Challenges and Complexities in Leveraging Data for Evidence-based Policymaking: A Scoping Review

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Abstract: Evidence-based policymaking stands at the forefront of contemporary governance, where data and evidence have emerged as indispensable allies in shaping effective and informed decisions. This article embarks on a comprehensive exploration of the challenges and critical issues encountered when data assumes the role of evidence in policy formulation. The foundation of this investigation is rooted in the extensive body of literature on evidence-based policy-making. We delve into the scholarly discourse, tracing the evolution of policy formulation from relying on intuition to being guided by empirical insights. As we navigate through this intellectual landscape, the crucial role of data as a catalyst for this transformation becomes apparent. Delving deeper, we will explore the intricacies of data and the rise of big data. Once regarded as mere numbers, data now represents the currency of the information age. Its volume, velocity, and variety characterize it, making it a powerful tool for generating evidence and formulating policies. As we explore its features, we uncover the potential of data to unlock unprecedented insights and inform governance with empirical precision. To conduct a comprehensive examination of the difficulties encountered when

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utilizing data as evidence in policy-making, we employ a rigorous scoping review methodology. Through meticulous screening, we have identified and analyzed 36 exemplary articles that offer invaluable insights into the multifaceted landscape of data-driven governance. These articles provide a comprehensive overview of the challenges, which can be grouped into three distinct clusters: technical challenges arising from data complexities, legal and privacy dilemmas intertwined with governance, and the formidable issues faced by policymakers. Our discussion unravels the intricate web of challenges, ranging from data quality and integration to confidentiality, ethics, and governance issues. We delve into the intricacies of data access, the fight against bias, and the challenges posed by data volume and complexity. Simultaneously, we explore the complex legal landscape of data ownership, security, sharing, and compliance. The challenges policymakers face in fostering data-driven cultures, navigating resource constraints, and communicating data-driven insights are brought to the forefront. In conclusion, our exploration sheds light on the complex challenges and crucial issues that underlie the use of data as evidence in evidence-based policy-making. This research underscores the transformative power of data in governance and emphasizes the challenges and pressing issues associated with using data as evidence in policymaking.

Keywords: Evidence, Data, Big data, Policy, Evidence-Based Policymaking

1. Introduction

The pursuit of informed and effective policymaking has remained a constant priority in the constantly changing landscape of governance. Grounded in the pursuit of evidence-based decision-making, this research reflects a significant paradigm shift from intuition-driven governance to one in which empirical evidence plays a central role. The integration of data-driven insights with the art of policy formulation has become a defining characteristic of contemporary governance, offering the potential for a more knowledgeable and fair future for societies across the globe (Hong et al., 2019). The emergence of evidence-based policy-making (EBPM) has its roots in a diverse range of literature that spans across various disciplines and several decades. This multifaceted body of knowledge has gradually permeated academia, government, and public policy, reshaping how policies are conceived, implemented, and evaluated (Head and Brian W, 2016). The cornerstone of Evidence-Based Policy Making (EBPM) is the meticulous integration of empirical

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evidence into the policymaking process. Central to this integration is the role of data, which is a quintessential asset in the modern policymaker's toolkit. In its myriad forms, data serves as the raw material from which evidence is derived, empowering policymakers to make decisions based on objectivity and precision (Valle-Cruz, 2020; Van der Voort, 2019). However, the data landscape has undergone a significant transformation in recent years with the emergence of big data. Big data, characterized by its volume, velocity, value, and variety (Chen et al., 2013), represents a digital deluge that has redefined the boundaries of what is possible in policymaking. This era of abundant information sources, ranging from sensor networks to social media platforms, presents unprecedented opportunities and challenges.

The dynamic nature of big data sources, coupled with their vastness, necessitates innovative approaches to harness their potential for evidence-based governance (Chen et al., 2012; Brown et al., 2011). Amidst this backdrop, this article undertakes a scoping literature review. This endeavor seeks to illuminate the multifaceted challenges faced when using data, including big data, as evidence in policymaking. Drawing from a wide range of disciplines including public administration, political science, data science, and ethics, our review aims to categorize, synthesize, and clarify the critical challenges that policymakers face in their pursuit of evidence-based governance. To undertake this comprehensive exploration, we have meticulously identified and scrutinized articles selected for their relevance and significance in shedding light on the complexities of data utilization in policymaking. These articles, representing a range of research paradigms, have been organized into a matrix that categorizes the challenges into three distinct clusters. In the following sections of this article, we will explore each of these clusters of challenges in detail, uncovering the complexities that policymakers face as they strive for evidence-based governance. As governance dynamics evolve in an increasingly data-centric world, this scoping review aims to serve as a guide, helping policymakers and researchers navigate the complex landscape of challenges and opportunities that characterize the era of evidence-based policy-making.

