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# Circular Economy Model for Elderly Tourism Operation Based on Multi-source Heterogeneous Data Integration

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## ABSTRACT

The emerging senior tourism industry has attracted increasing attention in China due to the continuous development of social, economic and technological factors. However, the senior tourism market in China still faces significant shortages, and further market development is needed. To address this issue, a senior tourism business model based on the circular economy, artificial intelligence (AI) technology and multi-source heterogeneous data integration has been proposed in this study. The model uses AI technology to integrate and analyze multi-source heterogeneous data, providing insights into the senior tourism market and facilitating precise marketing. Additionally, the model combines senior tourism products with sustainable development by adopting a circular economy model, achieving both economic and environmental benefits. The application of this model is expected to enhance the competitiveness and sustainable development of the Chinese senior tourism market, providing new ideas and references for the development of the industry. The integration of multi-source heterogeneous data is a significant feature of this model, which facilitates a more in-depth understanding of the senior tourism market. By analyzing various data sources, such as social media, search engines, and online reviews, the model can better identify senior tourists' preferences and behaviors, thereby improving the precision of marketing strategies. Furthermore, by integrating environmental data, such as carbon footprint and energy consumption, the model can assess the sustainability of senior tourism products, contributing to the development of eco-friendly senior tourism.

## ARTICLE HISTORY

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## Introduction

The development of society, economy, and technology has led to an increase in overall life expectancy and the number of elderly people worldwide. As the senior tourism industry develops rapidly, there is a significant shortage of senior tourism products in China (Wan, Lo, and Eddy-U 2022). The concept of circular economy has become more closely integrated with senior tourism, and it is increasingly accepted as

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an important direction for economic development. However, the Chinese senior tourism market started late, and the industry underestimated the demand for senior tourism. The lack of tourism products for the elderly and inadequate legal and political protection have hindered the growth of the industry.

To address these challenges, there is a need for a research model that incorporates the principles of circular economy and leverages multiple sources of heterogeneous data to gain a deeper understanding of the senior tourism market and enable precise marketing (José António and Margarida Custódio 2021; Pedro, Ana Isabel, and Costa Liliana 2022).

Precise marketing refers to the use of data-driven insights and targeted strategies to reach specific customer segments with tailored messages and offerings. In the context of the senior tourism market, precise marketing involves leveraging data on senior travelers' preferences, behaviors, and needs to develop targeted marketing strategies that are more likely to resonate with this demographic (José et al. 2022).

The use of precise marketing can help tourism businesses to more effectively reach and engage with senior travelers, ultimately leading to increased bookings and revenue. By analyzing data from various sources, such as online reviews, social media, and customer surveys, tourism businesses can gain a deeper understanding of the senior tourism market and use this knowledge to develop more personalized marketing campaigns.

For example, tourism businesses can use data analytics tools to identify common themes or trends in customer reviews and feedback, allowing them to develop targeted messaging that addresses the specific concerns or desires of senior travelers. Additionally, tourism businesses can use social media platforms to engage with senior travelers directly, providing them with personalized recommendations and travel tips based on their interests and preferences.

As the population in China ages, the government's pension policy is gradually improving, which greatly increases the enthusiasm for senior tourism. The data on senior tourism is diverse and heterogeneous, making it essential to expand the channels for data acquisition (Ieva). The development of a senior tourism circular economy model that integrates multiple sources of heterogeneous data is essential for improving the competitiveness and sustainable development of the senior tourism market in China (Guanghui et al. 2022).

Sustainable development in tourism refers to the practice of managing tourism activities in a way that balances economic, social, and environmental considerations to ensure long-term sustainability. This approach recognizes that tourism can have both positive and negative impacts on destinations and local communities and aims to mitigate negative impacts while maximizing positive impacts.

Sustainable development in tourism involves several key principles, including:

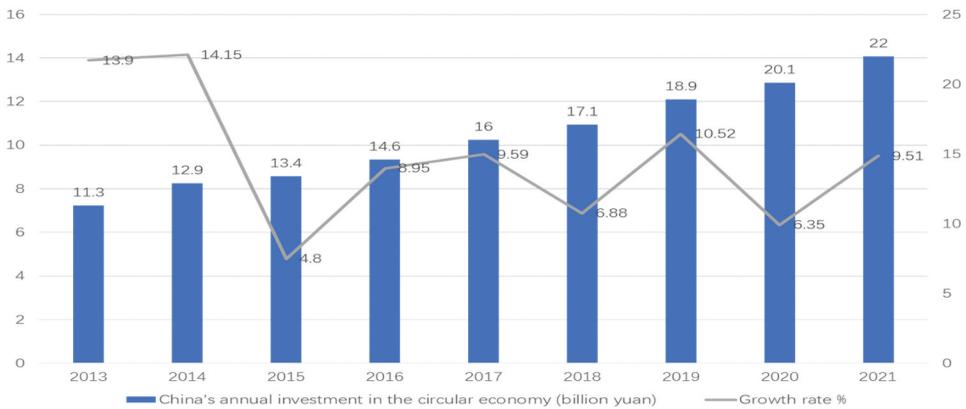
- (1) Environmental conservation: This principle involves minimizing the negative environmental impacts of tourism, such as reducing waste and energy use, protecting biodiversity, and preserving natural resources.
- (2) Social responsibility: This principle involves promoting social and cultural sustainability by respecting local communities and their cultural practices, supporting local businesses and economies, and ensuring that tourism benefits the host community.
- (3) Economic viability: This principle involves promoting economic sustainability by generating income and employment opportunities for local communities and ensuring that tourism activities are financially viable over the long term.
- (4) Collaboration and stakeholder engagement: This principle involves engaging with stakeholders, including local communities, governments, and tourism businesses, to ensure that all parties benefit from tourism and to develop effective sustainable tourism strategies.

Achieving sustainable development in tourism requires collaboration and commitment from all stakeholders, including tourists, tourism businesses, and governments. Tourism businesses can adopt sustainable practices, such as using renewable energy sources, reducing waste, and promoting local products and services. Tourists can support sustainable tourism by choosing eco-friendly accommodations and activities, respecting local cultures and customs, and minimizing their environmental impact.

Governments can support sustainable tourism by implementing policies and regulations that promote sustainability, investing in infrastructure and facilities that support sustainable tourism, and providing education and training programs for tourism businesses and local communities.

Overall, sustainable development in tourism is crucial for ensuring that tourism activities are socially responsible, economically viable, and environmentally sustainable over the long term. By adopting sustainable practices and promoting collaboration and stakeholder engagement, the tourism industry can contribute to sustainable development and support the well-being of host communities and destinations.

With the aging population in China, there is a growing need to address the negative externalities of the aging population and promote the health and welfare of the elderly through the development of the senior tourism industry. This requires the implementation of effective circular economy practices and the utilization of various sources of data



**Figure 1.** China's annual investment in the circular economy.

to gain a deeper understanding of the senior tourism market (Noel and Kelliher 2022). Figure 1 shows China's annual investment in the circular economy.

