Asset Risk Management and Immovable Asset Management of Malaysian Government: Towards Digitalization

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ABSTRACT

Asset risk management is the process of identifying, assessing, and mitigating risk associated with an organization's asset. This research examines the intersection of asset risk management and Immovable Government Asset Management, highlighting the transformative potential of digitalization. A survey of 303 asset managers and practitioners evaluates existing practices, including Project Risk Plans, Facility Risk Plans, and Asset Immovable Risk Plans, within the context of physical asset life cycle management. The findings underscore the need for digital integration to address challenges and enhance government performance. By elucidating the direct and indirect effects of risk management practices on organizational outcomes, this study lays the groundwork for developing forward-looking digitalization strategies, enabling more resilient and effective public asset management. Hypotheses of this study is the integration of digital systems into government asset management significantly improves operational efficiency and stakeholder satisfaction. Furthermore, this study contributes to a better understanding of how the government could achieve higher performance results by implementing digitalization risk management practices. The results of this study can help the manager identify key asset risk management practices. By analyzing the 303 respondents between asset risk management practices and their direct and indirect effects (20 generic risks) on government performance, the study provides important insights into the development of digitalization strategies to promote the novel and important discipline of asset management. This proactive approach helps optimize asset utilization, extend lifespan, minimize financial risk and operational disruptions, ultimately maximizing asset value and reducing overall risks.

Keywords: Asset Risk Management; Government; Immovable Asset; Asset Life Cycle, Risk Plan, Digital Transformation.

INTRODUCTION

The digital transformation of asset management is reshaping public sector operations globally, with governments leveraging technology to improve efficiency, transparency, and decision-making. However, many countries face persistent challenges in ensuring data governance and data quality, particularly in the management of immovable assets. The digital transformation of public sector operations hinges on robust data governance and high-quality data. However, challenges such as fragmented data systems, limited adoption of asset management tools, and inconsistent data practices hinder progress. This paper explores the intersection of asset risk management and Immovable Government Asset Management, in advancing digital transformation within Public Work Department (PWD) of Malaysia. The management of immovable assets in the public sector is fundamental to ensuring the sustainability, efficiency, and effectiveness of government operations. Immovable assets, such as buildings, infrastructure, and land, require comprehensive management strategies to maximize their utility and lifespan. For instance, Mohd Nasir et. al. (2022) emphasizes the importance of effective and efficient practices to ensure assets are utilized for their intended

purposes. Effective asset management involves proper planning, maintenance, monitoring, and evaluation to ensure that resources are utilized optimally. In many countries, particularly in developing economies, the management of immovable assets has been plagued by numerous challenges, including inadequate data governance, fragmented administrative practices, and a lack of technological integration. These inefficiencies result in suboptimal asset performance, increased maintenance costs, and ineffective decision-making. Further, data governance involves establishing policies, standards, and procedures to ensure data integrity, security, and accessibility. This paper aims to explore the significance of asset risk management in the context of immovable asset management within the Public Works Department of Malaysia. By examining current asset management challenges, evaluating existing digital transformation efforts, and analyzing empirical data from asset managers, this study provides insights into effective strategies for improving data governance. The findings contribute to the growing body of knowledge on public sector asset management and offer practical recommendations for policymakers, practitioners, and researchers interested in leveraging digital transformation to enhance data-driven decision-making and operational efficiency. The adoption of a lifecycle-based risk management approach is underpinned by the need to identify, assess, and mitigate risks systematically across all phases of an asset's lifecycle from planning, design, construction, and operation, through to maintenance and eventual disposal. This approach is particularly critical in Malaysia, where public sector immovable assets are expected to deliver long-term value under constrained maintenance budgets. Historical cases of structural failures, cost overruns, and asset underperformance often stem from unmanaged risks during early lifecycle stages, such as inadequate design validation, procurement issues, or poor-quality construction. A lifecycle-focused framework enables proactive risk mitigation, cost forecasting, and performance optimization from inception to decommissioning. Furthermore, this approach aligns well with Malaysia's ongoing digital transformation agenda, including initiatives such as Digital Twin, Building Information Modelling (BIM), and Facility and Asset Management Systems (FAMS). These technologies require reliable, lifecycle-based data to support predictive analytics, sustainability goals, and performance-based asset management. By embedding risk management across the asset lifecycle, organizations can enhance asset resilience, optimize total cost of ownership, and support evidence-based decision-making.

