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Integrating Data Governance into Public Sector Decision-Making Processes

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Abstract
This research explores the integration of data governance into public sector decision-making processes, emphasising its critical role in enhancing service delivery and addressing societal challenges. Utilizing a systematic literature review of 50 sources, the study identifies three primary themes: policy activities, organisational activities, and informational activities, which collectively facilitate effective data governance. The findings reveal significant barriers to integration, including institutional resistance, resource limitations, and bureaucratic inertia, which hinder the adoption of robust data governance frameworks. The research highlights the necessity for adaptive strategies that promote stakeholder engagement and transparency while ensuring data quality and compliance. Recommendations for practice are structured around five essential elements: people and organisation, processes and methods, technology and data, control and compliance, and culture and attitudes. These elements are crucial for developing effective data governance practices that can support evidence-based policy-making. The study concludes that while integrated data systems can significantly improve decision-making and resource allocation, challenges such as siloed data systems and compliance tensions remain prevalent. Future research directions are suggested, focusing on the implications of emerging technologies like artificial intelligence and big data management for public sector governance. This research contributes valuable insights for policymakers and practitioners aiming to enhance data governance frameworks within public administration.

Keywords: *Data governance, Decision making, Public sector, Technology*

1. Introduction

The need for effective data governance practices is increasingly important for enabling public sector entities to achieve their goals. In this context, the integration of data governance in the decision-making process of the public sector is of utmost importance to be able to meet the needs of public administration in an increasingly complex and evolving environment (Rijal, 2023; Nisar et al., 2021). This study contributes to the development of a structured approach through identifying how data governance is currently used by public sectors in the context of decision-making, and factors promoting the ability of public sector entities to use decisions as the basis for further methodological developments to improve the use of data governance. As in all other sectors, the volume and complexity of available data for public sector decision-making are increasing. due to new data sources and technical capacity. In light of this, access to the right data has become a core aspect of effective decision-making (Nadal et al., 2022). However, the increasing scale and scope of data collection have paradoxically called attention to the necessity of ensuring that data are accurate and well managed. Data governance can be understood as practices necessary to preserve and deepen accuracy and accountability in the handling of data, particularly datasets collected by government (Choenni et al.2022).

Quantitative, social, and ethical threats loom over poorly governed data (Kempeneer, 2021; Kazansky, 2021). From a quantitative perspective, vast stores of numbers and text now stream through policy processes without checks on their credibility. Stories of published papers based on randomised controlled trials that are often neither replicable nor evidentiary have proven especially resonant, prompting fears of wholesale ‘data tribalism’ in policy. From a social perspective, the substantial potential for data and algorithmic systems to systematise and

reproduce discrimination highlights the importance of ensuring that data feeding any algorithm can be defended as informative and pertinent. Such a defense becomes difficult, if not impossible, with poorly documented data (Hawn Nelson & Zanti, 2023).

2. Conceptual Framework for Data Governance

Big Data has gained a central role in decision-making across most sectors of society. Governments are no exception. With the growing digitalisation of government activities, the availability of Big Data provides ample opportunities for (re)designing and (re)organising public services (Nadal et al., 2022). Cloud based services are widely implemented between governmental agencies and third party services, contributing to the availability of vast amounts of data.

2.1. Definition of Data Governance

Operationalising and automating Data Governance is a difficult task in large and heterogeneous data ecosystems. This difficulty hinders insightful data analysis and the ad-hoc definition of the most relevant data treatments to cover the relevant decisional aspects. Central to that are the semantic, what the data is about, and syntactic, the structure of data: text, image, etc. The relationship between the variables provides valuable information (Adepoju et al., 2023). In public institutions, transparency and trust are built not only by adopting policies that foster information sharing, but also by implementing government and institutional transparency, accountability, and governance mechanisms. Accountability mechanisms can take effect if realistic data are easily available. Consequently, the organisations need data governance rules and procedures covering the data lifecycle: from data definition or acquisition to data disposal or archival in order to establish an intuitive context in which data analytics can be setup. Moreover, good governance cannot exist without governance over the management and treatment of data. Hence, it is important to define relations between data governance and established authority within broader government contexts (Zhang & Zhang, 2023).

