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A Review on PDM Decision-Making for Public Sector Construction Projects Using PESTEL Analysis Framework

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ABSTRACT

Successful public sector construction project delivery is crucial for public benefit and national economic growth. Project delivery performance typically depends on the appropriateness of the project delivery method (PDM), which plays a significant role in project development. This paper comprehensively reviews the public sector's macro-environment perspective in applying descriptive and structured PDM decision-making for public sector construction projects. Based on a systematic literature review, the public sector macro-environment opportunities and threats in PDM decision-making are assessed using a strategic management tool, the political, economic, social, technological, environmental, and legal (PESTEL) analysis framework. Findings reveal that political direction, consultant and contractor abilities, and public sector personnel culture are significant threats that influence the public sector to uphold prescriptive and authoritarian decision-making in PDM selection. Financial conditions, technology integration, and strict public sector policy, rules, and regulations are significant opportunities for the public sector to improvise if determining to adopt various potential PDMs in public sector construction projects. An adequate understanding of the public sector macro-environment perspective in adopting proliferated PDMs contributes to different philosophical views on public sector PDM decision-making. The findings of this paper are substantial in establishing relevant criteria for developing a workable PDM decision-making framework for the public sector.

Keywords: PESTEL analysis, project delivery method, decision-making framework, public sector, construction project

1.0 INTRODUCTION

Malaysian government spent around MYR268.6 billion between the year 2017 and 2021, on top of commitment to 159 Public-Private Partnership (PPP) projects worth MYR130.34 billion in the year 2021 for public sector construction projects (EPU JPM, 2022). Although the numbers and expenses of development expenditures increase annually, the growth of the construction industry in 2021 is facing a deficit of -5.2% of the total gross domestic product (GDP) (EPU JPM, 2022). The public sector construction projects still encounter continual issues that hinder the achievement of project objectives (Riazi & Nawi, 2018).

Malaysia's Audit Report from 2019 to 2022 reveals improper planning, inapplicable delivery methods, inconsistent monitoring, and time at large are significant issues that affect public projects' success (National Audit Department, 2022). This finding is supported by Azmi & Ismail (2022) and Jatarona et al. (2016) studies on the Audit Report from 2002 until 2018. They expose inappropriate project delivery method (PDM) decision-making as one criterion impacting project performance. In addition, a study on the perception of the delivery method in Saudi Arabia by Alofi et al. (2016) reveals that dependency on prominent delivery methods has been one of the major causes of public sector underperformance projects for over 20 years. Prescriptive decision-making in the public sector leads to inefficient project delivery, subtly affecting economic performance (Mohammed, 2019).

Although extensive research on PDM decision-making has been conducted, the decision-making framework is still too universal, unconcluded, and unapplied (Zhao et al., 2022). An innovative decision-making framework based on the organisation context is essential for better project owners' adaptability (Demetracopoulou et al., 2022). Idham et al. (2022) review of public sector practice in PDM selection reveals that developing countries still practice prescriptive decision-making mechanisms in selecting PDMs. The government procurement policy is the primary constraint influencing public agencies to continue employing traditional delivery methods. Thus, this paper will comprehensively review the public sector macro-environment perspective in PDM decision-making. An improved understanding of public sector organisations' perspectives is crucial in enriching PDM decision-making theory and developing a practical and descriptive public sector decision-making framework.

2.0 OVERVIEW OF PUBLIC SECTOR PDM DECISION-MAKING

The public sector construction industry is rapidly growing worldwide. The evolution of the construction industry and the complexity of project requirements have generated various concepts of PDMs (Ahmed & El-sayegh, 2021). The project delivery method defines the roles and responsibilities of the participants involved in the project (Bingham et al., 2019). It also structured project financing and reimbursement mechanisms for the project. Kenig (2011) revealed that Design-Bid-Build (DBB), a universally known traditional delivery method, has been a prevalent PDM in most public construction projects since the 20th century. However, DBB became intolerable in certain circumstances due to adversarial relationships between project team members (Gad et al., 2015).

Hence, alternative delivery, such as the Design and Build (DB) and Construction Management (CM) delivery method, was introduced in the 1960s and 1970s to improve project execution performance (Konchar & Sanvido, 1998; Molenaar et al., 1999). In the late 1980s and 1990s, economic turmoil and recession worldwide changed most government policies to encourage the adoption of the PPP delivery method (Davies et al., 2019). However, recently, some of the public sectors, especially in developed countries, have started to deploy Integrated Project Delivery (IPD) for complex projects to improve effectiveness in construction processes by using advanced construction management technologies like Building Information Modelling (BIM) (Durdyev et al., 2020).

Literature reveals that most PDM selection practices in the public sector are based on prescriptive and authoritarian decision-making (i.e., Australia (Love et al., 2010), Finland (Pakkala, 2002), Norway (Haugen et al., 2017), Nigeria (Jimoh et al., 2016), Turkey (Akiner & Akiner, 2018), Saudi Arabia (Alofi et al., 2016), South Korea (Yoon et al., 2016), and Malaysia (Jin Lin, 2014)). Decision-makers in most countries are restrained by statutory and government policies that intuitively influence them to choose PDM based on general terms and previous experiences (Love et al., 2010). The selection for the alternative delivery method is usually through a directive from the top management.

However, a recent review of public sector PDM decision-making practices by Idham et al. (2022) in Table 1 reveals that developed countries have recently adopted structured and systematic procurement guidelines in selecting PDM. In developing countries such as Malaysia, Nigeria, and Saudi Arabia, the government is still confined by rigid and authoritarian guidelines with no descriptive assessment of PDM appropriateness (Aljohani, 2019; Jimoh et al., 2016; Jin Lin et al., 2015; Yoon et al., 2016). The traditional delivery method is still prevalent in developing countries.

Table 1. The Comparison of PDM Selection Guideline Between Developed Countries (Australia, United Kingdom, and United States) and Malaysia (Idham et al., 2022, pg. 12).

Country	PDM Statutory and Guidelines	PDM Selection Framework	Review of PDM Selection Framework
Australia	• National Guidelines for Infrastructure Project • Delivery (Australian Government, 2018)	• Procurement Options Analysis (Australian Government, 2008)	Robust financial analysis and value for money assessment in the business case study.
United Kingdom	Government Construction Strategy (Cabinet Office UK, 2011)	• The Common Minimum Standards (Cabinet Office UK, 2012)	The decision on project delivery options is guided by the Green Book (HM Treasury, 2020). It sets out a rigorous yet pragmatic approach to weighing up the costs and benefits and illuminating the key issues, uncertainties, and risks in potential projects.
United States	• Federal Acquisition Regulation • (US Government, 2022) • Clinger-Cohen Act 1996	*A Guidebook for the Evaluation of Project Delivery Methods (Touran et al., 2009)	A three-tiered decision-making framework to assess the advantages and disadvantages of several potential delivery methods.
Malaysia	• Financial Procedures Act 1957 and the Government Contracts Act 1949 • Treasury Instruction (MOF, 2008)	• Treasury Circular PK. 2: Government Procurement Method (MOF, 2022)	The traditional delivery method is the preferred delivery. No decision-making framework is formed. Alternative delivery is only applicable if public decision-makers define the project as complex, specialist building and infrastructures and have a short timeline for execution

*due to varies in regulations between the federal and states of the United States, the analysis only focuses on the Federal Highway Administration (FHWA) practice.

