Available Online at www.e-iph.co.uk
Indexed in Clarivate Analytics WoS, and ScienceOPEN

E-B Environment - Behaviour Proceedings Journal

KICSS2024

Kedah International Conference on Social Sciences:
https://kicss2024.wixsite.com/kicss2024

e-IPH e-International Publishing House Ltd., United Kingdom

InforMaTIC2024: Information Management and Technology International Conference
Virtual Conference, UiTM Kedah, Malaysia

Organised by: Universiti Teknologi MARA, Kedah, Malaysia

Evaluating the Characteristics and Suitability of Data Governance Models for Adoption in Malaysia's Mobility Services Sector

Juliana Hamka Kamaroddin[1*], Siti Salwa Salleh[1], Syaripah Ruzaini Syed Aris[2]

[1] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Cawangan Negeri Sembilan Kampus Seremban, Seremban, Malaysia
[2] Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA, Shah Alam, Malaysia

juana217@uitm.edu.my, ssalwa@uitm.edu.my, ruzaini@uitm.edu.my
Tel: +60123605104

Abstract
Malaysia's mobility services sector requires a robust data governance (DG) framework to ensure secure, transparent, and efficient data management. This study evaluates six established DG models including COBIT, DAMA-DMBOK, and the DGI Framework through a thematic literature review, identifying 16 key components grouped into four categories: data, authority, policy and control, and protection. Among these, data architecture, data integration, and data quality are the most critical. The findings provide a foundation for developing a tailored DG framework that supports regulatory compliance, fosters trust, and enhances operational effectiveness across the country's evolving digital mobility ecosystem.

Keywords: data governance; mobility services; framework evaluation; digital transformation

DOI: https://doi.org/10.21834/e-bpj.v10iSI31.6927

1.0 Introduction

Malaysia's mobility services sector which includes e-hailing and app-based transport platforms, is rapidly transforming urban transportation. These services leverage IoT technologies to enable real-time ride bookings, tracking, and payments with minimal human input. E-hailing has significantly impacted Malaysia's transport economy and public mobility (Jais & Marzuki, 2020). To regulate this growth, the Land Public Transport Agency (APAD) introduced policies on pricing, safety, and licensing. However, enforcement remains fragmented, and data oversight is weak. Without a structured data governance (DG) framework, risks to data privacy, transparency, and system reliability persist. Robust DG practices are essential not only for managing data flow and protecting sensitive information, but also for fostering public trust and ensuring regulatory compliance (Lu et al., 2022). Building trust through strong governance practices will be critical for enhancing public confidence, operational efficiency, and digital maturity in Malaysia's evolving mobility ecosystem.

1.1 Research background

According to DAMA International (2014), DG enhances organisational data management by establishing clear authority, control mechanisms, and policies. It ensures the quality, availability, integrity, and security of data through defined rules and structured guidelines for data handling (Ruslan et al., 2022). Foundational practices such as maturity models, standardised procedures, and frameworks like DAMA-DMBOK are essential to building effective DG. In parallel, IT governance and e-government systems help

eISSN: 2398-4287 © 2025. The Authors. Published for AMER by e-International Publishing House, Ltd., UK. This is an open access article under the CC BY-NC-ND license (http://c5eativecommons.org/licenses/by-nc-nd/4.0/). Peer–review under responsibility of AMER (Association of Malaysian Environment-Behaviour Researchers
DOI: https://doi.org/10.21834/e-bpj.v10iSI31.6927

safeguard data and mitigate risks of unauthorised access.

DG spans the entire data lifecycle, from creation and organisation to storage and maintenance. ICT governance plays a complementary role by aligning technological processes with institutional objectives. In mobility services, including e-hailing, DG is vital to ensure data integrity, user privacy, and operational efficiency. However, ambiguity in stakeholder roles can weaken governance structures and reduce data quality. A robust DG framework fosters fairness, promotes transparency, and builds trust among providers, regulators, and users.

1.2 Problem statement and objective

Government institutions often lack comprehensive DG frameworks suited to the specific needs of rapidly evolving digital sectors such as mobility services. Most existing DG models focus on broad principles and may not fully address the real-time, integrated, and user-centric data challenges posed by platforms such as e-hailing, ride-sharing, and multimodal transport systems. This gap highlights the need for a robust and context-sensitive DG framework capable of managing large volumes of sensitive data while ensuring availability, integrity, privacy, and security.

This study aims to evaluate components of established DG models to propose a suitable framework for Malaysia's mobility services sector. The specific objectives are: (i) to identify key DG components; (ii) to map these across existing models; and (iii) to determine the three most critical components for sectoral adoption. The paper is structured into six sections, covering the research background, literature review, methodology, findings, discussion of key components, and a conclusion with recommendations for future research.

2.0 Literature Review

This section reviews the mobility services ecosystem and six DG models. Some of these models, such as COBIT, the IBM DG Framework, DAMA-DMBOK, and the DGI DG Framework, are widely recognised in the industry, while others are based on academic research.