As an enjoyable way to spend money, seniors are increasingly embracing senior travel, which has become an integral part of their daily lives. However, travel service providers are facing new challenges due to old travel motivations and travel habits. Developing senior travel has become a major choice for many travel service providers. It is known that some travel companies have started to offer tourism products to older people (Joanna). We also note that the development of tourism for seniors can play a positive role in de-sensitizing tourism, releasing unused tourism resources out of season, and improving the quality of life of seniors. However, at this stage, due to various reasons, the development of senior tourism in China is slow and unable to meet the growing social demand (C. and Custódio).

There are several challenges facing tourism companies and researchers in the seniors' tourism market. Some of these challenges include:

- (1) Addressing the needs and preferences of diverse senior travelers: Seniors represent a diverse demographic with varying needs, preferences, and expectations. Tourism companies and researchers must recognize this diversity and design their offerings and research accordingly.
- (2) Addressing physical limitations and accessibility: Seniors may experience physical limitations that can make it more challenging to participate in tourism activities. Tourism companies and researchers must consider accessibility issues and design their offerings and research with these limitations in mind.
- (3) Ensuring safety and security: Seniors may be more vulnerable to risks such as theft, fraud, or health emergencies. Tourism companies and

researchers must ensure that their offerings and research provide a safe and secure environment for senior travelers.

- (4) Providing adequate support and assistance: Seniors may require additional support and assistance during travel, such as help with luggage or mobility aids. Tourism companies and researchers must provide adequate support and assistance to ensure that senior travelers can fully participate in tourism activities.
- (5) Keeping up with technological advancements: The use of technology in the tourism industry is rapidly evolving, and seniors may not be as comfortable with or knowledgeable about technology as younger generations. Tourism companies and researchers must consider how to effectively use technology to enhance the travel experience for seniors while also addressing potential barriers to its adoption.

Overall, tourism companies and researchers in the seniors' tourism market face several challenges related to addressing the diverse needs and preferences of senior travelers, ensuring accessibility and safety, providing adequate support and assistance, and keeping up with technological advancements. By addressing these challenges, tourism companies and researchers can help ensure that the seniors' tourism market continues to grow and provide valuable experiences for older adults.

The emerging senior tourism industry in China has been receiving increasing attention due to the continuous development of social, economic, and technological factors. However, despite this growth, the senior tourism market in China still faces significant shortages, indicating a research gap that needs to be addressed. While there has been some research on senior tourism in China, there is a lack of comprehensive and innovative approaches that can effectively enhance the competitiveness and sustainable development of this industry.

To address this research gap, a senior tourism business model based on the circular economy, artificial intelligence (AI) technology, and multi-source heterogeneous data integration has been proposed in this study. The scientific claims made in connection with this model include the potential to integrate and analyze multi-source heterogeneous data using AI technology, providing valuable insights into the senior tourism market and facilitating precise marketing strategies. Furthermore, the model's adoption of a circular economy model combines senior tourism products with sustainable development, which can have both economic and environmental benefits. Additionally, the integration of environmental data, such as carbon footprint and energy consumption, can assess the sustainability of senior tourism products, contributing to the development of eco-friendly senior tourism.

Despite these claims, there is a lack of research on the effectiveness of this proposed senior tourism business model in addressing the research gap and enhancing the competitiveness and sustainable development of the senior

tourism market in China. Therefore, the research question that needs to be answered is whether this model can effectively integrate multi-source heterogeneous data using AI technology and combine senior tourism products with sustainable development to enhance the competitiveness and sustainable development of the senior tourism market in China. This study does not present any hypotheses but aims to provide empirical evidence to answer this research question.

Therefore, this paper delves into the management characteristics and market development model of senior tourism based on the circular economy model, with an eye on the development of China's senior tourism market, and proposes corresponding countermeasures.

## Research Background

Nowadays, the physical condition of the elderly is more suitable for senior tourism activities. For older tourists, tourism is developing. The lack of theory and practice can easily lead to blind industrial development and waste of resources. Therefore, it is of great importance to study and evaluate the development of senior tourism in China and systematically analyze the feasibility of developing senior tourism in China (Hyelin et al. 2021).

This work highlights the importance of integrating multiple heterogeneous data sources and utilizing artificial intelligence (AI) techniques in the development of senior tourism. The analysis of the characteristics of supply and demand of senior tourism can be enhanced by incorporating data from various sources such as social media, booking platforms, and tourism statistics databases. Through the use of AI algorithms, such as machine learning and natural language processing, patterns and trends in senior tourism can be identified and analyzed. This can aid in the identification of main contradictions in the development of senior tourism and provide insights for developing effective countermeasures. The application of AI in the development of senior tourism can also assist in the creation of personalized travel packages and recommendations for senior tourists based on their preferences and travel history. Additionally, the integration of data from various sources can provide a more accurate representation of the demand for senior tourism, enabling service providers to tailor their offerings to meet the specific needs and expectations of senior tourists (Elvis et al. 2021). By leveraging the power of multiple data sources and AI techniques, the development of senior tourism can be accelerated and expanded, ultimately leading to a more vibrant and sustainable senior tourism market Li, Pi, and Lin (2020). This paper combines theory and practice, theoretical research with interviews and industry experience to conduct an in-depth study and make a series of practical recommendations. This promotes the practical application of theory and positively

influences the development of the senior tourism market. Senior tourism is an important part of the banking economy and, in addition to its economic importance, it can contribute to the well-being of older people and address the social issues arising from an aging population by making recommendations for the development of senior tourism.

Banking economy refers to the role that banks and financial institutions play in the broader economy. Banks play a critical role in providing financing and credit to individuals and businesses, facilitating the flow of money through the economy, and promoting economic growth.

In a banking economy, banks collect deposits from individuals and businesses and use those deposits to make loans and investments. These loans and investments can help finance new businesses, support consumer spending, and fuel economic expansion. Banks also provide a range of other financial services, such as investment management, insurance, and foreign exchange services.

Banks also play a critical role in managing risk in the economy. Through careful underwriting and risk management practices, banks can help prevent financial instability and ensure the stability of the financial system. Additionally, banks must comply with various regulations and standards designed to promote financial stability and protect consumers.

The elderly population is often considered a significant group of digitally excluded consumers due to several reasons. Firstly, many seniors did not grow up with the same level of exposure to digital technology as younger generations. Therefore, they may be less comfortable with technology and less familiar with its usage. Additionally, seniors may not have had the same opportunities for digital education or may not have access to the necessary equipment or infrastructure to use technology.

Moreover, physical changes that come with aging, such as vision or hearing impairment, may create barriers to using digital technology, making it difficult for seniors to interact with technology in the same way as younger generations. Furthermore, seniors may have concerns around the security of digital transactions, making them more hesitant to engage in online purchasing.

When it comes to purchasing travel products, seniors may be less likely to use smartphones due to several factors. Firstly, they may not be as familiar with smartphone technology or may have physical limitations that make using a smartphone more challenging. Additionally, they may prefer more traditional methods of purchasing travel products, such as through travel agents or in-person bookings. This preference may be due to a lack of trust in technology or a desire for a more personalized experience (Lubowiecki-Vikuk and Sousa 2020).