In Malaysia, the selection of PDM for public fund construction projects is determined by the guidelines outlined in Treasury Circular PK 2.1: Government Procurement Method (2022) and PK 4.1: General Government Procurement Contract Administration (2013). These guidelines strongly recommend the use of traditional delivery methods for the execution of public construction projects. The Design and Build delivery method is only suitable for selection when the project is complex and has a tight timeline. Nevertheless, all projects must adhere to pre-approved plans and are limited to the DBB delivery method. The project delivery method selection process for the Malaysian public sector construction project is depicted in Figure 1.

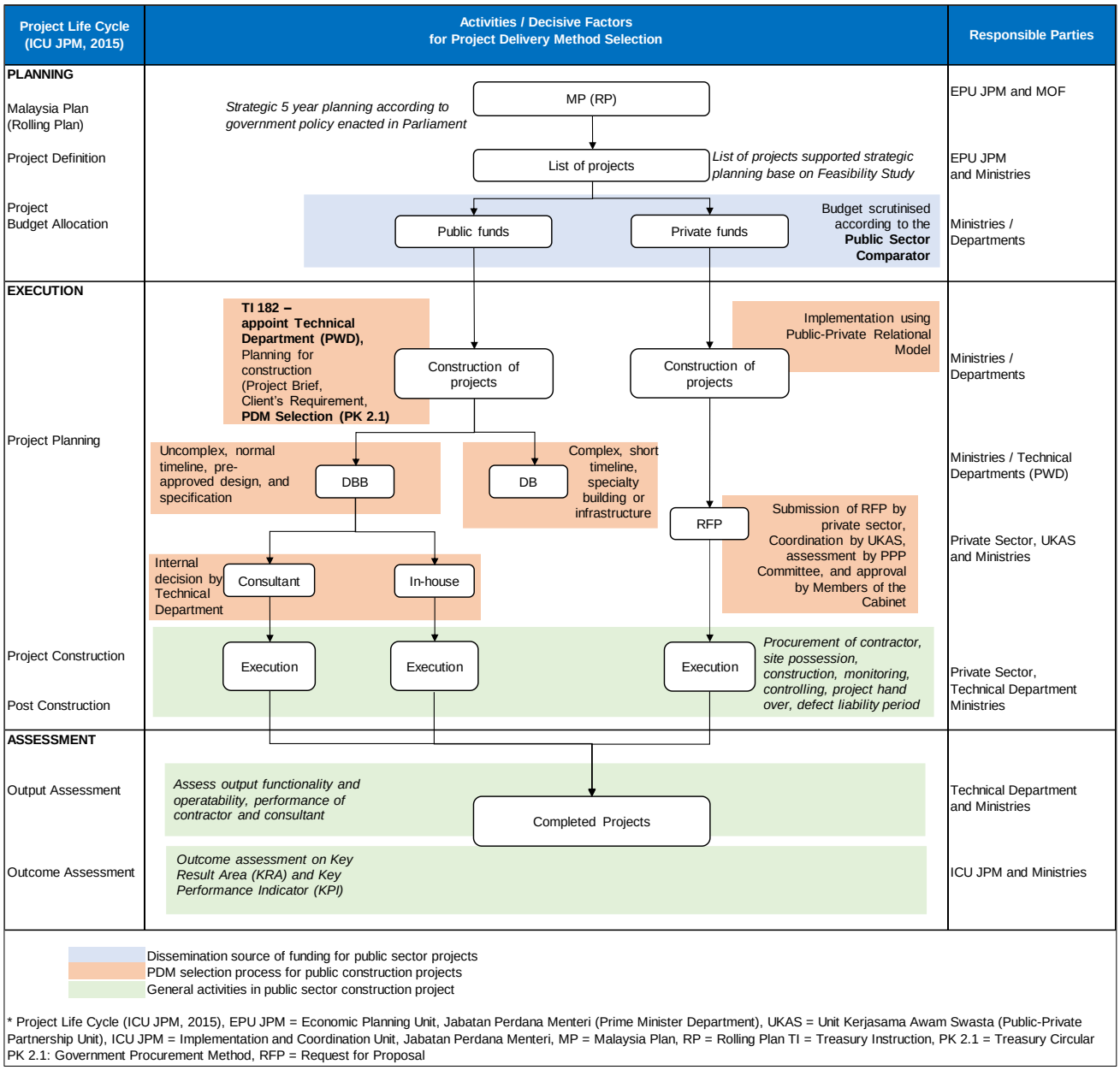

Figure 1. PDM Selection Process for The Malaysian Public Sector Construction Project (Idham et al., 2022).

In Nigeria, the government implemented the Public Procurement Act to establish ethical guidelines in public project acquisition without an apparent mechanism for selecting appropriate PDM (Olanrewaju et al., 2016). In Saudi Arabia, PDM is determined according to the Government Tenders and Procurement Law (GTL), which explicitly shows that the formal contracts for construction projects are established in a distinct contract document for design, consulting, and construction services. According to Aljohani (2019), Saudi Arabia's public institutions are regulated by a quadripartite structure (Client-Contractor-Consultant-Designer), which typically utilises the traditional delivery method for executing public construction projects.

Selecting PDM presents a tricky challenge for the project owner due to the complexity of the construction project's nature and the ambiguity of human thinking in real-life decision-making (Cao et al., 2020; Su et al., 2019). The primary aspects of the extensive PDM selection process are selection criteria and the interrelationship between criteria (Hosseini et al., 2016). Theoretically, prevalent criteria for PDM selection are related to performance indicators, organisation characteristics, project characteristics, and external environment (Bolomope et al., 2022; Demetracopoulou et al., 2022; Hosseini et al., 2016; Mahdi & Alreshaid, 2005; Nouh Meshref et al., 2021; Skitmore & Marsden, 1988). Figure 2 illustrates the interrelation among selection criteria in the PDM decision-making process, as discussed by scholars.