2.1 Mobility services ecosystem

Fig. 1 illustrates the mobility services ecosystem, comprising seven interconnected components essential for service delivery: (i) the digital platform, (ii) drivers or operators, (iii) passengers or users, (iv) vehicles, (v) payment systems, (vi) regulatory frameworks, and (vii) support and customer care. Platforms like e-hailing and ride-sharing apps act as intermediaries, providing the digital infrastructure for booking, route matching, and payments. Drivers use their own vehicles and navigate via integrated systems, while passengers enjoy flexible ride options and real-time tracking. Regulatory measures, including insurance and vehicle eligibility, aim to ensure safety and compliance across services. Cashless payment solutions enhance efficiency, and dedicated support systems address complaints, technical issues, and emergencies. Oversight by government agencies, such as APAD, involves licensing, safety standards, and data protection protocols. As of now, 27 e-hailing operators are registered in Malaysia. However, ambiguity in stakeholder responsibilities remains a barrier to sustained trust, transparency, and effective governance within the mobility sector.

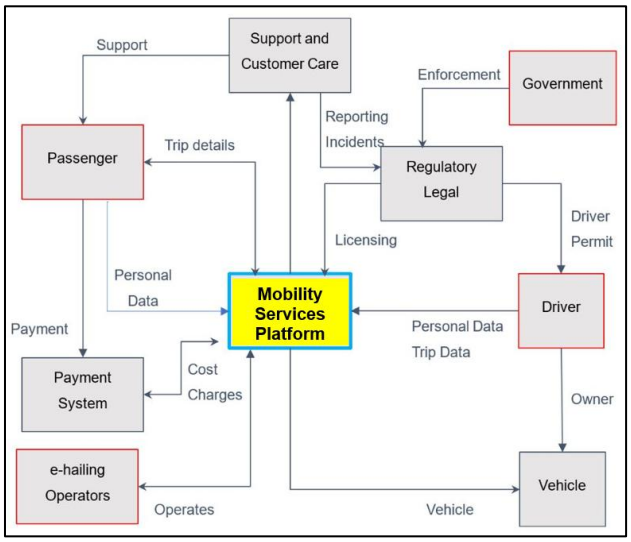

Fig. 1: The mobility services platform

(Source: adapted from Al-Shakhrit et al. (2021), Gehrke et al. (2019), Jais and Marzuki (2020)

2.2 Overview of data governance models

Over the past two decades, a variety of DG models have been developed to manage data securely, transparently, and efficiently. These models differ in complexity, scope, and application, ranging from enterprise-focused frameworks to those designed for digitally dynamic environments like smart cities. This section critically examines six key DG models and evaluates their relevance to the specific context of Malaysia's mobility services sector.

2.2.1 Enterprise-oriented governance models

Enterprise DG models typically emerge from corporate IT governance and are widely used across industries. One prominent example is COBIT, developed by ISACA (2019), which focuses on aligning IT strategies with business objectives (see Fig. 2). Although COBIT was not originally developed as a DG model, COBIT's structured emphasis on control, standardised processes, and risk mitigation renders it adaptable to data-intensive sectors such as mobility services. However, its broad enterprise orientation may require tailoring to address transport-specific operational nuances.

The IBM DG Framework (Ballard et al., 2014) further builds on enterprise principles by differentiating between supporting disciplines (e.g., architecture, classification), key governance disciplines (e.g., data quality, lifecycle), and operational enablers (e.g., policy, stewardship) (see Fig. 3). It adopts an outcome-driven approach aimed at balancing value creation with risk control. Nevertheless, the framework's complexity may present adoption challenges for smaller agencies or local operators within Malaysia's mobility ecosystem.

Another influential model is the DAMA-DMBOK2 framework (DAMA International, 2014) (see Fig. 4), a widely recognised reference in data management literature (Ruslan et al., 2022). It comprises ten domains, including metadata, architecture, data quality, and security, offering a comprehensive and structured approach to DG. While robust in design and maturity modelling, its implementation may be resource-intensive for public agencies or SMEs. Despite this, its breadth and flexibility provide a valuable foundation for governance adaptation in the mobility sector.

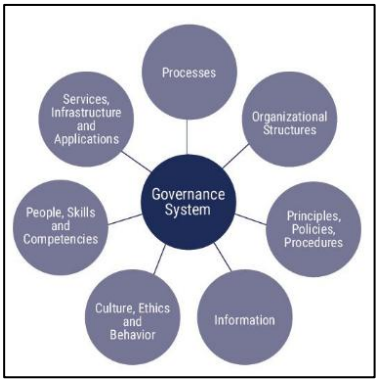

Fig. 2: The COBIT Framework
(Source: ISACA (2019))

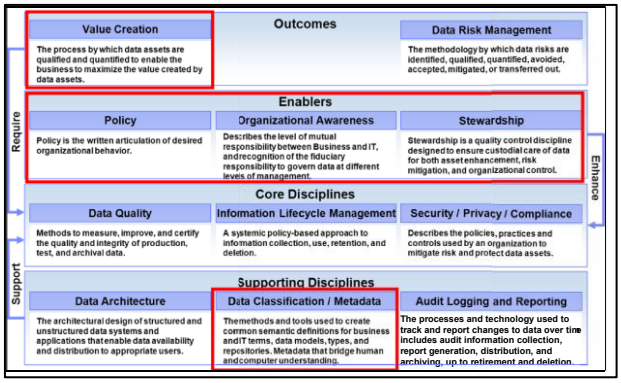

Fig. 3: The IBM DG Framework
(Source: Ballard et al. (2014))