2. Research background

2-1. Evidence-based policymaking

Defining the evidence-based practice (EBP) movement in precise terms is a considerable challenge. However, for the reasons at hand, a comprehensive classification is adequate. Advocates of evidence-based policy (EBP) seek to enhance the impact of study and evidence on the formulation of policies. They attempt to prioritize this objective within politics, with the overriding goal of fostering instrumental rationality in the policy-making process(Cairney,2016). The concept of evidence-based policy is characterized by its emphasis on utilizing the most relevant research findings to guide decision-making processes on policies, programs, and projects (Davies,1999). This approach opposes policy based on personal opinions, which rely on the biased use of evidence or untested perspectives from individuals or groups, often influenced by ideological beliefs or speculative assumptions. Evidence-based policymaking emerged as an extension of evidence-based medicine(Melnyk & Fineout,2005). Evidence-based medicine (EBM) identifies the optimal solution by incorporating experiential knowledge into problem-solving(Seppi et al., 2019). Evidence-based policymaking uses empirical evidence and rigorous research to inform and shape policy decisions(Head and Brian W,2016). Appropriate evidence provides the basis for good policy-making and helps governments identify the best courses of action when faced with complex issues.(Namdarian, 2016)

The presence of complexity and ambiguity significantly complicates the process of making policy choices, even though these choices may be solely based on technical considerations(Geyer et al., 2021). It is essential to note that policies are not formulated in isolation. However, these phenomena commonly arise from a complex interplay of political dynamics, vested interests, and lobbying efforts(Starke et al., 2020). Individuals with specific interests will frequently endeavor to harmonize their requests with the collective welfare. The evidence-based policy (EBP) movement is often characterized by its shared objective of removing ideology and politics from the policy process (Botterill, 2017). At the same time, within realpolitik, strong and publicly accessible evidence and analysis can mitigate the influence of particular interests. This, in turn, allows for a more informed understanding of the potential consequences of proposals by interest

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groups. Additionally, it empowers those individuals who would bear the burdens of implementing such proposals(Banks and Gray,2010).

2-2. Evidence-Based Practice & Policy Research

The concept of evidence-based policy has gained prominence in recent decades among countries that prioritize the rigorous examination of policy analyses and the assessment of program efficacy. The concept of evidence-based practice (EBP) being discussed has two fundamental underpinnings in the respective countries. To begin with, a conducive political culture has the potential to facilitate transparency and rationality within the policymaking process. Consequently, this may enhance decision-makers' inclination to prioritize the exploitation of policy-relevant knowledge. Additionally, the research culture associated with this will promote and foster a commitment to rigorous procedures to generate data that is relevant to policymaking (Gambrill and Eileen, 2006). Policy research has experienced significant growth due to the increasing demand and supply factors associated with evidence-based policy. These factors include the need for government decision-makers to obtain specific types of information regarding problems, programs, and the effectiveness of different options. Additionally, there has been a significant expansion in the variety of tools and techniques available for analyzing and evaluating policy options. This expansion has further contributed to the growth of evidence-based policy research in recent years (Spiel et al., 2012). Evidence-based practice (EBP) appeals to professionals who are interested in developing comprehensive information repositories and enhancing methods for analysis and evaluation (Head and Brian, 2010).

