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Research Article

Challenges in Enhancing Government Decision-Making Ability in the Big Data Era

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ABSTRACT

This article aimed to study: 1) the impact of big data on government decision-making processes; 2) case studies of successful big data applications in government decision-making; and 3) the key challenges and limitations that governments face when integrating big data into decision-making frameworks. The research methodology was qualitative, examining the challenges of government decision-making ability in the big data era. The key informants consisted of 20 policymakers, data analysts, IT experts, and administrative officials in Beijing, Shanghai, Zhengzhou, Zhumadian, and Hebi City, Henan Province, selected through purposive sampling. Data were collected using interviews, observations, and document analysis, and the data were analyzed using descriptive analysis. The results of the research study found that: 1) in analyzing the impact of big data on government decision-making processes, big data enhanced the efficiency and evidence-based quality of decision-making; 2) in exploring case studies of successful big data applications in government decision-making, it was found that successful applications relied on integrated platforms and cross-departmental data collaboration; and 3) in identifying the key challenges and limitations that governments faced when integrating big data into decision-making frameworks, it was found that data quality, institutional fragmentation, legal restrictions, and privacy issues remained the main challenges. In response, the study proposed an optimization framework that integrates technological, institutional, legal, and public participation dimensions to strengthen effective data-driven decision-making in the public sector.

Keywords: Challenging, Big Data, Government Decision-Making, China

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Introduction

In the era of big data, government decision-making was faced with unprecedented opportunities and challenges. Rapid advances in digital technology and the proliferation of connected systems had led to an explosion of data from a variety of sources, including social media, sensor networks, government databases, and private sector platforms. The influx of large and complex data sets had the potential to revolutionize the way governments formulated policy, allocated resources, and responded to public

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needs. When used effectively, big data analytics could significantly increase decision-making efficiency, improved service delivery, and enabled predictive governance (Chatterjee, 2021).

The role of big data in public governance was not merely technical but deeply political and social. Large-scale data analysis enabled governments to recognize social issues earlier than before, anticipate potential risks, and design policies tailored to the needs of specific communities (Fredriksson et al., 2017).

However, despite the potential benefits, many governments still relied on traditional decision-making models that did not take full advantage of big data analytics. Bureaucratic inertia, lacked of technical expertise, and inadequate infrastructure hindered the adoption of data-driven decision-making processes. These constraints led to inefficiencies such as slow policy responses, misallocation of resources, and inadequate preparation for emerging social challenges.

Concerns about data security, privacy, and ethical implications further complicated the integration of big data into governance. Ethical issues also emerged when algorithms were applied to sensitive areas such as welfare distribution, policing, or credit scoring, where biases embedded in data reinforced social inequalities. Research had shown that while big data could promote efficiency, it also risked creating opaque decision-making processes that challenged principles of accountability and fairness (Hochstetter-Diez, 2023).

The importance of studying how to improve government decision-making in the era of big data could not be overstated. Governments worldwide had to shift from intuition-based decision-making to evidence-based models that optimized accuracy, responsiveness, and transparency. By understanding how big data could be effectively integrated into public administration, decision-makers were able to develop frameworks that leveraged real-time insights, reduced uncertainty, and enhanced public trust in government institutions (Meijer, 2018).

At the same time, addressing challenges related to data quality, interoperability, and regulatory compliance was critical. Data fragmentation across departments also reduced the capacity to create holistic policies (Matheus et al., 2020).

The successful use of big data also depended on governments' ability to build technical capacity and human resources. Many public institutions still faced a shortage of data scientists, statisticians, and IT professionals who could design, manage, and interpret complex analytics systems. Investing in training programs, establishing partnerships with universities, and collaborating with private sector experts were necessary strategies to bridge this gap (Hossin et al., 2023).

This study focused on Henan Province, Beijing, and Shanghai due to their distinct administrative, economic, and technological characteristics, which provided valuable comparative insights into big data-driven governance. Beijing, as the political and administrative center of China, represented advanced policy-making and digital governance practices. Shanghai, as a leading global financial and technological hub, reflects high levels of digital innovation and smart city development. In contrast, Henan Province, as a major inland and populous region, represented areas with relatively different levels of digital infrastructure and governance capacity. Despite the growing body of research on big data in governance, limited studies had comparatively examined these diverse regional contexts. Therefore, selecting these areas helped address this research gap and provides a more comprehensive understanding of how big

data could be effectively integrated into government decision-making across different developmental settings.

