A New Digital Government Construction Based on Attention Mechanism

Chao Wu[1*], Guanqi He[2]

{chao.wu@zju.edu.cn[1], 22222154@zju.edu.cn[2]}

Zhejiang University, Zhejiang, 310030, China

Abstract. The development of big data has had a profound impact on the nature of information, which in turn has changed the processes and patterns of public decision-making. In order to better cope with such changes, information processing needs to be faster and more scientific, leading to smarter decision-making and a "smarter" government. Therefore, the construction of a new digital government needs to pay special attention to the organization and allocation of resources and the way decision-making information is collected. The attention mechanism reveals how intelligences can quickly filter and judge valuable targets in an information overloaded environment, which provides insights for the construction of smart government. In the academic research of public management, the existing discussion mainly focuses on the attention element of administration and policy, and it is necessary for us to further introduce the attention mechanism into the academic exploration and practical activities of decision-making information of digital government.

Keywords: Government Attention, Attention Mechanisms, New Digital Government, Bayesian Formulation.

1 Introduction

Organizational and social relations are complex and diverse. Both governments and other organizations face problems such as limited resources and insufficient staff, and how to allocate limited resources has become an important issue. Governments and other organizations need effective ways of allocating resources in order to maximize their use.

Governments and organizations need to use limited resources such as money, manpower, information and technology in their work. These resources are necessary for the proper functioning of the organization. Governments need money to build infrastructure and provide public services such as education and health care, and they also need specialized personnel to formulate policies and manage affairs. However, limited resources and insufficient personnel make it challenging for governments to allocate resources.

In the past, organizations often used simple ways of allocating resources, such as dividing land by district and taxing based on household income. As society progresses, organizations are beginning to adopt more complex ways of allocating resources. Governments and social organizations play an important role here. Governments can guide the distribution of resources and balance of interests through the formulation of policies and programs to promote sustainable development. In modern society, organizations must continuously improve their

PMBDA 2023, December 15-17, Nanjing, People's Republic of China

DOI 10.4108/eai.15-12-2023.2345364

resource allocation methods and adjust them to the changing social and economic environment. Governments should also actively adjust and optimize resource allocation to promote effective distribution and sustainable development. This paper argues that the introduction of an attention mechanism can optimize resource allocation and ensure maximum utilization [1-2].

2 Definition of the concept of government attention

Government attention, which refers to the range of issues and information on which the government focuses when dealing with public affairs, is considered by scholars to be a resource. Government attention is limited and proper allocation is critical. When information redundancy, urgency and unpredictability exceed response capacity, it is difficult to fully utilize attention resources by relying only on high-level empirical judgments[3]. Therefore, using big data methods to allocate attention resources is usually more rational than relying on human judgment. Assisting decision-making departments through attention modeling can lead to more rational resource allocation and more effective decision-making.

With the diversification of social needs and the increased requirements for governance modernization, local governments are faced with more burdensome and diversified administrative tasks and governance goals. In this process, the attention of local governments becomes more precious and a scarce resource. The allocation of local governments' attention directly affects the whole process of public policy. Especially in terms of administrative resource input, local governments' attention allocation plays an important role in the quality, direction and outcome of the implementation of public policies. Therefore, the allocation of local governments' attention is a key entry point for studying the behavior of local governments and the implementation mechanism of public policies in China.

The issue of government attention allocation requires comprehensive consideration of many aspects[4]. First, local governments need to satisfy the diversified needs of the society, and when determining the principles and standards of attention allocation, they should fully consider the public expectations and interests in order to realize a fair and equitable distribution of resources. Secondly, local governments should establish a scientific prioritization mechanism to efficiently allocate limited attention resources to the most prioritized areas and projects. Finally, cross-sectoral cooperation and information sharing are important means to improve the effectiveness of local governments' attention allocation, and by integrating resources and working together, they can better address governance challenges and achieve their goals.

3 Insights from neuroscience: mechanisms of attention

As a class of intelligences, governments have structures and functions that are very similar to those of the brain[5]. The attention mechanism established by the brain in an information overloaded environment provides a mechanism that can be used to minimize the cognitive errors of the government on the environment, update the cognitive model of the government, and build a smarter government.