In conclusion, the elderly population is often considered a significant group of digitally excluded consumers due to several factors, including a lack of exposure to digital technology, physical limitations, concerns around security,

and preferences for more traditional methods of purchasing products. These factors can all contribute to seniors being less likely to use smartphones when purchasing travel products or engaging in other digital activities.

This paper discusses the trend of aging tourism in the context of an aging society. First, the current situation and future trends of China's aging population are analyzed. You are correct, "senior" and "elderly" are not necessarily the same concepts when it comes to the tourism industry. While both terms refer to individuals of advanced age, they can have different connotations and implications.

The term "senior" generally refers to individuals who are over a certain age threshold, which can vary depending on the context and the country. In the tourism industry, "senior" typically refers to individuals who are over the age of 50 or 55 and who have retired or are nearing retirement age. These individuals may be financially stable, have more leisure time, and be interested in exploring new destinations and experiences. On the other hand, "elderly" typically refers to individuals who are much older and may have more physical or cognitive limitations due to their age. These individuals may require more specialized accommodations, transportation, and medical care. However, it is worth noting that some individuals in their 80s or 90s may still consider themselves "seniors" and be able to travel independently.

In recent years, the term "silver tourists" or "silver consumers" has emerged as a way to refer to the growing demographic of older adults who are interested in tourism and travel. This term may encompass both seniors and elderly individuals, as well as individuals who fall somewhere in between these age groups.

It is important for the tourism industry to recognize the differences between these concepts and tailor their offerings and services accordingly. For example, while seniors may be interested in adventure travel or cultural experiences, elderly individuals may require more accessible accommodations or transportation options. By understanding the diverse needs and preferences of silver tourists, the tourism industry can create more inclusive and enjoyable experiences for all travelers.

On the other hand, the physical condition of seniors can have a significant impact on their participation in tourism. As individuals age, they may experience changes in physical abilities, such as reduced mobility, hearing or vision impairments, or chronic health conditions. These physical limitations can make it more challenging for seniors to engage in tourism activities, particularly those that require physical exertion or extended periods of standing or walking.

However, it is worth noting that not all seniors have the same physical condition. Some older adults may be in excellent health and have no significant physical limitations, while others may require more specialized accommodations or medical care to participate in tourism activities. Therefore, it is

essential for the tourism industry to consider the diverse physical needs and abilities of seniors when designing and promoting their offerings (López-Marfil et al. 2021) and organizations in the tourism industry have begun to incorporate accessibility features into their facilities and services. For example, hotels may offer accessible rooms or equipment such as wheelchair ramps, while tourist attractions may provide audio guides or other accommodations for visitors with hearing or vision impairments. Additionally, some tour operators may offer specialized tours or activities that cater to seniors with specific physical limitations (Urbonavicius et al. 2017).

By recognizing the physical condition of seniors and taking steps to make tourism more accessible and inclusive, the tourism industry can help older adults to continue to participate in tourism activities and enjoy new experiences. This not only benefits seniors but also has economic benefits for the tourism industry, as the senior population represents a significant and growing market for tourism services.

In this context, the current situation of China's tourism development is introduced, the background and significance of the study are determined, and then the issue of population aging is explored with reference to relevant theories and literature. Based on previous studies, this paper applies relevant theoretical concepts and logical ideas, and finally explores the impact of China's aging population on domestic tourism, i.e., older people have more free time to travel and enjoy their spiritual life after retirement (Min et al. 2021). On a proper financial basis, they will be able to fulfill their aspirations.

## **Materials and Methods**

### ***Basic Theory***

#### ***Circular Economy Model***

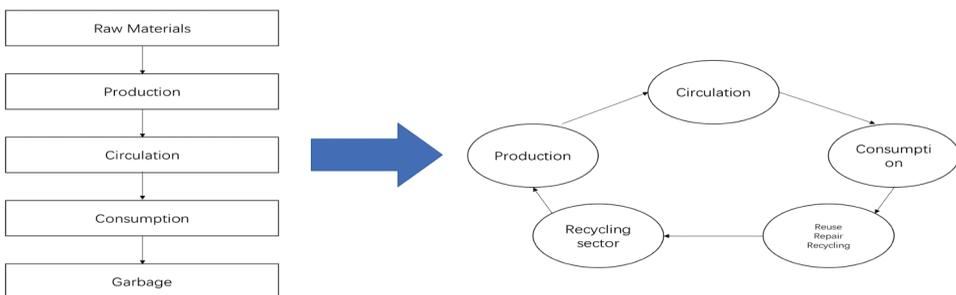
Circular economy is a necessary requirement for the development of the whole natural economy and is a driving force for the development of senior tourism. Today, circular economy is a kind of economic growth model, the core of which is emission reduction, reuse and resource mobilization, with low consumption, low emission and high productivity. The circular economy is a model of economic growth that is consistent with the concept of sustainable development. It is the key to China's relative lack of resources and high consumption. It is of practical importance to solve the bottleneck of China's economic development (Ana et al. 2021).

People are the center of the scientific concept of development in the development of circular economy and senior tourism. Respect for the people-centered principle requires us to see not only things but also people in the development process. The aim is to improve the living conditions of the

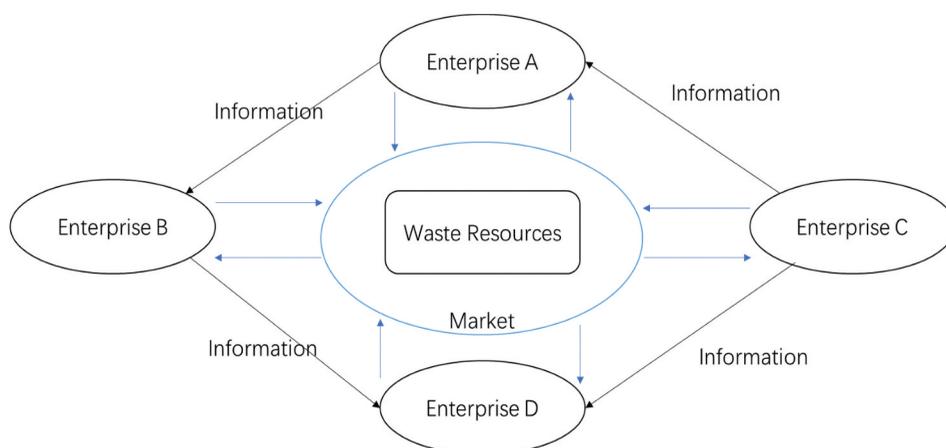
people, to improve the quality of their material, political and spiritual life and to promote their all-round development. It guides economic and social development and promotes the coordinated development of economy, population, natural resources and ecology (Artur, C., and A). In the long run, the green economy is a green economy that reflects and implements the concept of sustainable development.