Therefore, studying how to improve government decision-making in the era of big data was essential for enhancing evidence-based policymaking and strengthening public trust in government institutions.

Research Objectives

1. To analyze the impact of big data on government decision-making capability in the big data era.
2. To evaluate the effectiveness of current big data applications in government decision-making across selected regions in China.
3. To propose an optimization framework for strengthening government decision-making ability in the big data era.

Research Methodology

This study employed a qualitative research design, and the research procedures were conducted as follows.

1. Key Informants

This study used a purposive selection to select key informants who possess professional knowledge and experience related to big data governance and data-driven decision-making. The sample consisted of 20 key informants, including policymakers, big data specialists, IT experts, enterprise data managers, and academic scholars located in Beijing, Shanghai, Zhengzhou, Zhumadian, and Hebi City in Henan Province, China.

The key informants were selected based on the following criteria: (1) direct involvement in big data management, research, or digital governance; (2) at least five years of professional experience in data governance, digital technology, or related fields; and (3) the ability to provide professional insights into the use of big data in government decision-making.

To obtain diverse perspectives, the participants were drawn from four groups: government big data management officials, technical experts and big data professionals, enterprise data management specialists, and academic scholars or policy experts.

2. Research Instruments

The primary research instrument in this study was an interview guide designed for qualitative data collection. The interview questions were developed based on relevant literature and theoretical frameworks related to big data governance and public administration, and were aligned with the three research objectives of the study.

To address the research objectives, document analysis, semi-structured interviews, and non-participant observation were applied. Specifically, semi-structured interviews were used to explore the impact of big data on government decision-making, while interviews and observation were used to evaluate the effectiveness of big data applications in selected regions in China. The synthesis of interview, observation, and literature data was used to develop the optimization framework.

Three types of interview techniques were applied: open-ended questions, semi-structured interviews, and structured interviews. The interview guide covered key issues including data quality, data sharing mechanisms, legal and regulatory frameworks, public participation in decision-making, algorithms and analytical models, and emergency response management.

To ensure content validity, the interview questions were evaluated using the Index of Item-Objective Congruence (IOC) by three experts, and items with an IOC value above 0.50 were retained. In addition, non-participant observation was conducted in relevant government settings, including meetings, data management processes, and interdepartmental coordination activities, to support data triangulation.

3. Data Collection

Data were collected through three main methods: document analysis, in-depth interviews, and non-participant observation.

First, a literature review was conducted to examine academic articles, research reports, policy documents, and government publications related to big data governance and digital government.

Second, in-depth interviews were conducted with the 20 key informants using a semi-structured interview format. The interviews aimed to obtain detailed information about big data applications, decision-making practices, and governance challenges. All interviews were conducted with the informed consent of the participants, and the collected data were anonymized to ensure confidentiality.

Third, non-participant observation was used to observe organizational processes related to data integration, data analysis practices, and the operation of decision-support systems within relevant organizations.

4. Data Analysis

The collected data were analyzed using qualitative analytical methods, including content analysis, inductive analysis, and descriptive analysis.

Content analysis was applied to systematically categorize and interpret information obtained from documents and interview transcripts. Inductive analysis was used to identify patterns and themes emerging from the empirical data related to big data governance practices. Descriptive analysis was used to present and interpret the research findings in a narrative form.

Conceptual Framework

The conceptual framework of this study was developed through a synthesis of relevant theories, concepts, and prior studies, including Chen & Hsieh (2014), Janssen and Kuk (2016), Meijer (2014), Hashem et al. (2016), Zuiderwijk & Janssen (2014), Binns et al. (2018), and Chen & Zeng (2021). These studies covered key dimensions of big data governance, including data quality, data sharing mechanisms, legal and regulatory frameworks, algorithms, and public participation.

Research Results

From the research study, it was found that:

1. To analyze the impact of big data on government decision-making capability in the big data era.

This study examined the role of big data in strengthening government decision-making capability in the big data era. The research analyzed six key factors - application of big data technology, data quality and standards, digital sharing mechanisms, legal and regulatory guarantees, public participation and transparency, and algorithms and data models - and their influence on government decision-making capability. The main findings were summarized as follows:

1.1 Application of Big Data Technology

The application of big data technology significantly improved government decision-making capability. By integrating advanced data processing and analytical tools, government agencies could collect and analyzed large volumes of information from multiple sources, providing a stronger evidence base for policy formulation. This enhances decision quality, improved administrative efficiency, and enabled governments to respond more quickly to changing social and economic conditions.

