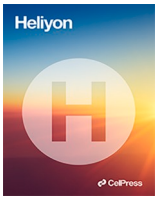
Heliyon 10 (2024) e28601

Contents lists available at ScienceDirect

Heliyon

journal homepage: www.cell.com/heliyon



Research article

Utilizing data platform management to implement "5W" analysis framework for preventing and controlling corruption in grassroots government

Zeyu Wang [a], Xin Guan [b], Yanzhao Zeng [c], Xinyi Liang [a], Shitao Dong [a,d,*]

[a] School of Public Administration, Guangzhou University, Guangzhou, 510006, China
[b] Guangzhou Xinhua University, Dongguan, 523133, China
[c] School of Economics and Statistics, Guangzhou University, Guangzhou, 510006, China
[d] Integrity Research Center of Guangzhou University, Guangzhou, 510006, China

ARTICLE INFO

JEL classification:
D73
M15

Keywords:
Data platform management
5W analysis framework
Grass-roots government
Corruption prevention and control
SWOT
PDCA

ABSTRACT

In the era of information technology advancement, big data analysis has emerged as a crucial tool for government governance. Despite this, corruption remains a challenge at the grass-roots level, primarily attributed to information asymmetry. To enhance the efficacy of corruption prevention and control in grass-roots government, this study introduces the concept of data platform management and integrates it with the "5W" (Who, What, When, Where, Why) analysis framework. The research is motivated by the observation that existing studies on corruption prevention primarily concentrate on the formulation of laws and regulations, neglecting the potential improvement in actual effectiveness through the utilization of data platforms and analytical frameworks. The research employs methodologies grounded in the Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis framework, the Plan, Do, Check, Act (PDCA) cycle analysis framework, and the 5W analysis framework. Throughout the iterative process of implementing data platform management, various timeframes are established, and the impact of the three models is evaluated using indicators such as public participation and government satisfaction. The research reveals that the SWOT framework can formulate targeted strategies, the PDCA framework continuously optimizes work processes, and the 5W framework profoundly explores the root causes of corruption. The outcomes indicate a 10.76% increase in the public participation level score with the 5W model, rising from 71.67%, and a 23.24% increase in the governance efficiency score, reaching 66.12%. The SWOT model excels in case handling prescription and corruption reporting rate. The synergistic application of the three models demonstrates a positive impact. In conclusion, the amalgamation of data platform management and a multi-model approach effectively enhances the corruption prevention capabilities of grass-roots governments, offering insights for the establishment of transparent and efficient grass-roots governance.

* Corresponding author.
E-mail addresses: theowang@gzhu.edu.cn (Z. Wang), guanxin@xhsysu.edu.cn (X. Guan), zyzcl@e.gzhu.edu.cn (Y. Zeng), lxy_cathy@e.gzhu.edu.cn (X. Liang), zyzcl@mails.ccnu.edu.cn (S. Dong).

https://doi.org/10.1016/j.heliyon.2024.e28601
Received 18 December 2023; Received in revised form 3 February 2024; Accepted 21 March 2024
Available online 22 March 2024

1. Introduction

In the current information age, the development of big data and data science provides unprecedented opportunities for society, government and organizations. Data analysis has been widely used in various fields, including government governance [1–3]. Analysis framework is a systematic method that applies data analysis methods and theories to specific problems. By constructing and applying an appropriate analytical framework, people can better understand and solve real-world problems. Based on this, this study aims to discuss the prevention and control of corruption in grass-roots government by introducing the "5W" (Who, What, When, Where, Why) analysis framework [4,5].

Data platform management refers to the process of integrating, managing and analyzing a large number of diverse and heterogeneous data. On the basis of large-scale data sets, data platform management can provide comprehensive, accurate and timely information support and provide a powerful tool for government decision-making and administrative management [6–8]. Grass-roots government is the primary link in the provision of public services, but due to information asymmetry and insufficient supervision, corruption in grass-roots government has become increasingly prominent. Therefore, the introduction of the concept of data platform management, combined with the needs of corruption prevention and control, can help to build an effective corruption prevention and control mechanism for grass-roots governments [9,10]. The core of data platform management is to integrate and optimize data resources to support government decision-making and improve governance efficiency. This process involves data collection, storage, processing, analysis and visualization to ensure the quality and security of data. Through advanced data mining technology and machine learning algorithm, the data platform can reveal potential patterns and trends and provide in-depth insight for the government. For example, by analyzing the usage of public services, the data platform can help the government identify underserved areas and optimize resource allocation. Meanwhile, the data platform can also monitor the implementation of government projects, ensure the effective use of funds, and reduce the occurrence of corruption. In addition, data platform management also includes establishing data governance structure, ensuring legal and compliant use of data, protecting citizens' privacy, promoting open sharing of data, and enhancing government transparency. Through these measures, data platform management not only improves the scientificity and accuracy of government governance, but also provides the possibility for public participation and supervision, further promoting the modernization of grassroots government governance system.

The research contribution of this study lies in introducing data platform management and "5W" analysis framework into the field of corruption prevention and control of grass-roots government, which makes up for the blank of current research. By establishing a comprehensive, accurate and timely data platform management system and applying the "5W" analysis framework to analyze the problem of government corruption, the study helps to improve the effectiveness and efficiency of corruption prevention and control in grass-roots governments. Meanwhile, this study explores innovative methods and technologies to provide new perspectives and ideas for the research on corruption prevention and control of grassroots governments. In a word, this study aims to provide theoretical and practical guidance for the prevention and control of corruption in grass-roots governments and provide useful reference for building clean and efficient grass-roots governments.