In order to promote the process of modern civilization in the development of circular economy and senior tourism, we must choose a more rational ecological and economic development policy that emphasizes the adaptation, mutual promotion and coordination of ecological and economic systems. Green economy is a form of economic activity that combines economic development, environmental protection and construction (Osvaldo et al. 2021). In the process of economic construction, we must pay attention to the contribution and benefits of ecological capital and recognize that ecological environment is not only the driving force of economic activities, but also an important factor of production. Ensuring the organic unity of economic development, natural resource conservation, environmental protection and harmonious development of man and nature (Lidia et al.). In order to develop a circular economy and ensure harmony between the environment and development, the goal is to achieve a qualitative leap from recycling to resource management and from waste recovery to reduction. The comparison between traditional economy and circular economy is shown in Figure 2.

The main goal of the circular economy is to minimize the impact of resources on economic processes and to systematically avoid and reduce the amount of waste that can only be recovered after final reduction. The importance of the 3 R principles of reduction, reuse and recycling in the circular economy is not parallel, but scientific and systematic. Waste prevention for disposal. Firstly, resource economy will be fully considered, such as resource acquisition, more efficient use of resources in production units, waste prevention and reduction (Ricardo et al. 2021). Secondly, sources of pollution should not reduce the contamination and use of packaging waste, waste and other recyclable materials by consumers and return them to the business cycle. The



**Figure 2.** Comparison between traditional and circular economy.



**Figure 3.** Circular economy model based on the exchange and utilization of waste resources.

final disposal of waste in an environmentally friendly way can only be done if production and recycling cannot be avoided. The main objective of the harmonization of environment and development is to significantly reduce pollution through a qualitative change from final control to source management and from waste recycling to reduction of waste and resource consumption (Paz Francisco, and Morillas-Jurado 2021). The circular economy model based on the exchange and utilization of waste resources is shown in Figure 3.

### **Implementation Principles of Circular Economy**

The principle of system analysis in the development of circular economy and senior tourism. Circular economy is a comprehensive analysis of the economic and production impact. It reviews economic legislation based on objective laws and balances the economic, social and environmental interests of population, natural resources, environment, economy, society, science and technology and other major systems. Its main tool is applied systems analysis. If we ignore them, they will eventually dry up like fish. Production leads to waste being transported to nature and ecosystems have a limited capacity. Ignoring them is the basis for self-destruction. Therefore, economic production must take ecosystems into account. Social consumption must also take into account the potential of ecosystems. It must respect the basic ecological objectives and achieve a harmonious development of all elements by considering population, economy, society, natural resources and environment as a large system (Min et al. 2021).

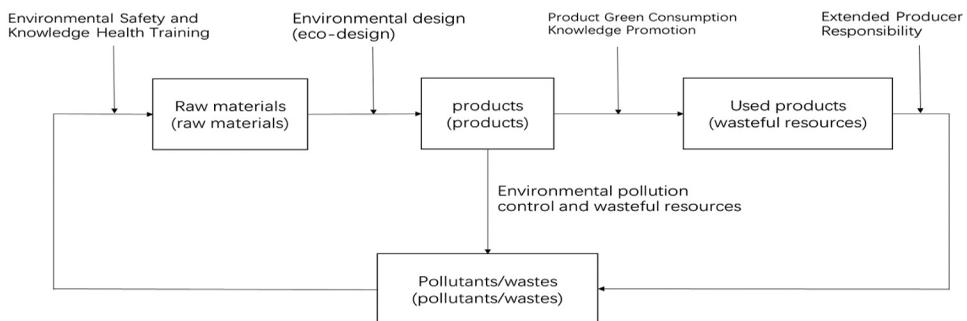
The principle of comprehensive control of environmental costs in the development of circular economy and senior tourism. For example, when water resources are relatively abundant, seawater is discharged, water is pumped away, and ecosystems along rivers are destroyed. Water resources

not only consume water resources, but also aquatic ecosystems. When it comes to water, it is a different kind of water that can damage water quality. It is also a heavy environmental burden. Environmental costs must be controlled across the board. For example, hundreds of studies conducted by the United Nations Educational, Scientific and Cultural Organization have shown that in temperate and semi-humid regions, rivers receive no more than 40% of the total water volume. This means that if the wastewater treatment meets the drainage requirements, less than 40% of the entire river's water will be removed without interrupting or maintaining the river's self-cleaning capacity (Elvis et al. 2021).

Circular economy and other rules in the development of senior tourism. The closed economy is a green economy that forms a rational cycle. This requires that, according to the natural ecosystem model, human economic activity is carried out in a cycle of renewable raw materials and renewable products. In this continuous economic cycle, raw materials and energy must be used as rationally as possible. Therefore, the environmental impact of business activities is minimized (Soojung, Insin, and Kim 2021).

The principle of resource limitation in the development of circular economy and senior tourism. The principle of decentralization is the basic principle of the circular economy. It requires improving the management of production processes. Reducing the use of materials and energy in production and consumption. Thus, the principle of minimization requires that economic growth is sustainable and environmentally sound (Leong, Siti Rahayu, and Nawal Hanim 2021).

Circular economy and the principle of product reuse in the development of senior tourism. Another principle of circular economy is to maximize the benefits for people. During reuse, early replacement of waste can be avoided. In order to maximize the useful life of products and containers in the production process, products and containers must be reused in their original form. Encourage the recycling industry to disassemble, repair and assemble waste and damaged products rather than replacing them quickly. Disposable



**Figure 4.** Corporate responsibility and its sources in the circular economy model.

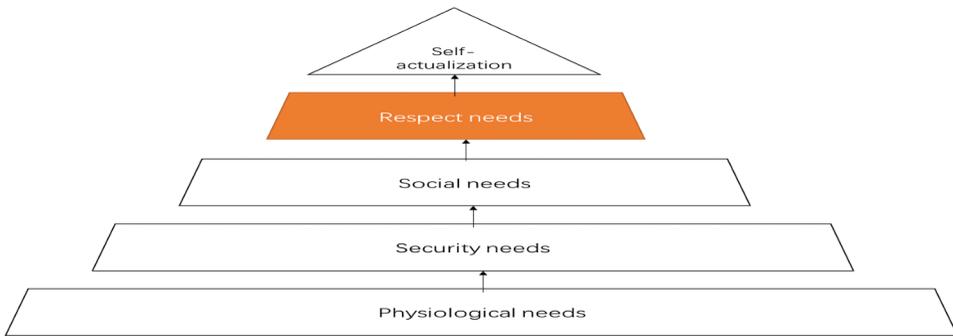
products impede the flow of all products in everyday life and encourage the return of useful or repairable products to the market so that others can use or ship products that are no longer needed. Corporate responsibility and its sources in the circular economy model are shown in [Figure 4](#).

### ***Tourism Management***

The main purpose of tourism management is to train students with knowledge and skills in economics, management, administration and other related fields, development of tourism, participation in hotel management, travel agencies, tourism management research and other border areas of tourism management and economics; to train students to focus on tourism management theory and knowledge, on tourism resources development and tourism management planning, and to acquire good basic skills for scientific development. On the basis of basic training in tourism management, planning and management of tourism resources, planning and development of tourism resources (Zielińska-Szczepkowska 2021).