When cognitive scholars studied human vision, they discovered a special signal processing mechanism. This mechanism enables the brain to focus on only a part of the information that is significant or interesting when receiving external information, thus filtering out unimportant information and improving the efficiency of information processing. This is the attention mechanism. Later, the attention mechanism was introduced into the field of machine learning and was widely used in tasks such as natural language processing (NLP), image processing (CV) and speech recognition.

3.1 Building a brain-like government

Government, as the core of social governance, shares many similarities with the brain. The brain receives and selectively processes large amounts of information, transmits signals through neurons to direct the body's actions, and has separate but interconnected functional areas that can be strengthened through learning. Similarly, government has similar characteristics: as the center of information and decision-making in society, different government departments deal with related matters relatively independently but are interconnected, and government consciously strengthens its organizational capacity through continuous learning[6-7]. The brain and the government share so many common characteristics that it can be said that the government is the brain of society.

3.2 Attention mechanisms in the brain

The main task of the brain is to receive and process information that interacts with the environment. Sensory information is formed by the senses, while perceptual information is formed in the brain through the process of synthesis. Part of the sensory and perceptual information becomes part of the memory, stored in the brain to guide future experiences. Constantly stimulated sensations, perceptual information, experiences, and emotions work together to trigger internal thinking, planning, and decision-making. At the same time, the brain uses language to associate objects with abstract symbols to convey information. This series of brain activities guides the organism consciously or unconsciously. It can be said that brain functioning begins with and revolves around information.

The constant influx of sensory information and the limited memory of the human brain triggered a contradiction[8]. As a result, neuroscience has discovered that the brain produces a mechanism to cope with the problem of information processing, known as the attentional mechanism.

The attentional mechanism consists of the following key elements and capabilities: the ability to acquire information from the cognitive model of the environment (pre-existing or updated) and the ability to make model judgments[9]. When the cognitive model can efficiently acquire information from the pre-existing environment and build a cognitive model with a good fit, it can effectively judge the current environment, solve the information overload problem, and make decisions and predictions through efficient model judgment ability.

3.3 Bayesian Formulation and Attention Mechanisms

In fact we can explain the government's attention mechanism by using the Bayesian formula as shown in the following equation:

$$P(M \mid E) = \frac{P(M)P(E \mid M)}{P(E)} \tag{1}$$

In the equation (1), E represents the environmental state and M represents the cognitive model, then P(E) represents the underlying probability, which is a constant: P(M) represents the probability distribution of the cognitive model obtained prior to the observation of the environmental state-generally referred to as "prior "; P(M|E) represents the probability distribution of the model given the state of the environment-generally referred to as the "a posteriori" in attentional mechanisms; and P(E|M) represents the likelihood ratio. When the difference between the prior and the posterior is extremely large, the likelihood ratio will be extremely small because P(E) is a constant, indicating that the model's ability to judge the environment is extremely poor. In this way, in order to improve the accuracy of judgment, the intelligent body will continuously carry out self-regulation to improve its judgment level to ultimately realize the correct cognition of the environment.

Simply put, it is possible to improve the government's cognition in a complex environment through modeling from the perspective of information[10-12]. The improvement of the government's correct cognition of the environment - the increase of the value of P(S|M) can be constantly corrected according to the difference between the a priori P(M) and the a posteriori P(M|S), and the initial stage of the model's judgment ability - the value of P(M) - is not so strong or weak. --is not so important. Through the constant comparison and feedback of ex ante empirical judgment and ex post state information, the government can gradually revise the cognitive model and finally achieve accurate judgment of the environmental state[13].

In short, the attention mechanism helps to answer the question of "how to judge which information is unnecessary, which information should be paid extra attention to, and how to use it" in a complex information environment. This mechanism of attention provides a comparable, computable, concise and smarter analytical framework for the government to collect information, judge information and make information-based predictions in complex information environments.

3.4 The Case for Health Codes

During an epidemic, we can apply the Bayesian formulation to optimize health codes. Suppose P(M) denotes the prior probability of an individual's health state, P(E|M) denotes the likelihood that E (e.g., normal temperature, no respiratory distress, etc.) will be observed in a health state of M, and P(M|E) denotes the probability that, based on the observed E, the individual's health state will be M.