2. Recent related work

In modern society, government data management and governance have attracted more and more attention. Relevant research shows that open government data, government platform design, public participation platform, intelligent technology and data center are all innovations and improvements to promote government operation at different levels. These studies show how the government can use technology and data to improve efficiency, provide better service quality and establish closer ties with citizens. Ruijer and Meijer [11] adopted the method of laboratory experiment, and explored its influence on the innovation process by introducing open government data into the experiment. The results showed that opening government data can promote innovation and public participation, but its effect is affected by trust, data quality and data privacy protection. Huang and Li [12] adopted the design model of government affairs platform to solve the problems under the background of big data, and put forward a design model of government affairs platform for big data. The research results showed that the model can improve the efficiency of government affairs and enhance the scientificity and accuracy of government decision-making. Cho, Mossberger [13] explored the public participation platform of local government experimentally, and discussed the application and influence of this platform in local government. The results showed that the public participation platform can promote the interaction and communication between local governments and citizens, and improve the effectiveness and fairness of policy decisions. Deng, Jiang [14] used artificial intelligence (AI) algorithm to assess the economic growth of coal resource cities under low carbon (LC) economic growth. The main focus of this study was how to improve the resource allocation and utilization of enterprises by applying AI algorithms to improve production efficiency, reduce resource waste and achieve sustainable development while economic growth.

Taking Hera Clion in Crete as an example, Nikolopoulou [15] discussed the implementation and influence of grassroots initiatives and bottom-up urban space museum mechanism in this area. The results showed that grassroots initiatives and bottom-up urban space museum mechanism can promote the protection and inheritance of local culture, and enhance community cohesion and city image. Jia [16] discussed the importance of animal breeding and epidemic prevention and control, and based on the perspective of legal construction, studied relevant government policies and regulations. The results showed that the prevention of animal epidemics in animal husbandry and veterinary needed the active participation of the government and the sound construction of relevant laws to ensure the health and safety of livestock and poultry breeding and protect people's lives and property. Ducrée, Etzrodt [17] discussed the application of blockchain technology in global public affairs, and explored the grassroots action model based on blockchain. The research results showed that blockchain technology can improve the efficiency and transparency of grassroots actions, strengthen

cooperation and coordination among organizations, and thus better save the planet. Sakib [18] adopted the method of case analysis, and deeply studied the anti-corruption work carried out by Corruption Crisis Center (CCC) and Youth Engagement and Support (YES) organizations of Transparency International in Bangladesh at the community level. The results showed that corruption can be effectively prevented and social changes can be promoted through the participation of community organizations and the improvement of community awareness. Nan [19] adopted quantitative research methods. Through statistical data and economic model analysis, the research team revealed the negative impact of grassroots corruption on government expenditure, and discussed the strategies to solve grassroots corruption. The research results showed that strengthening supervision mechanism, improving government transparency and strengthening public participation are the keys to solve the problem of grassroots corruption. Zhu [20] studied the long-term prevention and control mechanism of evil forces in villages, and discussed the problems and solutions in grass-roots governance. By analyzing the experiences and practices of preventing and controlling evil forces in different regions and villages, the research team summed up some effective prevention and control mechanisms. The results showed that strengthening village autonomy, promoting the construction of rule of law, raising residents' awareness of law and strengthening the participation of social organizations were the keys to effectively prevent and control evil forces in villages. The research of Wang, Deng [21] discussed how to realize enterprise resource optimization through AI algorithm to help realize sustainable development goal 9 (SDG 9). The research used AI technology to optimize enterprise resource allocation aimed at promoting inclusive, fair and sustainable industrialization, enhancing infrastructure construction and promoting innovation on a global scale. Through empirical analysis, the research showed the potential of AI algorithm in improving resource utilization efficiency, reducing resource waste and achieving sustainable development while economic growth [22]. Wang, Zhang [23] discussed the risk prediction and credibility detection of online public opinion by using blockchain technology. The research pointed out that blockchain technology can provide a decentralized, transparent and tamper-proof data recording method, which was of great significance for the supervision and analysis of online public opinion. By constructing a model based on blockchain, the research can predict the risk of public opinion more accurately, improve the credibility of public opinion analysis, and provide support for network governance and public decision-making. Li, Liang [24] discussed the relationship between low-carbon strategy, entrepreneurial activities and industrial structure changes. Based on the evidence of quasi-natural experiments, this paper analyzed how low-carbon policies affect entrepreneurial activities and industrial structure adjustment. The results showed that the low-carbon strategy can not only help to reduce greenhouse gas emissions, but also promote the development of green technologies and innovative industries, and promote the transformation of industrial structure to a more environmentally friendly and efficient direction.

To sum up, the above literature review covers the related research of government data management and governance, including opening government data, designing government affairs platform, public participation platform, intelligent technology and data center. These studies reveal how the government can use technology and data to improve efficiency, provide better service quality and establish closer ties with citizens. In addition, it also includes research on corruption of grassroots governments, such as grassroots initiatives and bottom-up urban space museum mechanism, animal breeding and epidemic prevention and control, application of blockchain technology in global public affairs, and anti-corruption work carried out by community organizations. The results and findings of these studies are of great significance to government decision-making and social development.

3. Government corruption prevention strategy based on 5W analysis framework under data platform management

3.1. Model construction based on SWOT analysis framework

Based on Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis framework, this study constructs a model of corruption prevention and control in grass-roots government. Firstly, through literature research, expert interviews, government data analysis, etc., comprehensively collect the SWOT of grassroots government corruption prevention and control work [25,26]. Then, the SWOT matrix is constructed to identify the key internal factors (strengths and weaknesses) and external environmental factors (opportunities and threats) of corruption prevention and control in grass-roots governments, and the corresponding strategies are put forward. For example, give full play to the advantages of improving the education level of grassroots cadres, overcome the disadvantages such as the lack of grassroots supervision resources, seize the good opportunity such as the construction of social participation mechanism, and prevent threats such as cross-regional spread of corruption. Finally, in the process of introducing data platform management, the number of iterations is set, the strategy is gradually optimized, and indicators such as public participation and government satisfaction are used to evaluate the support effect of the model on government corruption prevention and control in different iterations. Through SWOT analysis framework, targeted strategies are put forward, which is helpful to improve the corruption prevention and control ability of grassroots governments under the management of data platform. In the process of constructing the model of grassroots government's anti-corruption based on SWOT analysis framework, the study firstly collects the SWOT elements of grassroots government's anti-corruption work through literature review, expert interviews and government data analysis. Then, using SWOT matrix, the internal key factors (strengths and weaknesses) and external environmental factors (opportunities and threats) are defined, and corresponding strategies are put forward for these factors. For example, the study emphasizes the advantages of improving the education level of grassroots cadres, points out the disadvantages of insufficient supervision resources at the grassroots level, and puts forward corresponding improvement measures. In the external environment, the study seizes the opportunity of social participation mechanism construction, and puts forward strategies to prevent the spread of cross-regional corruption. In the process of introducing data platform management, the number of iterations is set, the strategy is gradually optimized, and the public participation and government satisfaction are used to evaluate the supporting effect of the model on the government's anti-corruption work in different iterative stages. Through the SWOT analysis framework, this study puts forward targeted strategies, which is helpful to improve the