Analyze the development and characteristics of tourism using a wide range of information technology in the development of circular economy and senior tourism. When using large-scale data analysis techniques for statistical analysis, in addition to analyzing current developments in the tourism market, existing data should be used to analyze and predict new trends and potential tensions in the tourism sector and to improve structures. Develop students' skills and use big data to analyze industrial developments. According to the market developments, teachers participating in tourism management training should develop training objectives and curricula by analyzing knowledge and skills needs and using the results of statistical analysis related to mass tourism. To train useful personnel that society and tourism industry really need.

The use of virtual learning platforms in tourism management education to train highly qualified tourism professionals in the development of circular economy and senior tourism. The virtual learning platform can enrich the practical content of tourism management from different perspectives and levels. Teachers can use the virtual simulation platform to create conditions for students to communicate in real time. An amazing virtual learning platform for tourism management can not only facilitate daily teacher training and classroom management, but also share quality teaching resources with students through downloads. Students should not be limited in time and location through the learning platform. Through this forum, teachers can also facilitate tourism education or organize tourism education design competitions. Through effective platform interaction, we can break the limitations of time, space and other objective conditions and allow students to stimulate their potential and creativity through competition. The level where tourism is located in Maslow's hierarchy of needs theory is shown in [Figure 5](#).



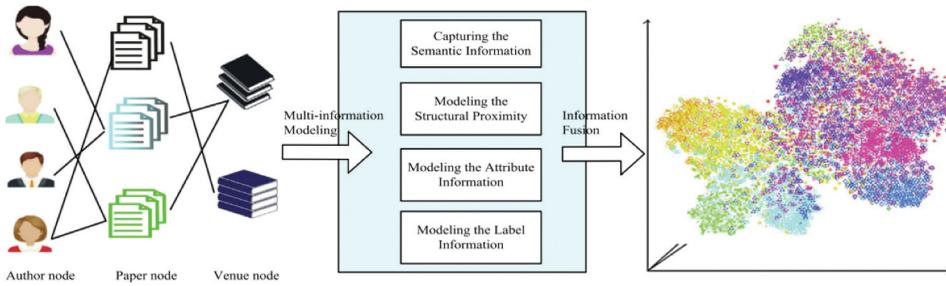
**Figure 5.** The level where tourism is located in Maslow's hierarchy of needs theory.

Collaboration between schools is enhanced through cloud conferencing, cloud classrooms, and other technological resources in the development of circular economy and senior tourism. When training tourism managers, universities should make full use of cloud conferencing, cloud classrooms and other technological services. We should remove obstacles, learn from each other, comprehensively study the interests of other universities in tourism education, seriously study and improve the problems and shortcomings in the education process, learn from advanced teaching and management experience, improve our own education level and train qualified tourism management skills.

### ***Preprocessing of Heterogeneous Data from Multiple Sources***

As the world's aging population grows, the elderly tourism industry is rapidly developing. However, in China, there is still a significant shortage of senior tourism products. With the development of the circular economy, senior tourism is becoming more closely integrated with it, and there is an increasing need to explore the potential of aging. To address these issues, we propose a multi-source heterogeneous data fusion approach to better understand the characteristics of elderly tourism and to develop effective market development strategies. Our approach involves collecting and integrating data from various sources, including online travel websites, social media platforms, and government statistics. We then preprocess the data and apply various data mining and machine learning techniques to identify patterns and trends in elderly tourism, such as popular destinations, preferred travel methods, and common health concerns.

Our outputs include a comprehensive understanding of the elderly tourism market, as well as recommendations for the development of new senior tourism products and marketing strategies. Our approach has shown promising results, with increased profitability and reputation for businesses that have implemented our recommendations. We believe that our multi-source heterogeneous data fusion approach can serve as a valuable tool for the development



**Figure 6.** An example of a multi-source data fusion method[10].

and growth of the elderly tourism industry. Figure 6 shows an example of a multi-source data fusion method.

### **Research Methods of Circular Economy**

The concept of emission reduction, reuse and recycling. “Green design” covers all areas of design and contributes to the sustainable development of society, the healthy development of human beings, and even the improvement of the environment. For example, clean design includes product design concepts, concepts, the selection of nonpolluting and nontoxic raw materials, and waste generation, use and disposal processes, as well as other aspects related to recycling and design, i.e., recycling and design. The entire life cycle of product design. Designers should consider not only the basic functional characteristics of the product, but also the product advancement to avoid adverse environmental impacts of the product and process. Waste management regulations. The third principle of circular economy is to maximize recycling. “Waste” should be recycled (reused) as much as possible to produce new products, products that consume fewer resources and energy, and then reintroduced into the market or production process to reduce waste generation. There are two types of recycling: the first is primary recycling. This is also recycling, so consumer waste is recycled to produce new products that resemble primary waste. For example, waste paper is used to make recycled paper and steel is used to make steel. This includes recycling waste that is used to produce other products with different characteristics, such as sugar cane used as a raw material for paper and molasses used as a raw material for brewing. Recycling is ideal for a circular economy as it reduces raw material consumption more efficiently than the second cycle. The specific model is shown below.

$$\phi(x_i, j) = \exp\left(-\frac{1}{2\sigma_j^2}x_i - c_i\right) \quad (1)$$

$$y_m = \varphi(\phi(x_i, j) * w_m) \quad (2)$$

$$w_t = w_{t-1} - u * \frac{\sigma E}{\sigma w_{t-1}} \quad (3)$$

Equation (1) is to calculate the state of change of the model expectation as the random value changes. Equation (2) is to calculate the change in the value of the nested function, and Equation (3) is to calculate the state of change in the output of the model output layer.

In the circular economy in senior tourism market development, the main idea of circular economy is mainly quoted to optimize the analysis of the senior tourism market development model, not to introduce all the economic development methods of the circular economy model to the development of the senior tourism market.

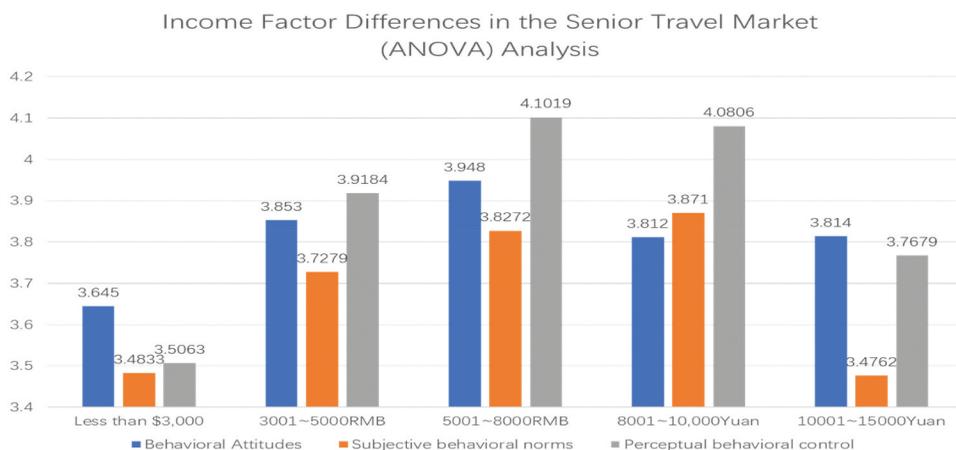
## Results and Discussion

### *The Current Situation of Senior Tourism Industry in China*

The senior tourism industry in China has started to collect data to understand and analyze the travel preferences of the elderly. China has many advantages in developing senior tourism, but as senior tourism develops, many problems are becoming increasingly evident, which pose many obstacles to the sustainable development of senior tourism.