The term data governance is used to refer to the decisions taken and methods used to ensure effective and efficient data management and data usage (Viljoen, 2021). Operational, legal, or strategic decisions are within the scope of data governance. Data governance also considers who makes the decisions, who is responsible, and what monitoring procedures there are. It is important to assess data governance on the whole data lifecycle, i.e., since data assets are defined or acquired, throughout data management and treatment, to later data consumption or sharing. A minimum set of data governance principles are defined that aim to collect metadata during the data lifecycle and transform it to ensure metadata continuity (Carroll et al., 2021; Lăzăroiu et. al., 2022).

2.2. Principles of Data Governance

There are numerous research about the ineffective use of data to drive decision-making but recent estimates suggest that society only uses two percent of the overwhelming amount of available data (Rukmini, 2022; Wiggins & Jones, 2023; Suleyman, 2023). Bridging the gap between initial data generation and decision-making is data management, a central part of which is data governance (Nisar et al.2021). With the burgeoning importance of data integration and management the time is ripe for the public sector to consider new strategies. This addresses the importance of data governance in the public sector and offers a framework that provides a starting point for managing data more effectively. Effective, equitable governance practices can be implemented and, in the context of data governance, will greatly enhance data management outcomes. Effective management of district data is realised most readily through the principles of transparency, collaboration, standardisation, privacy, and security (Nisar et al., 2021).

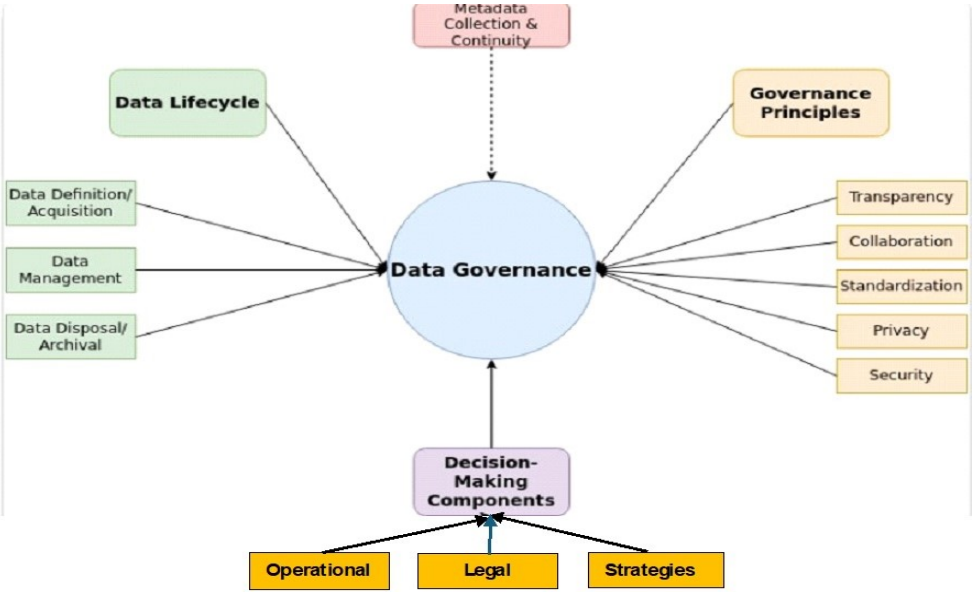

Fig 1: Conceptual framework of data governance in public sector

3. Public Sector Decision-Making Processes

The public sector is responsible for the provision of services to citizens and for working on safeguards against societal risks (disasters, lack of education, unemployment). The decision-making cycle in the public sector is based on key stages spanning from the identification of the problem to the implementation of solutions. Data is considered a driving force in each decision-making phase not only to steer objectives, but also to measure the effects of implementation (Nadal et al., 2022). Owing to its relevance, Data Governance (DG) is assumed to be a sustainable structure in the context of the decision-making structure which must involve stakeholders (Jarvenpaa & Essén, 2023; Sørensen et. al., 2021). Stakeholders' engagement should drive towards solutions; thus they must be aware of objectives and analysis (Hawn Nelson & Zanti, 2023). Measures to evaluate the consequences of the implemented solutions and the ways in which data are used is part of the design, hence they also must be known to potential stakeholders. The comprehensive view of the decision-making process encompasses the need to take action regarding the various rules (making, implementing or adjudicating) and the structural organisation having ability to execute fundamental decisions, making them broader, thereby more stable over time.