anti-corruption ability of grassroots governments under the management of data platform. This process not only enhances the pertinence of the strategy, but also provides a systematic and dynamic anti-corruption work model for the grass-roots government. The basic structure of the government corruption prevention model based on SWOT analysis framework is shown in Fig. 1.

3.2. Model construction based on PDCA cycle analysis framework

In this study, Plan, Do, Check, Act (PDCA) circular framework is used to construct the corruption prevention model of grass-roots government. The first step is to define the overall (Plan) of corruption prevention and control of grass-roots government, put forward solutions to key problems and risks, determine quantitative prevention and control objectives, and formulate implementation steps. The second step is to organize forces to carry out various corruption control measures (Do), such as conducting clean government education, establishing early warning and monitoring mechanisms, promoting online publicity and accepting reports [27–30]. The third step is to (Check) the implementation process and effect comprehensively, and identify the existing gaps by means of questionnaire survey and social evaluation. Finally, according to the inspection results, the strategies and measures are adjusted and improved (Act), such as updating relevant rules and regulations and strengthening supervision for the outstanding problems found. With the introduction of data management platform, this model is helpful to stimulate the endogenous motivation of corruption prevention and control work of grass-roots governments through the operation of PDCA cycle, and promote the continuous deepening of the work.

In this study, the cycle framework of Plan, execution, Check and action (PDCA) is adopted to build the corruption prevention model of grass-roots government. First, it makes clear the overall plan of corruption prevention and control of grass-roots government, puts forward solutions to key problems and risks, sets quantitative prevention and control targets, and formulates implementation steps. Then, it organizes forces to implement various corruption control measures, such as conducting clean government education, establishing early warning and monitoring mechanisms, promoting online publicity and accepting reports. The third step is to comprehensively check the implementation process and effect, and identify the shortcomings through questionnaire survey and social

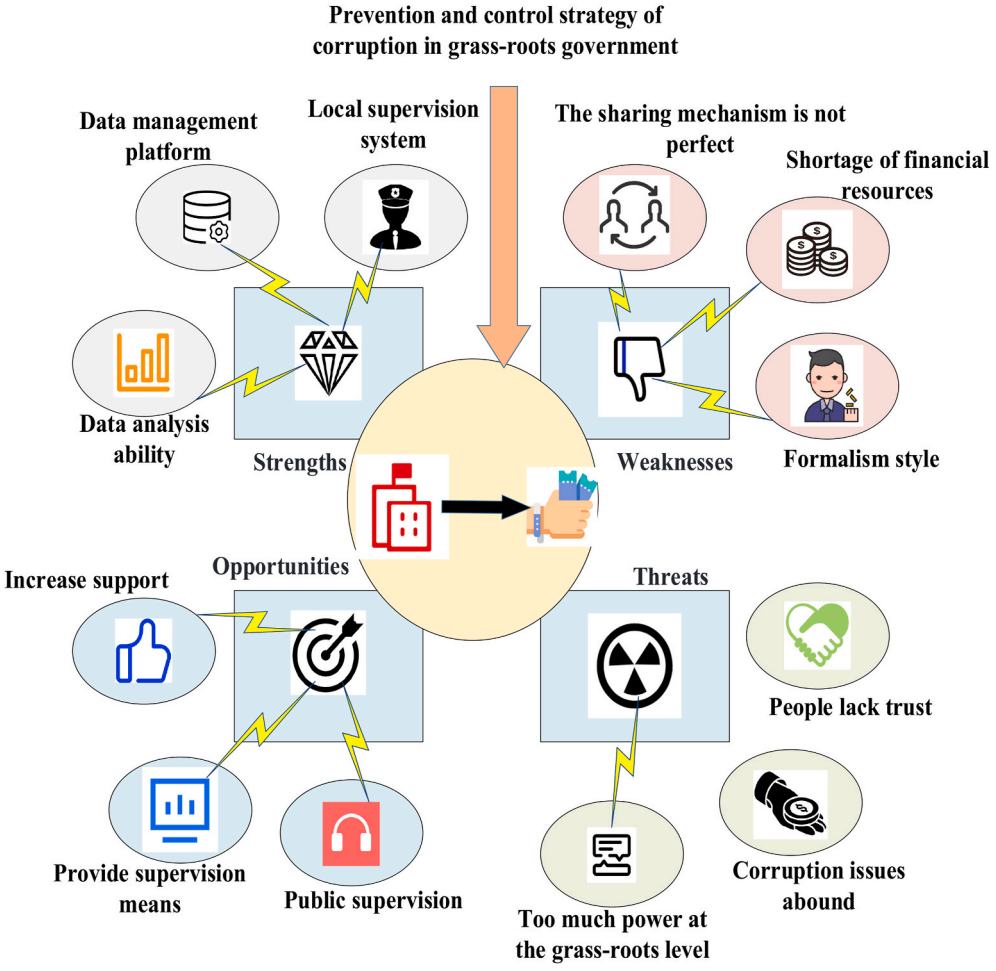


Fig. 1. Basic structure diagram of government corruption prevention model based on SWOT analysis framework.

evaluation. Finally, according to the inspection results, it adjusts and improves the strategies and measures, such as updating relevant rules and regulations and strengthening supervision over outstanding problems. With the introduction of data management platform, this model is helpful to stimulate the internal motivation of grassroots government's anti-corruption work through PDCA cycle and promote the continuous deepening of the work. Through this circular process, grass-roots governments can continuously optimize anti-corruption strategies, improve governance efficiency, and ensure the effectiveness and sustainability of corruption prevention and control. Based on PDCA cycle analysis framework, the structural framework of grass-roots government corruption governance strategy is shown in Fig. 2.