2-3. Evidence-Based Policy: Demand and Supply

When examining the progression of the evidence-based policy movement, it is advantageous to acknowledge the interplay between demand and supply issues. The primary source of demand for comprehensive social and economic research arises predominantly from governmental agencies and legislative bodies (Head and Brian, 2010). These entities often require relevant information to evaluate performance and meet the informational needs of decision-makers. Government-funded research has emerged as the primary and influential provider of social

scientific insights to governmental entities, both directly and indirectly (Cairney, 2016). Government entities' perceived preferences for specific study categories significantly impact research. Social and economic academics have developed research capabilities on the supply side, enabling them to provide research findings on topics of interest to the government. Funders' preferences typically influence the selection of themes and formats. Over time, significant research centers have successfully consolidated these research capabilities. The research sector encompasses several organizations, such as universities, consultancy firms, private sector think tanks (Stone & Denham, 2004), and not-for-profit social welfare agencies (e.g., Joseph Rowntree Foundation, 2000). Government agencies rely on various external entities to obtain information and guidance. Nevertheless, it is essential to note that these organizations also have significant divisions within the public sector that are responsible for collecting and analyzing social and economic data. These are used as essential inputs in formulating policies.

2-4. What is evidence?

It is crucial to emphasize that the primary objective of Evidence-Based Policy Making (EBPM) is to provide assistance and information to the policy process, rather than directly influencing the ultimate objectives of the policy (Sutcliffe and Court, 2005). EBPM amalgamates experience, judgment, and skill with the most reliable external evidence from systematic studies (Davies, 1999). In order to substantiate claims and support arguments, it is imperative to incorporate a comprehensive range of evidence (De Marchi et al., 2016). What is the definition of evidence? The term 'evidence' is defined by the Chambers English dictionary (CED, 1990) as "that which provides clarity or makes something evident, serving as a means to establish the truth of an unknown or disputed fact, offering support for a belief, or acting as an indication." In a legal proceeding, "testimony" refers to the collective statements provided by one or more witnesses. The statement provided is sufficient, but it necessitates a comprehensive examination of the methodology employed to assess the comparative worth of various forms of evidence. (Namdarian, 2019). In the context of policy formulation, it is argued that Michael Harrison has proposed a more comprehensive and improved definition,

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which justifies further exploration. In an initial draft of this academic paper, the author proposed:

Evidence for policymaking is any information that helps to turn a department's strategic priorities and other objectives into something concrete, manageable, and achievable.

Nevertheless, it is essential to note that the evidence base is subject to constant change and evolution. Knowledge evolves as individuals' comprehension and interpretation undergo transformations, novel research findings emerge, our grasp of seemingly unrelated matters deepens, and fresh approaches to utilizing and construing existing information are developed. In light of the evolving evidence base, we must adapt our approaches to managing, filtering, and utilizing it for policy purposes. Evidence-based policymaking entails more than accumulating a comprehensive database and the selective extraction of the most favorable, easily accessible, or immediately applicable information(Shaxson 2005).

2-5. Big data

Historically, governmental entities have employed a discerning approach in creating and administering information. The government should prioritize using data for institutional upkeep and enhancing organizational capabilities, rather than making it publicly accessible. Over time, there has been a growing push for governments to transition away from their monopolistic approach to information management. The implementation of governmental policies has been influenced by several factors, such as globalization, the evolving sociocultural landscape, and advancements in information and communication technology (ICT) (Mulgan, 2003). These factors have led to significant changes in the operational context of policy implementation. It is advocated that policy choices be grounded in verifiable evidence supported by comprehensive access to data (Gray, 1997). Scholarly investigations have revealed that utilizing evidence-based policymaking enables governments to foster trust in a dynamic environment (Jennings, 2012). This approach also supports policy decisions, speeds up the decision-making process, reduces conflicts during policy formulation and implementation, and improves the overall quality of policies (Triantafillou, 2015).

Two crucial elements of evidence-based policymaking include ensuring the

impartiality of the materials or data utilized (Ferrandino, 2014) and conducting scientific analysis (Jost et al., 2009). Therefore, in order to promote the creation of evidence-based policies, it is crucial to collect high-quality data that allows for a thorough examination of the issue at hand, utilize scientific methodologies to analyze the gathered data, and utilize the analytical findings to guide policy development. Nevertheless, governments have acquired sufficient data with established impartiality in various domains, including healthcare, security, public safety, and environmental monitoring and response. These data have undergone scientific analysis, and the resulting insights have been used to develop effective policy frameworks. The lack of available data is the main factor causing the slow progress. Nevertheless, data-driven approaches are expected to expand across various disciplines due to advancements in data collection, integration, and analysis methodologies.