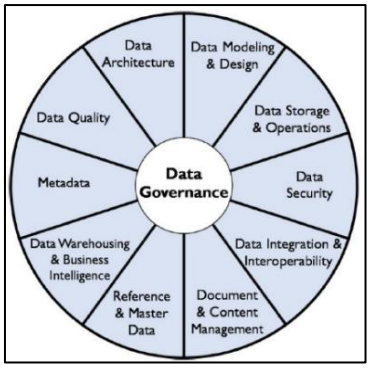

Fig. 4: The DAMA-DMBOK Framework
(Source: DAMA International (2014))

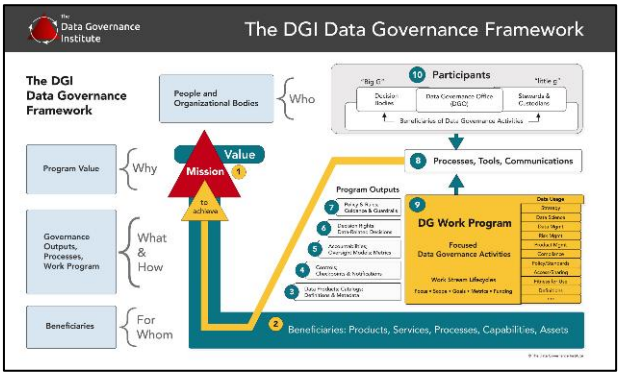

Fig. 5: The DGI DG Framework
(Source: https://datagovernance.com/the-dgi-data-governance-framework/

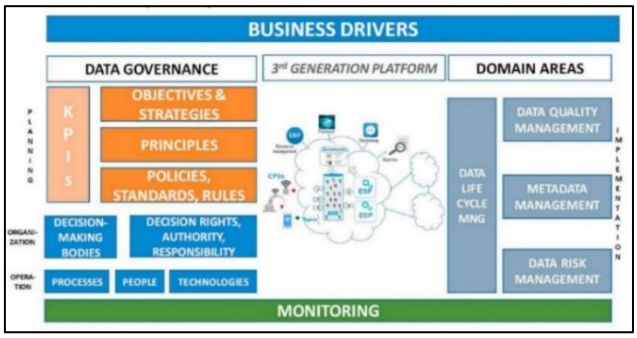

Fig. 6 DG Framework for Industry 4.0
(Source: Yebenes and Zorrilla (2019))

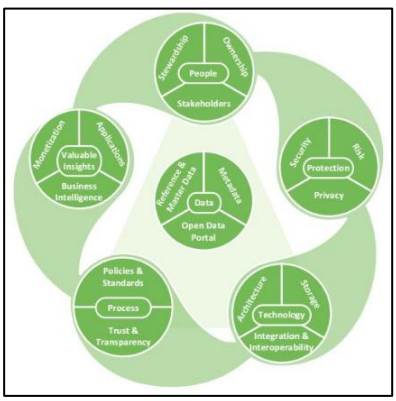

Fig. 7 DG Framework for Smart Cities
(Source: Osu and Navarra (2022))

2.2.2 Digital and urban governance models

In contrast to enterprise-oriented approaches, newer frameworks have emerged to address governance challenges in interconnected and fast-evolving digital environments. The DGI DG Framework (Ekundayo et al., 2023) (see Fig. 5) presents a high-level structure organised around four core dimensions: purpose (why), stakeholders (who), activities (what), and processes (how). Its adaptable and stakeholder-driven design is well-suited for collaborative governance settings involving regulators, private platforms, and service users. However, it offers limited operational guidance on real-time data integration, an essential requirement for mobility services.

The Industry 4.0 DG Framework (Yebenes & Zorrilla, 2019) (see Fig. 6) responds to the needs of IoT-based and cyber-physical environments. It includes structured domains such as planning, organisation, operation, and tracking, making it technically relevant to mobility platforms like ride-hailing. Still, its industrial emphasis may overlook crucial governance aspects such as user trust, public accountability, and regulatory alignment, which are core elements in the Malaysian mobility context.

The Smart Cities DG Framework (Osu & Navarra, 2022) (see Fig. 7) is explicitly designed for urban data ecosystems. It was developed through expert consultation and synthesis of existing models, including DAMA-DMBOK and DGI. It incorporates five integrated components: people, processes, technology, protection, and insights. Its balanced attention to ethical, technical, and operational dimensions makes it particularly relevant to smart mobility ambitions in Malaysia, especially where urban governance, real-time responsiveness, and cross-sector coordination intersect.

