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DEVELOPING MAINTENANCE STRATEGY FRAMEWORK FOR MASJID KARIAH IN KELANTAN STATE, MALAYSIA

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DEVELOPING MAINTENANCE STRATEGY FRAMEWORK FOR MASJID KARIAH IN KELANTAN STATE, MALAYSIA

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of the requirements for the degree of
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I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

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ABSTRACT

Masjid kariah in Kelantan are community-managed facilities that support worship and wider social functions, yet their maintenance practices often remain reactive, fragmented, and weakly linked to systematic planning and measurable performance. This study aimed to develop a performance-based maintenance planning framework for *Masjid kariah* in Kelantan State, Malaysia by integrating maintenance strategy criteria with maintenance performance measurement dimensions grounded in recognised maintenance and facility management standards. An exploratory sequential mixed-method design was adopted. First, a critical literature review was undertaken to establish the conceptual basis and initial constructs. Second, a two-round Delphi process was conducted to refine and validate the maintenance constructs, dimensions, and indicators. Third, the refined instrument was empirically tested through a structured questionnaire survey administered to committee members of *Masjid kariah* in Kelantan, followed by measurement validation and hypothesis testing using Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA), and Partial Least Squares Structural Equation Modelling (PLS-SEM). Finally, the proposed framework was independently reviewed by a separate expert panel to assess its practical applicability and contextual fit. The findings confirm that *Masjid kariah* Maintenance Planning (MKMP) can be represented through three Maintenance Strategy Criteria (MSC), namely Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM), and Unplanned Maintenance (UM), influenced by seven Maintenance Performance Measurement (MPM) dimensions. The PLS-SEM results identify Planning and Scheduling, Resource Allocation, Assessment, and Service Quality as the principal operational drivers shaping maintenance planning decisions. These findings indicate that stronger work programming, resource readiness, routine assessment, and service verification can increase planned maintenance practices and reduce reliance on unplanned, complaint-driven repairs. Although Organisation Management, Financial Provision, and Safety and Health show weaker direct effects in the structural model, expert validation confirms their continuing importance as contextual enablers that govern feasibility, continuity, accountability, and safety assurance. Based on the integration of empirical modelling and expert review, the study proposes a refined maintenance planning framework that retains the validated constructs while strengthening their practical operationalisation for *Masjid kariah* committees. The refined framework distinguishes between operational drivers and contextual enablers and is supported by implementation mechanisms and control measures such as periodic AJK sharing sessions and basic training, a dedicated maintenance fund with cost-control measures, tiered procurement procedures, safety-critical prioritisation, and post-work verification practices. Overall, the study contributes a validated and practice-oriented framework that can guide mosque committees, religious authorities, and supporting technical agencies in institutionalising more systematic, transparent, and sustainable maintenance planning for *Masjid kariah* in Kelantan.

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LIST OF SYMBOLS

Symbols

α	Alpha
R^2	Coefficient of Determination on Regression
R	Correlation
β	Parameters of the Variables
Y	Dependent Variables
X_1	Independent Variables
ε	Error Estimation
Q^2	Predictive Relevance

LIST OF ABBREVIATIONS

Abbreviations

B.S.	British Standard
CVI	Content Validity Index
HVAC	Heating, Ventilation, and Air Conditioning
ICT	Information and Communication Technology
JAHEAIK	Jabatan Hal Ehwal Agama Islam Negeri Kelantan
JAIS	Jabatan Agama Islam Selangor
JAKIM	Jabatan Kemajuan Islam Malaysia
JKR	Jabatan Kerja Raya
KKR	Kementerian Kerja Raya
MAIN/SIRC	Majlis Agama Islam Negeri
MAIK	Majlis Agama Islam Kelantan
MAIS	Majlis Agama Islam Selangor
MCO	Movement Control Order
MPM	Maintenance Performance Measurement
PAID	Pejabat Agama Islam Daerah
S.A.W	Sollahu Alaihi Wasallam
SPSS	Statistical Package for the Social Science
S.W.T.	Subhanahu Wataala
UPMD	Unit Pengurusan Masjid Daerah

PLS-SEM	Partial Least Squares-Structural Equation Modelling
MSC	Maintenance Strategy Criteria
PPM	Planned Preventive Maintenance
PCM	Planned Corrective Maintenance
UM	Unplanned Maintenance
OM	Organisation Management
PS	Planning and Scheduling
FP	Financial Provision
RA	Resource Allocation
SQ	Service Quality
AS	Assessment
SH	Safety and Health

LIST OF NOMENCLATURES

Nomenclatures

ﷺ Sallallahu Alaihi Wasallam

CHAPTER 1
INTRODUCTION

1.1 Introduction

The mosque (*masjid*) has long served as the nucleus of Muslim community life, functioning not merely as a place of worship but also as a centre for education, welfare, and social cohesion (Hamdan et al., 2024). Within this framework, the *Masjid Kariah* – a community-level mosque – embodies the essence of Islamic stewardship (*khilāfah*) through collective maintenance, order, and discipline. The Qur'an enjoins the preservation of such sacred institutions in Surah An-Nūr (24:36):

فِي بُيُوتٍ أَذِنَ ٱللَّهُ أَن تُرۡفَعَ وَيُذۡكَرَ فِيهَا ٱسۡمُهُۥ يُسَبِّحُ لَهُۥ فِيهَا بِٱلۡغُدُوِّ وَٱلۡأٓصَالِ٣٦
[النور: 36]

« [Such niches are] in mosques, which Allah has ordered to be raised and that His name be mentioned therein, exalting Him within them in the mornings and the evenings (36) »

This verse reflects a divine command for cleanliness, safety, and dignity in maintaining places of worship. Hence, mosque maintenance transcends physical upkeep; it signifies obedience, responsibility, and devotion to community well-being. However, many *Masjid kariah* in Malaysia struggle with maintenance management due to limited financial resources, lack of skilled personnel, and unstructured planning systems (Muin, 2024). As these mosques deteriorate, their role as centres of faith and unity becomes increasingly constrained, highlighting the need for a systematic, performance-based maintenance planning approach that integrates both spiritual and managerial perspectives.

