

# Application of Big Data Technology in Intelligent Decision-Making of Public Policy

Sizhe Ding \*

Central South university School of Literature and Journalism and Communication Changsha, China

\* Corresponding Author Email: Dsz020422@163.com

**Abstract.** For the analysis of the application effect of public policies in life, this paper uses big data technology to conduct in-depth understanding and analysis. Firstly, use big data analysis technology to build a more comprehensive, scientific and reasonable evaluation index system; Secondly, based on the concept of "whole process equilibrium", all primary indicators are given equal weight, and the improved group G2 model is constructed based on the expert assignment interval to solve the weight of each secondary indicator; Finally, according to the evaluation results, the application of big data technology in public policy aided decision-making analysis is realized

**Keywords:** Public policy; Big data technology; G2 model; Auxiliary decision-making.

## 1. Introduction

With the development of economy and the improvement of living standard, the rapid development of computer technology has greatly improved the informatization level of all industries. Today, human society is in the information age. Big data has been widely used in the business field. Alibaba has started to independently develop a big data cloud computing platform in 2010. Big data is not only used in the business field, but also the information storm it brings will bring about changes, and is changing the way of human thinking and social governance. Big data is an information asset with predictability. It can use a large amount of data occurred in the past and collected to predict the future of the world, which is also the core of big data; With big data focuses more on correlation than causality, which is the thinking of big data [1-2]. If big data is compared to an industry, the analysis and processing process of big data is the process of adding value to this industry. After the data is integrated and analyzed, new conclusions are drawn, which makes the original data have new value and bring new cognition. In the era of big data, the development of the Internet, the proposal of the cloud concept, the rise of the Internet of Things [3-4]. have all provided new ideas and methods for contemporary public management, which are used to build public policy issues more accurately and quickly and are opportunities and challenges for the development of administrative management in the new era [5-6]. At the same time, we can also see that with the rapid development of the economic level and the rising material and cultural level, the needs of the people are increasingly diverse; The spread of various public issues has accelerated, and their impact has expanded, thus increasing the risk of social governance. This has also increased the difficulty of public management and posed a serious challenge for the formulation of public policies [7-8].

The public management function of the government includes many links, and the formulation of public policy is one of the most important links [9-10]. Big data, known as the oil of the 21st century, is characterized by large amount of information, fast processing speed, low value density, etc. Its in-depth research, analysis and application will bring many new methods and means for the government to formulate public policies [11-12]. The core of big data is to establish the integration and correlation analysis between data, which provides a new tool for people's cognition, judgment and decision-making [13-14]. It will change the operation and supervision mode of the government, boost the economic restructuring, and make life more convenient for people. For the government, big data can improve its efficiency and effectively supervise its power. Today, big data brings opportunities and new vitality to public policy formulation. First of all, big data broadens the collection channels of data information, helping to ensure the comprehensiveness of information collection; Secondly, it ensures the quality of information and lays the foundation for public policy formulation; Finally, it

has realized public participation, promoted regulatory compliance, increased information transparency, and effectively enhanced the public's sense of trust in the government, which is conducive to building a sunshine government and enhancing the credibility of the government[15-16].

The practical significance of big data in public policy formulation is:

(1) Using the objectivity and accuracy of big data, by sorting out data, analyzing and processing, we can build a corresponding event model to prevent a one size fits all phenomenon in the process of policy formulation, constantly improve the level of policy formulation, and constantly improve the government's service capacity;

(2) The use of big data can effectively integrate public resources, establish a more complete data information sharing platform, and promote the birth of a multi governance situation; On the other hand, it can also break the data barrier and promote the construction of the coordination mechanism of various departments;

(3) Use big data to collect data information on urban politics, economy, education, transportation infrastructure, etc., summarize and integrate data resources, and provide the public with "one-stop" convenient e-government services. From "running at most once" to "not running at all", let the people run less and data more, constantly improve their public service level in practice, realize the reform of decentralization and service, and effectively guarantee and improve people's livelihood.

## 2. Establishment of model

Assume that the number of experts is  $L$ , The evaluation index is  $x_i$  ( $i = 1, 2, \dots, m$ ),  $x_m$  indicates that experts agree on the least important indicator.  $a_i^{(k)}$  give experts the relative importance value of indicators. The assignment interval is marked as  $D_i^{(k)} = [d_{1i}^{(k)}, d_{2i}^{(k)}]$ ,  $1 \leq d_{1i}^{(k)} \leq d_{2i}^{(k)}$ ,  $d_{1m}^{(k)} = d_{2m}^{(k)} = 1$ ,  $i = 1, 2, \dots, m$ ,  $k = 1, 2, \dots, L$ .