Each framework offers unique strengths and limitations. Enterprise-oriented frameworks like COBIT and DAMA-DMBOK offer established structures and procedural rigor, making them valuable for control and compliance-focused environments. Digital-focused models like Smart Cities and Industry 4.0 better suit dynamic, real-time environments but often require more contextual adaptation for local regulatory and public service needs. Understanding the comparative relevance of these models lays the groundwork for tailoring a DG framework suited to Malaysia's evolving mobility services landscape.

2.3 Implications for Malaysia's mobility services sector

The six reviewed DG models each offer distinct strengths and limitations in relation to the complex needs of Malaysia's mobility services sector. Enterprise-oriented frameworks such as COBIT and DAMA-DMBOK provide structured methodologies and institutional maturity, which are advantageous for managing data quality and regulatory compliance. However, their rigid frameworks may require contextual adjustments to accommodate the decentralised and real-time nature of mobility services in Malaysia. IBM and DGI frameworks strike a balance between strategic alignment and practical implementation. Their layered or stakeholder-driven approaches are useful for coordinating roles and responsibilities across diverse actors in the ecosystem. However, their adaptability to real-time, data-intensive environments may be constrained without further contextualisation. For instance, adapting DAMA-DMBOK to Malaysia's mobility context may require simplifying its implementation for smaller municipal agencies or integrating local transport data privacy standards.

Industry 4.0 and Smart Cities frameworks are best suited to dynamic, IoT-based mobility environments. They emphasise integration, automation, and data responsiveness, making them relevant for platforms like e-hailing. Yet, their general industrial focus may overlook essential governance concerns such as public accountability and regulatory oversight. A hybrid framework that integrates data quality, architecture, and integration while clearly defining authority roles and reinforcing policy enforcement is therefore essential for governing Malaysia's evolving mobility services ecosystem. These insights directly inform the methodological selection of DG models for comparative analysis, as discussed in the following section.

2.4 Relation of current research to previous studies in mobility services sectors

Recent literature increasingly recognises the importance of context-specific DG frameworks in strengthening the operational resilience of mobility services. Such frameworks are essential for enabling effective planning, monitoring, compliance, and adaptive decision-making in response to the growing demands for efficiency and sustainability in urban transport ecosystems.

Studies by Cordero et al. (2023) and Anjos (2023) emphasise the need for flexible, locally tailored data governance (DG) approaches to manage growing data complexity and enable risk-informed decision-making. These principles are especially relevant to decentralised, data-intensive mobility platforms. Similarly, Zhang et al. (2024) highlights the importance of inter-agency collaboration, proposing DG-enabled transport data platforms to enhance coordination across sectors. In the Malaysian context, Rahman et al. (2018) underscore the need for integrated governance structures to address institutional fragmentation in urban mobility management.

However, these contributions seldom consider DG as a foundational element. Although various DG frameworks exist, many are technically focused and lack the breadth to address the strategic and operational needs of the mobility services sector. This study addresses these gaps by proposing a tailored DG framework for Malaysia's mobility services sector, aiming to enhance interoperability, regulatory alignment, and trust in digital transport ecosystems.

3.0 Research Methodology

This study adopts a structured four-phase methodology to identify and synthesise components of DG frameworks relevant to the mobility services sector (see Fig. 8). Phase 1 involved a comprehensive literature search across the Scopus and Web of Science databases, which yielded 486 articles. After applying inclusion criteria focused on relevance to DG frameworks and mobility services, 50 articles were selected for in-depth analysis.

Phase 2 entailed a thematic analysis of the 50 selected articles, leading to the development of a structured literature review matrix. This matrix captured essential details such as framework names, reference models, applicability to mobility services, publication specifics, research methodologies, and key findings. Through this systematic approach, 18 distinct DG models were identified.

Subsequently, six prominent models were selected for detailed comparative analysis: COBIT, DAMA-DMBOK, DG Institute (DGI) Framework, IBM DG Framework, Industry 4.0 DG Model, and Smart Cities DG Framework.

Phase 3 involved a comparative analysis of the six selected DG models. This phase is grounded in Yin's (2014) cross-case analysis approach, which supports the comparison of multiple cases which in this context are DG models, to identify recurring themes, patterns, and contrasts. Treating each DG model as an individual case enabled structured comparison and deeper analytical insights. A comparison matrix was developed, with rows representing DG models and columns denoting 16 key DG components, including data architecture, metadata management, ownership, quality, safety, and security. This matrix facilitated the evaluation of each model against established criteria to assess their suitability and adaptability to the mobility services context.

Phase 4 synthesised the comparative findings into four overarching categories: data, authority, policy and control, and protection. This synthesis informed the development of a tailored DG framework designed to address the specific needs and challenges of the mobility services sector.

This structured four-phase methodology provides a clear and systematic approach for evaluating DG frameworks within the context of Malaysia's mobility services ecosystem. By combining quantitative breadth from a comprehensive literature search with qualitative depth through thematic and comparative analysis, the study ensures both analytical rigour and contextual relevance.