3.3. Model construction based on 5W analytical framework

Based on the Who, What, When, Where, why (5W) analytical framework, this study establishes the model of corruption prevention and control of grass-roots government. Firs, according to 5W and other elements, information about corruption cases are collected extensively, such as the participants in the corruption incident, the place and time of the incident, the form and reasons of the incident, etc. Secondly, an information-based 5W analysis system is established, an association network is built, important associations are identified, and the crux of the problem is found. Thirdly, with the support of data management platform, the collected 5W information is continuously enriched and improved, and a dynamically updated analysis system is formed. Finally, the 5W analysis framework is applied to evaluate the public participation in anti-corruption and the level of data governance in different iterations, and the influencing factors and improvement directions are found [31–33]. By building a 5W information analysis network, it is helpful to deeply understand the problem of grassroots corruption and improve the support efficiency of data management for corruption prevention and control.

In the process of constructing the model of corruption prevention and control in grass-roots government based on the "5W" analysis framework, the study first collects the relevant information of corruption cases, including the people involved, the place and time of the incident, the form of the incident and its reasons. Subsequently, an information-based "5W" analysis system is established, and the correlation network is constructed, and the key correlation points are identified, thus revealing the essence of the problem. With the support of data management platform, the collected "5W" information has been continuously enriched and improved, forming a dynamically updated analysis system. Finally, the "5W" analytical framework is applied to evaluate the level of public participation in anti-corruption and data governance in different iterative stages, and the influencing factors and improvement directions are found out. By constructing the "5W" information analysis network, it is helpful to deeply understand the problem of grassroots corruption and improve the support efficiency of data management in corruption prevention and control. This model not only enhances the understanding of corruption, but also provides a systematic and dynamic tool for grass-roots governments to identify and solve corruption more effectively. Under the data management platform, the architecture of corruption prevention and control strategy of grass-roots government based on 5W analysis framework is shown in Fig. 3.

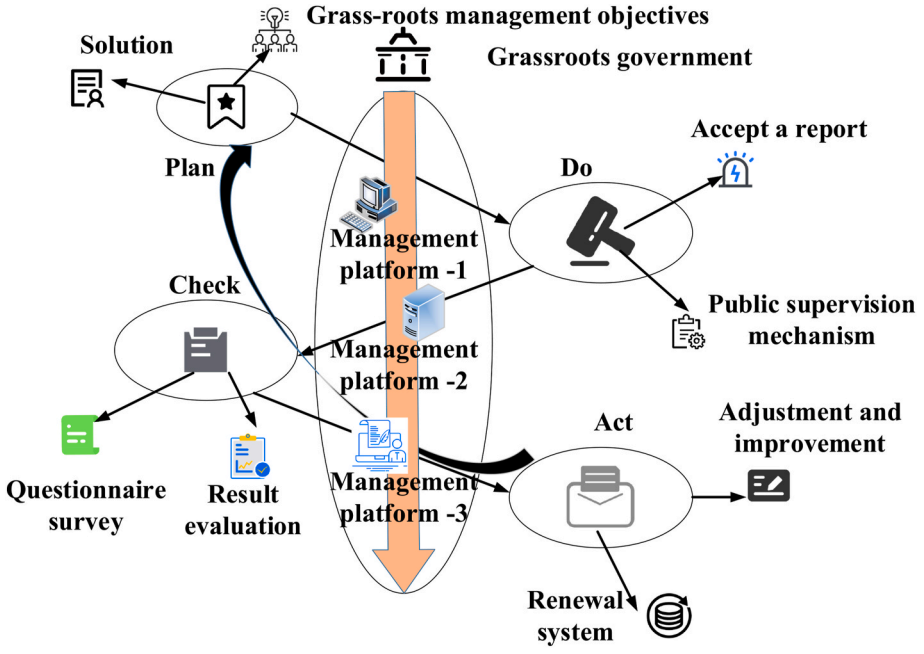


Fig. 2. Structure frame diagram of corruption governance strategy of grass-roots government based on PDCA cycle analysis framework.

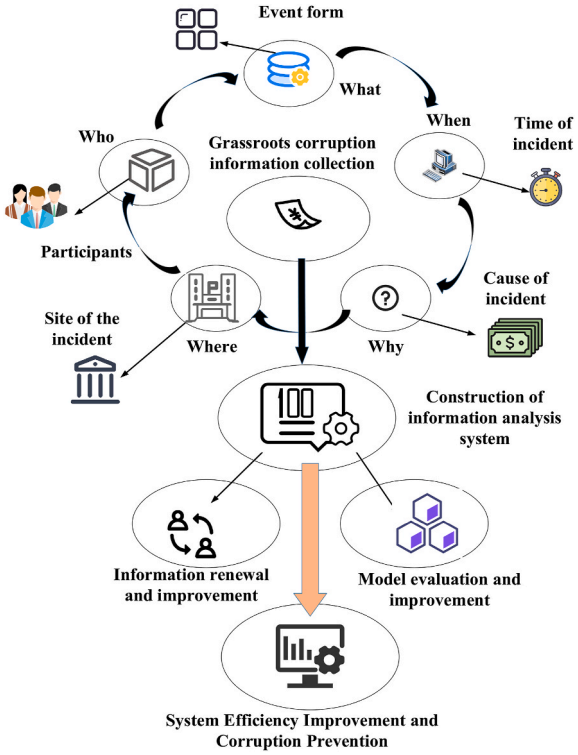


Fig. 3. Architecture diagram of corruption prevention and control strategy of grass-roots government based on 5W analysis framework.

