Analysis of Information Technology Management Development in the Context of Population Aging -- Based on Gray Prediction Algorithm

Yongsheng Lian, Wei Xu*

Harbin University of Commerce, Songbei Street, Harbin, Heilongjiang Province, China
Harbin University of Commerce, Songbei Street, Harbin, Heilongjiang Province, China
*Lian Yongsheng: 410586736@qq.com, Xu Wei: 1716879339@qq.com**
Corresponding Author: Wei Xu

ABSTRACT

Management science has been extended to various fields, forming an independent discipline system with a wide range of contents and complete categories, and management science has become the third category of science alongside social science and natural science. Information technology plays an important role as one of them with the rapid development of science and technology, information technology has become the mainstream of the technological revolution, and at the same time, actively dealing with aging has been elevated to a national strategy, and age-appropriate information technology has become a topic that needs to be addressed. In this paper, the number of aging population in 2022 is predicted by gray prediction algorithm, and the results show that the number of aging population will continue to grow. The growth of the aging population will be accompanied by problems such as the digital divide of the aging population and deviation from the acceptability of the aging population in information technology management. In response to this problem, we explore where information technology should go in terms of policy, technology, society, and personnel management.

Keywords*: aging; information technology; gray prediction; Management Science*

1. INTRODUCTION

With the rapid development of science and technology, information technology has become the mainstream of the technological revolution, and modern information technology is developed on the basis of audiovisual information technology and program teaching. The new generation of information technology is the integration and development of communication, computer and Internet technologies, which is an important driving force of economic development.

From 1953 to 2021, China's population aged 65 and above increased from 26.32 million to 200 million, and the proportion increased from 4.4% to 14.2%. 2022 Government Work Report proposed to "actively cope with the aging population, optimize the supply of urban and rural elderly services, and promote the high-quality development of the aging business and industry". Coping with the aging population has been elevated to a national strategy.

The "Implementation Plan on Effectively Solving the Difficulties of Using Smart Technology for the Elderly" issued by the General Office of the State Council focuses on seven types of high-frequency matters and service scenarios related to the daily life of the elderly, such as travel, medical care, consumption, recreation and errands, responding to many social concerns, and stipulates that by the end of 2022, a long-term mechanism to solve the problem of the "digital divide" faced by the elderly will be basically established. This paper analyzes the aging growth situation and gives information technology countermeasures through empirical analysis

2. LITERATURE REVIEW

2.1 Research related to population aging

Scholars analyze the social problems that will arise from the trend of aging and offer relevant solutions to them. (Tao 2021, Jin 2021) [9] believe that it is difficult to reverse the negative population growth in China, and

S. A. R. Khan et al. (Eds.): ICMSSE 2022, AHCS 12, pp. 467–471, 2023.
https://doi.org/10.2991/978-94-6463-056-5_68

that China will still start the era of negative population growth in the near future, and that accelerating industrial upgrading and promoting new production and life styles is the way forward.(Hu 2019, Peng 2019) [4] believe that aging is the result of the transformation of human reproduction patterns and the eventual becoming of socioeconomic development, it has no exceptions in any country or region, only the early or late emergence and the speed of the process, and future demographic changes should adapt to the demographic dynamics .Some scholars have also studied it in terms of risks and impacts, and (Qu 2021) [7] studied that population aging can exacerbate deflationary risks and weaken the effects of monetary policy implementation, and that the economy needs to be wary of falling into the trap of very low inflation levels .(Kong 2015) [6] found that there is a negative effect of birth rate on population aging .(Ji 2022) [5] used kernel density estimation, coupled coordination model, and spatial Durbin model to explore the evolutionary pattern of aging, old-age resource allocation, and the fitness of old-age resource allocation and aging in China, and to reveal the influencing factors of spatial fitness.

2.2 IT management-related research

(Tan 2015) [8] found that information technology applications arise as a result of complex strategic activities under the different roles of different cognitions plus rights-interest relations. (Han 2019) [3] argued that the development and application of information technology has brought progress in technological governance and more possibilities for urban governance. However, at the same time, information technology has its drawbacks, and issues of privacy and efficiency of individuals have arisen. (Zhang 2015) analyzed the relationship between the innovation of information technology and the modernization of governmental governance capacity, and proposed countermeasures to use emerging information technology to help modernize governmental governance capacity.