In Malaysia, more than 6,000 mosques exist nationwide, with *Masjid kariah* forming the largest category, while in Kelantan State alone, 584 community mosques operate under local Islamic councils (Department of Statistics Malaysia, 2023; JAKIM, 2021). In Malaysia, the development and management of mosques are administered through a multi-tiered system involving both federal and state religious authorities. The process begins with site approval and project endorsement by the respective State

Islamic Religious Council (SIRC) such as MAIK in Kelantan, which acts as the legal trustee (mutawalli) under the State Islamic Religious and Malay Customs Enactment (Enactment No. 2, 1994). Construction and design are usually coordinated with technical agencies like JKR, JAWHAR, and local authorities in accordance with the Local Government Act 1976 (Act 171) to ensure safety and compliance with development standards. Upon completion, mosques are formally registered under the SIRC and categorised as State Mosque, District Mosque, or *Masjid kariah*, with appointed officers (e.g. Nazir, Imam, Secretary, Treasurer) responsible for daily operations. Funding is derived from state and federal allocations, *zakat* and *wakaf* resources, and community donations. During occupancy, SIRC oversees policy and financial governance, JAKIM provides national guidelines and training, while mosque committees manage local administration, worship activities, and building upkeep through volunteer participation. This integrated yet decentralised model sustains Malaysia's mosques as religious, educational, and social institutions that combine central oversight with community stewardship.

Funding for mosque development and maintenance is derived from state and federal allocations, *waqf* and *zakat* funds, as well as community donations. During occupancy, SIRC oversees policy and financial governance, JAKIM provides national guidelines and capacity-building programmes, while mosque committees manage local administration, worship activities, and facility upkeep through volunteer participation. This integrated yet decentralised model sustains Malaysian mosques as religious, educational, and social institutions, combining central oversight with community stewardship.

The management of *Masjid kariah* in Malaysia, however, predominantly adopts a reactive maintenance approach, where repair works are carried out only after defects occur – resulting in inefficiency, higher operational costs, and reduced asset performance (Yusof et al., 2025). The British Standard 3811 (1993) defines maintenance as "*the combination of all technical and administrative actions intended to retain or restore an item to a state in which it can perform a required function*". This standard provides the conceptual foundation for this study, encompassing three principal strategies: planned preventive, planned corrective, and unplanned maintenance. While BS 3811 remains an authoritative reference, Malaysia has progressively adopted international frameworks to strengthen its facility management practices.

Among them, the MS ISO 41001:2018 Facility Management – Management Systems – Requirements with Guidance for Use (Department of Standards Malaysia, 2018) establishes a systematic structure for managing facility performance through resource optimisation, stakeholder integration, and continual improvement. Together, BS 3811 and MS ISO 41001:2018 reflect the evolution of Malaysia's maintenance management – from a reactive, ad hoc system toward a holistic, evidence-based, and performance-driven discipline aligned with global standards of facility management.

Building upon these foundations, this study – Developing Maintenance Planning Framework for *Masjid kariah* in Kelantan State, Malaysia – aims to formulate a systematic and performance-based maintenance planning model tailored to community mosques. Grounded in the principles of British Standard 3811 (1993) and guided by the framework of MS ISO 41001:2018, the study addresses the issues and challenges of mosque maintenance, identifies performance indicators for evaluating *Masjid kariah* maintenance planning, and develops a framework applicable to the Kelantan context. By integrating these standards, the study reinforces both academic rigour and practical relevance in Malaysia's building maintenance environment. Ultimately, the proposed framework aspires to enhance operational efficiency, sustainability, and accountability in *Masjid kariah* management in preserving their functional integrity and spiritual significance as the heart of Muslim community life.

1.2 Problem Statement

There are four main problem statements of this study i.e. (1) issues of *Masjid kariah* maintenance in Kelantan State, (2) challenges in maintenance planning and implementation, (3) gaps in existing literature on *Masjid kariah* and (4) policy and rational for the present study (novelty).

1.2.1 Issues of Masjid Kariah Maintenance in Malaysia

Mosques are central institutions for spiritual development and social cohesion in Muslim communities. In Kelantan State, *Masjid kariah*, which form the largest category of religious buildings (JAKIM, 2021) – often face recurrent maintenance challenges, including structural deterioration, limited financial resources, and the absence of preventive maintenance planning. Studies by Muin et al. (2016), Muin

(2017) and Zolkepli & Latiffi (2021) reveal that while state and district mosques benefit from structured oversight, community mosques depend heavily on donations and volunteers, resulting in reactive, short-term repairs rather than long-term asset management. According to the British Standard 3811 (1993), maintenance involves "*all technical and administrative actions intended to retain an item in, or restore it to, a state in which it can perform its required function*". Yet, most *Masjid kariah* fail to adopt this systematic definition, leading to inconsistent maintenance practices and operational inefficiencies.