"...Governments improved decision quality by using big data technologies to integrate information from multiple administrative systems. Through real-time data analysis, policymakers could obtain more accurate and comprehensive information, which supported evidence-based decision-making. ..." (Key informant 1)

1.2 Data Quality and Standards

Data quality and standardized data management were essential for effective government decision-making. Accurate, reliable, and timely data provided a solid foundation for policy analysis and strategic planning. The establishment of unified data standards also facilitated data integration and accessibility across government departments, thereby improving decision quality and policy effectiveness.

" ...When departments adopted standardized data exchange protocols, information could be transferred automatically between systems. Automated data transmission accelerated administrative decision processes..." (Key informant 6)

1.3 Digital Sharing Mechanism

Digital data-sharing mechanisms significantly enhance interdepartmental coordination and decision-making efficiency. Integrated data platforms allow government agencies to exchange information more effectively and obtain comprehensive data from multiple sources. This reduced information fragmentation and enabled faster and more coordinated policy responses.

" ...The absence of unified regulations for digital data sharing increases legal risks. Different departments might apply inconsistent data protection standards, which created compliance challenges..." (Key informant 4)

1.4 Legal and Regulatory Guarantees

Legal and regulatory guarantees provided an important institutional framework for the responsible use of big data in government decision-making. Clear regulations governing data collection, management, and utilization helped ensure transparency, accountability, and ethical data practices. These safeguards strengthen public trust and supported more legitimate and reliable policy decisions.

"...Citizen involvement encouraged government agencies to disclose more information related to policy development. This openness enhanced transparency and promoted greater accountability in decision-making processes..." (Key informant 2)

1.5 Public Participation and Transparency

Public participation and transparency contributed to more inclusive and legitimate government decision-making. Digital platforms enabled citizens to access information and provided feedback on policy issues, which improved openness and accountability in governance. Incorporating public input also helped governments developed policies that better reflected social needs and public interests.

"...Data analytics algorithms could also analyze public opinion collected from digital platforms. Understanding citizens' perspectives helped policymakers design policies that better reflected public needs..." (Key informant 12)

1.6 Algorithms and Data Models

Algorithms and data models supported evidence-based decision-making and improved emergency response capability. Advanced analytics and predictive models enable governments to analyze complex datasets, identify potential risks, and forecast emergency situations. These technologies enhanced situational awareness, accelerated decision-making, and strengthened the government's capacity to respond effectively to crises.

"...Data-driven systems enabled more accurate situational awareness during emergencies. Decision-makers could analyze complex information quickly and coordinate responsed effectively..." (Key informant 18)

2. To evaluate the effectiveness of current big data applications in government decision-making across selected regions in China.

The findings indicated that the effectiveness of big data applications in government decision-making largely depended on data quality, digital sharing mechanisms, and institutional governance frameworks. This was supported by Key Informant 1, who stated that "the integration of multiple administrative systems through big data technologies improved decision quality by providing more comprehensive and accurate data for evidence-based decision-making."

The study revealed that centralized data-sharing platforms, cloud-based systems, and digital dashboards enabled government agencies to exchange information more efficiently and supported faster administrative decisions. Key Informant 2 further emphasized that "big data enabled the analysis of large volumes of structured and unstructured data, helping decision-makers identify patterns and trends that were not visible through traditional methods."

These technologies improved coordination among departments and enhanced the overall efficiency of policy implementation. However, the results also highlight several challenged that affected the effectiveness of big data implementation. These included inconsistent data standards, limited interoperability among digital systems, and insufficient technical training for government personnel. In addition, some institutions still rely on traditional manual data management systems, which might slow down information transmission and reduced decision-making efficiency. Therefore, strengthening data

governance structures and improving digital infrastructure were essential for enhancing the effectiveness of big data applications in government decision-making.

3. To propose an optimization framework for strengthening government decision-making ability in the big data era.

Based on the research findings, this study proposes an optimization framework for strengthening government decision-making capability in the big data era. The results highlight the importance of integrating public participation mechanisms, algorithmic technologies, and legal governance structures into the decision-making process. Digital participation platforms and open data initiatives allowed citizens to access policy information and provided feedback, thereby increasing transparency and public trust in government institutions. At the same time, advanced analytical technologies, including predictive models and machine learning algorithms, enable governments to analyze complex datasets, identify potential risks, and evaluate policy alternatives more effectively. When combined with appropriate legal safeguards and data governance mechanisms, these technologies contributed to more transparent, accountable, and evidence-based decision-making processes in the public sector.

