



Using Big Data Methods in Bandung City Planning Research: Urban Resilient Governance with Smart City

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Abstract

This study explores the significance of big data methods in urban planning, focusing on their application in Bandung City's smart city initiatives, the challenges involved, and their potential in foster a resilient urban environment. This research adopts a descriptive approach, utilizing big data methods to analyze urban resilience governance within the smart city framework of Bandung City. The study provides insights into the challenges, ethical considerations, and potential benefits of applying big data methods in urban planning for Bandung City. It also examines the concept of resilient urban governance in the development of smart cities. However, this study does not specifically analyze a particular case in Bandung City. Instead, it aims to offer valuable perspectives on the role of big data in broader urban planning and key strategies that can be applied to enhance urban governance resilience—both in Bandung City and in other cities facing similar challenges and opportunities. Integrating big data methods into Bandung City's urban planning is a crucial step toward achieving resilient governance in the context of a smart city. By leveraging advanced data analytics, cities can enhance decision-making processes, optimize resource management, and improve public services, ultimately fostering a more sustainable and liveable urban environment.

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Highlights

- The study emphasizes the crucial role of big data methods in urban planning, particularly in fostering urban resilience and supporting smart city initiatives in Bandung City.
- This integration of study is seen as essential for enhancing decision-making and improving public service.
- The study outlines several challenges associated with utilizing big data, such as data security and privacy concerns, as well as the need for theoretical frameworks to better address urban policy issues.
- These complexities of study require careful consideration to effectively harness big data for urban planning.
- The study describes a comprehensive methodological approach using various analytical tools (e.g., social media analytics, qualitative methods) to assess urban resilience governance.

Keywords: Urban planning; Smart City; Urban Resilience; Cities Emergency Governance; Big Data Analytics.

Introduction

Urban planning in Bandung City is undergoing a transformative change with the integration of big data methods, which aims to promote urban resilience and smart city governance (Kurniasih et al., 2023; Abdillah et al., 2024a; Abdillah et al., 2024b). The concept of a smart city involves the use of advanced technologies to improve the quality of life of citizens, optimize public services, and improve urban governance (Kurniasih et al., 2023). Big data plays a critical role in this transformation by providing valuable insights that inform the decision-making process and formulation of city policies (Strielkowski et al., 2021; Sarker et al., 2020). This study discusses the importance of big data methods in urban planning to reveal specific smart city applications in Bandung City, the challenges faced, and the potential for creating a resilient urban environment.

Big data methods are essential in modern urban planning as they enable the collection, analysis and visualization of large amounts of data from multiple sources such as sensors, social media and IoT devices. These data streams provide real-time insights into urban dynamics, helping planners make informed decisions (Sareen et al., 2024; Lnenicka et al., 2024). In the context of smart cities, big data facilitates efficient resource management, improves public service delivery and supports sustainable urban development (Sarker et al., 2020; Anggoro et al., 2016). By integrating big data into urban planning, cities can anticipate and respond to challenges more effectively, thereby improving overall governance and resilience (Schintler & McNeely, 2022; Hahn & Ryu, 2024).

In Bandung City, the application of big data methods is a collaborative effort between the local government and private sector partners such as PT. Telkom. This collaboration aims to create a smart city that is advanced, independent, and competitive (Anggoro et al., 2016; Kurniasih et al., 2023). One important application is the use of social media analysis to collect citizen feedback and address urban problems promptly. By processing data from social media, the government can classify and prioritize problems, leading to more responsive and effective governance (Anggoro et al., 2016; Kurniasih et al., 2023; Hahn & Ryu, 2024). In addition, big data is used to optimize urban infrastructure, regulate traffic, and improve public safety, which contributes to a more resilient urban environment (Ju et al., 2018; Kameswari et al., 2025).

Paradigm of Methodology

The use of big data methods in planning efforts for the city of Bandung (one of the largest metropolitan cities in Indonesia) has significant potential to improve urban resilience. By providing a detailed understanding of urban dynamics, big data enables cities to anticipate, absorb, and recover from disruptions more efficiently (Schintler & McNeely, 2022; Kameswari et al., 2025). This proactive approach to urban governance ensures that cities can adapt to changing conditions and maintain functionality during crises. Furthermore, the continued improvement of big data technology and methodologies will support the development of a more resilient and sustainable urban environment, ultimately improving the quality of life for all urban communities (Strielkowski et al., 2021; Sareen et al., 2024; Sassite et al., 2022).