A recent systematic review by Yusof et al. (2025) identified six critical dimensions of mosque maintenance issues in Malaysia, particularly among *Masjid kariah*: financial constraints, limited technical expertise, weak leadership and governance, architectural heritage conflicts, rural–urban contextual differences, and the absence of performance-based frameworks. These factors collectively hinder the sustainability of mosque facilities and their ability to serve as safe, inclusive, and functional community hubs. The implications of such neglect extend beyond physical deterioration to safety, service quality, and the religious sanctity of the mosque. Inadequate maintenance compromises user comfort and increases operational risks (Radwan, 2021). Although Section 95 of the Street, Drainage and Building Act 1974 (Government of Malaysia, 1974: Act 133) legally mandates building inspections and periodic maintenance, such provisions are rarely enforced for religious buildings, leaving community mosques without structured oversight and accountability mechanisms.

1.2.2 Challenges in Maintenance Planning and Implementation

Maintenance planning in Malaysia is hindered by managerial, technical, and institutional obstacles. Hauashdh et al. (2020) categorised the main challenges into four areas i.e. management, technical, human resource, and finance – each directly affecting mosque maintenance. Weak coordination between State Islamic Religious Council (SIRC), local councils and mosque committees has resulted in fragmented maintenance execution (Muin, 2017; Muin et al., 2016; Omar et al., 2016). The Local Government Act 1976 (Government of Malaysia, 1976: Act 171) empowers local authorities to oversee and maintain public facilities, yet practical collaboration with religious councils remains minimal. Consequently, many mosques operate without clear maintenance

policies or standardised procedures. Furthermore, the lack of skilled personnel and technical training exacerbates inefficiencies (Lee & Zainordin, 2019).

Operationally, mosque maintenance remains reactive and seldom integrates performance monitoring or modern management tools. MS ISO 41001:2018 Facility Management – Management Systems (Department of Standards Malaysia, 2018) underscores the importance of integrated management systems that align organisational objectives, resource optimisation, and performance evaluation. The absence of such a framework within *Masjid kariah* indicates a significant deviation from global best practices. Yusof et al. (2025) confirmed that *Masjid kariah* in Malaysia lack structured frameworks comparable to global standards, underscoring the need for integrated and culturally contextualised models. Without data-driven decision-making or benchmarking indicators, maintenance activities lack accountability and transparency. This disconnection between statutory requirements (under Acts 133 and 171) and the practical realities of mosque-level management highlights a systemic implementation gap that compromises accountability, transparency, and efficiency – one which this study aims to address.

1.2.3 Gaps in Existing Literature on Masjid Kariah and Policy

Existing research on mosque maintenance remains fragmented and largely descriptive rather than analytical. Previous studies have primarily focused on isolated aspects such as cost reduction (Ibrahim, 2014), building repairs (Mazlan et al., 2018), or facility management at state-level mosques (Muin, 2017), without integrating maintenance-strategy criteria and performance evaluation. Comparative research on public facilities (Graubner et al., 2016; Gala Mong et al., 2018) offers robust methodologies for assessing maintenance performance but remains under-applied in religious contexts. Moreover, Yusof et al. (2025) identified that most studies lack quantifiable performance indicators specific to mosque facilities, reinforcing the need for a structured, performance-based framework tailored to Malaysia's religious institutions. From a regulatory standpoint, the *Enactment of the Islamic Religious and Malay Customs Council of Kelantan 1994* (Enactment No. 2, 1994) defines MAIK's custodial authority but omits detailed technical procedures for inspection or maintenance assessment. This policy vacuum, coupled with limited enforcement of Acts 133 and 171, perpetuates an ad-hoc and reactive maintenance culture.

At the policy level, national planning instruments such as the National Physical Plan 4 (RFN4, 2025–2045) and the forthcoming Thirteenth Malaysia Plan (RMK-13, 2026–2030) emphasise sustainable spatial development, resilient infrastructure, and inclusive community well-being (Economic Planning Unit, 2025; PlanMalaysia, 2025). However, these long-term frameworks pay limited attention to systematic maintenance and facility management strategies for community-based religious buildings. However, neither document explicitly integrates maintenance planning for community-based religious facilities. Likewise, the *Facility Management Strategy for the Construction Industry 2021–2025* (CIDB, 2021) recognises structured facility management but focuses primarily on industrial and commercial assets. This misalignment between research, national policy and local practice highlights a critical need for an integrative framework that bridges theory, governance and implementation in the context of *Masjid kariah* maintenance.

1.2.4 Rational for the Present Study (Novelty)

This study addresses the recurring inefficiencies and regulatory fragmentation in mosque maintenance by proposing a structured and performance-based maintenance planning framework for *Masjid kariah* in Kelantan State, Malaysia. The framework aims to integrate international standards – BS 3811:1993 and MS ISO 41001:2018 with Malaysia's legal and institutional frameworks, namely the Street, Drainage and Building Act 1974 (Act 133), Local Government Act 1976 (Act 171), and strategic national development plans (RFN4, 2025–2045; RMK-13, 2026–2030). Although national policy documents emphasise sustainability and infrastructure resilience, maintenance planning for community religious facilities remains underrepresented (PlanMalaysia, 2025; EPU, 2025). Previous research (Ali et al., 2013; Abdullah et al., 2017; Hauashdh et al., 2020; Yusof et al., 2025) confirms that the success of maintenance strategies depends on measurable organisational, financial and safety indicators. Yet, mosque maintenance continues to rely on reactive, short-term responses rather than data-driven systems. Thus, this study introduces an integrated framework that connects national policy, facility management standards, and local religious governance under MAIK to strengthen planning efficiency, safety compliance, and long-term sustainability. This approach not only fills the empirical and policy gaps

identified but also represents a novel contribution to the contextual application of international facility management standards within Malaysia's religious infrastructure.