DIGITAL TRANSFORMATION IN IMMOVABLE ASSET MANAGEMENT

When managing immovable assets, maintaining high-quality data is not just a procedural need, but a crucial strategic priority. The asset management industry is constantly changing due to the impact of digital revolution. This trend signifies the introduction of technical solutions that tackle long-standing difficulties related to the accuracy of data. The latest advancements include a variety of technologies and approaches that are ready to greatly improve the management, monitoring, and maintenance of public assets (Walter et al., 2007). Shifting our attention to digital transformation necessitates examining its significant influence on asset management frameworks. Digital transformation goes beyond just adopting new technology; it signifies a monumental change in how the researchers connect with, analyse, and strategically utilize physical resources to benefit society. The use of smart sensors and Internet of Things (IoT) technologies enables the immediate collection and distribution of data. By integrating artificial intelligence (AI) with predictive analytics, these innovations have the potential to profoundly transform the field of immovable asset management (Pramanik et al., 2018). The preceding discussion has proven the utmost significance of data quality in asset management. High-quality data forms the foundation of strong asset management strategies, enabling organizations to make well-informed decisions, improve maintenance processes, and meet legal requirements. However, conventional techniques for ensuring data quality, despite their systematic approach, sometimes struggle with the large amount and dynamic nature of data, as well as the intricate and linked characteristics of static assets (Chen et. al. 2014).

In terms of opportunities for Digital Transformation, implementing robust data governance can lead to significant cost savings and efficiency gains. Improved data quality reduces errors in asset procurement, enhances energy management, and minimizes downtime. By making better use of data, organizations can streamline their operations, leading to financial savings and operational improvements. Another opportunity

is proactive maintenance, where predictive maintenance, enabled by accurate and real-time data, helps prevent unplanned asset failures. By leveraging advanced analytics, organizations can extend the lifespan of their assets, reduce maintenance costs, and improve overall reliability. Better decision-making is another significant benefit of improved data governance. Access to integrated and reliable data allows decision-makers to make informed choices in planning, budgeting, operations, and asset disposal, which ultimately optimizes asset utilization. Furthermore, accurate data supports sustainability goals, allowing organizations to make better decisions regarding energy consumption, resource usage, and environmental impact. This contributes to Corporate Social Responsibility (CSR) initiatives and helps meet sustainability targets.

ASSET RISK MANAGEMENT

Asset risk management within the Malaysian government, particularly concerning immovable assets, is essential to safeguard public investments and ensure long-term sustainability of national infrastructure. Immovable assets such as land, buildings, and public facilities are inherently exposed to various risks, including physical deterioration, legal disputes, valuation fluctuations, underutilization, and obsolescence. Effective risk management in this domain enables the government to optimize asset performance, improve service delivery, and ensure accountability in public resource use. A more holistic approach to asset risk management necessitates addressing vulnerabilities across the entire asset lifecycle encompassing planning, acquisition, utilization, maintenance, and eventual disposal as in Figure 1.

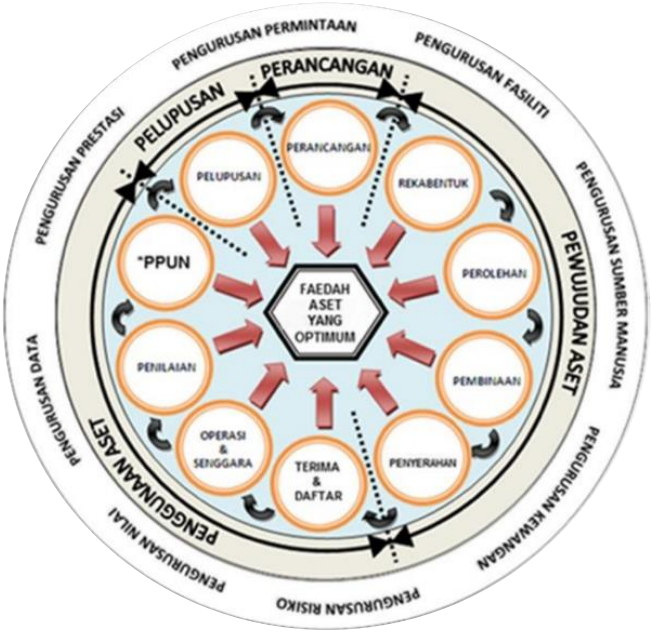

Figure 1: Asset whole life cycle

Each stage presents its own set of potential risks that, if not systematically managed, can compound over time and result in substantial fiscal, operational, and reputational damage to the government. In the planning and acquisition phase, risks often arise from poor demand forecasting, incomplete feasibility analysis, or misalignment with national priorities, which can lead to overinvestment or misallocation of resources. The procurement process may be susceptible to inefficiencies, cost overruns, or lack of transparency, especially when procurement policies are not tightly aligned with risk controls.