China's senior tourism industry has been formed and is in the primary development stage. It also consolidates the current situation through surveys, large databases and institutions. In 2014, Chinese media released a survey on the overall travel preferences of Chinese seniors. Thirty-three percent of the sample liked to travel a lot. Most seniors like to travel. Four types of tourism products were identified based on the needs, preferences and physical activities of older adults: historical and cultural, natural landscape, leisure and folklore. The results showed that nature tourism (32.8%), folk customs and habits (30%), leisure (20%) and history and culture (18%) were favored. It can be seen that seniors have a positive preference for tourism products. The assessment of natural landscapes reflects the older people's learning and experience of folk culture, which is their favorite among the tourism programs.

In 2017, the travel website released an analysis of parental consumer behavior based on big data and systematic analysis of the senior online travel market. Based on follow-up data from 2016, seniors are more likely to travel with family, neighbors and older friends based on the average trip. Due to lack of time, seniors want to travel in the mountains. The observed data show that seniors mainly travel in March, April, May, June and November, with good weather from March to June each year. In addition to spring break and summer peaks, seniors travel frequently. Seniors rarely travel alone, but prefer

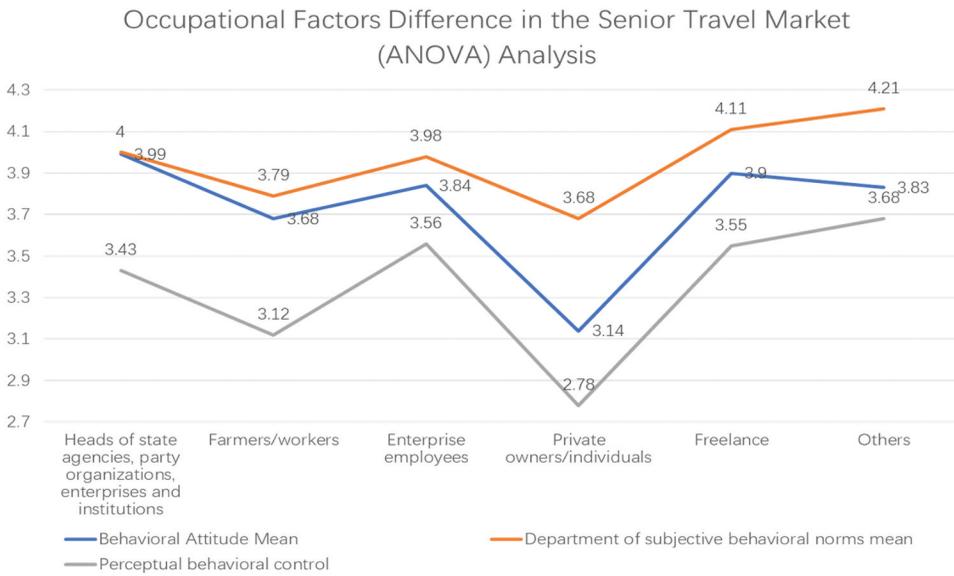


**Figure 7.** Income factor difference in senior tourism market (ANOVA) analysis.

to travel during peak times. The report also notes that travel agencies remain the primary travel channel for seniors, with about 70% of senior travelers choosing travel agencies and commercial channels where they can inquire about travel products and tourism. The main sales channel is stores outside of traditional travel agencies, accounting for about 60%. As a result, seniors prefer traditional booking methods such as cable TV bookings, telephone bookings and office bookings, which account for 62% of total bookings. Mobile apps are used to book travel products and are typically used by seniors and children. As you can see, seniors always want to travel through a travel agency. Offline travel agency stores are the most important place for seniors to purchase travel products. Income factors differ in the senior travel market (ANOVA) analysis, as shown in [Figure 7](#).

### ***Analysis of the Relative Advantages Existing in China in the Senior Tourism Industry***

The development of senior tourism in China is long-term, which provides a reliable guarantee for the development of senior tourism. According to the data from the National Office for the Aging at the end of 2017, China will account for about 24% of the world's population and will become the largest country in the world. Firstly, the aging population is an important source for the growth and development of senior tourism in China. As the consumer group of senior tourism services, a large number of elderly people bring a huge demand for domestic senior tourism, creating a favorable environment for senior tourism and providing sufficient momentum for the development of senior tourism. Article 14 of the Government Headquarters proposes countermeasures to further develop tourism, giving it political influence and recognizing the market potential



**Figure 8.** Occupational factors in the senior tourism market differences (ANOVA) analysis.

and good development prospects of senior tourism. The government’s 13th Five-Year Plan, released in 2016, aims to respond to the growing material and cultural needs of the people, placing higher demands on tourism development and introducing the new concept of “tourism+.” Tourism has entered a new golden age. Tourism has become a dynamic sector, an important part of people’s lives and an important tool for improving their lives. This policy provides for increased political support for older visitors, which is one of the priorities for the future development of tourism.

Article 14 of the 2019 Development Plan of the State Council in the Circular Economy Development proposes a response to further develop tourism by giving it political influence and recognizing the market potential and good prospects for the development of senior tourism. In 2016, the government released and implemented the 13th Five-Year Plan for National Tourism Development, which aims to respond to the growing material and cultural needs of the Chinese people, placing greater demands on tourism development and proposing the innovative concept of “Tourism+.” This marks a new golden age for tourism development. Tourism has become a dynamic sector, an important part of people’s lives and an important tool for improving them. This policy provides for increased political support for older tourists, which is one of the priorities for the future development of tourism. According to statistics, by the end of 2017, China had more than 30,000 tourist destinations (more than 10,000 A-class, more than 250 5A-class and more than 3,000 4A-class), more than 50 world heritage sites, more than 500 tourism

demonstration zones and more than 300 red tourism destinations. Occupational factors differ in the senior tourism market (ANOVA) analysis, as shown in [Figure 8](#).