Therefore, there is a need to develop a comprehensive and performance-based maintenance planning framework for *Masjid kariah* in Kelantan State to enhance the mosque maintenance management. In this regard, the study is guided by four key research questions, research aim, four research objectives, scope of study, research methodology, definition of terms, significance of study and the structure of the thesis.

1.3 Research Questions (RQs)

There are four research questions to achieve the objective of this study:

RQ1: What are the main issues and challenges associated with mosque maintenance in Malaysia?

RQ2: What are the key performance indicators for current maintenance planning of *Masjid kariah* from Malaysia's perspective?

RQ3: How effective are the identified performance indicators in evaluating the current maintenance planning of *Masjid kariah* in Kelantan State?

RQ4: How can maintenance planning framework could be enhanced to address the issues and improve outcomes for *Masjid kariah* in Kelantan State?

1.4 Research Aim

To develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.

1.5 Research Objectives (ROs)

To achieve the aim of this study, several objectives are outlined as follows:

RO1: To address the issues and challenges related to mosque maintenance as a foundational aspect

RO2: To investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective

RO3: To evaluate the performance indicators on maintenance planning of *Masjid kariah* in Kelantan State

RO4: To develop a framework for Masjid Kariah's maintenance planning in Kelantan State, Malaysia

The research questions and objectives are systematically aligned to ensure a coherent progression of inquiry. RQ1 and RO1 establish the foundational understanding of issues and challenges related to mosque maintenance through in-depth literature review approach. RQ2 and RO2 identify and validate the key performance indicators of maintenance planning via an in-depth literature review and Delphi method involving expert panels. RQ3 and RO3 empirically evaluate these indicators using the PLS-SEM method to assess their significance and interrelationships. Finally, RQ4 and RO4 synthesise the findings to develop and validate a comprehensive maintenance planning framework for *Masjid kariah* in Kelantan State. This alignment reflects the exploratory sequential mixed-method design adopted in this study, ensuring both theoretical and practical contributions to mosque maintenance management.

1.6 Research Hypotheses

This study has developed a hypothetical model called the mosque Maintenance Planning Model using the SmartPLS Statistics software application to align with Research Objective Three (RO3) and Research Question Three (RQ3). This model comprised seven main constructs based on the conceptual framework of this study, as follows:

H1 : Organisation Management (OM) has a significant positive influence on *Masjid kariah* Maintenance Planning (MKMP)

H2 : Planning and Scheduling (PS) has a significant positive influence on MKMP

H3 : Financial Provision (FP) has a significant positive influence on MKMP.

H4 : Service Quality (SQ) has a significant positive influence on MKMP.

H5 : Assessment (AS) has a significant positive influence on MKMP.

H6 : Resource Allocation (RA) has a significant positive influence on MKMP.

H7 : Safety and Health (SH) has a significant positive influence on MKMP.

Figure 1.1 shows the structure of the hypotheses of this study, which refer to the main scope.