Once the asset enters the operational phase, risk factors shift toward performance degradation, misuse, or poor maintenance practices, often exacerbated by the absence of condition monitoring systems or budgetary constraints. The maintenance phase is critical yet frequently underprioritized, with deferred maintenance leading to safety hazards, increased operational downtime, and accelerated asset depreciation. Failure to embed predictive maintenance strategies or real-time condition assessments can result in unexpected failures and costly emergency interventions.

Finally, in the disposal and decommissioning phase, government agencies face challenges related to regulatory compliance, environmental sustainability, and asset write-off accuracy. Without clear guidelines and accountability frameworks, obsolete or redundant assets may continue incurring hidden costs or become liabilities, such as safety risks or environmental violations.

By integrating lifecycle-based risk management, agencies can move from reactive to proactive governance embedding risk assessment, monitoring, and mitigation mechanisms at each phase of the asset's existence. This lifecycle perspective facilitates early detection of risk signals, enables better budgeting and resource allocation, and supports strategic decision-making. Moreover, it lays the groundwork for the adoption of digital tools that offer predictive analytics and continuous monitoring, such as IoT sensors, asset health dashboards, and centralized data repositories. These tools empower agencies to track asset performance longitudinally, forecast risks, and implement timely interventions—ultimately enhancing transparency, accountability, and value for public money.

It is crucial to outline a risk-based approach to asset registration, classification, and auditing thus the need for guidelines as in Figure 2, including Guideline for the Risk Management Plan of Immovable Assets, Risk Management Guideline for JKR Projects and Facility Risk Management Guideline within the context of physical asset life cycle management. The application of risk management techniques to portfolio management crucially depends upon modern portfolio theory, beginning with the seminal contributions of Markowitz (1952), Treynor (1961, 1999), Sharpe (1964), and Lintner (1965). However, challenges remain, such as inconsistent documentation, lack of real-time tracking, and inadequate integration across government departments. These inefficiencies lead to asset mismanagement, duplication of records, and increased costs related to maintenance and litigation.

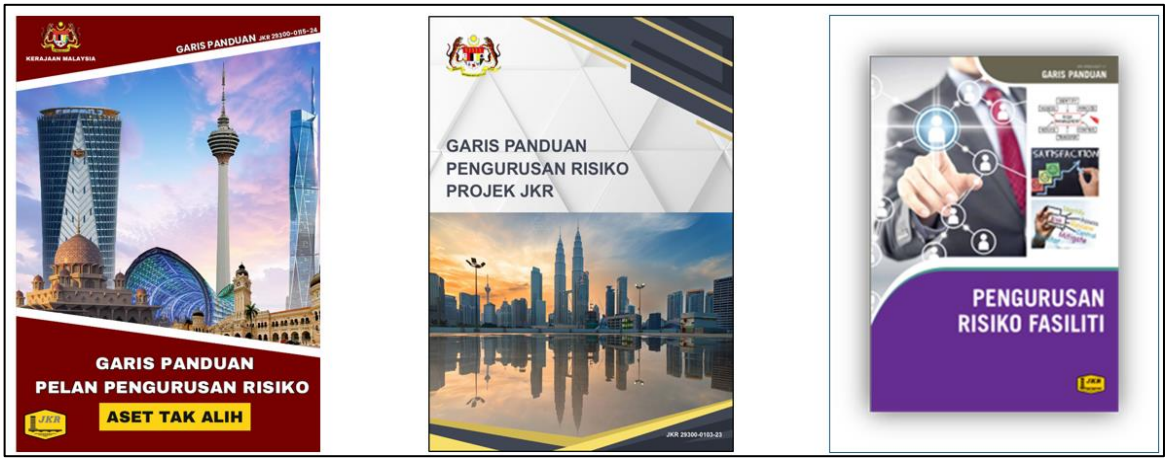

Figure 2: Guidelines for asset risk management

The goal of risk management in portfolio management is not to eliminate risk, but to choose which risks bearing and to avoid unnecessary risks. What risks are appropriate for a particular portfolio will depend on the risk preferences of the investor and the role that portfolio plays in the investor's overall portfolio strategy. This study will make the distinction between the investor's overall/total portfolio and sub-component portfolios. The total portfolio is the ultimate portfolio formed by combining subcomponent portfolios. The goal of the investor is to construct a total portfolio from subcomponent assets and portfolios that best suits the return requirements and risk aversion of the investor. What might constitute a good sub-component of the portfolio (e.g., a hedge fund manager earning a high risk-adjusted return) may be totally inappropriate as 2 the sole component of the total portfolio because of the high risk involved. Throughout, the researchers treat the portfolio optimization problem and risk budgeting as "flipsides" to the same coin (also see Scherer (2002)