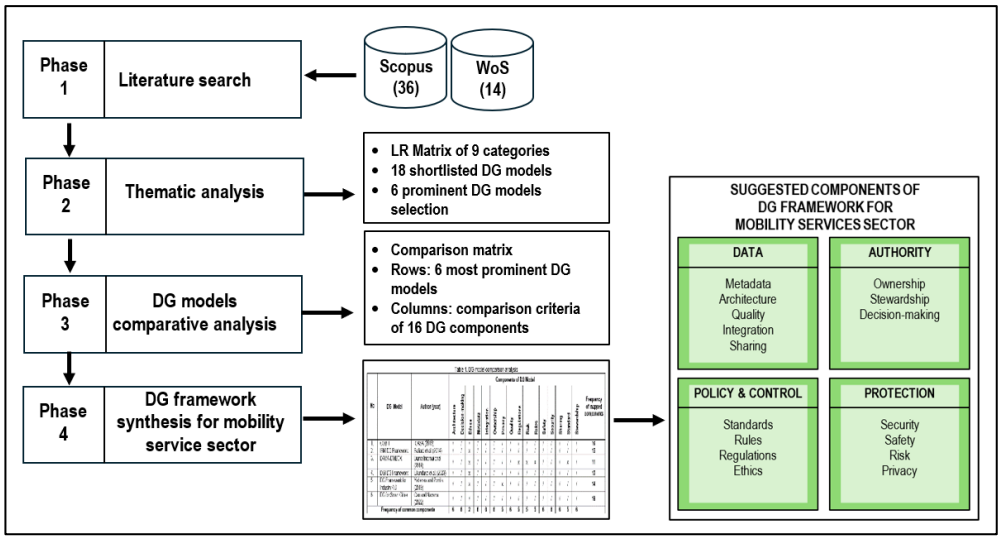

Fig. 8 Research Methodology

4.0 Findings

This section presents a comparative analysis of six DG models, summarised in Tables 1–3. The thematic review and literature analysis identified 16 key components relevant to DG in the mobility services sector: architecture, decision-making, ethics, metadata, integration, ownership, privacy, quality, regulations, risk, rules, safety, sharing, security, standards, and stewardship. Table 1 compares these components across the six models, with the rightmost column indicating the frequency of each component and the bottom row showing the total occurrences. Table 2 further elaborates on these findings.

Table 1. The DG model comparison matrix

No	DG Model	Author (year)	Components of DG Model																Frequency of mapped components
			Architecture	Decision-making	Ethics	Metadata	Integration	Ownership	Privacy	Quality	Regulations	Risk	Rules	Safety	Security	Sharing	Standard	Stewardship	
1.	COBIT	ICASA (2019)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	**16**
2.	IBM DG Framework	Ballard et al. (2014)	/	/	x	/	/	/	/	/	/	/	/	/	/	/	/	/	**15**
3.	DAMA-DMBOK	Dama International (2014)	/	/	x	/	/	/	/	/	x	x	x	/	/	/	x	/	**11**
4.	DGI DG Framework	Ekundayo et al. (2023)	/	/	x	/	/	/	/	/	/	/	/	/	/	/	/	/	**15**
5.	DG Framework for Industry 4.0	Yebenes and Zorrilla (2019)	/	/	x	/	/	/	x	/	/	/	/	/	/	/	/	/	**14**
6.	DG for Smart Cities	Osu and Navarra (2022)	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	**16**
Frequency of common components			**6**	**6**	**2**	**6**	**6**	**6**	**5**	**6**	**5**	**5**	**5**	**6**	**6**	**6**	**5**	**6**	

Table 2 ranks the DG models based on their coverage of the 16 components, illustrating their hierarchical relevance. COBIT and the DG Framework for Smart Cities are the most comprehensive, encompassing all components. The IBM and DGI frameworks follow closely, each covering 15 components, while the Industry 4.0 framework addresses 14. DAMA-DMBOK, although methodologically robust, addresses only 11 components. Despite COBIT and Smart Cities models being the most extensive, all six frameworks provide valuable insights for developing a robust DG framework for the mobility services sector. Fig. 9 visualises these rankings in a column chart, displaying component coverage from highest to lowest.

Table 2. The DG model based on the frequency of mapped components by hierarchical relevance

	DG Model	Author (year)	Frequency of mapped components
1.	COBIT	ICASA (2019)	**16**
2.	DG for Smart Cities	Osu and Navarra (2022)	**16**
3.	IBM DG Framework	Ballard et al. (2014)	**15**
4.	DGI DG Framework	Ekundayo et al. (2023)	**15**
5.	DG Framework for Industry 4.0	Yebenes and Zorrilla (2019)	**14**
6.	DAMA-DMBOK	Dama International (2014)	**11**

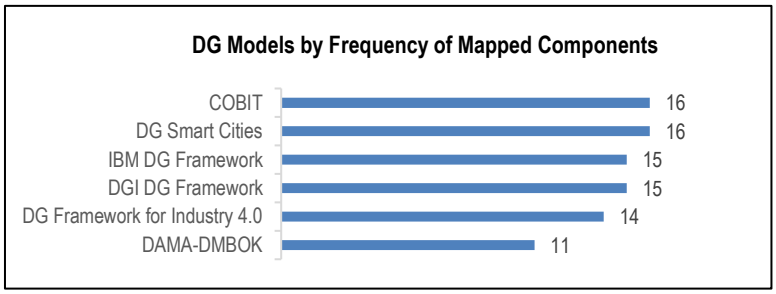

Fig. 9 The frequency of mapped components across DG models

Table 3 highlights the frequency of common components across the models. All six consistently include components such as architecture, decision-making, integration, metadata, ownership, quality, safety, security, sharing, and stewardship. Five models include standards, rules, regulations, risk, and privacy. However, ethics though is critical for protecting user data, appears in only two models.