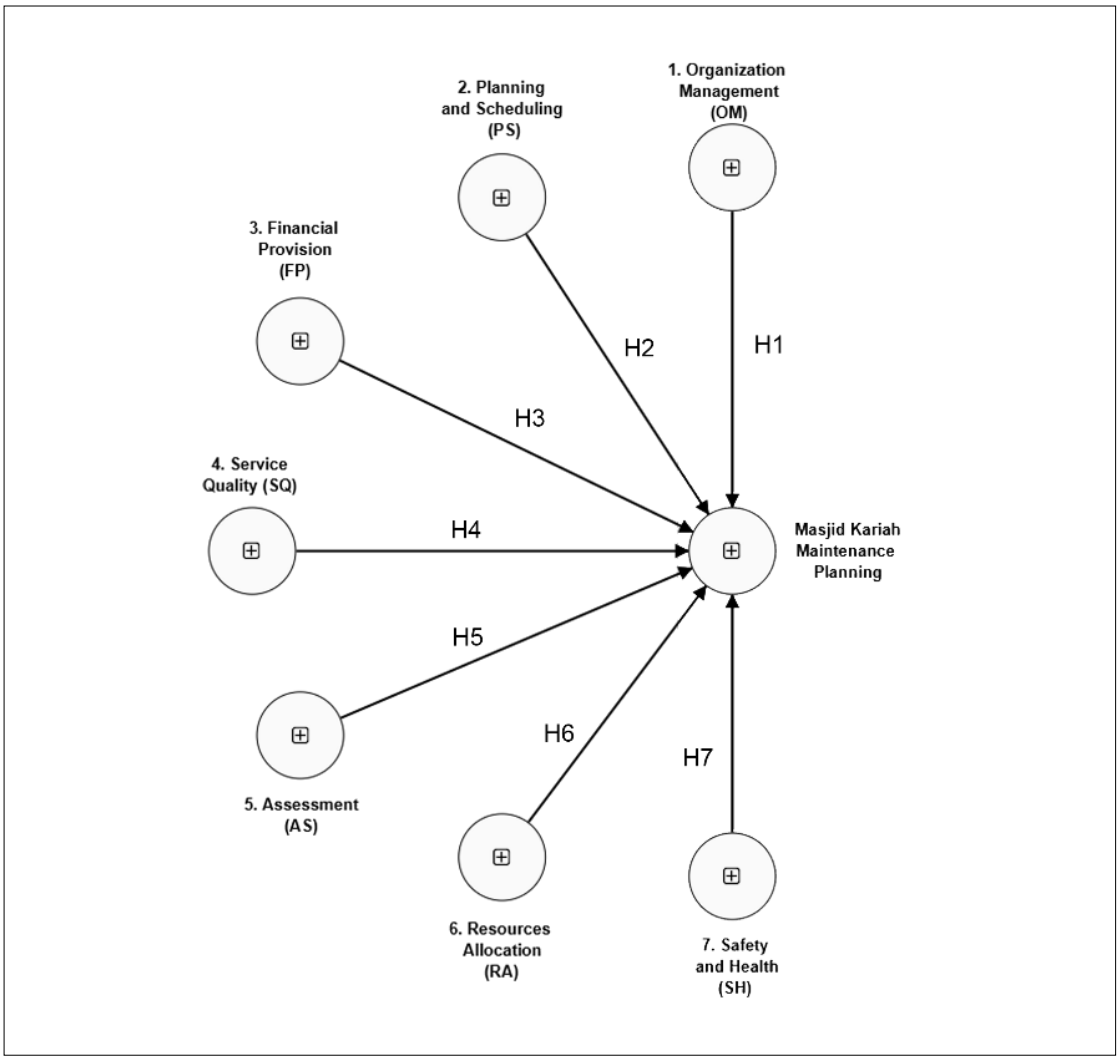

Figure 1.1 Hypotheses of the Study

1.7 Scope and Delimitation of Study

This study focuses on the development of a performance-based maintenance planning framework for *Masjid kariah* in the state of Kelantan, Malaysia. The scope of this study is defined by four major components: (1) the location of study, (2) the type of mosque institution, (3) the respondent group, and (4) the primary variables and dimensions assessed. The delimitations clarify the aspects intentionally excluded to maintain the study's focus.

1.7.1 Location and Institutional Scope

The study is geographically confined to Kelantan, one of Malaysia's states with the highest number of *Masjid kariah* (community mosques) under the supervision of the Majlis Agama Islam dan Adat Istiadat Melayu Kelantan (MAIK). The state was selected due to its extensive mosque network (584 *Masjid kariah* across 10 districts) and the institutionalised maintenance system coordinated through Jabatan Hal Ehwal Agama Islam Kelantan (JAHEAIK), Jabatan Kerja Raya (JKR), and the Unit Pengurusan Masjid Daerah (UPMD). These institutional linkages provide a structured yet practical environment to study community-based maintenance operations.

1.7.2 Type of Mosque Institution

The study is limited to *Masjid kariah* – community mosques that serve as local religious, educational, and social hubs for Muslim communities. Other community mosque typologies such as Government Mosque, State Mosque, and District Mosque are excluded to ensure homogeneity in operational scale, governance, and community involvement. *Masjid kariah* was chosen because it represents the grassroots level of religious infrastructure where resource constraints, volunteer management, and local governance strongly influence maintenance practices.

1.7.3 Respondents Group

Respondents in this study comprise two distinct groups: (1) expert panels engaged during the qualitative phase and (2) committee members involved in the quantitative phase.

i. Expert Panels (Qualitative Phase)

A total of 10 experts participated in the Delphi method, representing diverse professional backgrounds relevant to mosque maintenance and facility management. The experts were purposefully selected based on their institutional expertise and practical experience – including academicians, maintenance practitioners, Jabatan Kerja Raya (JKR) and officers from Unit Pengurusan Masjid Daerah (UPMD) and Jabatan Hal Ehwal Agama Islam Negeri Kelantan (JAHEAIK). Their participation ensured the credibility and relevance of the proposed indicators and constructs in developing the maintenance planning framework.

In the first round, semi-structured interviews were conducted to elicit professional insights into existing maintenance strategies and performance measurement indicators relevant to *Masjid kariah*. In the second round, a structured Delphi questionnaire was administered to consolidate the qualitative inputs, refine the wording and scope of constructs, and prioritise the indicators through consensus-based ratings. Importantly, the Delphi process in this study functioned as a construct refinement and prioritisation mechanism rather than a framework validation exercise.

The validation of the proposed maintenance planning framework was conducted as a separate stage using a dedicated expert review (five experts) to assess practical applicability, implement ability, and contextual fit to the *Masjid kariah* setting in Kelantan.

ii. Committee Members (Quantitative Phase)

The second group of respondents comprises 354 committee members (AJK Masjid) from 59 selected *Masjid kariah* representing all 10 districts in Kelantan – Kota Bharu, Pasir Mas, Pasir Puteh, Bachok, Machang, Tanah Merah, Kuala Krai, Jeli, Gua Musang, and Tumpat. The respondents include nazirs, deputy nazirs, secretaries, deputy secretaries, treasurers, and members of the Bureau of Development who are directly responsible for decision-making and implementation of maintenance activities at the community level.

The inclusion of both expert and community-level respondents provides a comprehensive multilevel perspective on maintenance planning: the expert panels contribute conceptual and professional validation, while the mosque committees provide empirical insights grounded in operational practice. This dual-respondent structure strengthens the robustness and triangulation of the research findings.