Study Design

This study is a descriptive study using big data methods of Urban resilient governance in Smart City of Bandung City. In the future research agenda to study important problems in Bandung City, it can focus on issues and agendas of resilience in the Ecological, Social, and Economic dimensions in Bandung City. Data sources can be primary data and secondary data, primary data comes from researchers as a key instrument in this study which is obtained through studies, observations and various simple discussion forums on the impacts of climate change, globalization, and urbanization. Secondary data can also be used which can be obtained through document studies, literature reviews, online media, and policy surveys that contain issues of resilience and urban governance in Bandung City and Indonesia (See Figure 1).

The conceptual approach that can be used in the big data method research in Bandung City is Resilient Governance from the basic concept of Urban governance and Urban Resilience which in the last two years has become a concept with significant development in the study of urban governance and resilience. This concept examines the threats and challenges of climate change, the impact of urbanization, and globalization in global crisis situations, crisis management patterns, and resilience strategy models that are attempted to be implemented optimally in overcoming poverty and vulnerability to create resilience and a better quality of life (Abdillah et al., 2024a; Abdillah et al., 2024b; Abdillah et al., 2023; Abdillah et al., 2024c).

Data Source/Measurement & Ethical Considerations Associated with Using Big Data Methods

To create data sources and measure big data methods, it is important to understand the characteristics and origins of big data. Big data is generated from various sources such as social media, sensors, devices, transactions, and others, which contribute to its volume, velocity, and variety (Prasad & Prawal, 2024; Megahed & Jones-Farmer, 2025). These sources can include structured data such as financial records, semi-structured data such as XML files, and unstructured data such as multimedia files (Qureshi & Gupta, 2014). The selection of data sources is critical, as it affects the efficiency and effectiveness of data integration. Effective data source selection should consider the quality and relevance of the data, as well as the scalability of the approach to handle large data sets (Lin et al., 2019). For example, web scraping can be used to collect data from online sources, which can then be used to replace conventional data collection methods for more frequent and accurate measurements (Faramarzi et al., 2022).

Big data method measurement involves several steps, including data capture, storage, processing, and analysis. Advanced analytical techniques are required to handle large, diverse, and continuous data streams (Prasad & Prawal, 2024; Megahed & Jones-Farmer, 2025; Dhankhar & Solanki, 2019). Techniques such as clustering, classification, and optimization algorithms are often

used to extract meaningful insights from big data (Kulkarni et al., 2020; Gayathri & Bhaskari, 2021). For example, the MapReduce framework is commonly used to process large data sets in parallel, improving the efficiency of data analysis (Kulkarni et al., 2020; Gayathri & Bhaskari, 2021). In addition, big data analytics can leverage various models and frameworks to address specific challenges and improve the decision-making process (Prasad & Prawal, 2024; Megahed & Jones-Farmer, 2025; Dhankhar & Solanki, 2019; Qureshi & Gupta, 2014; Lin et al., 2019). The integration of new skills and roles, such as data analysts, is also required to effectively manage and analyze big data (Qureshi & Gupta, 2014). Overall, the creation and measurement of big data methods require a combination of innovative data collection techniques, advanced analytical tools, and a strategic approach to data management (see Figure 1).