Table 3. Frequency of common components across DG models ranked by significance

	DG Model	Frequency of common components
1.	Architecture	**6**
2.	Decision-making	**6**
3.	Integration	**6**
4.	Metadata	**6**
5.	Ownership	**6**
6.	Quality	**6**
7.	Safety	**6**
8.	Security	**6**
9.	Sharing	**6**
10.	Stewardship	**6**
11.	Privacy	**5**
12.	Regulations	**5**
13.	Risk	**5**
14.	Rules	**5**
15.	Standards	**5**
16.	Ethics	**2**

Fig. 10 synthesises the results from Tables 2 and 3. It aligns the frequency of component coverage (from Table 2, shown in the red-dashed box) with the consistency of representation across models (from Table 3, shown in the green-dashed box). These 16 components are grouped into four overarching categories: data, authority, policy and control, and protection, which form the foundational structure for a tailored DG framework for the mobility services sector. Of these three components, data architecture, data integration, and data quality, emerge as the most critical. These are designated as anchor elements (highlighted in blue-dashed boxes), and their strategic importance is explored further in the next section.

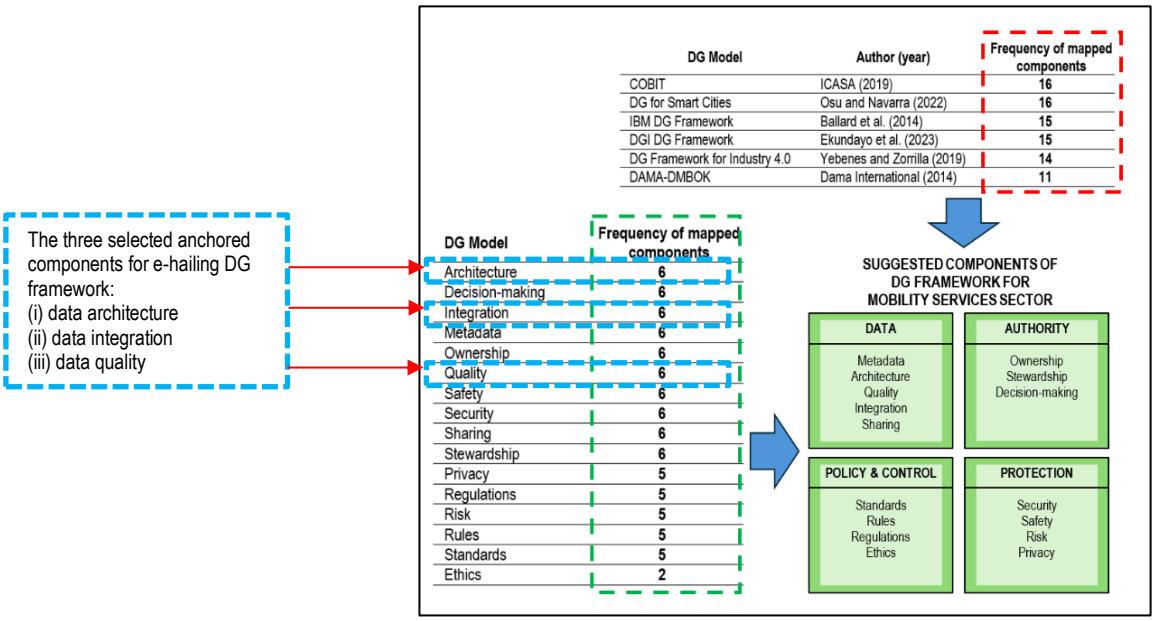

Fig. 10: Initial insights of DG framework for mobility services sector

5.0 Discussion

5.1 The key components of a dg framework for the mobility services sector

This study highlights four key categories for effective DG: data, authority, policy and control, and protection. These categories reflect a synthesis of empirical insights and align conceptually with Khatri and Brown's (2010) DG design model, which emphasises decision rights, data standards, and accountability structures.

The data category includes metadata, data architecture, quality, integration, and sharing. High-quality data supports accurate, real-time information flow across platforms, which is essential for service reliability. Robust DG capabilities are crucial for managing big data, aligning with socio-technical systems theory, which underscores the coordination of technological infrastructure and human processes in data environments (Janssen et al., 2020).

The authority category focuses on data ownership, stewardship, and decision-making. This reflects principles from stewardship theory, which advocates ethical, transparent data management through clearly defined roles. Assigning data ownership promotes accountability among stakeholders such as public regulators, private operators, and users, while distributed decision-making enhances cooperation (Habibie et al., 2023).