3.1. Challenges in Public Sector Decision-Making

Public sector decision-making is complex with many constraints and difficulties (Choi et al., 2016). The environment is complex with many challenges. Information is widely distributed into data silos (Li et al.2022). Decision-makers do not know where all the useful information is nor have immediate access to reliable information. They ask their subordinates for some information, expecting the truth, but as an old saying goes, "officers tell what they want not what is". As a consequence, decision-makers may either not get the information they need or take decisions that do not lead to the intended goal (Hemming et. al., 2022). Bureaucratic practices also pose an obstacle to effective decision-making. For instance, decision-making is hampered by procedures, requiring multiple steps which take time. Resistance to change ("business as usual") and its associated conservative behaviour further reduces the efficiency of the decision-making process.

The imperatives of data governance are particularly difficult to implement, given the myriad of challenges faced by public sector decision-making. For instance, the data governance model is based on the existence of data management guidelines, policies, roles and responsibilities that usually require a considerable effort to develop, implement and sustain (Díaz-Rodríguez et. al., 2023). Public sector organisations have limited resources and must deal with many and competing priorities, not all of them necessarily aligned with the development of a data governance model.

4. Methodology

To enable replication and to ensure rigor, a four-step search process was conducted. Articles were retrieved from various databases. Articles found in an electronic search of these databases were included. Additionally, a manual search was conducted for articles in relevant journals. For inclusiveness and accuracy, research by agencies was consulted. Finally, the bibliographies and notes of all relevant literature reviewed were searched, as there is a rapidly-growing literature on data and public sector governance that may not have yet been indexed by the previously mentioned databases. To ensure that potentially relevant grey literature was not omitted and instead evaluated critically for its validity, a process for identifying all relevant observational and experimental data was detailed. Grey literature was considered. The research was conducted to be forward-looking, using empirical data to explore decision-making processes in a public service setting. This type of research may also be of interest to donors or funding organisations. The qualitative findings are general in nature and may be relevant to other organisations undergoing similar internal reform.

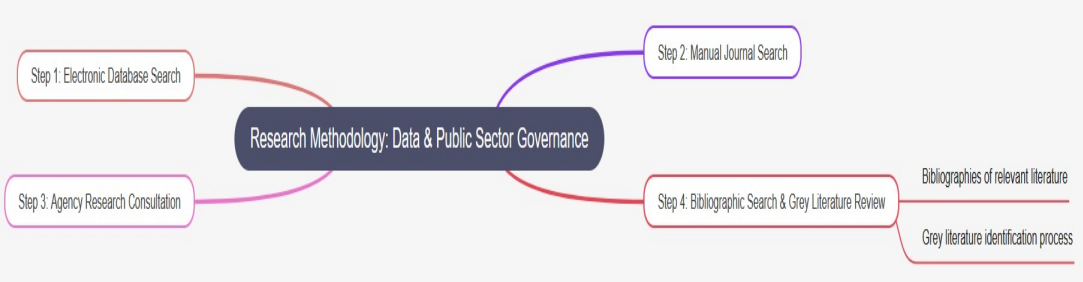

Fig 2: Four-step research process

4.1. Systematic Literature Review Process

The findings of a systematic review on data governance in the public sector are triangulated with policy analysis. This research was inspired by findings on the need to link data governance to the decision-making process. A comprehensive review served to develop a knowledge base, review methodologies enable a critical approach to the subject, potential associations between data governance and policy processes are assessed, and potential adaptations in light of this study are discussed.

4.2. Data Sources and Selection Criteria

There are various types of sources used for this study, including academic articles and governmental reports. The decision on data sources is led by their pledge to data governance practices, especially in the public sector. Selection is based on the relevance to the subject, but also on the credibility of the authors and timeliness of the information. To ensure data from different viewpoints are captured, it is crucial to diversify the potential data sources, including academic articles and reports, but also other low-level sources, such as governmental documents. Most of the public sector activities are based on the availability of high-quality data, and it is essential for public officials to have access to reliable data to support them in making enlightened decisions (Nadal et al., 2022).