Risk and asset management are connected in our focus upon the future that is, the future performance of assets. Asset management is used to plan for future asset performance. This is achieved by understanding

stakeholder needs, understanding the risks associated with the delivery of those needs and developing appropriate mitigation to those risks to deliver safe and reliable performance. Risk management provides the decision support processes and tools to deliver and sustain future asset performance. In essence then, risk management provides the foundation upon which asset managers can make the future come true, that is, predict the need for and deliver assets that are safe, meet the demanded service and achieve the required financial performance

Understanding asset-related risks is a key element of an asset management system. Analyzing and assessing risks and identifying control mitigations helps us understand the asset management tasks that the researchers need to undertake. While it is important to understand risks and their mitigation, the researchers must not forget to communicate and implement the practical tasks needed to deliver risk control. For instance, at times routine maintenance might not be completed: the impact of deferring maintenance should be communicated to stakeholders for risk-based acceptance and approval. Modified asset plans should be implemented to control risk and assure the ongoing safety of assets.

The risk management process model was developed in Australia as AS4360 Risk Management and remains valid today in ISO 31000. The defining model for both is shown at Figure 1, with the PDCA loops articulated over the model. Figure 3: Risk management process (ref ISO 31000) An asset management process model was also developed in Australia around the same time and formalised by the AM Council.

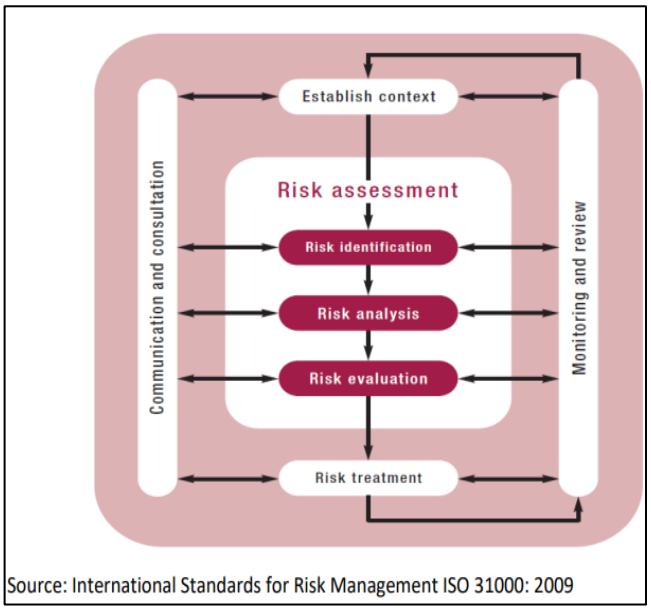

Figure 3: Risk management process

Step 1 Establish Context – Many asset failures are not related to asset condition but arise from the operational environment, maintenance practices or environmental reasons. Establishing the tendency towards failure requires Asset Risk Strategy assessing a few “Likelihood Indicators” but also considers the maintenance and operational regimes for the key elements of the asset. These likelihood indicators are rated against factual statements about asset failure which represent a scale from improbable to almost certain (1 to 5).

Step 2 Identify Risks –This involves defining a consequence profile for Level of Service failures. The consequence of failure typically considers the “triple bottom line” for a given asset failure. Typical 22 generic risk applied in the Project Risk Plans, Facility Risk Plans, and Asset Immovable Risk Plans, within the context of physical asset life cycle management categories could include the following:

1. **Cost Risks:**Budget overruns, underestimated costs, unexpected expenses.
2. **Schedule Risks:**Delays, missed deadlines, project overruns.

3. **Scope Risks:** Scope creep (unplanned changes), unclear requirements.
4. **Resource Risks:** Inadequate staff, lack of access to resources, high turnover.
5. **Performance Risks:** Poor project deliverables, failure to meet quality standards.
6. **Communication Risks:** Poor communication, lack of collaboration, misunderstandings.
7. **Technical Risks:** Technology failures, software bugs, security vulnerabilities.
8. **Financial Risks:** Loss of investment, debt issues, financial instability.
9. **Legal Risks:** Compliance failures, regulatory changes, lawsuits.
10. **Reputational Risks:** Negative publicity, damaged brand image, loss of trust.
11. **Compliance Risks:** Failure to meet legal or regulatory requirements.
12. **Operational Risks:** Process failures, disruption of services, safety incidents
13. **Cybersecurity Risks:** Data breaches, system failures, cyberattacks.
14. **Strategic Risks:** Failure to adapt to market changes, missed opportunities.
15. **Market Risks:** Economic downturn, competitor actions, changes in consumer demand.
16. **Environmental Risks:** Natural disasters, climate change, pollution.
17. **Political Risks:** Government regulations, political instability, trade wars.
18. **Dynamic Risk Assessment:** Continuously evaluating and updating risk assessments as projects progress.
19. **Ethics Risk:** Violations of ethical principles, damage to reputation.
20. **Data Risk:** Loss, damage, or misuse of sensitive data.

