Research on the Construction of Intelligent Public Decision-Making Model from the Perspective of Big Data

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Abstract. In view of the increasingly complex decision-making environment, an intelligent public decision-making model based on big data is proposed to enrich the existing public decision-making theoretical system and provide reference for public organization decision-making. Based on the normative rational research method, the research background, constituent elements and operation mechanism of the intelligent public decision-making model are mainly discussed. The research believes that the intelligent public decision-making model improves the ability of public organizations to use big data, reduces the bounded rationality of decision-making, and changes the traditional public decision-making model. Furthermore, the intelligent public decision-making model will be continuously revised and improved, and will gradually play a significant role in public decision-making. Therefore, it is suggested that the construction of big data technology infrastructure should be improved, the training of talents in big data technology should be increased, and intelligent public decision-making model should be integrated with intelligent city construction.

Keywords: big data · intelligent public decision-making · decision-making model

1 Introduction

Today, with the in-depth development of big data technology, big data technology has been gradually applied and penetrated into the fields of business, medical care, finance, scientific research, education and social networking, and is playing an irreplaceable and important role in people's daily life. The rapid economic and social development has also brought more decision-making problems to public decision-makers. In the era of big data, public decision-makers are faced with a more severe decision-making environment and need to solve more complex decision-making problems. Big data technology can not only be used in business, finance and other fields, but also in the field of public decision-making with its powerful data collection and processing capabilities, providing more decision-making intelligence for public decision-makers. Therefore, it is necessary for public decision-makers to improve the traditional public decision-making model with

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the help of big data technology, so as to continuously improve their decision-making ability to face the increasingly complex decision-making environment. Therefore, with the support of big data technology, this paper builds an intelligent public decision-making model, trying to improve and optimize the traditional public decision-making model, and improve the decision-making ability and decision-making quality of public organizations.

2 Research Background

2.1 Data Decision Technology Continues to Promote the Development of Network Economy

The continuous development of big data decision-making technology has promoted the continuous growth of the network economy. With the support of big data decision-making technology, the development scale of the network economy has continued to grow since 2015 (Table 1). According to the "Annual Insight Report on China's Internet Economy" (hereinafter referred to as the report) released by i-Research in 2020, the revenue of China's Internet economy in 2019 reached 53,774.2 billion yuan, with a year-on-year growth rate of 21.3%.

Big data technology has been widely used in business, finance, medical care, education, social networking, scientific research and other fields, and has produced innovative industrial space and certain social value (Table 2). According to the report, consumption, Internet finance and entertainment continue to be the main drivers of market revenue, and the three core tracks in 2019 accounted for nearly four-fifths of the total. In terms of the revenue composition of China's Internet economy market in 2019, the cultural and entertainment, consumer life and Internet finance tracks accounted for 15.5%, 44.2% and 19.4% respectively, and the total proportion of 79.1% is still the core contributor to the revenue of the network economy. In addition, online media, online education, transportation services and online medical services also contributed 7.0%, 6.0%, 4.4% and 0.4% of the market share of the network economy respectively, providing possibilities for the diversified development of the overall network economy market (Figs. 1 and 2).

2.2 Public Decision-Making Power is Increasingly Devolved

The advent of the era of big data has spawned a large number of network users. At present, my country's network users are large in scale and complex in structure. According to the 49th "Statistical Report on Internet Development in China" released by CNNIC, as of December 2021: the number of netizens in my country reached 1.032 billion, an increase of 42.96 million compared with December 2020, and the Internet penetration rate reached 73.0%. The structure of netizens in my country is also becoming more and more complex. According to the 41st "Report", in terms of age structure, the age structure of netizens in my country is concentrated in 20–29 years old, accounting for 30.3%, 10–19 years old accounting for 20.2%, and 30–39 years old accounting for 23.2%; In terms of educational structure, junior and senior high schools accounted for a relatively high proportion, 37.3%, 26.2%, respectively, and junior college, undergraduate and above