Numerous scholarly investigations have examined the utilization of Big Data Analytics (BDA) in government, specifically focusing on its implementation within the healthcare, security, and public safety domains. Within the healthcare industry, governmental entities employ Big Data to identify the most significant scientific evidence (Esty and Rushing, 2007) for mitigating the increase in healthcare costs. One of the primary objectives of governments has been to establish a comprehensive infrastructure that facilitates the integration of Big Data from diverse organizations. This is achieved by creating databases that interconnect individual patients from public administrative and medical institutions, thereby establishing a network of data related to existing medical services (Bradley et al., 2010). Previous research has utilized databases to examine the most effective treatments and potential cost savings by utilizing predictive models for high-cost patients, readmitted patients, and instances of complications and medical incidents. Additionally, other studies have focused on applying these findings to improve service optimization through personalized medical services, clinical decision support systems, and mobile devices (Zhang et al., 2007).

2-6. Big Data Definitions and Perspectives in the Disciplines

The term "big data" is a broad description that encompasses various aspects of this data-driven approach. Although the term "big data" is frequently used,

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alternative and more accurate terms such as "data analytics" and "data science" have also emerged to properly describe the concept. These words encompass the quantitative measurement of data, computational methodologies employed to gather extensive data sets from multiple sources, and analytical approaches that transform this data in real time. Data analytics primarily focuses on the emerging types of data generated by individuals on the Internet. This includes social networks formed through follower connections on social media platforms, interconnections between websites, and associations made through mobile phones.

Additionally, it involves using mobile applications that can be integrated with users' sociodemographic information. As mentioned earlier, data can also be generated using the "Internet of Things" technology. According to Bryant, Katz, and Lazowska (2008), there are devices that use the Internet to assist in managing relatively minor and specific tasks, such as controlling the temperature of a home, monitoring the battery level of an electric vehicle, or utilizing innovative technology like sensors. In recent times, there has been a growing trend of gadgets passively acquiring data pertaining to their owners and users. This data includes, but is not limited to, information regarding their location, schedule, speed, and health.

Table 1. Big Data Definitions across Disciplines (Mergel et al 2016)

Discipline	Author(s)	Definitions	Opportunities	Challenges
Management	(George, Hass, and Pentland, 2014)	"Big data is generated from an increasing plurality of sources, including Internet clicks, mobile transactions, user-generated content, and social media, as well as purposefully generated content through sensor networks and business transactions, such as sales queries and purchase transactions."	Signaling functions to understand emerging vulnerabilities Predict outcomes with greater precision.	Face-to-face communication versus automated analysis of behavioral patterns Stated versus automatically detected preferences

Discipline	Author(s)	Definitions	Opportunities	Challenges
Public policy	(Pirog, 2014)	New formats, quality, and availability of administrative data (volume, velocity)	Completeness and changes in the types of data (Data.gov)	Unstructured nature of the data
			Real-time availability of data	No breakthroughs in quasi-experimental research designs
			Connecting biology, psychology, and public policy to study risky behavior	
			Geospatial data increasingly accessible through incorporation of geocodes in large social surveys	
Political science	(Clark and Golder,2015)	"Technological innovations such as machine learning have allowed researchers to gather new types of data, such as social media. data, or vast quantities of traditional data with less expense" (65)	Benefits for description and measurement	Big data, better research designs or causal inference
			Access to "unfiltered" opinions	
Information and technology management	(Janssen and Van den Hoven, 2015)	BOLD—Big and Open Linked Data	Create public value by combining and analyzing large data sets	Ethical, cultural, technological challenges
	(Boyd and Crawford, 2012)	"massive quantities of information produced by and about people, things, and their interactions" (Janssen and Van den Hoven 2015, 662)		Unresolved privacy intrusions

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Discipline	Author(s)	Definitions	Opportunities	Challenges
Computational social sciences	(Lazer et al. 2009) (Lazer et al., 2014) (Denning, 1990) (Bryant, Katz, and Lazowska, 2008)	"Second-by-second picture of interactions over extended periods, providing information about both the structure and content of relationships" (Lazer et al. 2009, 2)	From individual-level data to society as a whole (micro to macro insights)	Acquisition and storage of data Design and test of algorithms Detecting patterns Overprediction/ estimation of Online searches (Lazer et al., 2014) False interpretation of signals