3.4. Data platform management and multi-model comprehensive comparison

Data platform management and multi-model comprehensive comparison are important tasks in modern data science. In this task, data scientists need to process various types of data and models and extract effective information from them. Data platform management involves various tools and technologies, such as data storage, processing, analysis and visualization, and at the same time needs to consider the reliability, security and privacy protection of data. Multi-model comprehensive comparison is to compare and synthesize different models to achieve better results. In data platform management, the existing technologies mainly include traditional relational databases and emerging NoSQL databases. Relational database has the advantages of being structured, reliable and extensible, but it has limitations in dealing with unstructured data. NoSQL database can effectively deal with unstructured data, but there are problems in data consistency and reliability. In addition, there are data management tools such as data warehouse, data pool and data mart, which can be selected and used according to different needs. In the aspect of multi-model comprehensive comparison, the commonly used technologies include decision tree, support vector machine (SVM), neural network, Bayesian network and so on. These models have their own advantages and disadvantages, and should be selected and used according to specific problems. In addition, there are various ensemble learning methods, such as Bagging, Boosting and Stacking, which can integrate different models

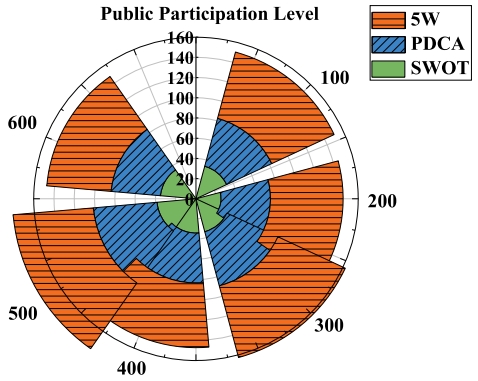


Fig. 4. The changing trend of public participation rating data in different analytical structural frameworks under the management of data platform.

to achieve better results.

In this study, the process of data acquisition and sample collection follows rigorous scientific methods. The research collects and analyses the information of corruption cases by building a model based on the "5W" analysis framework and using data platform management. This process involves extensive collection of key information such as participants, place, time, form and reasons of corruption cases in grass-roots governments. In order to ensure the comprehensiveness and accuracy of data, researchers may adopt various data collection methods, including but not limited to government public reports, case records, public reports and possible expert interviews. These data sources provide rich case information for the study and help to deeply analyze the root causes of corruption. In addition, in order to compare the performance of the proposed 5W analysis framework, the performance of the 5W analysis framework under data platform management proposed in this study is analyzed with the traditional SWOT analysis framework and PDCA cycle analysis framework. The public participation level, data governance efficiency, government service satisfaction, trust in local government, the prescription for handling government cases and corruption reporting rate are evaluated.

4. Result and discussion

4.1. Analysis of public participation level and data governance efficiency

Fig. 4 shows the data change trend of public participation rating by different analytical framework under the management of data platform. This diagram can be used to compare the influence of each framework on public participation after introducing data platform management. Fig. 5 shows the data change trend of data governance effectiveness scoring by different analytical framework under the management of data platform. Through this diagram, we can compare the effects of each framework on data governance after introducing data platform management.

In Fig. 4, the public participation rating data of 5W model shows a fluctuating upward trend from 100 to 600 iterations, from 71.67 to 79.40, an increase of 10.76%. This shows that the model can effectively collect and solve the relevant information of the problem and improve the public's interest and participation. During the iteration from 100 to 600, the data of PDCA model's public participation level shows a fluctuating upward trend, from 48.71 to 63.00, with an increase of 29.33%. This shows that the model can continuously improve and optimize the process and improve the public's satisfaction and trust. In the process of iteration from 100 to 600, the score data of public participation level of SWOT model shows a downward trend, from 24.82 to 38.64, with an increase of 55.66%. This shows that the model has encountered some difficulties and challenges in analyzing competitive advantages and disadvantages, which has reduced the public's recognition and support.

In Fig. 5, the score data of data governance effectiveness of 5W model shows a fluctuating upward trend from 100 to 600 iterations, from 66.12 to 81.49, with an increase of 23.24%. This shows that the model can effectively collect and solve data-related problems and improve the quality and value of data. The scoring data of data governance efficiency of PDCA model shows a fluctuating upward trend from 100 to 600 iterations, from 44.72 to 56.96, with an increase of 27.38%. This shows that the model can continuously improve and optimize data processes and products, and improve the reliability and availability of data. The score data of data governance effectiveness of SWOT model shows a fluctuating upward trend from 100 to 600 iterations, from 19.71 to 24.58, with an increase of 24.72%. This shows that the model encountered some difficulties and challenges when analyzing the advantages and disadvantages of data, which reduces the competitiveness and influence of data.

4.2. Analysis of government service satisfaction and trust

Fig. 6 shows the data change trend of government service satisfaction under the management of data platform. This diagram can be used to compare the impact of each framework on the service quality of grass-roots government after the introduction of data platform management. Fig. 7 shows the data change trend of trust degree of different analytical structural frameworks to grass-roots governments under the management of data platform. Through this diagram, people can compare the influence of each framework on the

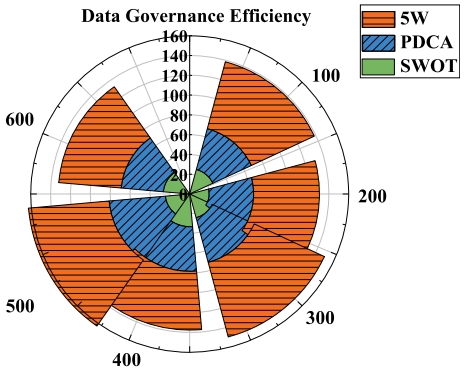


Fig. 5. The changing trend of data governance effectiveness score data of different analysis structural frameworks under the management of data platform.

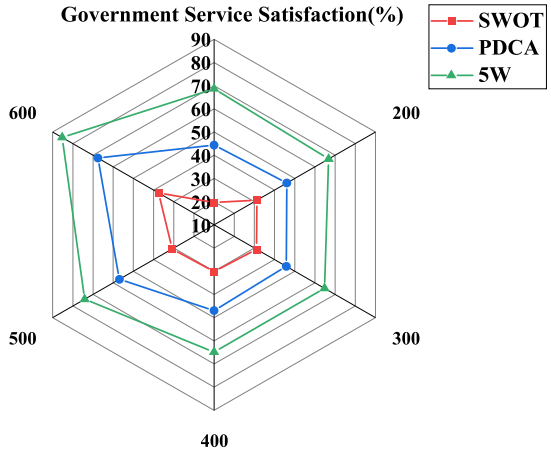


Fig. 6. The changing trend of government service satisfaction data under different analytical structural frameworks under the management of data platform.