Table 1: Data sources

Data Source Type	Key Characteristics	Importance
Academic Articles	Scholarly research, peer-reviewed, credible authors	Provides in-depth analysis and theoretical framework
Governmental Reports	Official documentation, data governance practices, public sector insights	Ensures reliable, authoritative information for decision-making
Low-Level Sources	Diverse governmental documents, supplementary information	Provides comprehensive perspective and additional context

5. Analysis and Findings

This research of data governance presents a systematic literature review and an analysis to find practices in public sector decision-making. In all, 50 sources are scrutinised to (a) present and analyse activities and processes linked to data governance practices in the public sector, and (b) to identify opportunities and barriers related to utilising data in the public sector to enhance decision-making.

Three significant themes are identified (policy, informational and organisational activities) along which data governance occurs in the public sector. In particular, policy activity focuses on setting the legislative and strategic framework for data-dependent decision-making, and organisational and technical activities plan resources and procedures to produce and use data. As for the information chain, activity involves collecting data, processing data into information, and making information available for informed decision-making (Hawn Nelson & Zanti, 2023). These processes interact in macro-level information cycles that are at work within the principal-agent framework of the hierarchical structure of the state between the political office and the public administration. Barrier activities are constraints and challenges related to utilising data in public sector decision-making.

Throughout this research, an attempt is made to contribute to understanding efforts to enhance decision-making meant to address public problems and challenges in society at large. As a means of synthesising the approach, six case examples are presented where successful or less successful data governance practices are observed in varying contexts, including multinational organisations, federal or state-level bureaucratic systems. The presented practices and cases are chosen with care because they illustrate particular complexities or significant aspects in a common and recognisable manner (Pencheva et al., 2018).

Table 2: Analysis and findings

Research Dimension	Key Findings
Research Scope	Systematic literature review of 50 sources on data governance in public sector decision-making
Three Primary Themes	1. Policy Activities: Legislative and strategic framework 2. Organisational Activities: Resource and procedure planning 3. Informational Activities: Data collection, processing, and availability
Key Processual Framework	Macro-level information cycles within principal-agent hierarchical state structure
Research Methodology	Comparative analysis of six case examples across multinational and governmental contexts
Research Objective	Understand and enhance decision-making processes to address societal challenges

6. Barriers to Integration

Data governance needs to be integrated into decision-making processes to support evidence-based policy but integrating data governance into the decision-making processes meet various challenges. Examples of these challenges include institutional resistance, lack of resources or skills, and bureaucratic inertia to change (Cronemberger et al., 2017). Data governance would also need robust technology and practices for data management in order for them to become part of everyday work routines of organisations that operate with several administrative systems that store, process, and output public sector information. In this context, the contribution of this research is, first, to explore and diagnose barriers to integration of data governance into the decision-making processes in the public sector. It is widely recognised that good leadership is required to introduce and ensure lasting changes, and adaptive frameworks are more likely to improve integration, and, respectively, second, to provide results on the barriers as impediment to integration that might help develop targeted strategies for its improvement.

It has been also suggested that the public sector is good at developing adaptive frameworks through which a variety of pressures lead to erratic, reactive change, rather than well-planned integration of new ideas (Ashok et al.2021). From this perspective, the findings along with the literature suggest that poor leadership commitment to change and the lack of frameworks for properly introducing or improving data governance should be considered at the macro-level as structural preconditions for the existence of the meso- and micro-level barriers to integration. On the other hand, at the meso- and micro-level there is an exhaustive list of further possible barriers that represent the impediments caused by structural preconditions (Ashok et. al., 2021; Tangi et. al., 2021; Merhi, 2021; Ojogiwa, 2021).

7. Discussion

This research seeks to gain a better understanding of data governance in the public sector. Existing literature predominantly focuses on data governance in private organisations. Drawing on the findings, this research provides practitioners with recommendations for improving the integration of data governance into decision-making processes. These recommendations urge that strategies to enhance data governance in the public sector need to be adaptive, catering to changing conditions, and should be grounded in advocacy-actions, driving long-term changes to the power differentials between stakeholders and enabling their deeper involvement in governance structures (Hawn Nelson & Zanti, 2023).