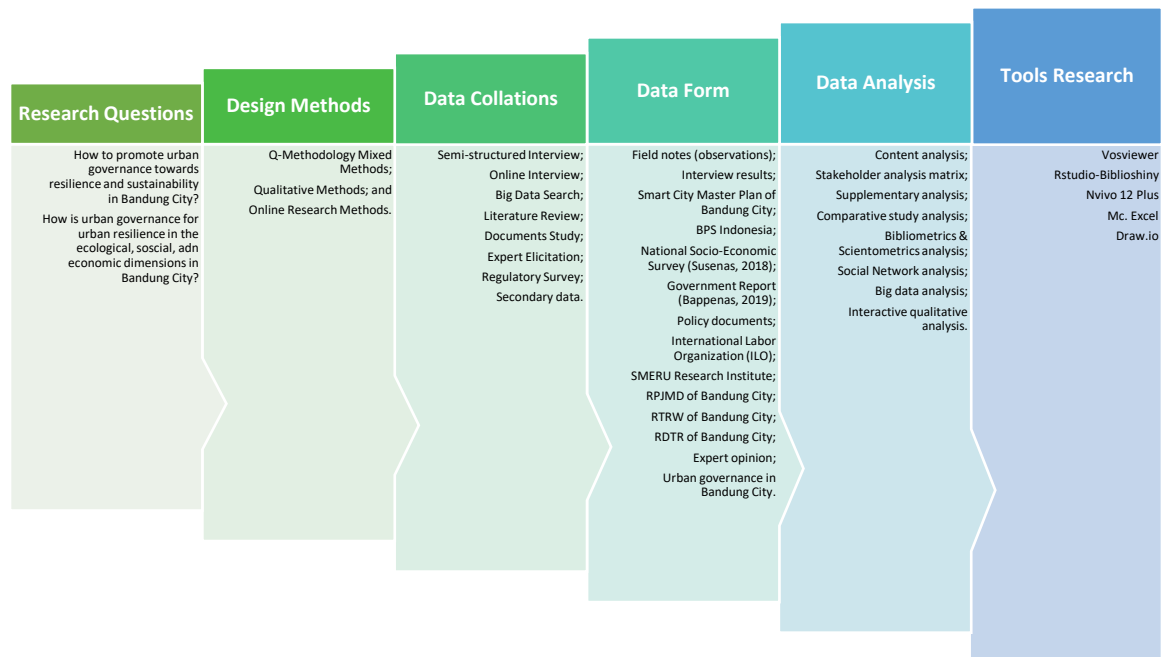


Figure 1. Biga Data Methods in Bandung City Resilience. Source: Processed by Authors, 2025

The ethical, governance, and social downsides of AI and big data can operate to hinder or compromise resilience, and there is a need to pay attention to relevant institutional dynamics and features in the context of smart and resilient cities (Schintler & McNeely, 2022). The use of big data in urban planning raises epistemological and practical challenges, and there is a need to consider the ethical implications of data-driven decision-making for strategic purposes (Kandt & Batty, 2021).

Analytical methods

The application of Big Data analytics in Bandung City aims to improve governance resilience by leveraging large amounts of data to inform decision-making and policy formulation. One of the main methods involves Social Media Analytics, where data from social media platforms is collected and analyzed to gauge public sentiment and identify pressing issues. This data is processed to provide actionable insights, allowing local governments to respond quickly and effectively to emerging issues (Kurniasih et al., 2023; Anggoro et al., 2016). By classifying and prioritizing issues based on their severity, governments can allocate resources more efficiently and address the most critical issues first, thereby improving overall governance and service delivery.

In addition, the integration of Big Data analytics into urban governance facilitates the development of a smart city framework. This involves the use of real-time data mining and pattern

detection to support evidence-based decision-making (Kurniasih et al., 2023; Anggoro et al., 2016; Kandt & Batty, 2021). As mentioned earlier, the collaboration between the Bandung government and PT. Telkom exemplifies how public-private partnerships can enhance data collection and analysis capabilities, leading to more informed and strategic urban planning (Kurniasih et al., 2023; Anggoro et al., 2016). In addition, the use of Big Data in urban governance helps in identifying and mitigating risks, improving infrastructure management, and enhancing the quality of life for residents. By adopting a comprehensive Big Data governance framework, Bandung can ensure the reliability, timeliness, and security of its data, which are critical to maintaining public trust and achieving sustainable urban development (Sarker et al., 2020; Qureshi & Gupta, 2014).

Important Steps in Big Data Method for Resilient Governance in the City of Bandung

The important steps in big data method research in urban resilience issues of Bandung City involve collaborative efforts, modernizing urban infrastructure, and stakeholder engagement. Key challenges include inadequate research scale and the need for localized approaches to governance and social dynamics. The contribution of big data methods to urban resilience research includes enhancing city 'smartness' with digital innovation and the development of an urban resilience evaluation index system. Ethical considerations in big data research for urban resilience involve ethical data sharing and the use of context-specific data sources. The potential applications of big data research in addressing urban resilience issues in Bandung City include enhancing resilience capacity and improving urban functionality.