In the context of health codes, P(M|E) denotes the probability that the individual's health state is M based on the observed information E. And P(E|M) denotes the probability of observing the information E in the context of a health state of M. P(M) denotes the a priori probability of an individual's health state, which can be determined from historical data or other relevant factors. p(E) denotes the probability of observing the information E.

In the process of health code generation, the health information of an individual as well as the related observations are fed into the model. According to the Bayesian formula, the model calculates the posterior probabilities of each health state and then generates the corresponding health codes based on these posterior probabilities. By continuously collecting and updating

individual health information and observation data, the health code model can be corrected according to the Bayesian formula, thus improving the accuracy and judgment of individual health states. This Bayesian formula-based approach enables the health codes to more accurately assess the health status of individuals and provide targeted prevention and control suggestions and measures for the government and related organizations.

4 Advantages of Attention Mechanisms

Traditional theories of public management are overly complex, involving a large number of concepts, frameworks and models. This makes the theory difficult to understand and apply, and causes problems for practitioners and policymakers. Complexity limits the practicality and applicability of theories to meet the real-world challenges of rapid change and uncertainty. They are too abstract and generalized and lack personalized guidance. There are huge differences between countries, organizations and domains, and a single theoretical framework cannot meet diverse management needs. Practitioners often have to translate and adapt theories and practices on their own, making management work more difficult and risky. In contrast, the attention mechanism is not only simple and clear, but also has a wide range of applications and strong explanatory power.

First, the principle of attention mechanism is simple. It explains decision-making behavior through Bayesian formulas without the need for complex frameworks and models, making it more rational. When applied to government decision-making, it relies not only on the rationality of the leadership group, but also on the technical rationality based on formulas and principles. Second, the attention mechanism has a wide range of application and can explain social phenomena in different times and domains. For example, the failure of planned economy can be explained in terms of insufficient governmental attention resources. During the New Crown epidemic, the attention mechanism can help focus attention on important information and adjust the risk level in time to respond. Finally, attention mechanisms can explain both success and failure cases. In success cases, effective attentional mechanisms can help focus attention and resources to achieve outstanding results in key areas. In failure cases, it is necessary to consider whether individual attention mechanisms are disturbed or misdirected, and to improve the management and deployment of attention in order to enhance decision-making and the effectiveness of actions.

5 Building a smarter government

Since ancient times, the mechanism of attention has played an important role in public administration. Ancient rulers had to allocate their attention effectively, prioritize important issues and promote national prosperity and stability. The information explosion in modern society makes the attention mechanism even more important. In order to realize accurate and rapid decision-making, we can conduct in-depth research in the following two directions:

First, create more social sensors. These technological tools and platforms are used to collect social data and information, and the government can obtain comprehensive and accurate social information to understand public needs and social issues, so as to direct attention to prioritize important matters.

Second, build new data-driven decision-making models based on data. Using methods such as machine learning, artificial intelligence, data analysis, complex systems theory and behavioral economics, the government can better understand policy issues, predict and evaluate policy effects, and make decisions more scientific.

Based on the principle of attention, a smarter digital government can be designed. Building a digital government is a long-term process, rather than constructing an optimal system at the beginning. The government organization structure may need to make some changes to adapt to the needs of digital government. Finally, we should propose principles for building digital government based on the principle of attention to guide the process of digitizing government.

In practice there are two progressive stages of building a smart government:

First, by analogy and simulation of the attention mechanism of the human brain, we can explain the mechanism of government administrative behavior and partially improve the government's cognition, decision-making behavior and future prediction in the external environment. The goal of this stage is to improve the government's sensitivity and responsiveness to the external environment in order to better realize the goals of social development.

The second stage is to optimize the government's internal organization, systems and processes through the attention mechanism, and to establish a long-term resilient human-computer collaborative decision-making mechanism that is constantly evolving. In this stage, the government can draw on the principles of the attention mechanism to improve its organizational structure and enhance information sharing, teamwork and decision-making efficiency. By introducing artificial intelligence and automation technologies, the government can make better use of attention resources, optimize the decision-making process, and adapt to the constant evolution of social changes and needs.