3. Research method

This study employs a discourse analysis framework and utilizes a scoping review approach to examine the primary concerns and obstacles associated with using data in evidence-based policymaking. Discourse analysis can be classified as an interdisciplinary qualitative analysis technique. This methodology involves the examination of the contextual elements of the text, delving further into its underlying significance (Ali, 2021). A scoping review is a comprehensive research synthesis grounded on evidence-based principles. Its primary objective is identifying and analyzing a research area's key objectives and gaps. The ultimate aim of a scoping review is to provide valuable insights that can inform policy reviews and guide future research endeavors. According to Gutierrez-Bucheli et al. (2022), the present approach enables the implementation of intricate matters or subjects that have not undergone comprehensive examination as a distinct undertaking. The scoping study involved the compilation of grey literature, academic research, and online reviews about the topics of "Evidence-Based," "Policymaking," and "Data-driven." These sources were obtained through an internet search conducted on Scopus and Scholar search engines. Of the vast corpus of 4098 articles about the evidence-based approach, 201 articles were found to address the intersection

of evidence-based and policymaking specifically. Conversely, a smaller subset of 83 articles were identified as discussing the amalgamation of evidence-based policymaking and data. Out of the figures, as mentioned earlier, 36 articles exhibited all the anticipated characteristics. Figure 1 presents the procedure for eliminating articles and the rationale behind their exclusion from the study methodology. As a result, a convenience sample methodology was employed to examine, analyze, and discuss publications that were thematically relevant to evidence-based policymaking and data.
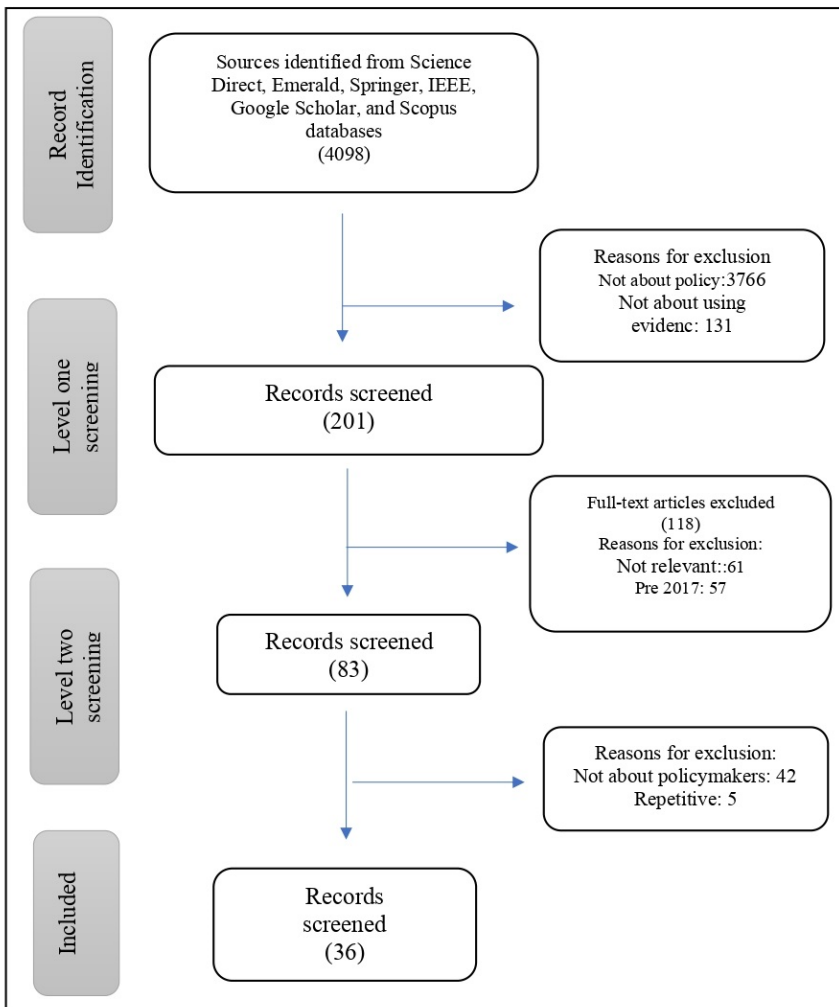

Figure 1. Study flow diagram

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By the procedural guidelines outlined in the research methodology section, the researcher Ultimately, 36 sources that were deemed reputable were examined. The present study has undertaken the extraction of findings from various sources and subsequently analyzed these findings. The primary objective of this analysis is to identify and explain the main issues and challenges associated with utilizing big data in evidence-based policy-making processes. We divide these challenges into three categories.