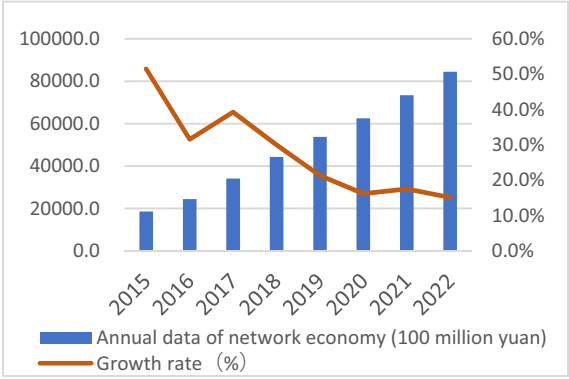

Fig. 1. Revenue Scale and Growth Rate of China's Internet Economy Market from 2015 to 2022 (Photo credit: Original)

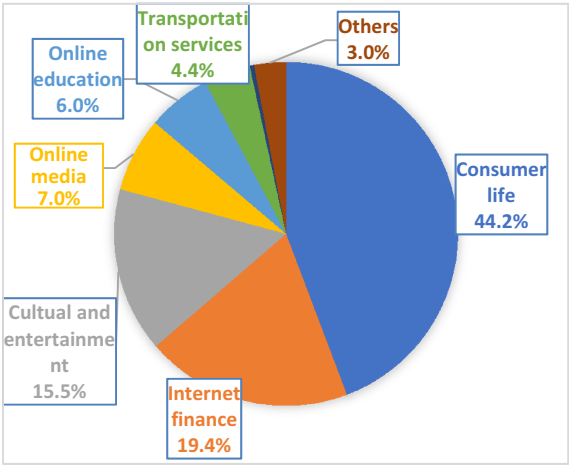

Fig. 2. Revenue Breakdown of China's Internet Economy Market in 2019 (Photo credit: Original)

accounted for a relatively low proportion, 9.1% and 11.5%, respectively; In terms of occupational composition, students, self-employed/freelancers, general employees of enterprises/company, employees of commercial service industries, employees of party and government organs and institutions, etc., account for a large proportion, mainly students and freelancers. The active participation of a large number of network users in public decision-making will improve the scientific and democratized degree of public decision-making. But how to accept network users to participate in public decision-making, this puts forward a test for the technology of public decision-making.

The development and application of big data decision-making technology has promoted the rapid development of business economy. As a public sector government, it should introduce big data decision-making technology into public decision-making to improve the intelligence of public decision-making. At the same time, in the face of an

Table 1. China's Internet User Structure in 2021 (Photo credit: Original)

China's Internet User Structure in 2021	age structure	10–19	20–29	30–39	Other age
		20.2%	30.3%	23.2%	26.3%
	Academic structure	secondary education	Tertiary education	Undergraduate Education	other education
		63.5%	9.1%	11.5%	15.9%

increasingly complex decision-making environment, in order to improve the democratization and rationality of public decision-making, the public sector should also continuously improve decision-making technology. Therefore, it is necessary to apply big data technology to public decision-making. For this reason, this paper tries to build an intelligent public decision-making model based on big data technology.

3 Model Components

The core elements of the intelligent public decision-making model are data, computing, algorithms and platforms.

3.1 Reconstructing Big Data Capabilities Based on Data

The core of the intelligent public decision-making model is data, and the most prominent is data collection, analysis and mining. Tools based on big data analysis effectively solve the problem of multi-source and heterogeneous data collection and unstructured data processing. The big data capability dimension is divided into resource integration, in-depth analysis, real-time prediction and insight, and machine learning capability. These dynamic capabilities focusing on big data will analyse, predict and discover future events in the intelligent public decision-making model, and will better predict the development direction of public events and the public's emotional changes, thereby providing public decision-makers with more information and actionable decision-making recommendations.

3.2 Distributed Real-Time Computing Power

The huge volume of big data computing, the close and complex internal connections, and the uneven distribution of data value density all put forward new requirements for the big data computing paradigm, and the emergence of cloud computing has effectively solved this problem. In the intelligent public decision-making model, cloud computing, as the core of "computing", highlights distributed data storage, data analysis, and IT solutions. Cloud computing, as a highly scalable, highly flexible and virtualized computing model, effectively solves the problem of insufficient computing power in traditional data mining.