2.3 Research on the relationship between information technology and population aging

(Chen 2009) [1] proposed to rely on information technology, improve the management level, and integrate the management of elderly service facilities into the track of informationization, standardization, systematization, and standardization. Wu Yushao and (Wang 2013) [10] analyzed the demand for information accessibility in population aging, and the smooth flow of information technology plays an important role in coping with population aging, and put forward relevant suggestions for the main problems .(Fang 2018) [2] put forward the difficulties faced by elderly groups in the use of information technology and gave a solution path by investigating the problem of information-based medical care for elderly groups .(Zhang 2021) argued that elderly groups face digital dilemmas due to the lack of knowledge of media and other aspects of use, and become a disadvantaged group in information use. The gradually deepening and widening digital divide forces older groups to withdraw from social life scenarios and suggests relevant bridging mechanisms.

Throughout the above, scholars have described the non-negligible role played by information technology in the elderly population and the needs of the aging population for information accessibility from various aspects, and less analyzed the development direction of information technology from the trend of population aging. Therefore, on the basis of existing studies on population aging, a gray prediction model is used to forecast the future aging population in China, analyze its development trend, analyze the existing problems of information technology it faces, and provide informative suggestions.

3. THE ALGORITHM BASED ON GRAY PREDICTION OF POPULATION AGING FORECAST

3.1 Research Methodology

Gray forecasting is to forecast systems containing known and unknown information, to find patterns of data variation, and to generate sequences with strong regularity.

Let the variable X(0) = {X(0)(i), i=1, 2, ..., n} be, the non-negative monotonic raw data of a certain prediction object, and in order to build a gray prediction model, first a cumulative sequence is generated for X(0) by a single accumulation (1 - AGO).

X (1)={X (1) (k), k=1, 2, …, n}

Among them,

$$X^{(1)}(k)=\sum_{i=1}^{k} x^{(0)}(i)=X^{(1)}(k-1)+X^{(0)}(k) \quad (1)$$

For X (1) the following differential equation for the formation of whitening can be established.

$$\frac{dX^{(1)}}{dt}+\alpha X^{(1)}=u \quad (2)$$

where, -α is the development coefficient, whose magnitude reflects the growth rate of the original time series data; u is the amount of gray effect。

That is, the GM (1, 1) model.

The solution of the above whitening differential equation is (discrete accordingly)

$$\hat{x}^{(1)}(k+1)=(X^{(0)}(1)-\frac{u}{\alpha})e^{-\alpha k}+\frac{u}{\alpha} \quad (3)$$

where α and u are found according to the least squares method, i.e., [α, u]T=(BTB)-1BTyn, where yn=[x(0)(2), x(0)(3),...,x(0)(n)]T, B is expressed by Eq.

$$B=\begin{bmatrix} -\frac{1}{2}(x^{(1)}(1), x^{(1)}(2)) & , & 1 \\ -\frac{1}{2}(x^{(1)}(2), x^{(1)}(3)) & , & 1 \\ \cdots & \cdots & \cdots \\ -\frac{1}{2}(x^{(1)}(n-1), x^{(1)}(n)) & , & 1 \end{bmatrix} \quad (4)$$

Again, the predicted results and reductions.

$$\hat{x}^{(0)}(k+1)=\hat{x}^{(1)}(k+1)-\hat{x}^{(1)}(k) \quad (5)$$

The model is tested i.e. residual test.

$$\varepsilon(k)=\frac{x^{(0)}(k)-\bar{x}^{(0)}(k)}{x^{(0)}(k)},k=1,2,\ldots, n \quad (6)$$

If the residual ε(k) < 0.2, it is proved that the difference between the fitted value and the actual value is not significant and can be used.

3.2 Research process

Based on the information compiled, the number of elderly population aged 65 years or older from 2011 to 2021 is shown in Table 1.

Table 1 Number of elderly people aged 65 years or older, 2011 to 2021

Year	Number of elderly population (million)
2011	12288
2012	12714
2013	13161
2014	13755
2015	14386
2016	15003
2017	15831
2018	16658
2019	17603
2020	19064
2021	20056

It was calculated that, α=-0.0522, u=11396.4437,

According to equation (3) we get.

$$x^{(1)}k=230321e^{0.0522(k-2011)}-218033 \quad (7)$$

According to Equation (6), we get ε<0.2, that is, the model is available.

The number of aging population in 2022 is calculated to be 204.28 million, which means that the projection results in a rising number of aging population.