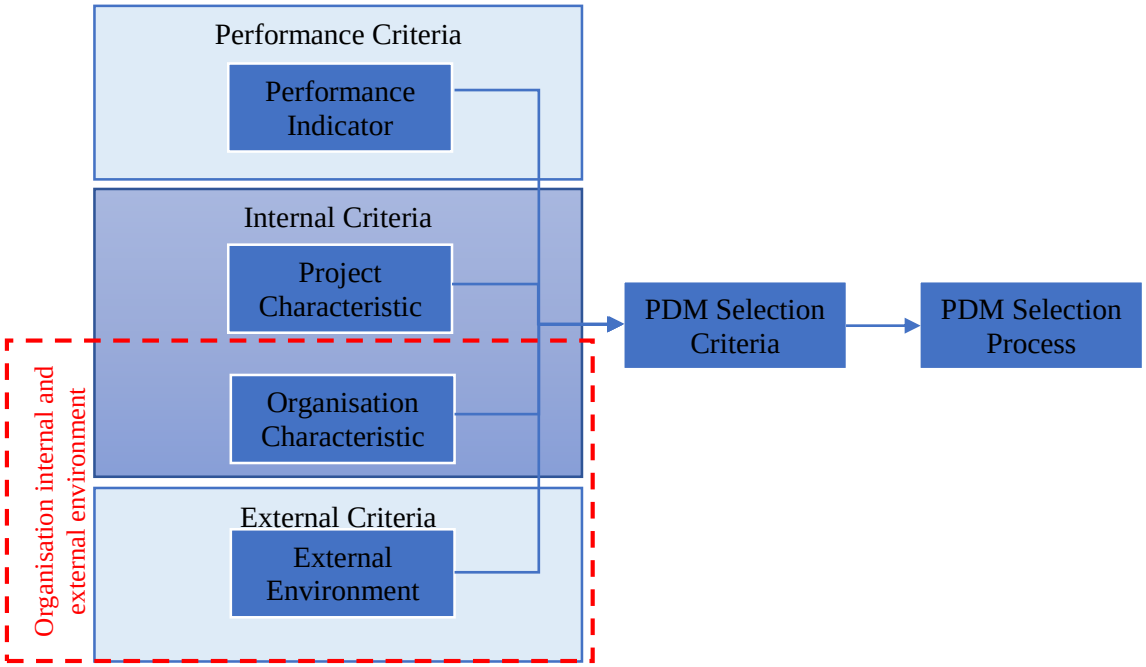

Figure 2. Organisation Internal and External Environment Criteria Relationship in the PDM Decision-Making Process (Assaf et al., 2023, pg 12).

The organisation's context (organisation's internal and external environment) significantly influences PDM decision-making (Liu et al., 2019; Nouh Meshref et al., 2021), as shown in Figure 2. Recently, numerous studies in the PDM decision-making focus more on the internal criteria, such as project and organisation's characteristics, rather than the whole of the organisation's context (Adamtey, 2022; Assaf et al., 2023). Typically, the organisational context significantly influences the feasibility of the PDM (Bidel et al., 2022; Q. P. Zhong et al., 2022; Zhu et al., 2020), whereby the project delivery success factor for certain countries does not apply to other nations' construction environments (Lee et al., 2022). Assessing the appropriateness of PDMs according to the organisation's context enables the establishment of a practical PDM decision-making framework that could address the project objective and the organisation's expectations (Agapiou, 2020). Moreover, the interactive and long-term project execution process is hypersensitive to the organisation's macro-environment, making the external environment play a significant role in PDM selection (Hamad et al., 2021; Liu et al., 2019; Ogbeifun & Pretorius, 2022). Thus, macro-environment analysis is crucial to ensure the PDM decision-making is aligned with the organisation's policy to avoid inefficient judgment by the public sector decision-makers (Bolomope et al., 2022; Q. Zhong et al., 2022).

3.0 METHODOLOGY

The main objective of this paper is to analyse the public sector's macro-environment perspective in PDM decision-making. This paper applied a qualitative approach through a narrative systematic review of published articles and documents as the primary data instrument. Then, the PESTEL analysis framework is used to analyse the opportunities and threats from the public sector's political, economic, social, technological, environmental, and legal perspectives on PDM decision-making. The methodology of this paper was initially adopted by Bhuiyan et al. (2023) in governance and business study.

3.1 Systematic Literature Review

The application of systematic review is crucial for the initial step of justifying this paper by systematically synthesizing related literature that is dynamically published in various sources (Torres-Carrión et al., 2018). Kitchenham (2004) asserts systematic reviews are conducted to assess the degree to which empirical data corroborates or refutes theoretical theories or to aid in the formulation of new interpretations. This paper conducted a systematic review based on Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) proposed by Moher et al. (2009), as illustrated in Figure 3.

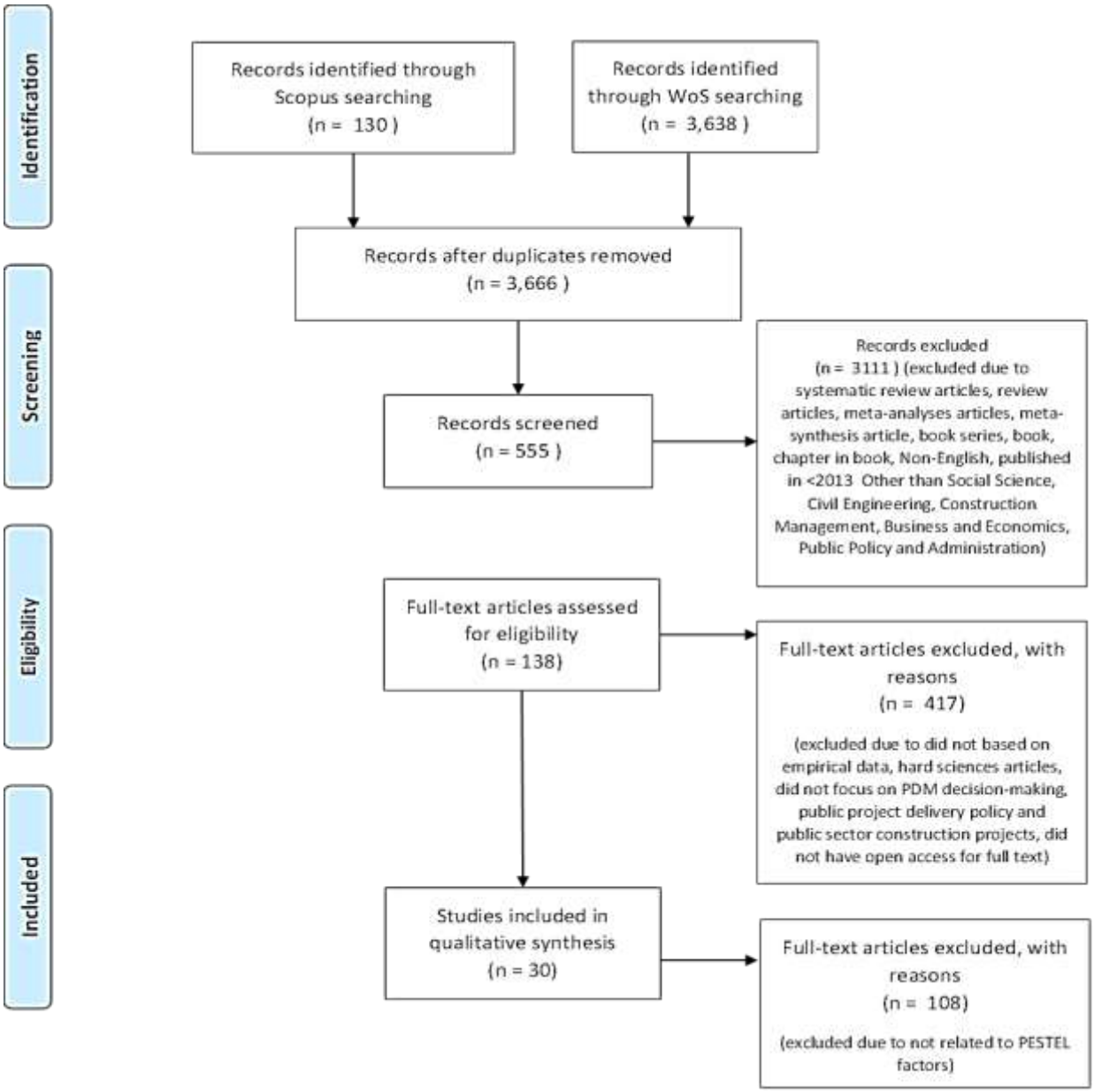

Figure 3. PRISMA Diagram of PDM Decision-Making for Public Sector Construction Projects.