$S = \{1, 2, \dots, L\}$ ,  $D_i^A$  is the minimum class nonempty intersection.  $D_i^A$  following three conditions are met:  $A$  is a nonempty subset of  $S$ ;  $D_i^A = \bigcap_{k \in A} D_i^{(k)} \neq \emptyset$ ;

$D_i^{Aj} = [x_{ij}^-, x_{ij}^+]$ ,  $i = 1, 2, \dots, m$ ,  $j = 1, 2, \dots, n$ ,  $D_i^{Aj}$  adjacency degree of non-empty intersection with other minimum classes  $l_j$ :

$$l_j = 1 / \sum_{p=1, p \neq j}^n \|D_i^{Aj} - D_i^{Ap}\| \quad (1)$$

$$\|D_i^{Aj} - D_i^{Ap}\| = \left[ (x_{ij}^- - x_{ip}^-)^2 + (x_{ij}^+ - x_{ip}^+)^2 \right]^{1/2} \quad (2)$$

$v_j$  is  $D_i^{Aj}$  weight:

$$v_j = P_j l_j / \sum_{j=1}^n P_j l_j \quad (3)$$

Set up a comprehensive evaluation interval representing the relative importance value of indicators of group experts  $D_i$ :

$$D_i = \sum_{j=1}^n v_j D_i^{Aj} \quad (4)$$

$LS_i^h$  is  $n(D_i^{(Nh)})$  and  $n(D_i)$  distance,  $-LS_i^h / d_1$  is  $n(D_i^{(Nh)})$  left deviation rate:

$$d_1 = n(D_i) - n(D_i^{(N1)}) \quad (5)$$

$RS_i^h / d_2$  is  $n(D_i^{(Mh)})$  in  $n(D_i)$  right deviation rate:

$$d_2 = n(D_i^{(M)Q_i^+}) - n(D_i) \quad (6)$$

$l_k^*$  adjacency between the assignment interval and all other assignment intervals:

$$l_k^* = 1 / \sum_{z=1, z \neq k}^L \|D_i^{(k)} - D_i^{(z)}\| \quad (7)$$

$D_i^{(k)}$  is normalized adjacency:

$$r_k = l_k^* / \sum_{z=1}^L l_z^* \quad (8)$$

Risk attitude factor  $\lambda_i$  is:

$$\lambda_i = \left( \sum_{h=1}^{Q_i^-} \frac{-LS_i^h}{d_1} r_{Nh} + \sum_{h=1}^{Q_i^+} \frac{RS_i^h}{d_2} r_{Mh} \right) / 2 \quad (9)$$

According to matter element theory, matter element  $R = (N, C, V)$ , There are three elements: Value range of things to be evaluated, evaluation indicators and evaluation indicators on things to be evaluated.

$$R_i = (U_i, C_k, V_i) = \begin{bmatrix} U_i & c_{k1} & \langle g_{i1}, l_{i1} \rangle \\ \vdots & \vdots & \vdots \\ c_{kj} & \langle g_{ij}, l_{ij} \rangle \\ \vdots & \vdots & \vdots \\ c_{kn} & \langle g_{in}, l_{in} \rangle \end{bmatrix} \quad (10)$$

In the formula,  $i = \{I, II, III, IV, V\}$ ,  $C_k = \{c_{kj} | k = 1, 2, \dots, m; j = 1, 2, \dots, n\}$ ,

$$R_U = (U, C_k, V_U) = \begin{bmatrix} U & c_{k1} & \langle g_{U1}, l_{U1} \rangle \\ \vdots & \vdots & \vdots \\ c_{kj} & \langle g_{Uj}, l_{Uj} \rangle \\ \vdots & \vdots & \vdots \\ c_{kn} & \langle g_{Un}, l_{Un} \rangle \end{bmatrix} \quad (11)$$

In the formula,  $g_{Uj}$  and  $l_{Uj}$  respectively  $c_{kj}$  maximum and minimum values at all risk levels

$$R_k = (N_k, C_k, V_k) = \begin{bmatrix} N_k & c_{k1} & \langle a_{k1}, b_{k1} \rangle \\ \vdots & \vdots & \vdots \\ c_{kj} & \langle a_{kj}, b_{kj} \rangle \\ \vdots & \vdots & \vdots \\ c_{kn} & \langle a_{kn}, b_{kn} \rangle \end{bmatrix} \quad (12)$$

In the formula,  $a_{kj}$  and  $b_{kj}$  Min and Max values of secondary indicators.

On the basis of this risk assessment, the accumulation of big data assessment results can be used for public policy support decision-making analysis, and public policy is the guiding principle for public organizations to manage social public affairs. It defines the direction and objectives of management activities, especially a series of policies used to coordinate economic and social activities and their interrelationships through the strategic use of resources. Correct policies, coupled with effective implementation, will have a positive impact on national economic and social development; However, if the policy is wrong or poorly implemented, it will lead to adverse consequences. In a sense, the issue of public policy is the core of national legislation and judicial activities, as well as the important foundation of administrative activities and political party activities.