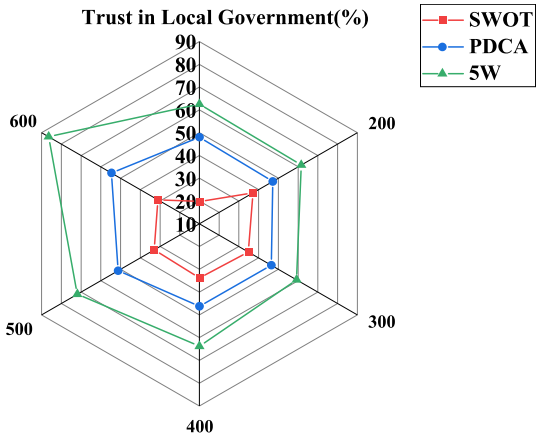


Fig. 7. He changing trend of trust data of grass-roots government under different analytical structural frameworks under the management of data platform.

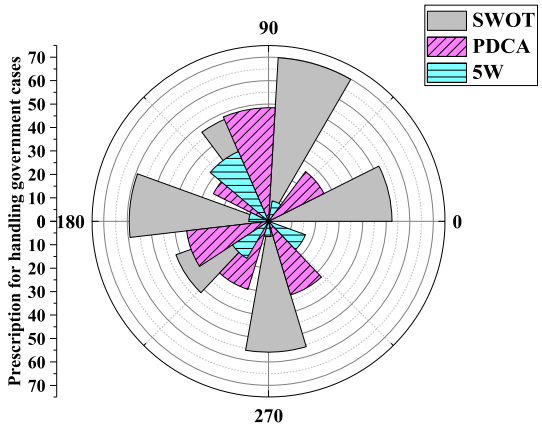


Fig. 8. The changing trend of the aging data of government cases with different analytical structural frameworks under the management of data platform.

trust of grassroots governments after introducing data platform management. These data can help to evaluate the effects of different frameworks in improving the quality of government services and public trust.

In Fig. 6, in the SWOT analysis, the satisfaction score of government services varies from 100 to 600. In the first few iterations, the satisfaction score increased, but the growth rate is slow. However, in the 500th and 600th iterations, the satisfaction score is significantly improved. In PDCA analysis, the satisfaction score of government services increases from the first iteration to the 600th iteration. The satisfaction score varies from 19.6 to 67.6, showing a gradual upward trend. In the 5W analysis model, the satisfaction of government services shows a positive growth trend in different iterations. This shows that the measures and strategies adopted by the government under the management of data platform have played a positive role in improving service quality and satisfaction.

In Fig. 7, in the SWOT analysis, the trust score fluctuated between 19.7 and 34.8 in each iteration, except for the 500th and 600th iterations, which reaches 32.9 and 31.1 respectively. In PDCA analysis, the trust score of grass-roots government increases from the first iteration until the 600th iteration. The trust score varies from 48.0 to 54.6, showing a slow but rising trend on the whole. In the 5W analysis model, the trust of grass-roots government shows a positive growth trend in different iterations. This shows that the measures and policies adopted by the grassroots government under the management of the data platform have played a positive role in enhancing residents' trust in the government. various optimization tasks, mitigating the risks associated with local optima and fostering more efficient convergence.

4.3. An analysis of the limitation of government case handling and the rate of corruption reporting

Fig. 8 shows the data change trend of corruption reporting rate of grass-roots government under the management of data platform under different analytical structural frameworks. Through this picture, people can compare the influence of each framework on corruption reporting of grass-roots governments after introducing data platform management. These data can help to evaluate the effectiveness of different frameworks in improving corruption reporting rate and supervision mechanism.

In Fig. 8, the SWOT analysis framework has the best effect in dealing with the prescription of government cases. After 100 iterations, the time limit score of government case handling based on SWOT analysis framework is 69.9, while PDCA and 5W are 48.5 and 32.4 respectively. In the subsequent iterations, the time limit score of government case handling based on SWOT analysis framework is always higher than PDCA and 5W. It is worth noting that with the increase of the number of iterations, the scores of the time limit for handling government cases in all three analytical frameworks show a downward trend. This may be due to the gradual decrease in handling efficiency when dealing with a large number of cases. However, in all iterations, the time limit score of government case handling based on SWOT analysis framework is always higher than the other two analysis frameworks. Generally speaking, these data show that under the management of data platform, using SWOT analysis framework can improve the efficiency of government case handling. Meanwhile, the influence of different analysis frameworks on processing efficiency may gradually weaken with the increase of iteration times.

In Fig. 9, the SWOT analysis framework has the best effect in dealing with the reporting rate of corruption at the grassroots level of the government. After 100 iterations, the report rate of grass-roots corruption in the government based on SWOT analysis framework is 81.5, while PDCA and 5W are 59.9 and 41.9 respectively. In the subsequent iterations, the report rate of corruption at the grass-roots level of the government based on SWOT analysis framework is always higher than that of PDCA and 5W. However, compared with the previous data of case handling prescription, these data show a different trend. In the reporting rate of corruption at the grass-roots level, with the increase of iterations, the scores of all three analytical frameworks showed a downward trend. This may indicate that the effectiveness of each analytical framework is getting worse when dealing with corruption reports. In addition, after 400 iterations, the report rate score of grass-roots corruption of the government based on SWOT analysis framework began to stabilize, and was slightly higher than PDCA and 5W. This may mean that the SWOT analysis framework is relatively more reliable in dealing with corruption reports. To sum up, these data show that under the management of data platform, the use of SWOT analysis framework can improve the reporting rate of government corruption at the grassroots level to a certain extent. However, when dealing with corruption reports, the effect of each analysis framework is not completely stable, and may deteriorate with the increase of iterations. In addition, comparing the overall performance of the above different analysis frameworks, the corresponding index levels of the compared models are shown in Table 1: evaluation results are recorded. The obtained results are summarized in Table 1, showcasing the comparative performance of the three optimization algorithms.