The journal and conference articles are identified using structured keyword searches, as disclosed in Table 2. These articles are explored in prominent electronic databases like SCOPUS and Web of Science (WoS). Xiao and Watson (2019) assert that the rationale for exploring multiple databases is to cover the weaknesses of other databases. These articles are screened based on inclusion and exclusion criteria dictated in Table 3. The eligibility of the articles is scrutinised accordingly through a full-text review. The articles related to the paper's objective have to discuss narratively the decision-making of PDM and public sector construction project delivery. The description and findings of the articles should based on empirical and hard science data and evidence, which excludes findings based on meta-analysis or meta-synthesis from the pieces of literature. The interpretive and literature review findings without data science analysis are also excluded from being reviewed. The designated time frame for the systematic review spans from 2013 to 2023, encompassing a decade of recent studies on public sector PDM decision-making at the time of this paper's preparation. Additionally, the practical time for a public project to complete the full cycle from inception until commissioning can be as much as ten years; therefore, the designated time frame criteria are reliable for the public sector macro-environment analysis (de Araújo et al., 2017).

Table 2. Structured Keyword Search String.

Database	Search String
SCOPUS	TITLE-ABS-KEY ((project AND delivery OR project AND delivery AND method OR project AND delivery AND strategy OR project AND delivery AND system OR delivery AND method OR delivery AND strategy OR delivery AND system OR project AND procurement OR project AND procurement AND method OR project AND procurement AND strategy OR project AND procurement AND system OR procurement AND method OR procurement AND strategy OR procurement AND system) AND (public AND sector OR public AND fund* OR public OR government) AND (building OR construction OR infrastructure))
Web of Science (WOS)	TS = ((project delivery OR project delivery method OR project delivery strategy OR project delivery system OR delivery method OR delivery strategy OR delivery system OR project procurement OR project procurement method OR project procurement strategy OR project procurement system OR procurement method OR procurement strategy OR procurement system) AND (public sector OR public fund* OR public OR government) AND (building OR construction OR infrastructure))

Table 3. Inclusion and Exclusion Criteria For Journal Articles Screening Process.

Criterion	Inclusion	Exclusion
Literature type	Journal (research articles)	Journals articles (systematic review articles, review articles, meta-analyses articles and meta-synthesis), Book Series, Book, Book Chapter, Conference Proceeding, Thesis and Dissertation
Language	English	Non-English
Year	2013 until 2023 (10 years)	< 2012
Field	Project Management, Construction Management, Architecture and Engineering, Built-Environment and Civil Engineering, Building, Infrastructure and Construction, Public Policy, Operation Research and Strategic Management, Business Management, Finance and Economics, Actuarial Science, Social Science	Chemical Engineering, Chemistry, Electrical and Mechanical Engineering, Electric and Electronics, Mechanical and Mechatronics, Mathematics, Medical and Medicine, Arts and Health, Physiology and Psychiatry, Computer and Information Technology, Communication, Automotive, Geography and Geology, Accounting and Econometrics, Environmental Science, Agriculture and Agronomy, Political Science and International Relations, Marine and Aquatic Studies, Applied Chemistry and Biology

Of 138 articles related to the paper's objective, only 30 articles are relevant to PDM decision-making and the public sector construction project delivery. The second data collection stage extracts information from news articles, magazines, government reports, or other related published reports on several accessible websites to support the findings. The Mendeley reference management software assembles and manages all the documents before being qualitatively synthesised according to narrative review. A narrative review in a systematic literature review is a narrative juxtaposition of evidence mostly applied in planning studies to support the paper's focus on the macro environment perspective (Xiao & Watson, 2019).

3.2 PESTEL Analysis Framework

The PESTEL analysis is a strategic management tool extensively applied in analysing the business macro-environment and organisation's scenario (Rothaermel, 2016). Recently, PESTEL analysis has been used in various research fields, such as healthcare, business strategies, policy-making, education, etc. It illustrates a big picture of the macro-environment, allowing the organisation to capitalise on opportunities and mitigate risks associated with its business activities (Johnson et al., 2016).

In this paper, the PESTEL analysis identifies and evaluates the opportunities and threats of the public sector macroenvironment. Badu (2002) asserts that success or failure, profit or loss, growth or decline, all depend on how well the public sector responds to macro-social, economic, technological, or

political/regulatory changes. Silva & Castañeda-Ayarza (2021) suggested the PESTEL analysis framework should consist of four interrelated activities - scanning, forecasting, association, and interpretation. The analysis is cross-sectional and not involving longitudinal organisation scenario monitoring activities. Thus, it enables exploratory findings analysis based on existing information such as published sources (e.g., journal articles, annual organisation reports, media articles, and third parties reports), which is sufficient to illustrate the overall public sector macro-environment perspective (Johnson et al., 2016). The PESTEL analysis framework is illustrated in Figure 4.

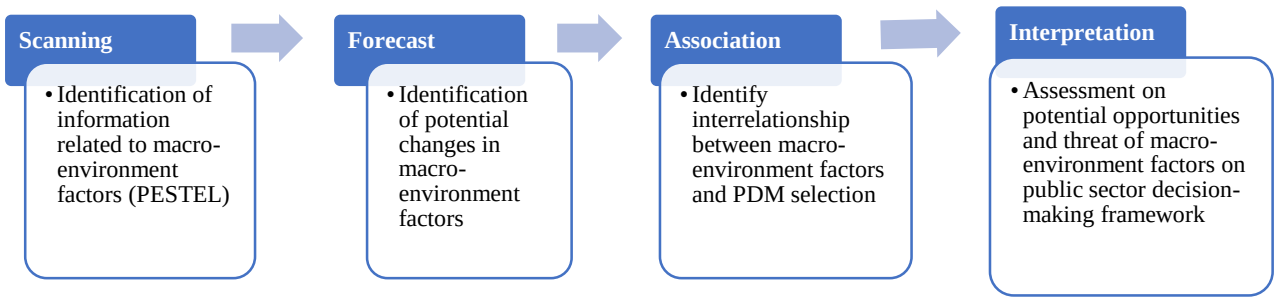

Figure 4. PESTEL Analysis Framework (Source: Silva & Castañeda-Ayarza, 2021).