6 Conclusions

In the future outlook for the application of the attention mechanism to government management, the following developments can be foreseen: first, with advances in technology, methods such as artificial intelligence and big data analysis can be used to optimize the allocation of government attention, accurately identify and solve social problems, and focus resources on priority areas to improve decision-making efficiency and accuracy. Second, emerging technologies and platforms create more opportunities for public participation in government decision-making and services, and direct and quick interaction with the public through digital platforms and social media to build an open, democratic, and mutually trusting government-citizen relationship. In addition, attention needs to be paid to the problem of attention bias in government management, and research needs to be conducted on how to identify and correct these biases, so as to ensure that decision-making is fair, objective and long-term. In addition, in the face of social complexity and diversity of problems, it is necessary to explore ways to effectively manage the government's attention resources, formulate prioritized management strategies, establish cross-departmental collaboration mechanisms, and cultivate high-quality public management personnel. In conclusion, in the future, in-depth research should be conducted on the application of advanced technology,

strengthening public participation, solving the problem of attention bias and effectively managing resources, in order to enhance the quality of government decision-making and services, and to realize good social governance and public management.

Acknowledgments. This work was supported by the National Key Research and Development Project of China (2021ZD0110505), National Natural Science Foundation of China (U19B2042), the Zhejiang Provincial Key Research and Development Project (2023C01043, 2022C03106), University Synergy Innovation Program of Anhui Province (GXXT-2021-004), Academy Of Social Governance Zhejiang University, Fundamental Research Funds for the Central Universities (226-2022-00064).

References

[1]Simon A H. A Behavioral Model of Rational Choice[J]. The Quarterly Journal of Economics,1955,69(1).

[2]Simon A H. The Future of Information Processing Technology[J]. Management Science,1968,14(9).

[3] Dai K. Attention distribution: a new perspective for the study of government behavior[J]. J Theory Monthly, 2017: 197-112.

[4]Chen Hui. Distribution of Leadership Attention in County Governance [J]. Seeker,2021(01):180-187.DOI:10.16059/j.cnki.cn43-1008/c.2021.01.018.

[5]Zhang Ao-chun. The Attention Mechanism of Government Decision-making:Theoretical Framework and lnstitutiona Design [J]. Journal of Yunnan University of Finance and Economics ,2017,33(04):153-160.DOI:10.16537/j.cnki.jynufe.000229.

[6]Mulgan G. Government as a Brain: How Can Governments Better Understand, Think, Create, and Remember, and Avoid the Traps of Collective Stupidity Both in Emergencies and Normal Times[J]. Digital Government: Research and Practice, 2022, 3(2): 1-10.

[7]Karl F. The free-energy principle: a unified brain theory?[J]. Nature reviews. Neuroscience,2010,11(2).

[8] Sun Baiying,Zhou Baomin. A Review on Government Attention Distribution: Theoretical Basis, Current Situation and Prospects [J]. Public Administration and Policy Review ,2022,11(05):156-168.

[9]Deakin M, Waer H A. From intelligent to smart cities. Intelligent Buildings International, 3 (3), 133-139[J]. 2011.

[10]Simon H A. Decision-making and administrative organization[J]. Public Administration Review, 1944, 4(1): 16-30.

[11]Zhou Shen. Lead to Smart Government:Research on the lnteractive Mechanism of lnformation Technology and Power Structure-Taking Zhejiang “Four Lists and One Net” Reform as Example [J]. Zhejiang Social Sciences ,2017(03):37-43+156.DOI:10.14167/j.zjss.2017.03.005.

[12] ZHANG Hai-tao,ZHOU Hong-lei，ZHANG Xin-rui,LIU Ya-shu. Information Science Wisdom Empowerment:Situational Awareness of Major Emergency [J]. Information Science,2020,38(09):9-13+22.DOI:10.13833/j.issn.1007-7634.2020.09.002.

[13] REN Huan, WANG Xuguang. Review of attention mechanism [J]. Journal of Computer Applications,2021,41(S1):1-6.