1. Technical challenges, which refer to data nature;
2. Legal and Security Issues; and
3. Policymaker-Related Challenges.

Table 2. Categorized Challenges in Utilizing Data as Evidence in Policy-Making

Category	Challenges	Definition	References
Technical challenges	**Data Quality**	Addressing issues related to data accuracy, completeness, and reliability	(Kim et al., 2020), (Mergel et al., 2016), (Perry & Uuk,2019), (Zhang et al., 2022)
	Data Integration	Overcoming obstacles in combining data from various sources and formats	(Kankanhalli et al., 2019), (Löfgren et al., 2020), (Kim et al., 2020), (Mergel et al., 2016), (Chang, 2021)
	Data Privacy and Ethics	Navigating the ethical considerations and privacy concerns associated with using sensitive data	(Kim et al., 2020), (Perry & Uuk, 2019), (Valle-Cruz et al., 2020), (Mergel et al., 2016), (Kempeneer, 2021), (Desouza & Jacob, 2017), (Palomino & Mondaca, 2017), (Günther et al., 2017), (Janssen et al., 2017), (Agarwal,2018), (Longo & Dobell, 2018)
	Data Analysis Tools	Discussing the availability and proficiency of tools for data analysis and interpretation	(Kankanhalli et al., 2019), (Perry & Uuk, 2019), (Mergel et al., 2016), (Desouza & Jacob, 2017), (Tomar et al., 2016),

Category	Challenges	Definition	References
	Data Literacy	Highlighting the importance of analysts possessing the necessary data skills	(Carmi et al., 2020), (Sander et al., 2020), (Perry & Uuk, 2019), (Mergel et al., 2016),
	Data Bias	Discussing the potential biases present in data sources and their impact on policy outcomes	(Zhang et al., 2022), (Janssen et al., 2020), (Perry & Uuk, 2019), (Mergel et al., 2016), (Chang, 2021), (van Noordt & Misuraca, 2022)
	Data Volume and Complexity	Addressing the challenges posed by the sheer volume and complexity of big data, including storage, processing, and analysis	(Kim et al., 2020), (Perry & Uuk, 2019), (Mergel et al., 2016), (Desouza & Jacob, 2017), (Günther et al., 2017), (Longo & Dobell, 2018)
Legal and Security Issues	**Data Governance**	Analyzing the framework for data collection, storage, and sharing within government agencies	(Kankanhalli et al., 2019), (Löfgren et al., 2020), (Abraham et al., 2019), (Abraham et al., 2019), (Janssen et al., 2020)
	Data Security	Addressing issues related to data breaches, cyber threats, and safeguarding sensitive information	(Löfgren et al., 2020), (Janssen et al., 2020), (Kimani et al. 2019), (Rawat et al., 2019), (Kim et al., 2020), (Desouza & Jacob, 2017), (Tomar et al., 2016), (Agarwal, 2018), (Longo & Dobell, 2018)
	Regulatory Compliance	Discussing adherence to data protection regulations and compliance requirements	(Janssen et al., 2020), (Dommett et al., 2019), (Desouza & Jacob,2017), (Tomar et al., 2016)

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Category	Challenges	Definition	References
	Data Ownership	Exploring questions of ownership and intellectual property rights related to the data	(Hummel, 2021), (Valle-Cruz et al., 2020), (Valle-Cruz et al., 2020), (Mergel et al., 2016), (Tomar et al., 2016), (Janssen et al., 2017)
	Data Sharing Agreements	Examining legal and contractual constraints that hinder data sharing between agencies and organizations	(Rantos et al., 2022), (Tan et al., 2023), (Valle-Cruz et al., 2020), (Mergel et al., 2016)
	Data Retention	Discussing the challenges of determining data retention policies and the impact on long-term analysis	(Habibzadeh et al., 2019), (Mergel et al., 2016), (Tomar et al., 2016), (Janssen et al., 2017)
Policy maker Related Challenges	**Decision-Making Culture**	Assessing the extent to which policymakers are open to data-driven decision-making	(Desouza & Jacob, 2017), (Tomar et al., 2016), (Medaglia et al., 2021), (van Noordt & Misuraca, 2022),
	Communication Gap	Highlighting the need for effective communication between data scientists and policymakers	(Paul & Kwiatkowski, 2017), (Mateheus et al, 2020)
	Policy Evaluation	Exploring challenges related to assessing the effectiveness of policies based on data	(Desouza & Jacob,2017), (Tomar et al., 2016),
	Political interests and Stakeholders' Influence	Examining how political interests and stakeholders' pressures can influence data usage in policymaking	(Medaglia et al., 2021), (van Noordt & Misuraca, 2022), (Desouza & Jacob, 2017), (Tomar et al., 2016), (Palomino & Mondaca, 2017), (De Marchi et al., 2020)
	Evidence Interpretability	Discussing the challenges in interpreting data-driven insights and translating them into actionable policies	(Medaglia et al. 2021), (van Noordt & Misuraca, 2022), (De Marchi et al. 2020)