To implement big data methods for resilient governance in the city of Bandung, two important steps can be taken, namely:

1. Social Media Analytics for Citizen Engagement

- **Data Collection and Analysis:** The Bandung District government, in collaboration with PT. Telkom, utilizes big data to gather and analyze social media data. This approach helps in understanding citizen aspirations and concerns by processing incoming data through Social Media Analytics (Kurniasih et al., 2023; Anggoro et al., 2016).
- **Decision-Making and Problem Solving:** The analyzed data is classified based on various parameters to identify pressing issues. This information is then used by the government to make informed decisions and provide timely solutions to city problems, enhancing the responsiveness and effectiveness of governance (Kurniasih et al., 2023; Anggoro et al., 2016).

2. Integration of Big Data with IoT for Disaster Resilience

- **Data Harvesting and Pre-processing:** Implementing a disaster-resilient smart city environment involves integrating IoT with big data analytics. This includes stages such as data harvesting, aggregation, and pre-processing to ensure the data is ready for analysis (Shah et al., 2019).
- **Real-time and Offline Analysis:** Utilizing platforms like Hadoop Ecosystem and Spark, the system supports both real-time and offline analysis. This capability is crucial for disaster management activities, enabling the city to detect and respond to emergencies such as fires, pollution, and natural disasters efficiently (Shah et al., 2019).

Table 1. Summary of Steps to implement big data methods for resilient governance in Bandung City (Indonesia).

No	Step		Description	Benefits
1	Social Analytics	Media	Collect and analyze social media data to understand citizen concerns and aspirations.	Enhances citizen engagement and enables informed decision-making.
2	Integration IoT	with	Implement IoT and big data analytics for disaster resilience, including data harvesting and real-time analysis.	Improves disaster response and management, ensuring city resilience.

Source: Processed by authors, 2025

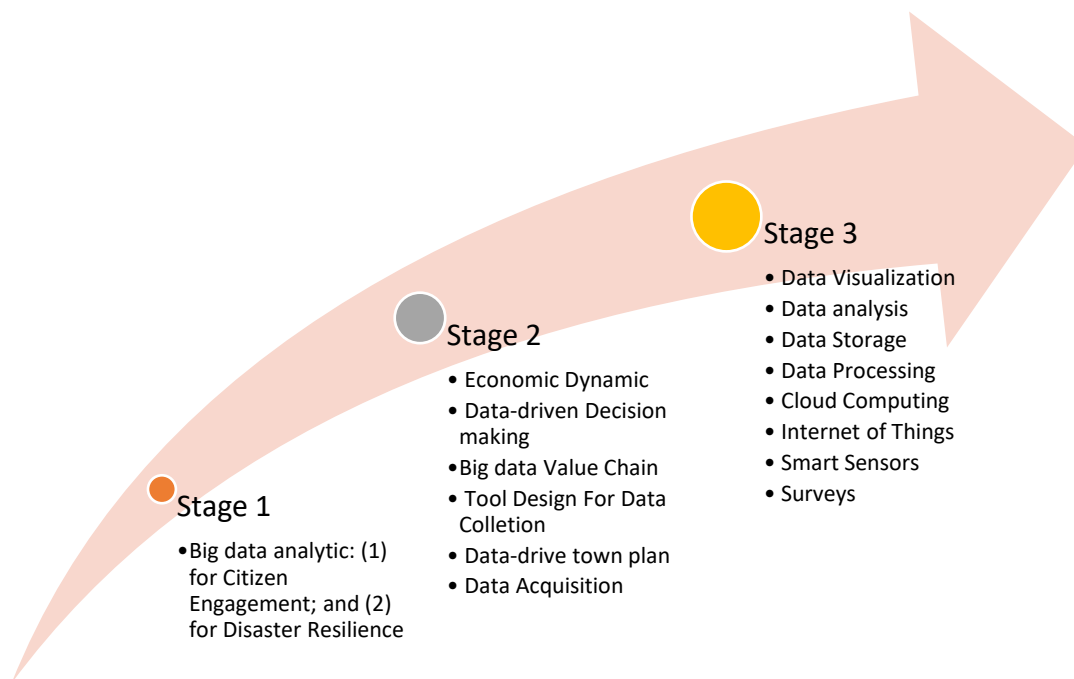


Figure 2. Important steps in Big Data Methods in Bandung city planning. Source: Processed by authors, 2025