Discussions

1. Discussion on the Impact of Big Data on Government Decision-Making Capability

The findings showed that big data enhances government decision-making capability by improving efficiency, accuracy, and responsiveness. However, its effectiveness depended not only on technology but also on data governance, institutional coordination, and analytical capacity within government systems. This was consistent with Janssen and Kuk (2016), who found that big data improved administrative efficiency and strengthened evidence-based decision-making when supported by effective data integration. The results also supported the data-driven governance perspective, indicating that big data enabled more evidence-based and timely policy decisions through improved access to and analysis of complex information. This aligned with Chen & Hsieh (2014), who emphasized that big data enhanced governmental decision-making by integrating multiple data sources for real-time policy formulation. Overall, big data strengthened government decision-making when it was effectively integrated into governance structures rather than applied as a standalone technological tool. This was supported by Zuiderwijk & Janssen (2014), who argued that effective big data governance required the integration of technological, institutional, and regulatory mechanisms.

2. Discussion on the Effectiveness of Big Data Applications in Government Decision-Making Across Selected Regions in China

At present, some local governments in China had made significant progress in the application of big data in decision-making. However, they still face some practical challenges. On one hand, many government agencies had begun to adopt digital platforms, data integration systems, and analysis tools to support administrative decisions. These technologies had improved the efficiency of information processing, enhanced the policy analysis capabilities, and strengthened the response capabilities of government organizations. Key informants highlighted that local governments collected data from multiple sources, including internal records, citizen feedback, social media, and sensor-based urban infrastructure (Russo et al., 2015; Meijer & Wessels, 2019). Departments relied on this data to inform

decision-making in areas such as traffic management, emergency response, healthcare planning, and environmental monitoring. However, inconsistent data formats, incomplete historical records, and human entry errors remained significant challenges affecting data reliability (Lan et al., 2025). The survey indicated that while big data significantly improved decision-making quality, speed, and situational awareness, governance challenges remained. Data quality, inter-departmental sharing, regulatory compliance, and ethical application of predictive tools were key areas requiring continuous improvement.

3. Discussion on the Optimization Framework for Strengthening Government Decision-Making Ability in the Big Data Era

The Optimization Framework proposed in this study advances existing understandings of data-driven governance by moving beyond fragmented and technology-centered perspectives that dominated prior research. While earlier studies had largely emphasized individual components such as data infrastructure, analytics systems, or digital platforms in isolation, the present framework integrated technological, institutional, and governance dimensions into a unified and interdependent structure. This integration addressed a key limitation in prior literature, namely the lack of holistic coordination between technical capacity and institutional readiness in enabling effective government decision-making.

A distinctive contribution of this framework lied in its emphasis on the interaction between data governance mechanisms and institutional coordination. Previous studied often assume that improving technological capability alone would automatically enhance decision performance; however, empirical findings from this study suggested that such a view was insufficient. In contrast, the proposed framework argued that even advanced analytics systems could not generate effective policy outcomes without standardized data governance, cross-departmental alignment, and clear institutional responsibility. This positions governance capacity, rather than technology alone, as the core determinant of decision-making effectiveness.

Furthermore, the framework explicitly addressed the persistent limitation of data fragmentation identified in both the literature and empirical findings. Unlike traditional models that treat data sharing as a technical function, this study conceptualized digital data sharing as an institutionalized governance mechanism that required regulatory clarity, organizational coordination, and standardized protocols. In doing so, the framework provided a more realistic explanation of why many big data initiatives in public administration failed to achieve full integration despite significant technological investment.

Another key distinction of the proposed framework was its stronger emphasis on the role of legal and ethical governance structures. While earlier research often treated legal and regulatory issues as external constraints, this study positions them as foundational components that directly shaped the legitimacy, transparency, and sustainability of data-driven decision-making. This shift reflected the empirical finding that public trust and accountability were not secondary outcomes, but essential preconditions for effective implementation of big data governance systems.

In addition, the framework expanded the analytical focus of prior studies by incorporating public participation as an active governance mechanism rather than a symbolic element. Instead of viewing citizen engagement merely as a transparency tool, the proposed model conceptualizes it as a feedback-driven component that enhanced policy responsiveness and strengthened decision quality through

continuous data input from society. This interpretation extended existing theoretical discussions by linking participatory governance directly with data analytics processes.