1.7.4 Primary Variables and Focus of Study

This study is centred on two main variables that form the foundation of the proposed planning framework for *Masjid kariah* in Kelantan:

i. Maintenance Strategy Criteria (MSC) as the dependent variable:

The MSC represents the outcome dimension of the study, referring to how maintenance works are planned, prioritised, and executed within mosque institutions. It follows the classification outlined in British Standard BS3811 (1993) and further refined through expert consensus and literature review (Chanter & Swallow, 2008; Wireman, 2013). The three criteria are:

i. Planned Preventive Maintenance (PPM) – periodic activities aimed at preventing deterioration of physical assets through scheduled inspections and minor repairs.
ii. Planned Corrective Maintenance (PCM) – pre-identified repairs to rectify minor defects before functional failure occurs.

iii. Unplanned Maintenance (UM) – unscheduled or emergency repairs conducted in response to sudden failures or safety concerns.

These three types of maintenance strategies reflect the operational readiness and decision-making responsiveness of mosque management bodies (Committee Mosque, UPMD and MAIK).

ii. Maintenance Performance Measurement (MPM) as the independent variable:

The MPM captures the determinants influencing maintenance effectiveness. It is derived from literature synthesis and expert validation, encompassing seven key indicators, all of which align with national guideline i.e. MS ISO 41001:2018 (Facility Management – Management Systems) and supported literature reviews. Table 1.1 shows the alignment of maintenance performance measurement indicators with facility management standard and supported depth literature reviews.

Table 1.1
Alignment of Maintenance Performance Measurement Indicators with Facility Management Standard

No.	Indicator	Alignment with MS ISO 41001:2018 (Facility Management – Management Systems)	Related Literature Review
1.	Organisation Management (OM)	Clause 5: Leadership & Clause 7: Support – *leadership commitment, policy, resources, and roles.*	(Waeyenbergh & Pintelon, 2002); (Ramly, 2002); (Smith, 2002); (Wireman, 2005); (Wordsworth & Lee, 2001); (Rozita, 2006); (Lee & Scott, 2009); (De Groote, 1995); (Adenuga & Raheem, 2010); (Ali, 2013); (Sapril et al., 2016); (Ahmad et al., 2018); (Ibrahim et al., 2009); (Ncamiso et al., 2022)
2.	Planning and Scheduling (PS)	Clause 6: Planning – *objectives, risks, and opportunities; maintenance scheduling and documentation*.	(A. Hauashdh, Jailani, & Rahman, 2022); (Hafizi et al., 2010); (Basiran, 2002); (E. M. A. Zawawi et al., 2011); (Yatim et al., 2011); (Radzuan, Hamdan, Hamid, & Abdullah-Halim, 2011); (Kreps, 1990); (DeCotiis & Summers, 1987); (Mazlan et al., 2018); (Madlock & Booth-Butterfield,

No.	Indicator	Alignment with MS ISO 41001:2018 (Facility Management – Management Systems)	Related Literature Review
			2008)
3.	Financial Provision (FP)	Clause 8.1: Operational Planning and Control – *ensuring financial and resource sufficiency*.	(Lavy et al., 2010); (Yasoa et al., 2019); (Razak et al., 2014); (Blessing et al., 2015); (Ali et al., 2016); (Gallimore & Penlesky, 1988); (Kamaruzzaman et al., 2016); (Au-Yong et al., 2014a); (Paulo et al., 2013); (Taillandier et al., 2011); (Adnan, 2015); (Ali, 2013); (Ncamiso et al., 2022); (Azlan, 2009); (Mong et al., 2018); (Parida & Kumar, 2006); (Ahmad et al., 2018); (Asharaf et al., 2012)
4.	Service Quality (SQ)	Clause 9: Performance Evaluation – *monitoring customer (user) satisfaction, service quality*.	(Douglas, 1996); (Waeyenbergh & Pintelon, 2002); (Lavy et al., 2010); (Zawawi et al., 2010); (Parasuraman et al., 1988); (Parasuraman & Berry, 1990); (Parasuraman et al., 1990); (Parasuraman et al., 1993); (Parasuraman et al., 1994); (Shandiz, 2015)
5.	Assessment (AS)	Clause 9.1: Monitoring, Measurement, Analysis & Evaluation – *asset condition and performance audit*.	(Ramly, 2003); (Azlan, 2009); (Muhey, 2012); (Hashim, 2006); (Ahmad et al., 2018); (Matos et al., 2021); (Al-Homoud et al., 2005)
6.	Resources Allocation (RA)	Clause 7: Support *(Resources, Competence, Awareness, Communication)*.	(Watson, 1998); (Tsang, 2002); (Cato & Mobley, 2002); (Newman, 2006); (Au-Yong et al., 2014b); (Mong et al., 2018); (Wireman, 2012); (Dzulkifli et al., 2021); (Ncamiso et al., 2022)
7.	Safety and Health (SH)	Clause 8.1: Operational Planning and Control	(Miles & Syagga, 1987); (Alner & Fellows, 1990); (Ramly, 2002); (Morris & Dennison, 1995); (Lewis et al., 2010); (Lee & Scott, 2009); (Lewis, 2012); (Rasdi & Utaberta, 2012); (Adewunmi et al., 2012); (Mutalib & Razali, 2013); (Yan et al., 2017); (Zawawi, 2009)

Source: Department of Standards Malaysia (2019) - MS ISO 41001:2018 Facility Management — Management Systems.

Each indicator serves as a performance dimension that directly affects the efficiency and sustainability of mosque maintenance planning. Collectively, these indicators ensure that maintenance strategies are implemented in compliance with Malaysian facility management standards while addressing the operational realities of *Masjid kariah*.