The first two steps are a group exercise that includes brainstorming risks; combining them by asset groups or service area; developing risk descriptions; and defining consequences should a risk occur. A clearly defined process for identifying risk ensures all Service Areas have the same understanding of how risk is determined and can be communicated to other stakeholders.

Step 3 Analyze Risks – The analysis and prioritization of risks is a repeatable Asset Risk Strategy process. Initial prioritization is done by the service areas objectively. The scores are based on the risk matrix. The risk matrix as shown in Figure 4 was developed based on the product of likelihood and consequence of failure. The score in the matrix is to a maximum of 25 and minimum of 1 and is color coded based on risk level. For example, risk levels of low (green), medium low (yellow), medium high (orange), high (red) and severe (dark red). Each risk is assigned an overall risk score which is a product of the likelihood and consequence scores. The Service Area records the risk score in their risk register and sorts the list in order of descending score. The prioritized registers for each Service Area are combined and reprioritized.

Ranking Matrix

Likelihood \ Consequence	1	2	3	4	5
1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

Risk Levels:	
	▪ Risk is Severe for any thing 20 and above
	▪ Risk is High for any thing 15 and below 20
	▪ Risk is Medium High for anything above 8 but below 15
	▪ Risk is Medium Low for anything 4 and above but 8 and below
	▪ Risk is Low for anything below 4

Figure 4: Risk matrix

Step 4 Evaluate Risks - Since a consistent risk framework is being adopted across the immovable asset, the risk scores produced by this approach will enable a comparison within a Service Area or across all Service Areas. This supports decision-making by comparing the magnitude of the risk with its risk tolerance.

Step 5 Treat Risks – Impact on Levels of Service due to risk is reflected in the risk register. The risk treatment identifies the current and possible mitigation actions used by the Town.

METHODOLOGY

This study utilized a mixed methods approach to collect and analyze data from 303 respondents engaged in asset management across various public sector organizations. A structured survey incorporating both quantitative and qualitative insights into the challenges faced with data governance and quality. The survey covered key themes, including system adoption, data accuracy, digital literacy, and process efficiency. Descriptive statistics and inferential analysis were applied to identify patterns and validate hypotheses regarding the relationship between data governance and digital transformation outcomes. Based on the integrated theoretical foundation comprising the Technology Organization Environment (TOE) framework, ISO 55000 asset management standards, and data governance models, this study identifies key factors influencing the digitalization of immovable asset management in the Malaysian public sector. These frameworks collectively suggest that data quality, organizational readiness, and systemic adoption of digital tools are critical determinants of asset performance, risk mitigation, and stakeholder satisfaction. Drawing from these insights and empirical precedents (e.g., Sulaiman & Abdullah Maamuom, 2017; Mohd Nasir et al., 2022), the following hypotheses are formulated to explore the direct and indirect impacts of digital transformation on asset management outcomes.

Table 1: Summary of Theoretical Foundation

Theory / Framework	Description	Relevance to This Study
Technology Organization Environment (TOE) Framework	Explains how technological, organisational, and environmental contexts affect technology adoption.	Structures analysis of digitalization factors: technology readiness, government policy, institutional readiness.
ISO 55000 Asset Management Standard	International standard for managing physical assets across their lifecycle with risk-based processes.	Provides benchmarks for government's immovable asset management and risk assessment.
Data Governance Framework	Defines decision rights, accountability, and processes for managing organizational data.	Supports hypothesis that strong data governance enhances digitalization effectiveness.
Corporate Digital Risk Theory (Fraud Triangle)	Posits U-shaped risk relationship through motivation, opportunity, management attitude under digital transformation.	Basis for hypothesizing nonlinear digitalization–risk relationship.
Digital Asset Governance	Systematic control over digital asset lifecycle (e.g. IoT, sensor data).	Frames digital management strategies for public-sector asset performance.
Critical Infrastructure Risk Management	Focuses on identification, mitigation, and interdependency in asset networks.	Emphasizes cascading impact and interdependent risk in immovable assets.
IT-Asset Management in Security Operations (MyJICT, 2022)	Systematic review on frameworks in security operation centres for IT asset management.	Relevant to structuring digital tools and integration in asset management systems.
Environmental, Social, Governance (ESG) & Digitalisation (SAGE Open, 2025)	Bibliometric study linking ESG initiatives with digital transformation processes.	Underlines the importance of dimension's importance in digital adoption and asset risk.
Digitalisation & Cybersecurity Operational	Provides ISO-based cybersecurity and risk management guidelines in	Reinforces need for cybersecurity controls (ISO 27001/27005) in asset

Framework (MDPI Electronics, 2023)	digital operations.	digital tools.
Malaysian PWD Digital Asset Governance Study (IJRISS)	Investigates data governance and quality in immovable asset management in Malaysia's PWD.	Direct empirical evidence supporting study hypotheses (303 respondents).