To sum up, the information technology targeting the elderly group should draw wide attention from the society, and there are still many problems in the information technology targeting the elderly, which need to be given solutions.

4. PROBLEMS OF INFORMATION TECHNOLOGY MANAGEMENT IN THE CONTEXT OF POPULATION AGING

4.1 Information technology tends to be digital, deepening the digital divide among the aging population

During the "13th Five-Year Plan" period, China has deeply implemented the digital economy development strategy, continuously improved the digital infrastructure, and achieved positive results in digital industrialization and industrial digitization. In today's epidemic normalization, the digitization of information technology has almost covered human life. However, for the elderly group, the increasingly digitalized information technology is undoubtedly a heavy burden. With the current epidemic, health codes have become an important proof of access, whether to and from shopping malls or to take public transportation on a daily basis, all require the possession of a health code. However, as a disadvantaged group in the digital age, they are trapped in the use of health codes, some of them can only register in and out of shopping malls, some of them cannot take public transportation because of this, and some of them are running around the community just to issue health code certificates. In contrast, young people are comfortable using digital information technology. In the long run, older people will gradually fail to keep up with the pace of social change and be eliminated in the digital life of information technology, and the digital divide faced by the elderly will gradually deepen and widen.

4.2 Information technology tends to be intelligent and deviates from the acceptance ability of the aging population

Today's information technology tends to be intelligent, whether it is communication, network or automated information technology is providing people with various comfortable, fast and intelligent services, but gradually intelligent information technology is slowly deviating from the acceptance ability of the elderly groups. An old man can only be picked up by his family to complete the relevant business in order to complete the face recognition of the social security card at the branch. There are many self-help services in daily life, so there are countless news about the inconvenience caused by the application of intelligent information technology for the elderly groups. There are inequalities between the elderly and the younger population in terms of computer ownership, computer use, access to Internet services, and smartphone ownership. The gradually accelerating pace

of society and intelligent information technology in life is gradually deviating from the pace of life, adaptability and acceptability of the aging population. As the aging population accelerates, the application of intelligent information technology and the coordination of the aging society become a challenge to be solved.

4.3 Information technology has security risks and increases the fear of the aging population

As of December 2021, the Internet penetration rate of China's elderly Internet users aged 60 and above reached 43.2% in scale, and the elderly began to try to contact the Internet, which is the progress of social civilization and information technology. However, at the same time, it also brings many security risks. In the face of complicated information, a variety of illegal links, fraudulent information, Internet rumors and other information technology, the elderly groups have a lower ability to identify, technical operation is not skilled, weaker awareness of prevention, if the platform or operator for the elderly information audit control is not strict, it is easy for the elderly unknowingly become the spread of Internet rumors, touching the red line of the law violators. Therefore, the security risks of information technology seriously endanger the personal and property safety of the elderly and increase the fear of the aging population.

5. CONCLUSION

Through empirical analysis, it can be obtained that the number of aging population is in a rising state. The following are the IT improvement countermeasures for the aging population.

5.1 At the technical level, creating a secure IT environment

In terms of information technology security, a good environment is created for the elderly groups to avoid damage to their rights and interests. The software is designed to set up an interface specifically for the use of the elderly, and in the exclusive interface, the appearance of illegal links, fraudulent information and Internet rumors is strictly prohibited to create a good security environment from the source of information technology. Meanwhile, in terms of services, the needs of the elderly are fully considered, and the use of voice functions is enhanced to avoid the difficulties of the elderly in using them as much as possible. Popularize as much as possible the voice as the core, combined with face, gestures and other artificial intelligence assistants, so that the elderly groups can feel a good experience of using. Create an exclusive software that serves the elderly group with high safety performance and good feedback.

5.2 At the policy level, provide an age-appropriate IT institutional environment

The development and promotion of age-friendly information technology is inseparable from the support of corresponding policies. The General Office of the State Council issued the "implementation plan to effectively solve the difficulties of the use of intelligent technology for the elderly" focused on the elderly in their daily lives involving travel, medical care, consumption, recreation, errands and other 7 types of high-frequency matters and service scenarios, responding to many social concerns. The program proposes "health code" management to facilitate the passage of the elderly and other 20 specific initiatives and set out a timetable, clear by the end of 2020, the urgent introduction and implementation of a number of effective measures to solve the most pressing problems of the use of intelligent technology for the elderly; by the end of 2021, around the elderly travel, medical care, consumption, recreation, office and other By the end of 2021, to promote the elderly to enjoy more common intelligent services around high-frequency matters and service scenarios; by the end of 2022, to solve the problem of the "digital divide" faced by the elderly to establish a long-term mechanism. The country has proposed the goal of promoting the elderly to enjoy more universal intelligent services by the end of 2021. However, to achieve this goal, it is necessary to pay attention to the implementation of specific measures in this regard, to apply the information technology adapted to the elderly groups to the practical life, and to put into law the strict punishment of various acts that bring the risk of fraud to the elderly groups, so as to match the information technology system with the life of the intelligent elderly groups, and to promote the reform and follow-up of the relevant public management system.