The conceptual framework was formulated to analyse the relationship between both variables, addressing Research Objective Three (RO3): to evaluate the performance indicators on maintenance planning of *Masjid kariah* in Kelantan State. The conceptual framework postulates that effective Maintenance Performance Measurement (MPM) positively influences Maintenance Strategy Criteria (MSC) decision-making. A higher level of organisational management, financial readiness, and safety control leads to improved implementation of preventive and corrective maintenance strategies.

The interaction between these variables enables data-driven decision-making and supports continuous improvement – consistent with the Plan–Do–Check–Act (PDCA) cycle embedded in MS ISO 41001. This framework thus provides an integrative model that connects performance indicators (independent variables) to maintenance outcomes (dependent variables), ultimately guiding mosque authorities to adopt a structured and sustainable approach to facility upkeep.

1.7.5 Delimitation of Study

The study deliberately excludes the following aspects to maintain methodological focus, research clarity, and contextual consistency within the Kelantan *Masjid kariah* environment:

i. State and district mosques:
   These mosques are excluded because they function under distinct administrative hierarchies and financial mechanisms governed by state-level authorities. Their maintenance budgets, staffing structures, and decision-making processes differ significantly from community-based *Masjid kariah*, making direct comparison impractical. Including them would compromise the homogeneity and contextual validity of the research findings.

ii. Technical assessment of building materials or engineering components:
   The study does not involve detailed technical evaluations of physical infrastructure, such as structural integrity or material deterioration analysis. Such assessments fall within the domain of engineering and

asset condition auditing, whereas this study focuses on managerial, financial, and organisational performance indicators. The exclusion ensures that the research remains aligned with its core objective—to develop a performance-based maintenance planning framework rather than a technical diagnostic model.

iii. Comparative analysis between states or mosque typologies:
To preserve contextual uniformity, this research limits its geographical scope to the state of Kelantan and its *Masjid kariah* network. Excluding other states or mosque categories (e.g., Masjid Negeri or Masjid Jamek) ensures that variations in governance structures, policy enforcement, and funding schemes do not distort the interpretation of results. This focus allows for a more precise evaluation of the maintenance planning ecosystem within a single institutional framework.

iv. Non-committee mosque users:
Input from general mosque users or congregants is excluded because their perspectives primarily concern user satisfaction, religious participation, and service delivery rather than strategic maintenance planning. The study instead prioritises respondents who are directly responsible for administrative, financial, and operational decisions, namely committee mosque, to ensure data reliability and managerial relevance.

1.8 Research Methodology

This study adopted an Exploratory Sequential Mixed-Method Design, integrating qualitative and quantitative approaches to develop a maintenance planning framework for *Masjid kariah* in Kelantan. The research design was organised into three main phases and operationalised through five sequential stages, as showed in Figure 1.2. The study was guided by two key standards: BS 3811 (1993: Glossary of Maintenance Management Terms in Terotechnology), which informed the maintenance strategy criteria, and MS ISO 41001:2018 (Facility Management — Management

Systems), which informed the maintenance performance measurement indicators. These standards formed the theoretical foundation of the proposed framework.

Phase I: Qualitative Exploration

i. Stage 1: Critical Literature Review and Problem Identification:
The first stage aimed to establish the theoretical and contextual foundation of the study by identifying the key issues, challenges, and constructs related to maintenance planning for *Masjid kariah* in Kelantan. This stage addressed RO1, which focused on exploring current maintenance practices, deficiencies, and relevant maintenance indicators through an in-depth literature review. The review covered journals, books, theses, conference proceedings, policy documents, and relevant standards. The findings from this stage identified the three indicators of maintenance strategy criteria, namely Planned Preventive, Planned Corrective, and Unplanned Maintenance, as well as seven indicators of maintenance performance measurement, namely Organisation Management, Planning and Scheduling, Resource Allocation, Service Quality, Assessment, Financial Provision, and Safety and Health. These findings established the preliminary conceptual and measurement foundation for the subsequent stages of the study.

ii. Stage 2: Qualitative Exploration and Delphi Refinement:
The second stage focused on the qualitative exploration, verification, and refinement of the constructs and indicators identified in Stage 1. This stage addressed RO2, which aimed to investigate the key performance indicators relevant to evaluating maintenance planning for *Masjid kariah* from Malaysia's perspective. At this stage, semi-structured interviews and Delphi rounds were conducted with a panel of 10 experts representing academia, maintenance practice, JKR, JAHEAIK, UPMD, and mosque administration. The Delphi process enabled the proposed constructs and indicators to be reviewed, clarified, and refined based on expert consensus. The outcomes of this stage strengthened the

conceptual structure of the study and ensured that the constructs were contextually relevant before quantitative validation was undertaken.