3.3 Algorithms' Automated Decision-Making Capabilities

On the one hand, algorithms as engines are the core of big data processing and analysis, and algorithms are involved in every step of data processing. On the other hand, with the support of big data, the combination of neural networks, deep learning, machine learning, advanced cognitive analysis, robotic process automation and other types of algorithms can form algorithms with stronger computing power, better analyse data, fully mining the value of data, making public decision-making automated and intelligent, simulating human thinking activities and expanding the scope of human cognition.

3.4 Supporting Ability of Big Data Platform

The first is the support of big data hardware platforms, including high-speed storage servers, computing servers and other high-performance hardware resources, which are the infrastructure necessary to implement big data-driven machine intelligence decision-making. The second is the support of the big data software platform, including the big data management platform, the big data technology platform, and the big data application platform. The specific functions are as follows.

3.4.1 Big Data Management Platform

The big data management platform is used to standardize the entire process of managing the data life cycle, and its basic goal is to manage the "dirty", "chaotic" and "miscellaneous" problems of big data. Data analysts clean, analyse, and manage the data according to actual needs, so as to extract valuable decision-making information, and finally produce practical benefits in application.

3.4.2 Big Data Technology Platform

Big data analysis is a technology platform that uses many classic data mining methods to predict, associate, and group. In terms of data analysis technology, mature distributed file systems, batch processing frameworks, open source implementation platforms, etc. have been formed. It is a very effective means for unstructured analysis and processing of data.

3.4.3 Big Data Application Platform

Through the big data application platform, we can gain insight into all aspects of public issues, so as to provide clues and technical foundations for the design of innovative application models to form predictions and discoveries of future events.

4 The Operating Mechanism of the Intelligent Public Decision-Making Model

The intelligent public decision-making model provides a path to solve modern public decision-making problems, but it is not only possible with a large amount of data, but

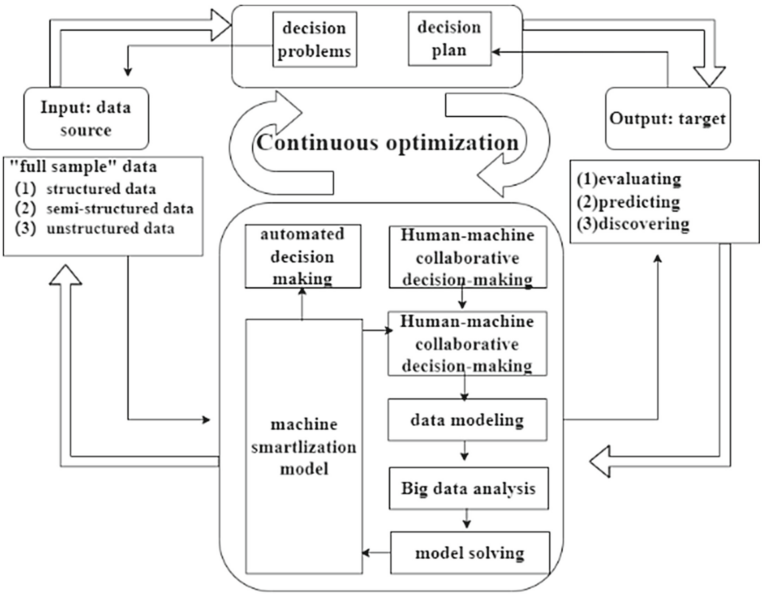

Fig. 3. The operating mechanism of the intelligent public decision-making model

must transform the data into evidence that can be used for decision-making. The operation procedure of the intelligent public decision-making model based on big data is shown in Fig. 3.

4.1 Classification of Decision Problems

The first type of problem is that people can do better, such as innovation, design, debate and other things that require creativity, and the role of big data is very limited; the second type of problem is that machines can do it better, such as repetitive and complex computing problems, for such problems of accurate calculation and rapid response, the advantages of big data can be maximized; the three type of problem is that machines and humans need to cooperate to complete better, and for such problems, human-machine collaborative decision-making is required. The above three types of problems cover all the problems in the decision-making process. In the decision-making process, on the basis of determining the classification problems, the problems that need to be decided are combined with the public problems to determine the scope of the decision-making problem and the decision-making goal. To do this, it is necessary to comprehensively analyse the current needs, competition and risks faced by the problem object, and gain a deep understanding of the problem to be solved.