5.3 At the social level, popularizing the use of age-friendly information technology

Information technology for the elderly is gradually appearing in the public eye, such as the one-touch taxi function. According to data released by the Ministry of Transportation and Communications in September 2021, major online taxi platform companies have opened the "one-touch taxi" function in nearly 300 cities, providing a total of more than 15 million services to more than 6.6 million elderly passengers, with all major platform companies displaying the "one-touch taxi" function on the home page of their APPs. All major platform companies have displayed the "one-click taxi hailing" function on the home page of their APPs. At present, 70 municipalities have opened 95128 taxi service numbers, and the target of 100 will be achieved by the end of the year. But older groups are not fully aware of similar functions. It is possible to set up courses for the elderly to improve their mastery of modern information technology, television media for the digital elderly groups, and

broadcast training activities on this aspect on time to create an exclusive channel for the elderly groups and effectively popularize knowledge about the use of information technology.

5.4 At the level of personnel, training professional IT personnel

China has a large demand for talents in the development of new generation information technology and high requirements for the quality of talents, therefore, universities should actively respond to the development of new generation information technology and accelerate the training of qualified talents. In recent years, the Ministry of Education is taking active measures to optimize the professional settings as a way to adapt to the new round of technological revolution and industrial changes. But professional IT talents are still in great demand. The status and role of information technology in various fields should be vigorously promoted, and certain administrative measures should be taken to create a favorable research environment for them to master the basic theories of modern information technology and its application techniques, and to be able to judge the actual situation at this stage according to the current social situation, especially to optimize information technology for the aging aspect, so that information technology can adapt to the current situation of an aging population society. In deepening the development of talents and continuously strengthening the independent innovation of information technology.

REFERENCES

[1] Chen F. Relying on information technology to improve management--the development and use of "Integrated Management System for Elderly Institutions"[J]. Social Welfare,2009(03):37-38.

[2] Fang Zhiyu. The current situation of information technology and capability cultivation of elderly groups in the context of smart city[J]. China's computerized education,2018(02):67-72.

[3] Han, C.. The fourfold illusion of technological governance - information technology in urban governance and its reflection [J]. Exploration and Controversy,2019(06):48-58+157+161.

[4] Hu Zhan, Peng Xizhe. Re-conceptualization of population aging and policy thinking[J]. Research on Socialism with Chinese Characteristics, 2019(05): 60-67.

[5] Ji YQ, Jiang HMM. Analysis of spatial and temporal differences in the new era of aging and the appropriateness of elderly resources and their influencing factors[J/OL]. Geoscience:1-12[2022-05-06]. http://kns.cnki.net/kcms/detail/22.1124.p.20220505.2313.002.html

[6] Kong LW, Chen ZZ. Impact of demographic and economic factors on population aging in China--an empirical analysis based on inter-provincial panel data [J]. Journal of Northeastern University (Social Science Edition), 2015, 17(03):252-259. DOI:10.15936/j.cnki.1008-3758.2015.03.006.

[7] Qu Lingyun. Estimation of future population aging trend and its impact on potential economic growth rate[J]. Shanghai Finance,2021(08):27-36. DOI:10.13910/j.cnki.shjr.2021.08.003.

[8] Tan, H. B., Meng, Q. G., Zhang, N.. Research on government operation mechanism in the application of information technology--J Municipal government online administrative service system construction as an example [J]. Sociological Research, 2015, 30(06): 73-98+243-244. DOI:10.19934/j.cnki.shxyj.2015.06.004.

[9] Tao T, Jin GZ, Guo YALONG. A comparison of two kinds of negative population growth: connotation definition, demographic significance and economic impact [J]. Population Research,2021,45(06):14-28.

[10] Wu Yushao, Wang Lili. Population Aging and Information Accessibility[J]. Lanzhou Journal, 2013(11): 64-70.