The integration of diverse theoretical frameworks provides a robust conceptual basis for understanding the interplay between digital transformation, data governance, and risk management in the public sector. The Technology Organization Environment (TOE) Framework, for instance, is instrumental in identifying the contextual dimensions that influence the adoption of digital technologies in governmental asset management. TOE asserts that technological readiness (e.g., system usability, interoperability), organizational factors (e.g., leadership support, digital skills), and environmental conditions (e.g., regulatory mandates, public expectations) jointly shape digital transformation outcomes. This framework underpins the assumption that while awareness of digital systems may be high, actual implementation may be constrained by internal and external limitations as a foundational premise for the third hypothesis.

Concurrently, the ISO 55000 Asset Management Standard offers internationally recognized principles for managing physical assets throughout their lifecycle. It emphasizes the importance of a structured, risk-based approach to asset planning, operation, and decommissioning. ISO 55000 aligns closely with the premise that operational excellence in asset management is inherently linked to proactive risk mitigation, data accuracy, and accountability core themes echoed throughout this research.

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Recognizing these cascading effects justifies the emphasis on lifecycle-based risk identification and treatment strategies within this study. The Digital Asset Governance perspective further reinforces the need for continuous, integrated control mechanisms over digital data, particularly as governments shift from paper-based systems to intelligent infrastructure platforms. The ability to manage digital assets from IoT sensor streams to centralized dashboards requires not only technical infrastructure but also institutional capacity and governance maturity. Taken together, these theoretical constructions enable the formulation of five testable hypotheses. Each is grounded in existing literature and reflects empirical concerns raised in the Malaysian public sector, particularly within the Public Works Department (PWD). The hypotheses are designed to examine the extent to which data quality, digitalization awareness, system adoption, and risk-driven decision-making influence overall satisfaction and effectiveness in immovable asset management.

The following hypotheses were formulated to guide the analysis:

H1: The majority of respondents agree on the importance of data quality in immovable asset management.

(Supported by the data governance literature highlighting accuracy, accessibility, and integrity as core dimensions; ISO 25012; Norbib et. al., 2021).

H2: There is a significant positive perception of the benefits of digitalization in asset management.

(Aligned with TOE framework emphasizing the role of perceived technological advantage in adoption decisions; Tornatzky et. al., 1990; Pramanik et. al., 2018).

H3: System adoption rates are lower than awareness rates due to barriers such as lack of training and accessibility.

(Rooted in organizational readiness and environmental constraints within the TOE framework; Ali et. al., 2018; Sulaiman et. al., 2017).

H4: Dissatisfaction with government infrastructure management correlates with challenges in asset management processes.

(Consistent with ISO 55000 principles linking performance to risk-based lifecycle management; Mohd Nasir et. al., 2022).

H5: Increased usage of digital tools and systems improves operational efficiency and overall satisfaction.

(Consistent with findings from integrated digital asset governance models; Ridwan Radzi et. al., 2021; De Best et.al., 2006).

A study based on the give hypotheses and survey data was conducted since there are several variables which include data quality awareness, digitalization perception, system adoption in influencing asset management effectiveness at different levels. Furthermore, the survey data itself involves different backgrounds of respondents with varying levels of digital adoption, experience and satisfaction.

RESULT AND DISCUSSION

Understanding the relationship between data governance, digitalization, and asset management challenges is crucial for improving public sector efficiency. The study's results confirm several key hypotheses, starting with the overwhelming agreement on the importance of data quality (H1), where 98% of respondents recognize its role in ensuring optimal asset utilization, cost efficiency, and regulatory compliance. Despite this awareness, many organizations still face challenges such as data fragmentation, duplication, and outdated records, emphasizing the need for a structured data governance framework. Similarly, the positive perception of digitalization (H2) is evident, with 99% of participants acknowledging its benefits in streamlining processes, improving decision-making, and enhancing asset tracking. However, while awareness is high, adoption rates remain significantly lower (H3), as only 58% of respondents report using digital asset management systems. Barriers such as lack of training, system complexity, and infrastructure limitations contribute to this gap, preventing organizations from fully leveraging digital tools. Further analysis supports H4, revealing that dissatisfaction with infrastructure management is closely linked to inefficiencies in asset maintenance, poor interdepartmental coordination, and reliance on reactive maintenance strategies rather than proactive planning. These shortcomings result in delayed repairs, increased costs, and misallocation of resources. On the other hand, findings affirm H5, demonstrating that organizations that actively use digital tools experience greater operational efficiency, improved real-time data access, and enhanced collaboration. Digital platforms enable predictive maintenance, reduce paperwork, and streamline decision-making, leading to higher satisfaction levels among users. Overall, these findings

highlight the urgent need for comprehensive data governance policies, targeted training programs, and better integration of digital asset management systems. Strengthening these areas will help overcome existing barriers, drive efficiency, and ensure long-term sustainability in public sector asset management.