4.2 Building a "Full Sample" Data Source to Aid Decision Making

First, big data expands data collection sources, such as artificially generated social network data, e-commerce shopping data, and various travel data; various types of operating

data generated by machines, sensor data scattered in different locations, and network search data, etc. By comprehensively collecting and accurately profiling the data generated by these people and machines, we can expand the data collection source and provide a basis for generating "full sample" data. The second is the overall analysis of the whole sample data. Big data can be analysed and processed through a large-scale full sample, which can overcome the dilemma of "limited information" in the decision-making process to a certain extent, and make the decision-making results more objective and rational.

4.3 Comprehensive Analysis of Decision Data

Comprehensive data analysis should complete the process from data aggregation, data mining to data interpretation". The first is data aggregation. The unified management of "full sample" data can complete the standardization, unification, update and use of data, and use the powerful distributed storage function of cloud computing to complete data storage management. The second is data mining. Driven by data, under the practice of exploratory knowledge discovery using statistics, data models, artificial intelligence and machine learning, the full-sample nature of massive data enables data mining to analyse data quality, aggregate social relationships, and deal with unstructured data and blurred data with noise, etc. The third is the data interpretation stage. The main function of data interpretation is human-computer interaction, resulting in the result that decision-making subjects can read and understand big data analysis. Displaying data analysis results through visualization technology can eliminate the boundary between the data world and the human cognitive world to the greatest extent, so that public decision makers can better understand and control big data, thereby improving the efficiency and effectiveness of decision-making.

4.4 Human-Machine Collaboration and Intelligent Decision-Making

On the one hand, automated decision-making is achieved through machine intelligent decision-making models. On the other hand, the visualization results of the data analysis stage are combined with decision-making problems and specific scenario applications, and organized and logical interactions are carried out through multiple decision-making subjects composed of data analysts, multi-domain experts, and decision-makers. In the intelligent public decision-making model, data analysts will be the connectors that connect data-driven machine intelligence and expert wisdom, and will form a decision interpretation model of "machine intelligence - data analyst - expert wisdom", and data analysts will reduce decision making. The limitations caused by "limited cognition" ensure the objectivity and rationality of decision-making results, and through this process, a decision-making plan is formed.

4.5 Feedback on Decision-Making

The goal of decision feedback is to measure and evaluate this decision, determine the accuracy and generality, and test whether the decision model in the actual environment

conforms to the public problem to be solved. At the same time, it is necessary to summarize experience and provide a more objective and scientific basis for the next public decision-making. There are three evaluation methods for decision feedback: the first is the evaluation of the decision maker's information processing ability. The second is the evaluation of the decision-making process. Whether the data-driven decision-making process plays a role in each link of data collection before decision-making, data analysis during decision-making, and data feedback after decision-making should be evaluated. The third is decision-making performance evaluation. Whether data-driven decision-making has a competitive advantage over its traditional decision-making model in terms of public sector performance, decision-making speed and so on should be evaluated, too. In short, the decision feedback process is a self-adjusting, self-learning, self-adaptive continuous improvement process. After each decision, the decision model database will be updated to provide more comprehensive data samples for the next decision.

5 Conclusion

This study innovatively proposes a intelligent public decision-making model based on big data. It focuses on the components of the intelligent public decision-making model, the decision-making organization process, the applicable conditions, and the operation mechanism and realization path from data to information, knowledge to decision-making under the systematic model. The advantages of the intelligent public decision-making model are mainly reflected in the following aspects:

5.1 The Intelligent Public Decision-Making Model Enhances the Ability of Public Organizations to Utilize Big Data

The process from data to intelligence is the process of public organizations gradually improving their ability to use big data. Specifically, in the process of big data application and management, public organizations have gradually enhanced big data thinking, resource integration capabilities, data mining capabilities, global insight and real-time prediction capabilities, machine learning capabilities, and the ability to transmit big data. Improve the innovation capacity of public organizations.