Overall, the Optimization Framework presented in this study contributed to the literature by reconceptualizing big data–driven governance as a multi-dimensional system in which technological capability, institutional coordination, regulatory structures, and public participation operate in an integrated and mutually reinforcing manner. Compared with prior models that tended to be either technologically deterministic or institutionally fragmented, this framework provided a more comprehensive and structurally balanced explanation of how government decision-making capability could be effectively strengthened in the big data era.

Originality and Body of Knowledge

This study developed a Big Data–Driven Government Decision-Making Model that explained how digital technologies could enhance government decision-making capability in the big data era (Figure 2). The model integrated five key components, including data governance mechanisms, data quality and sharing systems, algorithmic technology, emergency response capability, and transparency and accountability frameworks. These components collectively supported the transformation of large-scale data resources into actionable policy insights. Through the integration of standardized data governance, cross-departmental data sharing, predictive analytics, and real-time monitoring systems, the model enabled governments to improve decision quality, response speed, and coordination among public agencies. In addition, the model highlights the role of public participation and open data initiatives in strengthening transparency and accountability in digital governance. This integrated framework contributes to the literature by demonstrating how technological infrastructure and institutional governance mechanisms jointly supported effective data-driven decision-making in the public sector.

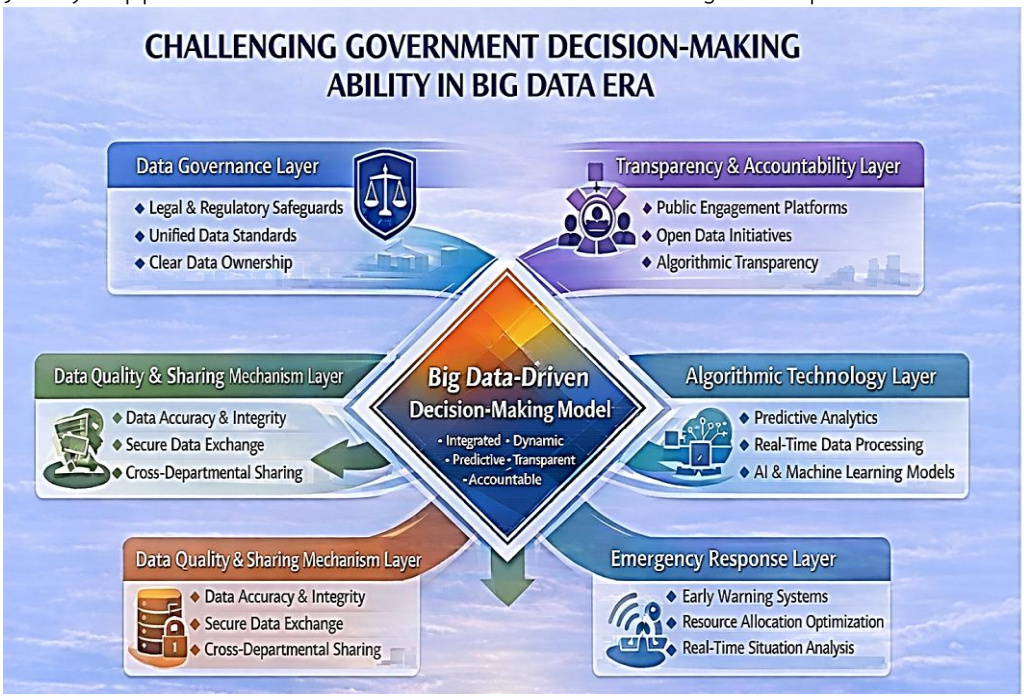


Figure 1 Challenging Government Decision-Making Ability in Big Data Era Model

Conclusions

This study demonstrated that the effectiveness of government decision-making in the big data era depended not on technology alone, but on the integrated alignment of data quality, governance structures, institutional coordination, and public engagement. While big data technologies could enhance decision speed, accuracy, and responsiveness, their impact was constrained without standardized data systems, reliable interdepartmental sharing, and strong regulatory and ethical safeguards. The key contribution of this research was the proposed integrated framework, which showed that sustainable improvement in evidence-based and transparent governance could only be achieved when technological capacity was embedded within coherent institutional and participatory governance systems.

Recommendations

1. Policymaking Recommendations

1.1 Governments should improve the institutional framework for big data governance by establishing unified standards for data collection, management, and sharing across departments.

1.2 Governments should strengthen data security and privacy protection by implementing strict access control, data protection technologies, and regulatory mechanisms.