The process starts with the scanning activity of the systematic review, which identifies the information related to PESTEL factors. The process continues with forecasting, association, and interpretation according to macro-environment analysis stages. The codes and patterns of the information are developed based on an interpretative approach. The interpretative approach is a catch-all term that refers to a particular perspective on organisational reality, predicated on the belief that reality is socially constructed or given meaning by actors' perceptions and interpretations of events (Putnam & Banghart, 2017). Then finally, the coding and pattern trends are categorised according to the PESTEL factor, as revealed in Table 4.

Table 4. Systematic Review of PDM in Public Sector Construction Project Based on PESTEL Factors.

PESTEL Factors	Categories	Narrative Review
Political	Government direction	– Government capital expenditure according to government direction (Davies et al., 2019) – Public project planning typically addresses political imperatives. (Pūlmanis, 2014) – Political interest influences project delivery (Gransberg & Molenaar, 2019) – Political intervention influences project performance (Windapo et al., 2021) – Project delivery and procurement is top-down decision (Jaafar & Radzi, 2013)
Economic	Financial condition	– Project delivery based on government fund sufficiency (Su et al., 2019) – Alternative funding initiatives due to government capital constraint (Davies et al., 2019) – Adequate government funding for successful project delivery (Damoah & Kumi, 2018) – Value for money expenditure (Hodge & Greve, 2017)
Social	Contractor and Consultant abilities	– Indigenous companies lack of capacity and capability (Jaafar & Radzi, 2013) – Demand for experienced and expertise consultants and contractors (Park & Kwak, 2017) – Poor performance of indigenous contractors (Oladinrin et al., 2013) – Contractor capability defines project success (Alashwal et al., 2017) – Social sustainability constraint on contractor's acquisition (Montalbán-Domingo et al., 2018) –

PESTEL Factors	Categories	Narrative Review
Technology	Technology integration	– Technology adoption is crucial for project success (Tawalare & Laishram, 2019) – Advanced technology deployment as the contractor selection criterion (Weisheng et al., 2013) – Policy on the construction technology adoption (Piroozfar et al., 2019) – Technology introduction is one of the PDM evolution factors (Adamtey, 2019) – Technology accessibility as a PDM selection factor (Ding et al., 2014) – Different levels of technology integration for every PDM (Choi et al., 2019)
Environmental	Public sector personnel culture	– Owner characteristics significant in PDM selection (Liu et al., 2019) – Owner experience and knowledge of alternative delivery (Z.P. Lee et al., 2020) – The efficiency of the public organisation's working culture (Blixt & Kirytopoulos, 2017) – Insufficient internal institutional capability (Asiedu & Adaku, 2018) – Require proficient personnel in PDM (Ahmad et al., 2023) – Support from the public organisations (Buertey et al., 2018) – Client's experience and skills in project execution (Liu et al., 2015) – Non-responsive employees in public sector organisations (Gomes et al., 2019)
Legal	Strict public sector policy, rules and regulation	– Traditional utilitarian policies in public project delivery (Hodge & Greve, 2017) – Governments have supremacies, unique requirements, and sovereign nature (Alanzi, 2021) – Rigid regulatory and legal requirements (Noor et al., 2013) – Strict rules to manage higher risk on government (Tran & Molenaar, 2014) – Specific rules and regulations in public project contracts (Bolomope et al., 2022) – Reduce bias and eliminate power abuse and improprieties (Buertey et al., 2018)

4.0 FINDING MACRO-ENVIRONMENT PERSPECTIVES

4.1 Politics

The policy of the public project is not an intellectual or deliberative action but a political action (Rondinelli, 1976) that may change whenever deviations occur in the current government. Caliste (2012) asserted that, although the strategic planning of public projects is conducted within ministries and agencies, the ruling government's political interest always plays a vital role in public project development. Certain projects may be expedited for political gain, while others may be carried out under established protocols (Windapo et al., 2021). Besides, Pūlmanis (2014) asserted that public project planning and decision-making inevitably become political activities. In most European countries, strategic planning based on appraisal, cost-benefit, or risk assessment tools is only formality compliance, while political determination will be the final decision. In the context of public project delivery, it is related to the political direction of how the government manages the expenditure (Davies et al., 2019). Jaafar and Radzi (2013) asserted that public project delivery selection is a top-down decision-making process bounded by government policy and current government political imperative. Generally, the political imperatives and negative perceptions of the outcome of alternative delivery methods impeded the public sector from deploying proliferated PDMs in the industry (Gransberg & Molenaar, 2019).

4.2 Economics

Yescombe (2014) reveals that public infrastructure project funding in developed and developing countries comes from income and taxation, while financial institutions or the private sector funds large-scale infrastructure projects. The government spending approach on public projects using public funds or taxpayer money has encouraged the government to deploy workable delivery methods to preserve the public interest by providing value-for-money facilities (Hodge & Greve, 2017). A resourceful government will likely adopt various delivery methods because of its financial strength, either through national capital or private sector sources (Damoah & Kumi, 2018). However, if the resource is limited and there is a possibility of a deficit budget, the government will prioritise delivery methods based on capital strength, as not all delivery methods will be workable (Su et al., 2019). Osipitan and Shofoluwe (2014) assert that the limited public funds for infrastructure project development led governments to invite private sector entities into a long-term contractual agreement for financing. The economic upheaval that triggered a recession in the United States and the United Kingdom in the 1980s and 1990s has led most governments to minimise public spending on infrastructure projects by encouraging private sector funding to boost infrastructure investment (Davies et al., 2019). Similarly, the Saudi Arabian government has initiated a Fiscal Balance Program, a five-year financial plan to eliminate the budget deficit by introducing a PPP approach in infrastructure construction and housing projects to balance government spending on infrastructure development (Hammad, 2020). Hence, since the early 1990s, PPPs have become a popular alternative delivery method for infrastructure projects.

4.3 Social

Social factors are another crucial factor that significantly affects the nature of demand and supply of national economic growth (Johnson et al., 2016). However, the social balance policy may restrict the government from introducing appropriate delivery mechanisms in public projects (Montalbán-Domingo et al., 2018). In Malaysia and Nigeria, the traditional delivery method has become prevalent for supporting indigenous-owned companies with limited financial capability, knowledge, and skills in public sector projects (Jaafar & Radzi, 2013; Oladinrin et al., 2013). In project management, the contractor's and consultant's capability determine the project's feasibility and the project delivery performance level (Alashwal et al., 2017). Ling et al. (2004), in their research on DBB and DB performance for the building project in Singapore, revealed that the contractor's capability and track record in a similar delivery method are significant to the project performance. Park and Kwak (2017) also reveal that the selection of DBB or DB delivery methods in public transportation projects in the United States relies on the experience and expertise of available contractors from their past projects with the transportation department. They reveal that limited numbers of capable contractors in the integrated and alternative delivery method, especially in advance funding, lead to pivotal problems during contractor selection. Only a few contractors have the capacities and sufficient funds to invest or commence large-scale public projects that typically adopt an alternative delivery method in project execution.