Policy and control encompasses data standards, rules, regulations, and ethical principles. These governance layers resonate with institutional theory, which frames data policies as mechanisms to ensure legitimacy and alignment with societal norms. Effective frameworks promote transparency and compliance with data protection legislation (Mao et al., 2021), ensuring organisational practices reflect public expectations.

Protection includes security, safety, risk management, and user privacy. Strong encryption and access control mechanisms build technical resilience, while privacy safeguards foster trust. The role of DG in securing digital ecosystems is reinforced by trust theory in e-government, which links clear governance protocols with public confidence (Yuan et al., 2024).

5.2 Justification for three critical components: data architecture, data integration, and data quality

In the context of digital transformation in the mobility services sector, this study identifies data architecture, data quality, and data integration as foundational to effective DG. These elements correspond with the information lifecycle management principle, which advocates for coherent data structures to ensure quality, interoperability, and value delivery across services.

A well-defined data architecture provides the structural basis for centralised and consistent data management, allowing systems such as ride-hailing, public transit, and micromobility to interoperate effectively. This supports enterprise architecture theory, which promotes alignment between IT systems and operational objectives (Jian et al., 2023).

Data integration enables communication across fragmented systems and platforms. This is particularly vital in mobility ecosystems, where service continuity and user experience depend on real-time interoperability (Gómez et al., 2024).

Data quality defined by accuracy, completeness, and reliability; underpins trust and operational performance. High-quality data supports predictive analytics and real-time decision-making, reinforcing the DG principle of "fitness for use" (So et al., 2020). These three components collectively reflect a systems thinking approach, where data reliability, system cohesion, and governance controls are interdependent.

5.3 Implications for mobility services governance in Malaysia

The proposed DG framework offers several implications for stakeholders in Malaysia's mobility services sector. Regulatory bodies such as APAD can utilise this framework to establish clearer governance standards and enforcement mechanisms, aligned with regulatory governance theory, which emphasises the institutional role in managing complex systems, especially in transport (Silva & Guimarães, 2023).

Service providers can leverage the framework to benchmark and enhance internal data practices, thereby improving interoperability, regulatory compliance, and public trust. These efforts align with adaptive governance, which is crucial in sectors experiencing rapid technological change. Adaptive governance is characterised by flexibility and responsiveness, enabling systems to adjust as new information and conditions emerge (Greenhill et al., 2020).

For end-users including passengers and drivers, the framework promises better data protection, service reliability, and transparency. The component-based design ensures scalability, making it adaptable across other sectors or regions undergoing digital transformation. This adaptability reflects design science principles, which advocate for context-aware, problem-driven frameworks that support practical implementation and iterative refinement. While a specific citation is not currently available, this assertion is conceptually grounded (Wang, 2023). In summary, the integrated approach proposed through this DG framework not only enhances the operational efficiency of mobility services but also strengthens user trust and organisational accountability in Malaysia.

6.0 Conclusion and Recommendations

This study identified 16 essential components of DG through a thematic review and comparative analysis of six established DG models. These components were organised into four overarching categories: data, authority, policy and control, and protection.

Among the models reviewed, the COBIT and Smart Cities frameworks emerged as the most comprehensive, each addressing all 16 components. The IBM and DGI frameworks also demonstrated strong relevance to the mobility services context. Of the 16 components, three components i.e., data architecture, data quality, and data integration, were found to be particularly critical for Malaysia's mobility services sector. These elements enable real-time operations, ensure data accuracy and reliability, and facilitate system-wide interoperability, which are key requirements for coordinating services across public transit, ride-hailing, and micromobility platforms.

While these three components form the core of an effective DG framework, the remaining elements such as data stewardship, regulatory compliance, ethics, and risk management, are equally essential in fostering a secure, transparent, and resilient data environment. A holistic approach that integrates all 16 components is necessary to build trust, uphold legal standards, and drive innovation across the mobility services sector.

Despite its structured approach, this study is not without limitations. Firstly, the analysis is based exclusively on literature, and empirical validation was beyond its scope. Secondly, as the proposed framework is specifically tailored to Malaysia's mobility context, its generalisability to other regions or sectors may require further adaptation. Lastly, given the evolving nature of DG, the framework may require periodic updates to align with emerging technologies and regulatory standards. Future research should focus on empirically validating this framework through stakeholder engagement and implementation testing. Additionally, its scalability and adaptability should be explored in other digitally transforming sectors within Malaysia.

Acknowledgements

This work was supported and funded by the Institute of Postgraduate Studies (IPSis), Universiti Teknologi MARA, Malaysia

Paper Contribution to Related Field of Study

This study offers a targeted assessment of DG models for Malaysia's mobility services sector, identifying core components such as data architecture, quality, and integration. The proposed framework supports safer, more reliable, and efficient operations across diverse mobility platforms. It contributes to the broader DG discourse by emphasizing the role of governance in digital infrastructure, regulatory compliance, and trust in providing a foundation for future research in sustainable and adaptive governance models.

References

Al-Shakhrit, A., Masri, K. A., & Othman, C. (2021). The Social and Economic Impacts of E-hailing Application in Malaysia: A Review. Construction, 1(2), 40–44.