1.3 Governments should promote organizational reforms and increase investment in digital infrastructure to support the effective application of big data in decision-making.

2. Recommendations for Future Research

2.1 Future studies should conduct comparative research across different regions and administrative contexts to examine variations in big data governance practices.

2.2 Future research should explore ethical issues related to algorithmic decision-making, including transparency, accountability, and algorithm bias.

2.3 Future studies should investigate how public participation could be integrated into data-driven governance and decision-making processes.

References

Binns, R., Van Kleek, M., Veale, M., Lyngs, U., Zhao, J., & Shadbolt, N. (2018, April). 'It's Reducing a Human Being to a Percentage' Perceptions of Justice in Algorithmic Decisions. In *Proceedings of the 2018 Chi conference on human factors in computing systems* (pp. 1-14). Montréal, QC, Canada: Association for Computing Machinery.

Chatterjee, H. A. (2021). Big Data Analytics in E-Governance: Insights for Policy Formulation and Public Service Delivery. *International Journal of Research Publications in Engineering, Technology and Management, 4*(1), 4337-4339.

Chen, L., & Zeng, S. (2021). The relationship between intolerance of uncertainty and employment anxiety of graduates during COVID-19: The moderating role of career planning. *Frontiers in Psychology, 12*, 694785.

Chen, Y. C., & Hsieh, T. C. (2014). Big data for digital government: Opportunities, challenges, and strategies. *International journal of public administration in the digital age, 1*(1), 1-14.

Fredriksson, C., Mubarak, F., Tuohimaa, M., & Zhan, M. (2017). Big data in the public sector: A systematic literature review. *Scandinavian Journal of Public Administration, 21*(3), 39-61.

Hashem, A., Abd_Allah, E. F., Alqarawi, A. A., Al-Huqail, A. A., Wirth, S., & Egamberdieva, D. (2016). The interaction between arbuscular mycorrhizal fungi and endophytic bacteria enhances plant growth of Acacia gerrardii under salt stress. *Frontiers in microbiology, 7*, 1089.

Hochstetter-Diez, J., Negrier-Seguel, M., Diéguez-Rebolledo, M., Vásquez-Morales, F., & Sancho-Chavarría, L. (2023). Governance Democratic and Big Data: A Systematic Mapping Review. *Sustainability, 15*(16), 12630.

Hossin, M. A., Du, J., Mu, L., & Asante, I. O. (2023). Big data-driven public policy decisions: Transformation toward smart governance. *Sage Open, 13*(4), 21582440231215123.

Janssen, M., & Kuk, G. (2016). The challenges and limits of big data algorithms in technocratic governance. *Government Information Quarterly, 33*(3), 371-377.

Key Informant 1. (2025). Vice President and Chief Engineer. *Interview*. 12 December.

Key Informant 12. (2025). Digital Media Expert, Professor. *Interview*. 20 December.

Key Informant 18. (2025). Associate Professor, Data Governance Expert. *Interview*. 25 December.

Key Informant 2. (2025). Chief Data Officer. *Interview*. 18 December.

Key Informant 4. (2025). Chief Data Officer and Chief Engineer. *Interview*. 14 December.

Key Informant 6. (2025). Deputy Director and Senior Engineer. *Interview*. 22 December.

Lan, X., Pang, X., Tan, K., Hu, M., Zhu, X., Li, D., & Wang, Y. (2025). Reproductive effects of phthalates and microplastics on marine mussels based on adverse outcome pathway. *Environmental Science & Technology, 59*(16), 7835-7844.

Matheus, R., Janssen, M., & Maheshwari, D. (2020). Data science empowering the public: Data-driven dashboards for transparent and accountable decision-making in smart cities. *Government Information Quarterly, 37*(3), 101284.

Meijer, A. (2018). Datapolis: A public governance perspective on “smart cities”. *Perspectives on public management and governance, 1*(3), 195-206.

Meijer, A., & Wessels, M. (2019). Predictive policing: Review of benefits and drawbacks. *International journal of public administration, 42*(12), 1031-1039.

Russo, S., Sillmann, J., & Fischer, E. M. (2015). Top ten European heatwaves since 1950 and their occurrence in the coming decades. *Environmental Research Letters, 10*(12), 124003.

Zuiderwijk, A., & Janssen, M. (2014). Open data policies, their implementation and impact: A framework for comparison. *Government information quarterly, 31*(1), 17-29.