### ***Problems Emerge in the Rapid Development of Senior Tourism***

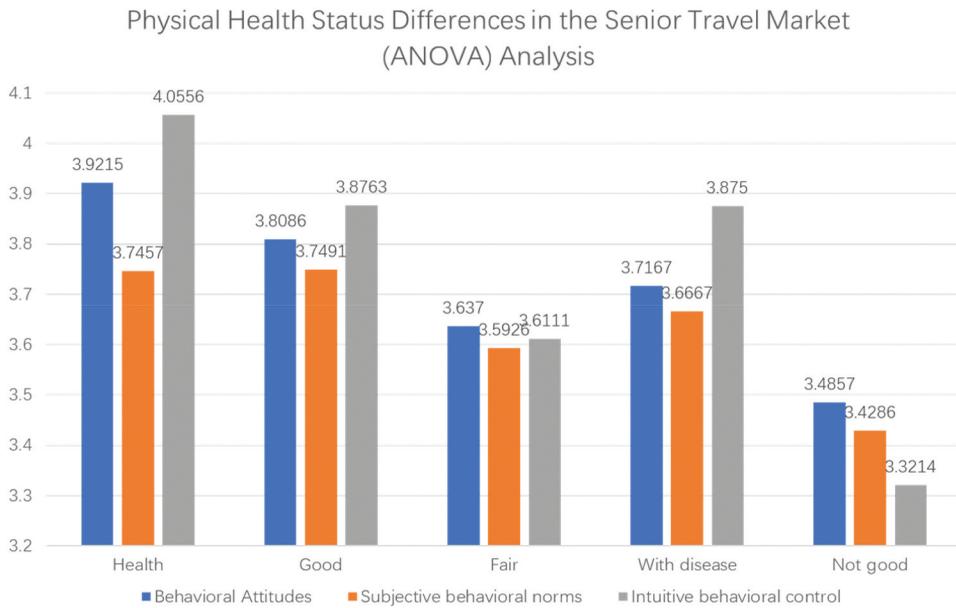
The problem of senior tourists is that the needs of senior citizens have their own characteristics, but in the tourism sector, senior tourists are not given enough attention and the market is not effectively divided (Ana et al. 2021). With aging, the huge demand for senior tourism is not only a new breakthrough for the tourism industry, but also poses many challenges and practical problems, such as

The development of senior tourism is still in its infancy and the level of development is relatively low. According to the overall stage of tourism development, it can be divided into tourism, leisure and leisure industry. According to the results of a sample survey on the comprehensive penetration rate of Chinese seniors, the penetration rate of Chinese seniors in tourism is still in the development stage, indicating that tourism for Chinese seniors is still in the primary stage.

There are no tourism products especially for the elderly. According to an analysis of some travel companies providing care for seniors, current senior travel products focus on the needs of younger consumers and have been adapted to provide solutions for older travelers. There is no effective competition. For example, the Parents website offers a travel product to parents. While the product is part of a professional services program, it does not limit participation by seniors. In addition, the working group developed plans for SUVs, bicyclists, and other older adults with unrestricted physical conditions and conflicting consumer preferences with the program.

The development of senior tourism lacks the necessary legal support. The lack of regulation of senior travelers makes it difficult for service providers to offer tours and limits the mobility of visitors. Although in 2016, the tourism board issued service standards for senior travel agents that require seniors over 75 to sign the signatures of their closest family members when traveling, the tourism industry is a low-income sector. Many travel agents may overlook people over 75.

Senior travel care services need to be enhanced. Many landscapes remain inaccessible. Zhengzhou media reports that the access route is closed and unavailable. Older travelers need better infrastructure such as medical stations, more comprehensive and accurate markings, older vehicles, wheelchair access, etc. However, many landscape sites are inadequately equipped or, although well-equipped, are not functioning due to a lack of monitoring equipment. Physical health status varies across the senior tourism market (ANOVA) analysis, as shown in [Figure 9](#).



**Figure 9.** Physical Health Status Disparity in the Senior Tourism Market (ANOVA) Analysis.

### ***Supply and Demand Characteristics in the Development Process of Senior Tourism***

#### ***Significant Characteristics of Demand for Senior Tourism***

Senior tourism market is a tourism market for older consumers. Of course, they need the help of the elderly. Due to the differences in physiology, psychology, living conditions and values, there are great differences in the status of men and women in society.

Older people have enough free time to travel. The most important characteristic of older people is that they have more travel time and relatively free time compared to other consumer groups. A report entitled “Analysis of the Behavior of Older Chinese Travelers” found that older travelers spend an average of 15 days more time traveling than younger people and travel more in the off-season. In 2017, the website released “Parental Travel Consumption Analysis,” which systematically analyzed the parental online travel market based on the Happy Parent Travel Product Guarantee and senior citizen consumption analysis, relying on big data. The data shows that seniors want to move from top to bottom because they have less time. In March, April, May, June and November 2016, seniors had to travel abroad. This is especially true in March, when the weather is pleasant and the high point of the spring season begins in the summer, which is the high point of travel for seniors.

Older adults travel with high income and savings as a foundation. In the life cycle scenario, middle-aged people save by earning more than they consume. After retirement, the income-to-consumption ratio gradually changes. Thus,

the young and the old, in other words, the elderly and the seniors, are entitled to social security. According to the Chinese context, older people are more conservative and have higher saving habits, which is in line with this view. In addition, an increasing number of older people are receiving long-term pensions, some health pensions, optimistic expectations of future income, and stable and affordable sources of funding. It is worth noting that austerity measures and disposable income directly affect the financial ability of seniors to purchase travel products (Parreira et al. 2021).

Older adults are more price-sensitive in the travel process. According to some studies, older people have a more rational consumer mind-set and savings are more popular. Price is an important factor influencing older people's consumption decisions. As the economy develops, in addition to favoring inexpensive products, seniors increasingly value the quality of products. Therefore, suppliers must be flexible in using pricing strategies to segment the market. The difference between China and developed countries is that Chinese seniors are usually economically disadvantaged when they are young and used to saving, which explains their perception of conservative consumption and highlights the economic benefits of products. The situation has changed as economic performance has improved, but the importance of price factors in tourism product decisions remains.

The results show that older people travel their main expectations are comfort, safety and reasonable travel conditions. Older people tend to be less fit than boys for excitement and driving. Since many seniors must take long-term medication, they can monitor their health rather than the risks and pay special attention to the comfort and safety of the trip.

Older adults prefer to travel to visit the countryside and learn about folk culture. According to the above analysis of the senior travel market, unique destinations and popular routes are the main choices for senior travelers. According to the big data analysis, 23% of seniors choose award themes, 37% choose general themes, 26% choose old town popular themes and 14% choose city parks. This is in principle consistent with the sample report mentioned above. Seniors want to visit natural landscapes and experience the characteristics of folklore tourism.

Older people prefer offline shopping in their travels. Although the Internet is developing rapidly and travel service providers are making full use of online resources to promote their products, seniors prefer to use traditional booking methods such as shopping consultation, telephone and in-store booking to book meetings.