4.4 Technology

The advancement of construction technology is one of the factors of PDM evolution in the public sector (Adamtey, 2019; Davies et al., 2019). Large-scale projects with high complexity and demand for advanced technology applications require an innovative project delivery approach, as the deployment of the DBB approach is unreliable. For instance, in China, the construction of the longest bridge-cum-tunnel sea, the Hong Kong-Zhuhai-Macao Bridge, deployed a DB delivery method due to the need for engineering technology and management of science primarily related to environmental innovative reclamation technology (Ding et al., 2014). The DB delivery method, which leans towards innovation and performance-based specification, encourages project team members to adopt innovative technology to fulfill client's requirements and improve project performance. Tawalare and Laishram (2019), in their research on Indian public construction projects, reveal that fast, open, and effective information and communication technology by using an appropriate medium, such as emails, fax, and telephone conversations, as an alternative to the traditional approach of using letters has contributed to successful project execution. In China's public sector, Weisheng et al. (2013) reveal that leveraging technology is an essential criterion in selecting contractors or awarding government contracts. Meanwhile, in the United Kingdom in 2011, the government enacted a mandatory policy of adopting BIM level 2 for all public construction projects by 2016 (Piroozfar et al., 2019). Building information modeling is an information technology that emerged in design and construction process innovation. Choi et al. (2019) reveal that adopting BIM in certain delivery methods has different circumstances and levels of integration. The tool can produce design documents with 3D rendering and is practical for optimisation, simulation, estimation,

building automation, monitoring, and facility management for the planned project, starting from pre-planning until post-contract (Ashcraft Jr, 2014).

4.5 Environmental

Most scholars reveal that PDM selection is more significant in public sector organisations' internal and external environments. Liu et al. (2019) asserted that identifying key factors in the organisation's environment is vital in guiding project owners in selecting an appropriate delivery method. They discover that external environmental factors such as market competitiveness, technology accessibility, material availability, and regulatory impact are critical in choosing a delivery method. However, the internal environment factor, such as the public sector organisation's characteristic of adopting alternative delivery methods, is the most influential factor in PDM selection. Liu et al. (2015) assert that client experience, ability, risk preference, and desired involvement of the client in a particular project are significant factors in determining appropriate PDM. The project team (client, contractors, architects, and engineers) is typically unfamiliar and inexperienced in dealing with new innovative or alternative delivery methods (Lee et al., 2020). Asiedu and Adaku (2018) stated that inadequate institutional capability, particularly human resource capacity and inherent inefficiencies in handling construction processes, causes a weak institutional environment.

The effectiveness and efficiency of public sector construction projects rely on personnel skills and knowledge. Ahmad et al. (2023) assert public organisations, alongside their consultants, should enhance their knowledge of various methods of execution to enhance their PDMs competency. This step will empower them to make well-informed decisions on their delivery strategies. However, the characteristics of public sector organisations impede public sector personnel from corresponding effectively with the operational structure of alternative project delivery (Buertey et al., 2018). Gomes et al. (2019) state that the intricacy of public sector projects' operation is typically due to internal issues such as entrenched bureaucracies and non-responsive employees in public sector organisations. The effectiveness of public project delivery depends on the efficiency of the public sector organisation's operating environment to reduce bureaucracies and red tape (Blixt & Kirytopoulos, 2017).

4.6 Legal

Legal factors require the public sector to exert strict rules and regulations in implementing public projects to protect the public interest (Rothaermel, 2016). Hodge and Greve (2017) state that most governments enacted traditional utilitarian policies in public project delivery to ensure value for money expenditure of the public fund, with accountable and transparent governance. Public projects have specific supremacies, unique requirements, and sovereign nature (Alanzi, 2021). Typical stringent regulation in the public sector tends to diminish the likelihood of bias and possible abuses of power and impropriety under constitutionally required public procedures (Buertey et al., 2018). Due to the huge annual contracting amount, the government has dominant bargaining power by enforcing specific rules and regulations in public project contracts (Bolomope et al., 2022). Most governments establish specific rules or guidelines for public sector project delivery. Noor et al. (2013) state that applying various PDMs in public construction projects is only feasible when laws and regulations are enacted. Tran and Molenaar (2014) explain that if the public sector establishes inadequate regulation and legislation on alternative delivery methods, it could impose a higher risk to the organisation if only inexperienced contractors are available on the market. Thus, Magagula and Agumba (2017) asserted that the government needs to establish flexible regulations in project delivery to ensure that public organisations can review and analyse the advantages and disadvantages of all alternative delivery methods.

5.0 DISCUSSION

The PESTEL analysis in the previous section reveals that macro-environment factors significantly influence the public sector perspective in PDM decision-making. Political, economic, social, technological, environmental, and legal factors are substantially associated with public sector direction in PDM selection, whereby it exhibits the potential opportunities and threats in assessing and adopting an appropriate PDM for public sector construction projects. These opportunities and threats are illustrated by the macro-environment review on project delivery method decision-making for public sector construction projects in Figure 5.

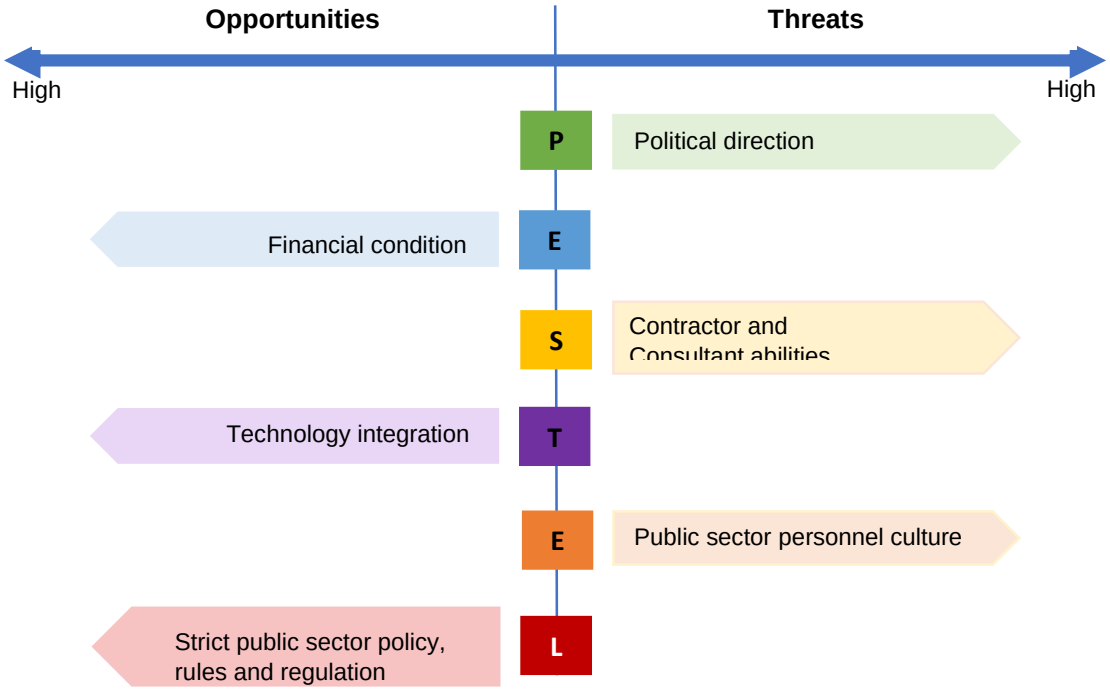

Figure 5. PESTEL Analysis On Project Delivery Method Decision-Making For Public Sector Construction Projects (Johnson et al., 2016, pg 36)