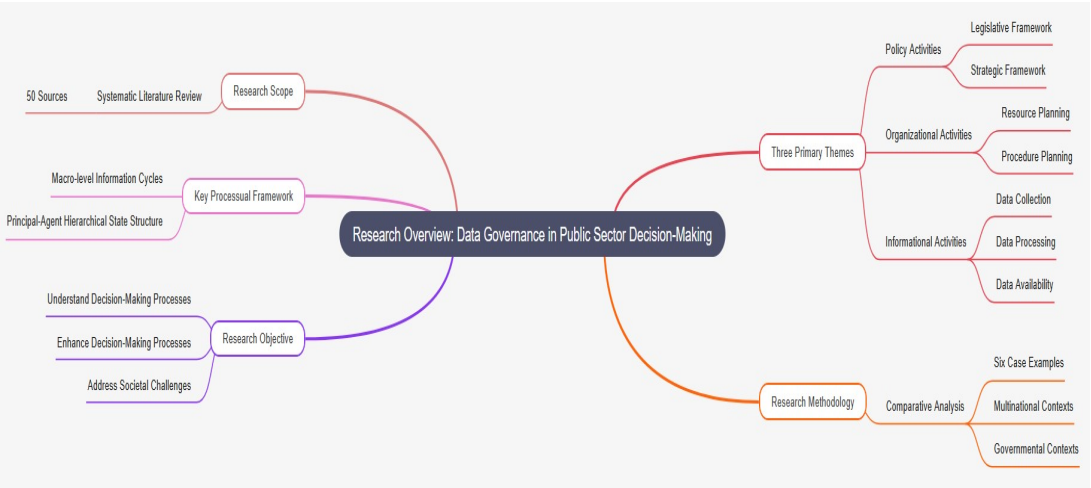

Fig 3: Research Overview: Data Governance in Public Sector Decision-Making

7.1. Implications for Policy Makers

At the heart of the matter seems to be a fundamental misunderstanding of the nature and potential of government data. "Government has always been big on data. From the earliest censuses, number crunching has been a crucial tool of the state. Creating opportunities for the generation and analysis of high-quality publicly-relevant data has always been central to government. However, like in the private sector, unnoticed by most, it has not always been about big data. It certainly is now (Pencheva et al., 2018). An understanding of data's nature as a 'vital asset' is starting to bring up the structured governance approach. In response to the issues at the end of the twentieth century, governments have started to establish the basic building blocks for the structured governance of their official data assets – inventorying them, publishing information about data and statistics, and legislating to protect some datasets and safeguard their value. However, as it is three decades and counting after computers have started to revolutionise the collecting, management, and storing of official data on the larger scale, governments are in a dire need of a revolution in its management.

7.2. Recommendations for Practice

Building on a comprehensive academic literature, this paper identifies strategies for effective practice of integrating data governance into decision-making processes. Recommendations for practice are structured using the five themes of the Four Pillars Model and shed light on the most pressing needs and gaps in public sector management and data governance in the public sector (Viljoen, 2021; Azbeg et al., 2022; Bingham, 2023; Mäntymäki et al., 2022; Shet et al., 2021). Broadly, the proposed framework identifies five essential elements of data governance: people and organisation, processes and methods, technology and data, control and compliance, and culture and attitudes. These five themes encompass the main aspects on which an institution must take action to govern its data efficiently and effectively. This list of strategies is not sequential; rather, they interact with each other.

Recommendations should be seen as an overall approach for organisations looking to develop well-rounded data governance approaches that consider the main aspects defined above. Building a framework of pointers to facilitate the effective practice of data governance in the public sector will help with a broad, systematic, and pioneering approach to this subject in the literature, shedding light on the most pressing needs and gaps in public sector management and in data governance in public institutions (Bingham, 2023; Mäntymäki et al., 2022; Shet et al., 2021). Substantively, the proposal articulates the need for appropriate support for the involvement of public sector actors in data governance processes and for technological and enablers resources, taking into account the specificities of public services.