Therefore, governments around the world are paying more and more attention to it and strengthening their research.

### 3. Validation analysis

Data has time attribute, that is, data life. Data of different ages have different value characteristics. Generally, old data has overall or trend analysis value, while new data has more individual application value. In the age of big data, information updates very quickly. From the perspective of practical application, the timeliness of big data is usually very short. The timeliness of big data requires high standards for real-time data collection, real-time processing and real-time distribution. There is a well-known "one second law" in data processing, that is, the analysis results are calculated and distributed within a time range of a few seconds, beyond which time, the data will lose value. In many cases, this is still difficult to achieve, which largely limits the application of big data. Therefore, from the perspective of evaluation, this paper verifies the necessity of combining big data with public policy, and provides a theoretical method for the evaluation of overall performance.

Five experts in the research field participated in the determination of the secondary index weight, and the calculation results of the index weight are shown in Table 1:

**Table 1** Index Weight Calculation Results

| Level I indicator (weight) | Secondary indicator (weight) |                  |
|----------------------------|------------------------------|------------------|
| $V_1 (1/7)$                | $V_{11} (0.341)$             | $V_{12} (0.305)$ |
|                            | $V_{13} (0.251)$             | $V_{14} (0.103)$ |
| $V_2 (1/7)$                | $V_{21} (0.472)$             | $V_{22} (0.149)$ |
|                            | $V_{23} (0.379)$             | —                |
| $V_3 (1/7)$                | $V_{31} (0.682)$             | $V_{32} (0.318)$ |
| $V_4 (1/7)$                | $V_{41} (0.151)$             | $V_{42} (0.497)$ |
|                            | $V_{43} (0.352)$             | —                |
| $V_5 (1/7)$                | $V_{51} (0.713)$             | $V_{52} (0.287)$ |
| $V_6 (1/7)$                | $V_{61} (0.733)$             | $V_{62} (0.267)$ |
| $V_7 (1/7)$                | $V_{71} (0.415)$             | $V_{72} (0.146)$ |
|                            | $V_{73} (0.439)$             | —                |

The classical domain is determined as follows:

$$\begin{aligned}
 R_I &= \begin{bmatrix} U_I & c_{11} & \langle 0.85, 1 \rangle \\ & c_{12} & \langle 0.85, 1 \rangle \\ & c_{13} & \langle 0.85, 1 \rangle \\ & c_{14} & \langle 0.85, 1 \rangle \end{bmatrix}, \\
 R_{II} &= \begin{bmatrix} U_{II} & c_{11} & \langle 0.65, 0.85 \rangle \\ & c_{12} & \langle 0.65, 0.85 \rangle \\ & c_{13} & \langle 0.65, 0.85 \rangle \\ & c_{14} & \langle 0.65, 0.85 \rangle \end{bmatrix}, \quad R_{III} = \begin{bmatrix} U_{III} & c_{11} & \langle 0.35, 0.65 \rangle \\ & c_{12} & \langle 0.35, 0.65 \rangle \\ & c_{13} & \langle 0.35, 0.65 \rangle \\ & c_{14} & \langle 0.35, 0.65 \rangle \end{bmatrix}, \quad R_{IV} = \begin{bmatrix} U_{IV} & c_{11} & \langle 0.15, 0.35 \rangle \\ & c_{12} & \langle 0.15, 0.35 \rangle \\ & c_{13} & \langle 0.15, 0.35 \rangle \\ & c_{14} & \langle 0.15, 0.35 \rangle \end{bmatrix}, \\
 R_V &= \begin{bmatrix} U_V & c_{11} & \langle 0, 0.15 \rangle \\ & c_{12} & \langle 0, 0.15 \rangle \\ & c_{13} & \langle 0, 0.15 \rangle \\ & c_{14} & \langle 0, 0.15 \rangle \end{bmatrix}, \\
 R_U &= \begin{bmatrix} U & c_{11} & \langle 0, 1 \rangle \\ & c_{12} & \langle 0, 1 \rangle \\ & c_{13} & \langle 0, 1 \rangle \\ & c_{14} & \langle 0, 1 \rangle \end{bmatrix}, \\
 R_1 &= \begin{bmatrix} N_1 & c_{11} & \langle 0.5, 0.75 \rangle \\ & c_{12} & \langle 0.1, 0.25 \rangle \\ & c_{13} & \langle 0.4, 0.7 \rangle \\ & c_{14} & \langle 0.25, 0.4 \rangle \end{bmatrix}
 \end{aligned}$$

Finally, the comprehensive correlation matrix is obtained:

$$H(N) = [-0.569, -0.412, -0.051, -0.140, -0.387]$$

Thus, the comprehensive grade can be calculated:

$$H_{io}(N) = \max_{i=\{I,II,III,IV,V\}} H_i(N) = H_{III}(N)$$

According to the evaluation results, it can provide services for the integration of big data technology and public policy.