Equations The Importance of Data Governance in Asset Management

H1: The majority of respondents agree on the importance of data quality in immovable asset management.

Asset management within the public sector relies heavily on accurate and reliable data to ensure optimal asset utilization, cost efficiency, and regulatory compliance. The findings indicate that 98% of respondents recognize the importance of data quality in asset management. This near-unanimous agreement underscores the widespread acknowledgment that data serves as the backbone for effective decision-making, maintenance scheduling, and financial planning. Despite this awareness, most organizations still struggle with inconsistent data governance practices. A significant proportion of respondents reported challenges such as data duplication, outdated records, and fragmented data sources. Without a structured governance framework, asset data often remains unreliable, leading to misinformed decisions, suboptimal asset performance, and increased maintenance costs. A well-structured data governance framework ensures that asset information remains accurate, complete, and accessible to all stakeholders. However, many government agencies operate in siloed environments, where departments use different data management systems without proper integration. This lack of standardization leads to discrepancies in asset records, making it difficult to determine asset conditions, historical maintenance records, and real-time asset availability. Furthermore, poor data governance can lead to financial inefficiencies, as inaccurate records may result in unnecessary asset replacements, over-budgeting for maintenance, and misallocated resources. These issues highlight the need for robust policies and technological interventions to enhance data consistency, transparency, and accuracy in immovable asset management.

Perceived Benefits of Digitalization

H2: There is a significant positive perception of the benefits of digitalization in asset management.

The transition toward digital asset management systems is seen as a transformative step in ensuring real-time data access, automation of manual processes, and improved asset tracking. The study found that 99% of respondents believe digitalization makes asset management easier, strongly supporting H2. This overwhelming consensus suggests that digital transformation is widely viewed as a necessary advancement for improving efficiency, accessibility, and operational effectiveness. Qualitative responses further reinforce this perspective. Many participants noted that digitalization reduces paperwork, minimizes human errors, and enables better communication between asset managers and policymakers. The automation of data entry, report generation, and predictive maintenance can significantly improve response times and asset lifecycle management. However, while the perceived benefits are evident, the actual implementation of digitalization is not without challenges. Digital transformation requires a shift in organizational culture, training, and infrastructure investment. Without proper change management strategies, the adoption process may face resistance from personnel accustomed to traditional asset management practices. Thus, while digitalization is recognized as a key enabler of efficiency, its success hinges on proper training, system integration, and long-term commitment from leadership.

Perceived Benefits of Digitalization System Adoption vs. Awareness

H3: System adoption rates are lower than awareness rates due to barriers such as lack of training and accessibility.

While 98% of respondents acknowledge the importance of data, only 58% reported using digital asset management systems. This gap between awareness and adoption confirms H3, highlighting the presence of significant barriers that hinder system utilization.

Several key factors contribute to this adoption gap which include lack of training and technical knowledge as many asset managers lack the necessary technical expertise to fully utilize asset management systems. Without proper training, employees may struggle with data entry, report generation, and analytics features within these platforms. Moreover, system complexity and usability issues in which some respondents mentioned that existing systems are not user-friendly and require frequent troubleshooting, discouraging users from consistent engagement with digital platforms. This highlights the limited accessibility and infrastructure gaps in addition to resistance to change among others. In some public sector agencies, internet connectivity, outdated hardware, and insufficient IT support limit system performance and prevent real-time data entry and retrieval. While remains a major obstacle to digital transformation. Employees accustomed to manual documentation and traditional workflows may perceive digital systems as an additional burden rather than an improvement. Addressing these barriers requires comprehensive training programs, improved system interfaces, and a more supportive IT infrastructure. Without addressing these adoption challenges, the full benefits of digitalization cannot be realized.

Dissatisfaction and Challenges

H4: Dissatisfaction with government infrastructure management correlates with challenges in asset management processes.