### ***Supply Characteristics of Senior Tourism***

Vendors of senior travel services have also launched a range of products, but it is clear that the development of senior travel is still in its early stages and the industry has not yet given it sufficient attention, but it is also an

important sector. Research shows that the majority of senior travel products are large products from large integrated travel providers. These products are categorized as senior travel and are not suitable or only suitable for seniors. Seniors only purchase conventional tourism goods. Parents of tourism products offered by Landscape Attractions chose a more practical itinerary that was not different from other products in the same destination. Most products do not limit the participation of seniors. Some sites also produce products for middle-aged people, but there are not many products, and older people always choose the usual product groups. However, the travel agencies developing senior tourism are small, the overall strength of the travel agencies is not strong and the brand is not efficient enough.

Low prices in senior tourism can attract older people. There are a variety of products in the market. Many travel agents are very price sensitive to the tour product, so they attract seniors to shop at affordable prices. Yang Liu of the University of Maryland School of Urban Studies says seniors are taking a more cost-effective approach, which is likely to be a more cost-effective approach. However, according to Zhang Xu of National University, seniors have much higher disposable income than young people, and young people prefer the “cheap group” because of their long-term spending habits. However, the excessive pursuit of low prices also brings problems to the industry. Zhou Weihong, deputy director of Spring Travel, pointed out that poor black travel agencies began to low prices for shopping, and not all travel routes are strictly controlled, which ultimately harmed the interests of consumers.

It is necessary to strengthen the construction of senior tourism services. An analysis of the current situation of senior tourism in China shows that there are more and more senior destinations in China, but the construction of barrier-free facilities needs to be further improved and accelerated, and a comprehensive support system to meet the needs of the elderly should be established. In addition, due to the deteriorating physical and mental conditions of the elderly, older travelers may feel unwell and require first aid while traveling, but existing tourism products cannot guarantee the safety of the elderly.

There is a lack of laws to restrict or protect the senior tourism market. Currently, the guiding document for the Tourism Law is the Tourism Law of the People’s Republic of China, which was passed on April 25, 2013. It is not possible to organize risk programs as the travel time cannot exceed three consecutive hours, and doctors must attend as a group. However, the distribution of rights and responsibilities between suppliers and clients is not clear and the board has not established any other relevant regulations. As a result, the unilateral demands of travel agencies increasingly limit the enthusiasm of travel service providers for their tourism products. On the other hand, the order did not produce the desired effect and did not bind the travel service providers.

## ***Policy Recommendations for the Development of Senior Tourism in China***

### ***The Government Should Take the Initiative to Serve the Senior Tourism Market***

“During the 13th Five-Year Plan, the government began to ask the society to pay more attention to the development of tourism, but there are still not enough preferential policies or support. For example, there is no tourism product for the elderly, so the government can promote tourism for the elderly by prioritizing the development of tourism enterprises for the elderly or supporting local tourism centers. The profitability of tourism service providers is also an objective condition for marketing. Since tourism is a complex and multidisciplinary sector, governments can also send working groups to discuss cross-sectoral coordination and to create favorable conditions for the development of tourism for older people.

Governments should also pay more attention to long-term and sustainable accessibility, ensuring that it is fully developed and utilized over time, and that the priority concerns of older visitors are effectively addressed to meet the travel needs of certain groups. You’re missing the mark on the details. Senior citizen tourism development centers have also been established. Local governments should also take full advantage of the opportunities offered by senior tourism development and combine regional interests to establish special tourism centers that suit the needs of seniors and attract them to visit or live in the city. Develop the spending power of the elderly and promote local economic development.

### ***Improve Senior Tourism Market Development Norms and Laws***

The development of senior tourism in China faces significant challenges, including the absence of legal frameworks that would protect the interests of elderly travelers. The lack of a legal system makes it difficult to delineate the rights and obligations of the elderly, which can lead to conflicts between travel agencies and travelers. Additionally, the health and safety risks associated with traveling can be amplified for elderly individuals, increasing the need for reliable protections. To address these issues, advanced legal systems such as those employed by the European Union should be considered, and an integrated system for dealing with disputes should be established. Leveraging the power of artificial intelligence technologies, such as natural language processing and machine learning, can support this system by automatically identifying and processing complaints, thus reducing the burden on human resource (Stončikaitė et al. 2022).

To further promote the development of the tourism market, it is essential to prioritize the protection of the legal rights and interests of tour operators. By implementing an organization dedicated to protecting tour operators and perfecting the current legal system, both parties can benefit from clarified liability systems and efficient dispute resolution mechanisms. Artificial

intelligence can also contribute to this effort by providing automated tools for analyzing and managing legal disputes, further streamlining the resolution process. With strong legal protections in place, the tourism industry can work collaboratively to build a trustworthy and flourishing market for senior tourism.

### ***The Government Should Be Involved in Setting Prices in the Senior Tourism Market***

The rise in living standards among Chinese citizens has led to a growing number of elderly people engaging in tourism. Tourism has become a necessity for the elderly in many regions, resulting in a stable and increasing demand for tourism services. Empirical analysis indicates that the price of tourism goods is closely linked to tourism consumption, and as such, the prices of tourism products rise as demand increases. Despite the general increase in prices, overall demand for tourism products continues to grow, indicating that consumers are not deterred by price increases. In the context of the aging industry, modernization is needed to meet the growing awareness and demand for tourism among the elderly. Consequently, the prices of tourism goods can be adjusted upwards. It is worth noting that while older consumers value the quality of tourism, chronically low prices can hinder the healthy development of tourism for the elderly.

The integration of artificial intelligence technology can help tourism operators improve their marketing strategies and pricing policies. By leveraging AI algorithms, operators can analyze market data, identify consumer behavior patterns, and predict future trends. This analysis can enable operators to adjust their pricing strategies to meet market demands and improve the customer experience. Additionally, AI-powered chatbots can provide personalized customer service, answer frequently asked questions, and handle booking and payment processes. This can significantly reduce the workload of human staff and improve customer satisfaction. In summary, the integration of AI technology can help tourism operators optimize their pricing strategies, improve the customer experience, and enhance the overall competitiveness of the aging tourism industry.

## **Conclusion**

The rise of the circular economy has transformed people's consumption patterns, shifting away from material possessions and toward a deeper sense of inner prosperity. In the context of elderly tourism, this means providing physical and mental support, adaptation, and spiritual purification. This study aims to propose countermeasures to address the underdevelopment of China's senior tourism market, improve the distribution of the tourism and leisure industry, and offer theoretical insights into market development. In the wake of the COVID-19 pandemic, people's perceptions of travel and the nature of

tourism are changing. Virtual tourism, which allows people to travel safely and comfortably, has emerged as a new travel experience. As the population ages, elderly tourism has become an urgent issue. The changing family structure, attitude toward the elderly, and increased national income have rendered the traditional pension system inadequate for meeting the needs of modern seniors. Although China's aging tourism industry is not yet mature, it is gradually being recognized as a unique product and a new form of tourism for the elderly. Despite the lack of a uniform definition for senior tourism and the unsustainable demand for senior tourism products, this paper explores the management characteristics and market development model of senior tourism based on the circular economy model.

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### Data Availability Statement

The labeled dataset used to support the findings of this study are available from the corresponding author upon request.

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