Anjos, P. C. d. (2023). Data governance: proposal for a conceptual framework for brazilian public administration. Law &Amp;amp; Digital Technologies, 3(2), 26.

Ballard, C., Baldwin, J., Baryudin, A., Brunell, G., Giardina, C., Haber, M., O'neill, E. A., & Shah, S. (2014). IBM Information Governance Solutions. Redbooks, 1–241.

Cordero, F. C., LaMondia, J. J., & Bowers, B. F. (2023). Performance measure–based framework for evaluating transportation infrastructure resilience. Transportation Research Record: Journal of the Transportation Research Board, 2678(5), 601-616.

DAMA International. (2014). DAMA-DMBOK2 framework. The Data Management Association, 1–27.

Ekundayo, T., Bhaumik, A., & Chinoperekweyi, J. (2023). Identifying the core data governance framework principle: A framework comparative analysis. *Organization Leadership and Development Quarterly*, 5(1), 30–53.

Gehrke, S. R., Felix, A., & Reardon, T. G. (2019). Substitution of ride-hailing services for more sustainable travel options in the greater Boston region. *Transportation* Research Record, 2673(1), 438–446.

Gómez, M., Ruiz, L., Torres, P., & Silva, F. (2024). Enhancing Data Integration for Interoperable Smart Mobility Systems. Journal of Urban Digital Innovation, 12(1), 55–73.

Greenhill, A., Fletcher, G., & Macdonald, S. (2020). Adaptive Governance in Digital Public Service Ecosystems. Government Information Quarterly, 37(1), 101414.

Habibie, K., Suhardi, S., & Muhamad, W. (2023). Implementation of Data Governance on the Open Government Data Management Platform to Improve Data Quality. IJAIT (International Journal of Applied Information Technology), 92-102.

ISACA. (2019). COBIT 2019 Framework - Introduction and Methodology.

Jais, A. S., & Marzuki, A. (2020). E-Hailing services in Malaysia: Current practices. Journal of the Malaysian Institute of Planners, 18(3), 128–141.

Janssen, M., Brous, P., Estévez, E., Barbosa, L. S., & Janowski, T. (2020). Data governance: organizing data for trustworthy artificial intelligence. Government Information Quarterly, 37(3), 101493.

Jian, Y., Zhang, H., Wang, R., & Lin, X. (2023). Integrating electric mobility-as-a-service (eMaaS) into smart city infrastructure: An architectural perspective. Journal of Smart Mobility Systems, 7(2), 101–117.

Khatri, V., & Brown, C. V. (2010). Designing data governance. Communications of the ACM, 53(1), 148-152.

Lu, Y., Qi, Y., Qi, S., Li, Y., Song, H., & Liu, Y. (2022). Say no to price discrimination: Decentralized and automated incentives for price auditing in ride-hailing services. IEEE Transactions on Mobile Computing, 21(2), 663–680.

Mao, Z., Wu, J., Qiao, Y., & Yao, H. (2021). Government data governance framework based on a data middle platform. Aslib Journal of Information Management, 74(2), 289-310.

Osu, T., & Navarra, D. (2022). Development of a data governance framework for smart cities. *International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences - ISPRS Archives*, 48(4/W5-2022), 129–136.

Rahman, N. A. A., Abdullah, Y. A., Nasrudin, N., & Yusoff, Z. M. (2018). Assessing urban public transportation institutional framework in klang valley. Planning Malaysia Journal, 16(7).

Ruslan, I. F., Alby, M. F., & Lubis, M. (2022). Applying data governance using DAMA-DMBOK 2 framework: The case for human capital management operations. ACM International Con*ference Proceeding Series*, 336–342.

Silva, R., & Guimarães, T. (2023). Regulatory Governance in Urban Transportation: Institutional Responses to Digital Disruption. Journal of Transport Policy and Regulation, 45(2), 98–112.

So, H., Tan, M., Lim, W., & Chua, Y. (2020). Enhancing Data Quality for Smart Mobility Systems: A Framework for Predictive Analytics. Journal of Urban Data Science, 8(1), 45–60.

Wang, L. (2023). Design Science Approaches for Data Governance Frameworks in Digital Ecosystems. Journal of Information Systems Design and Theory, 16(4), 67–82.

Yebenes, J., & Zorrilla, M. (2019). Towards a data governance framework for third generation platforms. In E. Shakshuki (Ed.), *Procedia computer science* (pp. 614–621, Vol. 151). Elsevier B.V.

Yin, R. K. (2014). Case Study Research: Design and Methods (5th ed.). Thousand Oaks, CA: SAGE Publications.

Yuan, J., Liu, T., Zhang, K., & Wang, Y. (2024). Blockchain-based data security frameworks for e-government services: Enhancing trust and transparency. Journal of Digital Governance, 10(1), 22–39.9.

Zhang, S., Gu, M., Wu, X., Liu, H., & Huang, X. (2024). Design and application of transport planning analysis and data service platform based on flexible architecture technology. Seventh International Conference on Traffic Engineering and Transportation System (ICTETS 2023), 92.