4. Analysis of findings

In evidence-based policy-making, data has emerged as a powerful ally, a beacon of light guiding the way toward informed decision-making. However, this beacon often shines amidst a sea of challenges, navigating which can be as treacherous as rewarding. Our exploration of these challenges unfolds as follows:

4-1. Data Challenges

Data quality is the bedrock upon which the edifice of evidence-based policy-making stands. It is not merely a challenge but a formidable gatekeeper, demanding meticulous scrutiny. As (Kim et al., 2020) elucidate, issues surrounding data accuracy, completeness, and reliability often plague the data landscape. The foundation upon which policies are built is compromised when data quality falters. Data from diverse sources must coalesce in our interconnected world to provide a holistic view. However, data integration is a complex challenge (Kankanhalli et al., 2019). The data puzzle must be assembled, each piece conforming to the other, to create a coherent picture that policymakers can decipher. The ethical dilemma in data-driven policy-making looms large (Kempeneer, 2021). As we harness data's power, we must also grapple with questions of privacy and responsibility. How do we navigate the labyrinth of ethical considerations while utilizing sensitive data for the common good?

The availability and proficiency of data analysis tools are essential in the arsenal of evidence-based policy-makers (Perry & Uuk, 2019).This challenge demands the adoption of cutting-edge tools and the skill to wield them effectively. In the digital age, data literacy bridges data and decision-making. Policymakers must have the knowledge and skills to interpret and use data effectively. Without data literacy, even the wealthiest datasets remain dormant, a treasure chest unopened. Data, often unwittingly, carries the biases of its creators and collectors(Perry & Uuk, 2019),. Addressing data bias is not just a technical challenge; it is a moral imperative in the pursuit of fair and equitable policies (Zhang et al., 2022)including public services, public security, and environmental protection, and to ultimately achieve Sustainable Development Goal (SDG. Managing, analyzing, and deriving actionable insights from this deluge is monumental (Kim et al., 2020). It necessitates the development of scalable solutions and the dexterity to decipher

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complexity. The data challenges on the path to evidence-based policy-making are multifaceted and interwoven. They demand technical acumen, ethical discernment, and a commitment to transparency and fairness. Overcoming these challenges is not merely a quest for better policies but a pursuit of a more enlightened, data-driven future.

4-2. Legal and Privacy Challenges

Data governance serves as the sentinel guarding data integrity in the policy-making process. The framework of accountability ensures responsible data collection, storage, and sharing. Navigating this landscape necessitates compliance with regulatory standards and establishing transparent and ethical data governance structures(Kankanhalli et al., 2019). In an era of cyber threats and data breaches, data security is an impenetrable fortress. The challenge lies in fortifying this fortress to protect sensitive information while enabling data-driven insight. A breach not only jeopardizes privacy but also undermines public trust. Data ownership remains an enigmatic challenge, entwined in legal intricacies. Determining who holds the rights to data and intellectual property rights can be contentious. Resolving these issues is imperative for smooth data sharing and collaboration (Hummel, 2021). Determining data retention policies is akin to deciding how long a time capsule should remain sealed. Too short and valuable historical data may be lost; too long and privacy concerns may arise. Policymakers must tread carefully in crafting these policies. In the quest for evidence-based policy-making, these legal and privacy challenges are not mere roadblocks but crucial facets that underscore the importance of ethical, secure, and accountable data usage. The balance between leveraging data's potential and upholding the principles of privacy and legality is a tightrope walk that policymakers must master.

