital literacy through education are effective measures to increase the labour participation rate of the elderly. Therefore, China should formulate more effective strategies for the development of old human resources from the aspects of high-level policy reform, construction of service system, family digital feedback and the acceptance of the digital identity of the elderly, so as to promote the all-round development of social economy and the social participation of the elderly.

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