In Table 1, the 5W analysis framework has a better effect in improving public participation, improving data governance and improving government service satisfaction. However, the performance of traditional SWOT and PDCA frameworks on these indicators is generally or poorly. This shows that the 5W analysis framework proposed in this study has more advantages and can effectively improve the government's governance capacity and social development level. The table intuitively shows the comparison of different analytical frameworks, which is helpful to understand the innovation of 5W analytical framework and proves the superiority of 5W analytical framework in improving government governance.

In this study, the iterative process refers to the continuous evaluation and adjustment of strategies to optimize the corruption prevention and control model during the implementation of data platform management. This process follows a cyclic pattern, namely, Plan, Do, Check and Act, which is the basic principle of PDCA cycle. In the planning stage, the objectives of corruption prevention and control are defined and the corresponding strategies are formulated. The implementation stage involves putting these strategies into practice, such as collecting and analyzing information on corruption cases through data platforms. The inspection stage is to evaluate the implementation effect, and identify the problems and deficiencies in the implementation process through questionnaire survey and social evaluation. Finally, in the action stage, the strategy is adjusted according to the inspection results to improve the efficiency of corruption prevention and control. This iterative process allows researchers to constantly learn and improve in practice, ensuring that

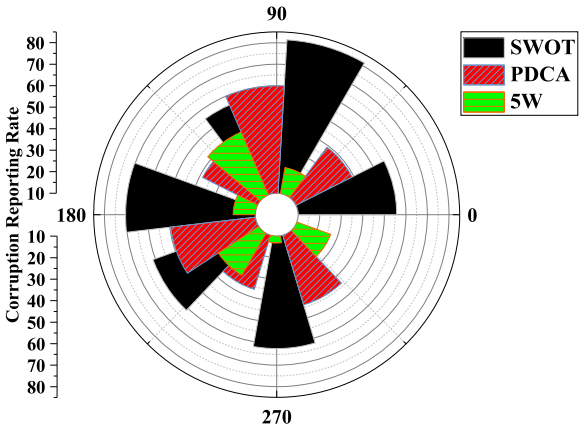


Fig. 9. The changing trend of corruption reporting rate at the grass-roots level of government under different analytical structural frameworks under the management of data platform.

Table 1
Comparison of performance ability of different analytical frameworks in government governance indicators.

Analytical framework	Public participation level	Data governance efficiency	Government service satisfaction	Trust of grass-roots government	Prescription for handling government cases	Corruption reporting rate
5W analytical framework	Relatively high	Relatively high	Relatively high	Relatively high	Relatively fast	Relatively high
SWOT analytical framework	General	General	General	General	General	General
PDCA circular analysis framework	Relatively low	Relatively low	Relatively low	Relatively low	Relatively low	Relatively low

data platform management can adapt to the changing environment and needs, thus more effectively supporting the anti-corruption work of grassroots governments.

To sum up, this study shows the effect of data platform management in improving the prevention and control of corruption in grass-roots governments through empirical analysis. The results show that the SWOT analysis framework is the most outstanding in dealing with the time limit of government cases and the reporting rate of corruption, especially in the initial stage of dealing with efficiency and reporting rate. However, with the increase of iteration times, the processing efficiency and reporting rate of all analytical frameworks have declined, which may be related to the decreasing efficiency in dealing with a large number of cases. Nevertheless, after 400 iterations, the SWOT framework still maintains a relatively stable reporting rate, showing its reliability in long-term management. The 5W analytical framework performs well in improving public participation, data governance efficiency and government service satisfaction, but its effect is not stable in dealing with corruption reporting rate. Generally speaking, data platform management combined with multi-model analysis framework can effectively improve the governance efficiency of grass-roots governments, especially in the initial stage. Future research should focus on how to further improve the stability and long-term effect of governance by continuously optimizing data platform management and combining with emerging technologies.

5. Conclusion

Aiming at the problem that the current research on corruption prevention and control of grass-roots government mainly focuses on laws and regulations and pays less attention to the actual effect, this study introduces the innovative perspective of data platform management and "5W" analysis framework. In terms of research methods, a corruption prevention model of grass-roots government based on SWOT, PDCA and 5W models is constructed. In the research process, in the iteration of introducing data platform management, public participation, government satisfaction and other indicators are used to evaluate the effects of the three models. The results show that SWOT model can formulate targeted strategies, PDCA model can continuously improve work, and 5W model can deeply explore the crux of corruption. The specific data results show that the public participation level score of 5W model is increased by 10.76%, and the governance efficiency score is increased by 23.24%. The SWOT model has the highest scores in the limitation of case handling and corruption reporting rate. The research proves that the combination of data platform management and multi-model can improve the effectiveness of corruption prevention and control in grass-roots governments. However, there are some shortcomings in this study, such as the evaluation index system is not comprehensive and systematic, and the amount of case data is limited. Future research needs to build a more scientific evaluation index system, collect more abundant case sample data, and conduct dynamic

tracking to improve the scientificity and persuasiveness of the research. Meanwhile future research can also explore the introduction of emerging technologies such as cloud computing and blockchain to further improve the support efficiency of the model. Generally speaking, this study provides useful reference and practical reference for using data analysis to improve government governance ability and build a clean grass-roots government.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author, upon reasonable request.

CRediT authorship contribution statement

Zeyu Wang: Writing – review & editing, Software, Formal analysis, Data curation, Conceptualization. **Xin Guan:** Writing – original draft, Formal analysis, Conceptualization. **Yanzhao Zeng:** Writing – original draft, Methodology, Investigation. **Xinyi Liang:** Writing – original draft, Visualization, Validation. **Shitao Dong:** Writing – review & editing, Resources, Project administration, Methodology, Investigation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This work was supported by Guangzhou Basic and Applied Basic Research Topics (Young Doctor's "Sailing" Program), "Research on Digital Intelligence Empowerment of Specialized and Specialized New Enterprises in Guangdong Province under the Background of High-Quality Development" (Grant No. 2024A04J4239). This work was also supported by the 2023 Special Research Project on People-to-People Exchange, Institute of International People-to-People Exchange for Textile and Clothing (Silk) Industry, "Study on 'Intelligent Intelligent Manufacturing' Empowering the Transformation and Upgrading of Textile and Garment Specialty Industries in Jiaxing Region" (Grant No. YJY202309).