The discussion intertwines these aspects with the particularities of the public sector, supporting the move towards broad, evidence and information-based accommodation, monitoring, and control of public administration, as well as the enhancing of public participation in decision-making and the open data sharing and re-use. Raising legal and ethical concerns and the imperative of increasing protection against data breaches and misuse of information in the public sector is also highlighted, from an organisational culture perspective, addressing awareness and training, social dialogue, and the promotion and sharing of knowledge and good practice.

8. Future Research Directions

In light of rapidly changing technological capabilities, public administration is a new direction for developing data governance; thus, emerging trends of Big Data management and analysis can be foreseen there. Utilisation of vast datasets created by digital activities in government operations and services is a function of Big Data and AI, starting a transformational shift of governance for the next decade. In the aspect of decision-making, applied AI and data

management increase their present possibilities in governmental analysis, policy evaluation, and prediction of administrative performance.

Building up the capacity of public institutions in AI implies that before any implementation is initiated, it should be possible to foresee possible drawbacks in the long run. For example, effective compatibility of digital interconnections was not previously considered for automotive vehicles, and a situation arose in which cars generally became part of the global network, but the security measures against pirated organisations had not been introduced yet. Today hackers are able to remotely manage the driving process of individual vehicles and provoke catastrophic accidents. The variety of consideration about future data governance in the public sector is fundamentally essential for its planned advancement and optimised performances.

Policymakers stimulated by artificial intelligence may essentially outweigh the initial support of human opinion. Large-scale recent national supplies of goods and concessions on a real-time basis very often disclose shortfalls of excel in synchronic actions. Massive delays in the accomplishment of valid resolutions are induced by singularly instructive data advice. It is also urgent to think ahead about the oncoming lapse and assure that the presented technology would not arise through disruptive rivalry positive end to current bodily establishments.

8.1. Emerging Trends in Data Governance

The emergence of artificial intelligence and machine learning is set to significantly expand the capacities of policy and decision-makers. With rapid advancements in technology, organisations are collecting a vast and diversified amount of data on a large scale. While many private organisations are capitalising on these advances to analyse and effectively utilise such data, governments are lagging behind. This topic is critical for policy makers to understand as it explores the latest technological trends in data governance and how they might help to facilitate the policy process (Pencheva et al., 2018). Such knowledge enables policy researchers to better understand the stakes and contribute to ongoing policy deliberations in order to seize the benefits and potential pitfalls of the latest technological trends.

Open data initiatives have gained strong momentum in the past few years and have the potential to positively reshape the interaction between government, civil society and citizens at large. Governments worldwide have embraced open data in their pursuit of promoting citizens' interests, encouraging transparency, fostering business activities and enhancing accountability and governance. This comes after almost a decade of efforts by the open data community to persuade and engage governments to make their data available online in open and machine-readable format. This transformative process led to the rapid growth in the number of open data portals and catalogs run by governments worldwide, mapping their data assets and matching data possessors (the supply side) with developers and end users (the demand side).

Major international organisations, civil society organisations and specialised entities have been established to monitor and coordinate open data related initiatives. However, the rapid increase in the number of open data initiatives and the diversity of the stakeholders involved in them makes it hard to assess the real benefits and public value impacts of the published datasets. On a global scale, each dataset released as open data will have different public value impacts and will have different performance vis a vis the fulfillment of predefined goals. Thus, data quality control and impact assessment are now major challenges that the emerging field of open data governance and management is facing (Holmes, 2016).

9. Conclusion

This research has examined the integration of data governance into public sector decision-making processes. It is concluded that integrated data systems can enhance data quality and

mitigate service gaps, leading to better-informed decision-making and resource allocation. However, as the data sources used were driven by specific data-sharing agreements, siloed data systems remained widespread, highlighting challenges to balancing transparency and data protection. Moreover, there were reported tensions between data governance compliance and making efficient data-driven decisions.

It was clear that well-crafted data governance facilitated efficient data utilisation—providing timely, robust, and pertinent information. Nonetheless, not all data agreements were found to be equally successful. While multi-agency data accesses were largely unproblematic and polished, intra-departmental data-sharing agreements remained cumbersome. Despite consenting to an overarching data-minimum principle, collated data sets were refused on grounds of data sharing clauses.

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