Based on Table 1 and Figure 2, by following these steps, Bandung City can utilize big data to improve its governance capabilities, making it more resilient and responsive to everyday problems and emergencies. Urban resilience research based on big data methods can be characterized by three aspects: emphasizing community-scale research to improve accuracy, basing urban resilience governance models on localized and equitable mechanisms, and focusing on interdisciplinary integration with geography, economics, and sociology. This research scale should strengthen community-scale comparative studies to improve accuracy in resilience studies and urban planning. This study provides insights into the key steps, challenges, contributions, ethical considerations, and potential future developments in applying big data methods to urban resilience research. However, the information is limited and does not cover all aspects of user queries.

Challenges and Potential Benefits of Big Data Methods

Potential Benefits of Integrating Big Data Methods into Bandung City Planning: (a) Integrating big data into city planning can facilitate effective and efficient planning solutions for smart cities, improve city planning strategies, and drive sustainable growth in smart cities (Sareen et al., 2024); and (b) Big data and data-driven decision making have the potential to revolutionize the sustainable development planning process in the context of sustainable smart cities, with a focus on the various dimensions and functions of planning and their synergies and integrations (Bibri, 2018).

Challenges in Implementing Big Data Methods in Urban Planning for Bandung City: (a) Challenges in utilizing big data in urban planning include data security and privacy issues, as well as tensions between high-frequency data and long-term structural challenges facing cities (Schintler & McNeely, 2022; Kandt & Batty, 2021); (b) The use of big data in urban planning also improves practical conditions for addressing urban policy issues and requires a theoretical perspective on urban analytics as part of new smart urbanism (Kandt & Batty, 2021).

This study provides insights into the challenges, ethical considerations, and potential benefits of applying big data methods in urban planning for Bandung City, as well as the concept of resilient urban governance in the development of Smart Cities. However, this study also does not directly discuss the specific case of Bandung City. Therefore, this study attempts to offer valuable insights into the broader concept of big data and urban planning, and key steps that can be applied in the study of urban governance resilience in Bandung City in particular, and in other cities that have similar problems and potentials in general (Chauhan et al., 2016; Jangirala & Chakravaram, 2021; Tang et al., 2024).

Conclusion

The study of resilience in the resilience agenda in Bandung City is a system, mechanism, and strategy that functions as an evolution of policy changes, which presents implications for institutions, actors, and systems over a certain period. Therefore, the big data method is one of the important steps in identifying, planning, and implementing the resilience actions needed in Bandung City in the mission of a resilient and sustainable city that is happy and comfortable. Specifically, the big data method in the resilience study in Bandung City is suitable for this study because of its nature that provides flexibility for researchers to collect and combine data and can be combined in the principles of qualitative and quantitative methods to obtain the best findings and compile the necessary city planning.

In conclusion, the integration of big data methods in Bandung city planning is an important step towards achieving resilient governance in the context of a smart city. By utilizing advanced data analysis, cities can improve decision-making processes, optimize resource management, and enhance public services, thereby creating a more sustainable and livable urban environment.

Limitations of this method, despite its benefits, big data integration in urban planning presents several challenges, including data privacy, security, and the complexity of managing large volumes of data [Chauhan et al., 2016; Jangirala & Chakravaram, 2021; Tang et al., 2024]. Ensuring data protection is critical to maintaining public trust and safeguarding sensitive information. In addition, the heterogeneity of data sources requires sophisticated analytical tools and frameworks to effectively combine and interpret data (Ju et al., 2018; Tang et al., 2024). Addressing these challenges involves implementing robust data management practices, applying advanced analytics, and encouraging collaboration among stakeholders to develop comprehensive and secure smart city strategies (Lnenicka et al., 2024; Chauhan et al., 2016).

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Competing Interest Statement

The authors state that they have no competing financial interests or personal relationships that could affect the work reported in this paper.

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