#### 4. Suggestion analysis

In order to ensure the scientific rationality of public policy formulation, in view of the data deviation problem in China's current data statistics, we must closely focus on the central work of the Party and the State, and speed up the construction of a data system with improved systems, jurisprudence, and high degree of informatization in accordance with the requirements of standardization, unity, rational division of labor, and cooperation and sharing, so as to clarify data statistics indicators, establish data statistics standards, and improve data processing capabilities, Correct data selection deviation, better serve macro decision-making and social development, and devote to the modernization of national governance capacity.

While improving the data processing technology, we should also recognize that the development of human society is full of uncertain events, which constitute a colorful world. In addition, the development of the contemporary network and economic progress have brought material prosperity and ideological liberation, deepening this uncertainty. This uncertainty also puts forward requirements for the formulation of public policies. When formulating public policies, the government needs to first establish issues, and then establish public policies through the process of policy agenda, scheme selection, scheme optimization, etc. This is a long-term process. However, the data after processing and analysis often reflect the current or previous public opinion feedback, which has a certain lag. If the data is directly used in the public policy formulation process, it may lead to the final policy failure. One of the most important characteristics of big data is that it is forward-looking and predictive. If we can fully analyze and use the forecasting function of big data, it will be relatively easy to measure uncertainty. People will have greater control and predictive power in the formulation of public policies, and can more calmly cope with various challenges.

#### 5. Conclusion

This paper uses big data technology for in-depth understanding and analysis. Based on the analysis of big data analysis technology, a more comprehensive, scientific and reasonable evaluation index system is built. Based on the concept of "whole process balance", all major indicators are given equal weight, and an improved G2 group model is constructed based on the expert allocation interval to solve the weight of each important indicator, realizing the application of big data technology in public policy aided decision-making analysis.

#### References

- [1] Yang Zhixin, Gao Xiang, Zhang Qing, Zhang Di. Research on the Evaluation of Public Policy Implementation under the Big Data Framework [J]. Computer Age, 2021 (01): 124-127
- [2] Wei Jingrong. Research on Evidence based Decision Making in the Age of Big Data: An Analysis Framework [J]. China Science and Technology Forum, 2020 (07): 24-32
- [3] Cheng Xiangru Research on the Application of Big Data in Public Policy Making [D]. Zhengzhou University, 2020
- [4] [4] Qin Hao. Big Data Driven Public Policy Transformation [J]. China Party and Government Cadres Forum, 2020 (02): 62-65

- [5] Yang Daifu, Yunzhan. Research on Innovation of Public Policy Evaluation in the Age of Big Data: A Process Based Perspective [J]. E-government, 2020 (02): 92-99
- [6] Zhang Hao. On Innovation of Public Policy Assessment in the Context of Big Data [J]. Information Technology and Informatization, 2018 (09): 178-179+182
- [7] Zhen Xulei. An Analysis of the Opportunities and Challenges of Building Public Policy Issues in the Age of Big Data [J]. Decision Exploration (II), 2018 (04): 23
- [8] Teaching and research platform integrating big data and virtual reality technology -- Analysis of the technical platform of the Public Policy Laboratory of Renmin University of China [J]. Experimental Technology and Management, 2017, 34 (10): 280
- [9] Yin Jie, Hu Min. Rebuilding the Public Policy Dimension of Social Sciences [J]. Hunan Social Sciences, 2017 (02): 38-44
- [10] Wang Chunfu. Double Risks of Big Data and Public Policy and Their Avoidance [J]. Theoretical Discussion, 2017 (02): 39-43
- [11] Pu Pan, Ma Haiqun. Building China's Open Data Policy Model in the Age of Big Data [J]. Information Science, 2017, 35 (02): 3-9
- [12] Han Zhenyan, Fei Chang. Opportunities, challenges and responses to public policy issues in the era of big data [J]. Journal of Hubei University of Administration, 2016 (06): 56-60
- [13] Zheng Shiming. Research on the Application of Big Data in Environmental Policy Analysis [J]. Hunan Social Sciences, 2016 (06): 7-12
- [14] Wang Haicheng. Research on Policy Values in the Age of Big Data [J]. Heihe Academic Journal, 2016 (04): 28-29
- [15] Xu Meiqi. Policy Values in the Age of Big Data [J]. World of Labor and Social Security, 2016 (08): 80-81
- [16] Wei Hang, Wang Jiandong, Tong Nannan. Research on Public Policy Evaluation Based on Big Data: Review and Suggestions [J]. E-government, 2016 (01): 11-17