5.1 Political Direction

The political direction is the decisive factor in the public sector construction industry, which formalises the government policy regulating a prescriptive and authoritarian PDM selection approach. Due to multi-stakeholder involvement, political imperatives that normally circulate as project objectives in public project planning have various dimensions (Damoah & Kumi, 2018; Q. P. Zhong et al., 2022). Politicians typically have particular policy aims in mind, such as encouraging the growth of local businesses, providing more employment opportunities, or emphasising environmentally sound infrastructure.

In the United Kingdom, in the 1990s, the Labour Party, led by Tony Blair, significantly reduced government spending by encouraging private involvement in financing and operating public facilities through the Private Finance Initiative (PFI) delivery method. Hodge and Greeve (2017) asserted that this method provides a political advantage whereby the cost incurred through private financing is considered an invisible borrowing concept. This method drastically became popular in liberal nations and developed countries in the 1990s for developing public infrastructures such as airports, railways, ports, and other essential facilities to reduce government spending (Davies et al., 2019). The introduction of the PFI approach changes government policies on taxes and bonds, which help to stimulate private sector involvement, indirectly leading to a stronger private organisation. However, in 2018, the UK Government, under the Conservative Party, announced a new delivery policy in Budget 2018 for no longer relying on the PFI approach in public sector projects due to several issues, whereby currently the delivery method is determined based on the Centre of Best Practice (HM Treasury, 2018).

In developing countries, such as Malaysia, the PFI approach was embraced in 2009 after changes in government leadership led by former prime minister Najib Razak. His policy is to build stronger private organisations by creating more capital investment in Malaysia to boost the country's economy and reduce the country's deficit (UKAS JPM, 2009). However, the PFI approach was deprioritised post-General Election (GE) in 2018, as the new government believes the PFI project is an ineffective investment that cause the country to accumulate more debts. The Public Account Committee (PAC) report in March 2015 revealed that the PFI program is an off-budget government loan that may cast curiosity and not reflect the actual financial position of the government, including contingent liability figures, deficit calculations, and government debt. In 2023, the government under Anwar Ibrahim reformed the public-private partnership strategy to enhance its advantages for the populace and the nation, promote private investment, and mitigate future financial repercussions on the government (BERNAMA, 2023).

Thus, the political orientation critically influences the decision-making process and influences PDM selection to fit its intended imperative. Practically, value for money and the project's impact on public socioeconomic development are the main objectives of public projects. However, the political direction that administers public project planning significantly impeded the adoption of various potential appropriate PDMs, which is considered a threat to project delivery policy stability.

5.2 Financial Conditions

The government's financial condition, which relates to the country's economic stability, is an opportunity that continuously encourages the public sector to practice proliferated PDM in the construction industry. Developed and developing countries with scarce resources tend to adopt alternative delivery methods without analysing the appropriateness of the project and the organisation's abilities with the delivery method. This strategy may resolve economic difficulties in a short period but does not improve the country's economic sustainability over the period, which may result in debt accumulation in the future.

Herrera (2007) asserted that the government needs to increase the efficiency of public project spending to achieve the targeted productivity growth that will significantly increase GDP growth. Investment in public projects can lead to short-term higher economic growth if the government efficiently and accountably manages government spending (Warner, 2014). Depressing economic activity and deficit budgets occur when the government's total spending does not tally with the revenues (Gomes et al., 2019). In micro-economic, economic efficiency prioritises the anticipated social benefit of the infrastructure projects over the marginal cost of public expenditures (Marketline Industry Profile, 2018). Thus, government expenditures and public project delivery require innovativeness and effectiveness (Johnson et al., 2016), besides accountability and value for money.

Aliza et al. (2011) state that the public sector is responsible for ensuring the effective delivery of services and infrastructure projects by fully utilising public monies according to the development plan. The liability of ineffective project delivery will fall on the ruling government, which is vulnerable to media and opposition group scrutiny and may be politically damaging. Thus, the government needs to review PDM as a business model to define a good return on investment for the country rather than presuming the delivery method is only a project execution mechanism. It will be a good opportunity for the public sector to bolster economic growth with efficient public project delivery by defining an appropriate PDM through descriptive assessment according to the country's economic condition.

5.3 Contractor and Consultant Abilities

Social factors of the contractor and consultant's abilities in adopting alternative delivery methods cause a significant threat to the government from introducing proliferated potential workable PDM. Developing countries are grappling with the issue of insufficient numbers of competent consultants and capable contractors to manage a new project operation and contracting system. Jaafar and Radzi (2012) asserted that the development of public projects is solely to obtain social support from the community. However, demographic factors in a multi-ethnic society like Malaysia sometimes necessitate realignment of the development and social needs, preventing the government from exploring more effective project delivery.

The government introduced the New Economic Policy (NEP) in 1970 to preserve national unity and restructure the socioeconomic imbalances of multi-racial societies by introducing a special allocation policy in public project acquisitions for indigenous-owned companies. The incapable or under-capacity contractors or consultants do not buy in with the alternative delivery methods. Besides, Love et al. (2010) also indicate that in Australia, most contractors are unwilling to commence public sector projects under a fixed-price contract, which is practically used in integrated delivery due to inflation, financing interest, and skill shortage. Moreover, a study by Pakkala (2002) on the alternative delivery method for public infrastructure projects reveals that architects and engineers prefer a segmented delivery approach to alternative delivery due to the authority of project control and design liability.

Incompetence and uncredible consultants and contractors could cause underperformance or unsuccessful project execution. Responsible agencies such as the Construction Industry Development Board (CIDB) or related agencies should be aware of the proliferated PDMs in the construction market and play their role by educating and providing appropriate training for the practitioners. Moreover, the accessibility of capable contractors, competent consultants, advanced technology, and sufficient materials on the external market is a significant constraint on applying various PDMs in the public sector, especially in developing countries.

5.4 Technology Integration

Nowadays, the public sector encourages the adoption of innovative and advanced technology in developing infrastructure projects. Besides, the evolution of PDM in the public sector is related to the progression of construction technology (Jaafar & Nuruddin, 2012). Alternative delivery methods seem more reliable considering the construction industry's rapid growth, increased construction project size and complexity, financial challenges, political and social considerations, and information technology evolution (Gajurel, 2014). Besides, Buertey et al. (2018) reveal that traditional delivery is irrelevant and impedes efficient procedures, technology development, and application. Separating the design and construction process creates an adversarial relationship between the parties involved and inhibits innovation and sustainability execution (Miller et al., 2009). For instance, BIM technology is not practical for every delivery method; the character of BIM requires information exchange and integration between project team members. Thus, a good understanding between project team members, especially on client requirements, is essential for effective execution in traditional delivery methods.