5.2 The Intelligent Public Decision-Making Model Reduces the Bounded Rationality of Decision-Making

In the era of big data, the intelligent public decision-making model can effectively reduce the bounded rationality of decision-making. On the one hand, in the face of complex decision-making environments and decision-making information, humans will increasingly rely on the intelligent decision-making of machines without more "cognitive resources" to rely on. On the other hand, the intelligent public decision-making model can easily complete the collection, analysis and processing of data, effectively reducing the dilemma of "limited information processing capability". Based on this, using the concept of big data-driven decision-making, the scope of human cognition will be expanded, the information processing ability will be enhanced, the decision-making process will be more rational, even close to "comprehensive rationality", and the decision-making results will be close to the "optimal solution". This improves the quality of decision-making.

5.3 The Intelligent Public Decision-Making Model Has Changed the Traditional Public Decision-Making Model

On the basis of big data technology, the intelligent public decision-making model changes the government-led public decision-making under the traditional model, and provides the possibility for public decision-makers to construct multiple subjects to participate in public decision-making. When faced with an increasingly complex decision-making environment, public decision-makers can use related technologies such as big data technology to collect and process more effective information, improve their own sensitivity and response speed to the outside world, thereby improving the quality of decision-making [1].

6 Suggestions

With the further development of information technology, in the future, the intelligent public decision-making model will be continuously revised and improved, and will gradually play a larger and larger role in public decision-making. In order to better cope with the increasingly complex internal and external environment, promote the optimization of public decision-making, and further improve the quality of public decision-making, it is necessary to increase the construction of information technology infrastructure and improve the training system for information technology talents. Based on this, can we fully endow technical capabilities for the optimization of the public decision-making.

6.1 Improve the Construction of Big Data Technology Infrastructure

A sound information technology infrastructure can greatly promote the effectiveness and efficiency of intelligent public decision-making model. First of all, it is necessary to build an information database to realize the interconnection of various databases, so that data in various fields can be transmitted and shared in real time; secondly, we must actively build a technological innovation platform, attach importance to the research on information technology [2], especially big data, and realize an innovative model that integrates production, education and research; finally, we must promote the progress of legislation, especially the protection of intellectual property rights, and strive to support innovation from the legal level [3], encourage innovation, and promote the vigorous development of information technology.

6.2 Increase the Training of Talents in Big Data Technology

Talent is the first resource for the development of information technology, and it is necessary to strengthen the training of information technology-related talents. The first is to improve the information technology personnel training mechanism of higher education, scientific research institutes and other institutions in my country, increase investment in information technology personnel training, and encourage enterprises to set up special funds to support the training of information technology personnel; The second is to set up senior management positions in information technology, so that talents and

positions are matched to avoid the loss of information technology talents; the third is to comprehensively absorb excellent talents in information technology and formulate relevant preferential treatment policies [4]. Through the training of information technology talents, it is beneficial to solve a variety of technical problems in network platform governance and improve the governance efficiency of network platforms [5].

6.3 Integrate Intelligent Public Decision-Making Models with Intelligent City Construction

The essence of the construction of a intelligent city is the continuous improvement of the city's intelligence. The process of urban intelligence is essentially the coordinated development process of the physical system, social system and information technology system of the city, especially the process of the gradual integration of the cyber system into the physical system and the social system. The process of urban intelligence involves many relevant subjects such as government departments, enterprises and institutions, social groups, and residents. Different subjects have different needs for intelligent cities [6]. Therefore, the process of building an intelligent city also involves the coordination of multiple interests. From the perspective of sustainable urban development and intelligent growth, the process of urban intelligence also needs to consider the coordinated development of the city's social system and the natural environment on which it depends. The application of the intelligent public decision-making model can fully express, collect and process the interests of multiple parties; at the same time, the intelligent public decision-making model can also timely perceive changes in the social system of the city and the natural environment on which the city depends [7]. Therefore, it is necessary to integrate the intelligent public decision-making model with the construction of intelligent cities to improve the construction capabilities of intelligent cities.

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