Efficient asset management is crucial for maintaining the functionality, safety, and longevity of government-owned infrastructure. However, the survey reveals that 83% of respondents faced difficulties in asset management processes, while 21% expressed dissatisfaction with current infrastructure management practices. This correlation strongly supports H4, suggesting that existing inefficiencies negatively impact user satisfaction. Several underlying issues contribute to this dissatisfaction including ineffective maintenance strategies and lack of data-driven decision making. Many respondents reported delays in asset repairs, leading to deterioration in facility conditions. Poor maintenance tracking results in reactive maintenance instead of proactive planning while, without reliable data, policymakers struggle to allocate budgets effectively, leading to underfunded maintenance programs and overlooked asset deterioration. On top of that, inefficient processes and interdepartmental communication gaps lead to asset inspections and reporting being conducted manually, leading to slow response times and data inaccuracy. Digital solutions could address these inefficiencies, but system adoption challenges hinder progress. Most importantly, asset management requires collaboration between various departments, yet many organizations operate in silos, preventing efficient coordination. Thus, it can be deduced that improving government infrastructure management requires a more integrated approach to asset data sharing, predictive maintenance strategies, and streamlined decision-making processes.

Dissatisfaction and Challenges Impact of Digital Tools

H5: Increased usage of digital tools and systems improves operational efficiency and overall satisfaction.

The survey findings reveal that respondents who actively use digital tools report improved workflows, real-time data access, and better decision-making capabilities. This supports H5, suggesting that digitalization positively influences operational efficiency. The reason is that increased system usage rapidly steers real-time asset tracking and predictive maintenance. For instance, digital platforms enable real-time monitoring, reducing unexpected breakdowns and repair costs. Predictive analytics help in identifying potential failures before they occur. On top of that, digital systems allow instant retrieval of asset information, reducing reliance on paper-based records and improving auditability and compliance tracking. Through streamlined data access and reporting. While cloud-based asset management tools promote better communication between field teams, maintenance personnel, and decision-makers, leading to quicker problem resolution thus, faster response times and enhance collaboration. Furthermore, employees who use asset management software report greater job efficiency, as digital tools automate repetitive tasks, allowing them to focus on more strategic asset planning thus, reflecting higher satisfaction levels among digital users. For the full potential of digitalization to be realized, government agencies must ensure proper user training, system

enhancements, and consistent IT support. Without these measures, the benefits of digital tools may remain underutilized.

CONCLUSION

This study has examined the interplay between asset risk management, immovable asset management, and the pursuit of digitalization within the Malaysian government's administrative and operational framework. The findings underscore the pressing need to modernize how immovable public assets are managed, valued, and safeguarded against risk. The potential links between asset risk management and immovable asset management outcomes have attracted considerable attention in recent years, as risk management issues have become one of the main concerns of a wide range of stakeholders in organizations. However, there are still few papers in the academic literature on asset management that specifically address the relationship between risk management and performance outcomes.

Asset risk management in the public sector must evolve from basic inventory control to a more strategic, risk-aware approach, as current practices expose the government to legal, financial, and operational vulnerabilities caused by data inaccuracies, asset underutilization, and fragmented oversight. Without a structured mechanism to assess and mitigate these risks, public resources remain susceptible to inefficiencies and potential loss. At the same time, immovable asset management plays a critical role in preserving national wealth and enhancing public service delivery; yet, overlapping responsibilities, inconsistent reporting, and limited real-time asset visibility continue to hinder optimal utilization. These structural weaknesses call for institutional reforms and clearer asset governance protocols. Digitalization emerges as the transformative enabler that bridges risk mitigation and asset optimization, with technologies such as Geographic Information Systems (GIS), Internet of Things (IoT), and centralized platforms like MyINFRA offering promising solutions for tracking, monitoring, and managing government assets more effectively. When fully integrated, these tools will support data-driven decisions, predictive maintenance, and greater transparency—cornerstones for future-proofing Malaysia’s public asset management strategy.

Looking ahead, the future of immovable asset management lies in the integration of emerging technologies such as artificial intelligence (AI), the Internet of Things (IoT), and blockchain for enhanced data security and transparency. AI-driven predictive analytics can optimize maintenance schedules, reduce downtime, and improve asset lifecycle management. IoT-enabled sensors can provide real-time data on asset conditions, facilitating proactive decision-making and reducing maintenance costs. Blockchain technology can enhance data security by ensuring tamper-proof records and transparent transactions, thus strengthening trust in asset management practices. In conclusion, achieving excellence in managing Malaysia's immovable public assets demands a digitally driven, risk-informed approach. Integrating digital systems with robust risk frameworks will not only improve operational efficiency and accountability but also unlock greater economic and public value from the nation’s asset base. While, strengthening data quality of asset risks in immovable asset management is fundamental to achieving digital transformation in the public sector. The study highlights the existing challenges, identifies key drivers of success, and provides actionable recommendations for improving data governance frameworks, enhancing digital adoption, and optimizing asset management processes. By embracing digital transformation, fostering a culture of data-driven decision-making, and investing in capacity-building initiatives, organizations can unlock the full potential of asset management and ensure sustainable infrastructure development for the future.

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