In Malaysia, CIDB is working towards introducing Industry Revolution 4.0 (IR4.0) in the local construction industry by emphasising the application of recent technology tools like the Industrialized Building System (IBS) and BIM (CIDB, 2020). The government policy for IBS technology adoption in public construction projects with values higher than MYR10 million has expanded technology usage. CIDB (2020) reveals that almost 81% of public construction projects embrace IBS technology. However, public organisations are not thoroughly analysing the technology's compatibility with the project delivery approach. Generally, construction technology such as IBS and BIM will likely improve the project's performance. USDOT (2006) reveals that a highly complex project's success depends on the delivery method's effectiveness in using new technology and construction techniques. Not all construction technology applies to every delivery method; the technology character must satisfy the different delivery methods, which means one size does not fit all (Liu et al., 2019).

Construction technology integration in project execution allows the public sector to adopt various PDM in public sector construction projects. Integrating construction technology effectively minimizes inefficiencies in project execution by expediting and streamlining complex activities, enhancing productivity, and achieving sustainable outcomes. Thus, public sector organisations should prioritise technology adoption, invest in workforce training and support, research technology solutions extensively, and regularly review and update their technology strategies to align with industry best practices to avoid inappropriate construction technology management.

5.5 Public Sector Personnel Culture

The environmental factor from the public sector perspective is related to a broader aspect of the project environment, such as public sector organizations' internal and external environment and natural environment factors. The natural environment factor is insignificant in the PDM selection. Public sector obligation in environmental sustainability for project development is stated in every contract, either in the traditional or alternative delivery methods. Typically, government contracts, such as those in the United Kingdom and Malaysia, establish special allocations in environmental sustainability by obliging contractors to ensure that high measures are taken to control environmental issues (CIDB, 2015).

Scholars reveal that the internal and external environment of the public sector significantly affects the decision-making process for PDM selection. The internal environment factors induce a big barrier in deploying alternative delivery methods, whereby a lack of expertise and knowledgeable public sector personnel in dealing with various PDMs could impede the public sector from executing the project with various delivery approaches. A study by CIOB (2010) on United Kingdom construction project delivery reveals that 77% of respondents believe inexperienced clients and a lack of experts on an alternative delivery method often lead to poor project management.

The underlying culture in the public sector organisation also plays a vital role in selecting appropriate and effective project delivery approaches. Love et al. (2008) assert that the culture of uncertainty avoidance among public sector decision-makers influences the delivery method selection. Decision-makers tend to select proven workable PDMs in previous projects rather than taking a risk by choosing an unfamiliar delivery method. Risk avoidance culture in public sector organisations inhibits knowledge and skill improvement in profilerated PDMs (Antoniou et al., 2016). Generally, project delivery practice in the public sector is coherent with the

culture of the particular community and its economic and administrative system configuration (Abbasi & Al-mharmah, 2000).

Public sector organisation avoidance culture causes a threat to the practice of descriptive assessment on project delivery appropriateness. The public sector personnel are complacent with traditional delivery due to the government's lack of exposure and education on alternative delivery benefits. Durdyev et al. (2020) assert that public organizations' lack of knowledge and awareness are the main barriers to project delivery innovation. Besides, a rigid and authoritative working culture that complies with a deep-rooted hierarchical structure and incumbent rules and guidelines causes bureaucracy and cultural change constraints.

5.6 Strict Public Sector Policy, Rules, and Regulations

Legal factors are the opportunities for public sector organisations to adopt various delivery methods in executing public projects. Mahdi & Alreshaid (2005) assert that project delivery's regulatory and statutory aspects are critical in selecting appropriate delivery methods. However, the primary barriers to adopting numerous delivery methods in the public sector are rigid regulatory and legal requirements, risks and contract management, and procurement principles (Ghavamifar & Touran, 2008).

Regulations and guidelines in the public sector are closely aligned with government policy that governs the judgment of public sector decision-makers. Strict public sector policies, rules, and guidelines aim to ensure transparency, accountability, and the best use of public resources. Public sector organisations must follow these policies and guidelines rigorously to maintain public trustworthiness.

In the United States, for the past decades, public procurement regulations have prohibited public sector agencies from employing alternative project delivery (Moynihan & Harsh, 2016). Touran et al. (2009) asserted that public procurement regulations outlined based on The Brooks Act ruled that public agencies should deploy traditional delivery methods for public sector project execution. However, in 1996, US Congress approved the 'Clinger-Cohen Act' that permitted flexibility for public sector agencies to employ alternative project delivery in construction and infrastructure projects (Perkins, 2009).

Thus, the public sector has the opportunity to revise the PDM selection policy and maintain control of its strict rules and regulations according to improvised policies. This structured and descriptive PDM decision-making process should be well-documented, transparent, and based on objective evaluation criteria to ensure fair assessment and effective project delivery to achieve its value-for-money purposes.

6.0 CONCLUSION

A systematic literature review reveals studies on PDM decision-making are rich and continuously updated from multi-angle year by year. Some scholars focus on explanatory and exploratory solutions for decision-making tools, and some studies concentrate on factors affecting PDM decision-making. However, very few studies emphasise the project owner's micro-environment perspective to apply theories of PDM decision-making, especially for the public sector. The public sector is a non-profit organisation with different goals and structures than the private sector. Besides, the best practice in a certain country does not apply to another country due to several conditions. Political, economic, social, technological, environmental, and legal conditions are substantial for the public sector. These factors determine the direction of a public organisation. An under-assessment of these factors could cause unreliable anticipation and response to external influences to build more informed decision-making and improved strategies for providing better public services in addressing societal needs. The public sector's macro-environment analysis helps to develop an ameliorated understanding of the external influences and challenges that may affect governmental operations, policies, and services.

This paper comprehensively reviews the public sector's macro-environment perspective in applying descriptive and structured PDM decision-making for public sector construction projects. Based on a systematic literature review, the public sector macro-environment opportunities and threats in PDM decision-making are assessed using a strategic management tool, the political, economic, social, technological, environmental, and legal analysis framework. Findings reveal that political direction, consultant and contractor abilities, and public sector personnel culture are significant threats that influence the public sector to uphold prescriptive and authoritarian decision-making in PDM selection. Financial conditions, technology integration, and strict public sector policy, rules, and regulations are significant opportunities for the public sector to improvise if determining to adopt various potential PDMs in public sector construction projects. An adequate understanding

of the public sector macro-environment perspective in adopting proliferated PDMs contributes to different philosophical views on public sector PDM decision-making. The findings of this paper are substantial in establishing relevant criteria for developing a workable PDM decision-making framework for the public sector. It is applicable for further explanatory and exploratory studies with empirical and hard science analysis to enrich the understanding of public sector PDM decision-making.

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