4-3. Policymaker-Related Issues

The transition to a data-driven decision-making culture is akin to changing the course of a mighty river. Policymakers often grapple with traditional paradigms prioritizing experience and intuition over data-driven insights (van Noordt & Misuraca, 2022). Cultivating a culture that values and relies on data requires a transformative shift in mindset. Resource constraints cast a shadow over the

path to data-driven policy-making. Policymakers are often tasked with achieving ambitious goals with limited time, budget, and personnel. Striking a balance between ambitions and resources is a perpetual challenge.

The language of data is often foreign to policymakers. Communicating complex data-driven insights in a way that resonates with decision-makers requires a unique skill set. Policymakers must be able to "see" the data for it to influence their decisions. Political interests and stakeholder pressures can influence considerably (Marchi et al., 2014). Policymakers often navigate treacherous waters where data-driven decisions must align with political agendas and satisfy diverse stakeholders. Data-driven insights are only as valuable as the actions they inspire. Policymakers must understand the data and translate it into actionable policies that benefit society. This requires a unique blend of analytical and strategic skills. In the crucible of policymaker-related issues, we find the human element of evidence-based policy-making. Policymakers are tasked with embracing data as a partner in decision-making while wrestling with traditional paradigms, resource limitations, and the complex art of policy interpretation. Overcoming these challenges requires data proficiency and a transformative shift in how policy-making is approached.

5. Conclusion

In the complex world of governance, the pursuit of evidence-based policymaking (EBPM) has become a transformative journey that bridges the gap between tradition and innovation. As we conclude this exploration of the challenges and critical issues surrounding the use of data as evidence in policymaking, we find ourselves at the threshold of a data-centric future. The trajectory of governance is now intricately connected to the insights derived from the digital realm. Integrating data into policymaking processes has become emblematic of modern governance, offering the promise of more informed, responsive, and equitable policies. In the age of big data, characterized by its unprecedented volume, velocity, and variety, data has emerged as both a catalyst and a challenge. The vast amount of data sources, which include social media platforms and sensor networks, offers exciting possibilities for evidence-based governance. However, these opportunities are accompanied by complex challenges, ranging from data

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quality and privacy to the formidable task of data integration. Our scoping review, a thorough exploration of the research, revealed 36 influential articles that provide insight into the complex challenges encountered by policymakers in their pursuit of evidence-based governance. These challenges have been categorized into three clusters: the technical challenges inherent in handling data, the legal and privacy complexities surrounding data usage, and the significant obstacles faced by policymakers. The technical challenges associated with data have highlighted the importance of data quality assurance, effective data integration strategies, and the advancement of state-of-the-art data analysis tools. With its voluminous and complex nature, big data demands not only scalable solutions but also the development of data literacy among policymakers to interpret its insights. Legal and privacy challenges have emerged as significant barriers in the data-driven governance landscape. Policymakers must navigate the intricate web of data governance, security, ownership, and compliance with data protection regulations. These legal enclaves demand compliance and the establishment of ethical and transparent data governance frameworks.

The challenges inherent to policymakers have emphasized the need for a cultural shift towards data-driven decision-making. Resource constraints call for innovative approaches, while effective communication and visualization of data insights become paramount. Resistance to change, the specter of political influence, and the challenge of policy interpretation all pose significant obstacles that policymakers must overcome. As we stand on the precipice of a data-centric future in policymaking, it is imperative to acknowledge that our research is far from complete. The challenges highlighted in this exploration are not static; they evolve in parallel with the data landscape. Future challenges may include the ethical use of emerging technologies, such as artificial intelligence, the need for strong data governance frameworks in an interconnected world, and the importance of promoting a diverse and inclusive data ecosystem. In conclusion, the challenges and critical issues presented in this article represent the crucible in which evidence-based governance is formed. They are not insurmountable barriers, but rather catalysts for innovation, transparency, and equity in policymaking. As we look ahead in evidence-based policymaking, it becomes clear that the data-driven landscape persists. This ongoing endeavor compels policymakers, researchers,

and stakeholders to navigate a trajectory that aligns the potential of data with ethical considerations, technical expertise, and an unwavering commitment to public welfare. In the dynamic orchestration of governance, evidence remains a guiding beacon, shedding light on research aimed at creating a more informed and equitable global landscape.

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