References

[1] M. Janssen, et al., Data governance: organizing data for trustworthy artificial intelligence, Govern. Inf. Q. 37 (3) (2020) 101493.
[2] E. Nica, Urban big data analytics and sustainable governance networks in integrated smart city planning and management, Geopolit. Hist. Int. Relat. 13 (2) (2021) 93–106.
[3] K. Xu, Challenges, opportunities and future paths: environmental governance of big data initiatives in China, Sustainability 15 (2023) 9975, https://doi.org/10.3390/su15139975.
[4] M. Flyverbom, R. Deibert, D. Matten, The governance of digital technology, big data, and the internet: new roles and responsibilities for business, Bus. Soc. 58 (1) (2017) 3–19.
[5] J.S. Winter, E. Davidson, Big data governance of personal health information and challenges to contextual integrity, Inf. Soc. 35 (1) (2019) 36–51.
[6] T. Bircan, E.E. Korkmaz, Big data for whose sake? Governing migration through artificial intelligence, Humanities and Social Sciences Communications 8 (1) (2021) 241.
[7] Y. Liang, et al., Financial big data analysis and early warning platform: a case study, IEEE Access 8 (2020) 36515–36526.
[8] J.E. Ricart, et al., Grassroots resistance to digital platforms and relational business model design to overcome it: a conceptual framework, Strat. Sci. 5 (3) (2020) 271–291.
[9] B.T. Bestelmeyer, et al., Assessing sustainability goals using big data: collaborative adaptive management in the Malpai Borderlands, Rangel. Ecol. Manag. 77 (2021) 17–29.
[10] S.A. Shah, et al., The rising role of big data analytics and IoT in disaster management: recent advances, taxonomy and prospects, IEEE Access 7 (2019) 54595–54614.
[11] E. Ruijer, A. Meijer, Open government data as an innovation process: lessons from a living lab experiment, Publ. Perform. Manag. Rev. 43 (3) (2020) 613–635.
[12] Q. Huang, X.W. Li, Research on the design of government affairs platform in the context of big data, Sci. Program. (2021) 9936217.
[13] S. Cho, et al., Experimenting with public engagement platforms in local government, Urban Aff. Rev. 57 (3) (2020) 763–793.
[14] Y. Deng, W. Jiang, Z. Wang, Economic resilience assessment and policy interaction of coal resource oriented cities for the low carbon economy based on AI, Resour. Pol. 82 (2023) 103522.
[15] K. Nikolopoulou, Grass-roots initiatives and bottom-up Musealisation mechanisms in urban space: the case of Heraklion Crete, Heritage 2 (3) (2019) 1912–1926.
[16] X. Jia, Animal husbandry and veterinary animal epidemic prevention and legal construction, Revista Científica de la Facultad de Ciencias Veterinarias 30 (4) (2020) 2089–2098.
[17] J. Ducrée, et al., Blockchain for organizing effective grass-roots actions on a global commons: saving the planet, Frontiers in Blockchain 3 (2020).
[18] N.H. Sakib, Corruption prevention through community organizing, Bangladesh Journal of Public Administration 269 (1) (2021) 1–25.
[19] S. Nan, Study on the relation of grassroots corruption and government expenditure, Procedia Comput. Sci. 199 (2022) 1031–1035.
[20] X. Zhu, Study on the long-term prevention and control mechanism of evil forces in villages, Frontiers in Business, Economics and Management 8 (3) (2023) 145–1550.
[21] Z. Wang, et al., Achieving sustainable development goal 9: a study of enterprise resource optimization based on artificial intelligence algorithms, Resour. Pol. 80 (2023) 103212.
[22] C. Li, et al., Digital finance and enterprise financing constraints: structural characteristics and mechanism identification, J. Bus. Res. 165 (2023) 114074.
[23] Z. Wang, et al., Risk prediction and credibility detection of network public opinion using blockchain technology, Technol. Forecast. Soc. Change 187 (2023) 122177.
[24] C. Li, et al., Low-carbon strategy, entrepreneurial activity, and industrial structure change: evidence from a quasi-natural experiment, J. Clean. Prod. 427 (2023) 139183.

[25] D. Gago, et al., Stakeholders' perceptions of new digital energy management platform in municipality of loulé, Southern Portugal: a SWOT-AHP analysis, Sustainability 14 (3) (2022) 1445.
[26] V. Prifti, Information data management in big data. Case study: E-Albania government portal, Industry 4.0 7 (3) (2022) 87–89.
[27] V.C.F. Gomes, G.R. Queiroz, K.R. Ferreira, An overview of platforms for big earth observation data management and analysis, Rem. Sens. 12 (8) (2020) 1253.
[28] M. Roose, et al., User-centred design of multidisciplinary spatial data platforms for human-history research, ISPRS Int. J. Geo-Inf. 10 (7) (2021) 467.
[29] T. Velev, N. Dobrinkova, *The logical Model of unified, innovative Platform for Automation and Management of standards (PAMS).* Information & security, Int. J. 43 (1) (2019) 113–120.
[30] D. Li, et al., The clean energy development path and sustainable development of the ecological environment driven by big data for mining projects, J. Environ. Manag. 348 (2023) 119426.
[31] D. Leidner, et al., Putting dignity at the core of employee data use, MIT Sloan Manag. Rev. 63 (1) (2021) 1–7.
[32] W. Mo, et al., SCTD: a spatiotemporal correlation truth discovery scheme for security management of data platform, Future Generat. Comput. Syst. 139 (2023) 109–125.
[33] W. Wang, Y. Zhang, E-Commerce short video marketing based on 5W model, Academic Journal of Computing & Information Science 4 (5) (2021) 41–47.