Phase II: Quantitative Validation

iii. Stage 3: Content Validity Assessment and Pilot Study:

The third stage involved the preliminary validation of the research instrument before the main survey. At this stage, the questionnaire developed from the literature review and Delphi findings was assessed for clarity, relevance, and suitability through content validity procedures. A pilot study was then conducted with 30 committee members from five selected *Masjid kariah* in Kelantan. This pilot phase served as a pre-test to evaluate the reliability and construct validity of the instrument prior to large-scale data collection. Preliminary analysis using SmartPLS confirmed that the instrument achieved acceptable internal consistency and validity thresholds. Minor linguistic refinements were also made based on respondent feedback. The findings from this stage confirmed that the questionnaire was appropriate and ready for the main survey.

iv. Stage 4: Main Survey and Quantitative Data Analysis:

The fourth stage focused on large-scale quantitative validation through questionnaire survey and statistical analysis. This stage addressed RO3, which aimed to evaluate the identified performance indicators on maintenance planning for *Masjid kariah* in Kelantan. Primary data were collected from committee members of selected *Masjid kariah* in Kelantan, including nazirs, deputy nazirs, secretaries, deputy secretaries, treasurers, and members of the Bureau of Development. The collected data were analysed using descriptive statistical analysis and inferential statistical analysis, particularly Partial Least Squares Structural Equation Modelling (PLS-SEM). The results from this stage provided empirical evidence to validate the measurement model and examine the structural relationships among the constructs.

Phase III: Framework Integration and Validation

v. Stage 5: Framework Development and Final Expert Validation:

The fifth stage focused on integrating the qualitative and quantitative findings to develop the final maintenance planning framework for *Masjid kariah* in Kelantan. This stage addressed RO4, which aimed to develop a maintenance planning framework for *Masjid kariah* in Kelantan, Malaysia. Based on the findings from the previous stages, the framework was formulated and then validated through face-to-face interviews with a separate panel of five experts consisting of academicians and industry practitioners who were not involved in the earlier Delphi rounds. This independent validation process ensured that the proposed framework was reviewed in terms of clarity, relevance, practicality, and applicability. Finally, the study was concluded by reflecting on the achievement of the research objectives, and recommendations for future research were outlined.

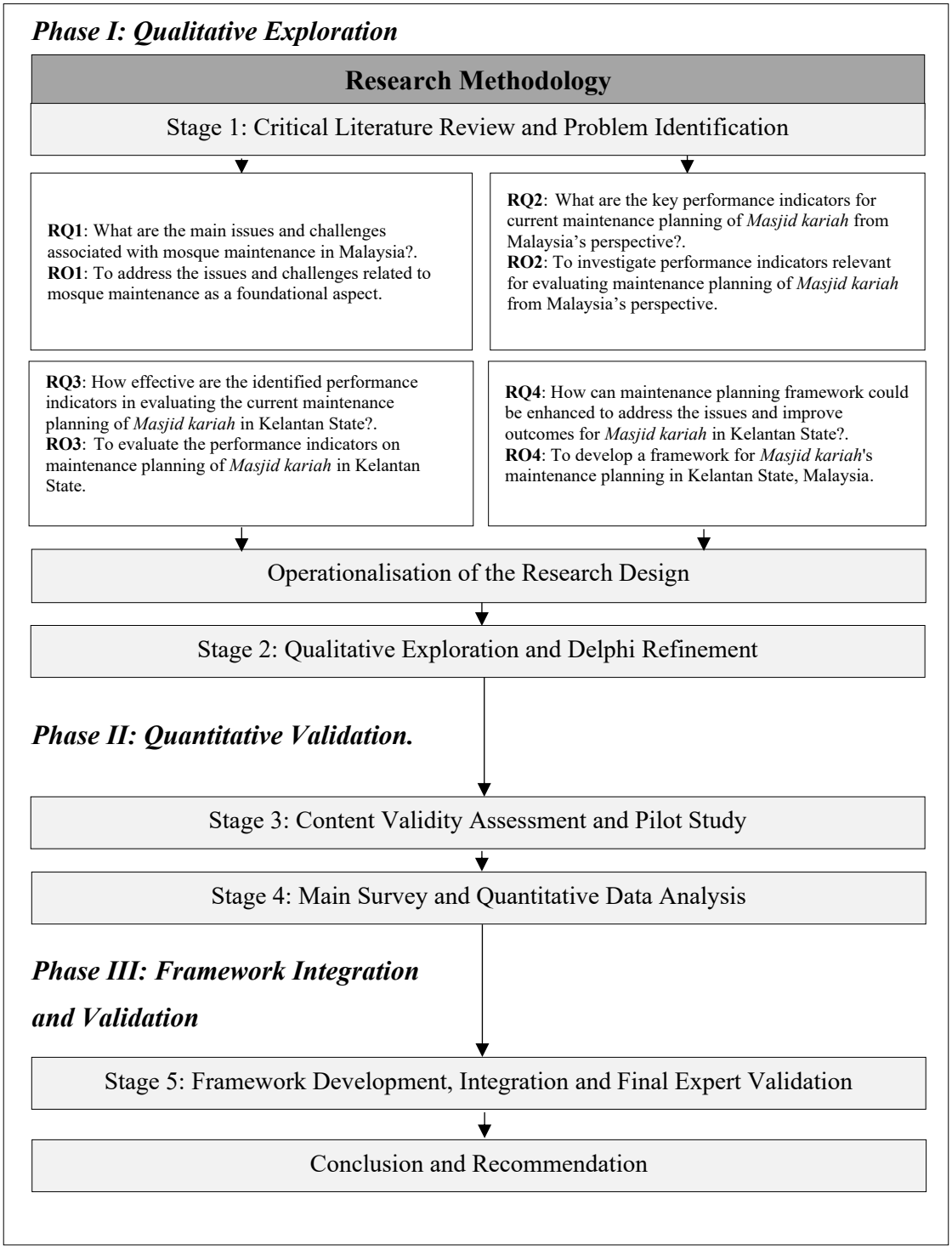

Figure 1.2 Flowchart of the Research Process

1.9 Definition of Terms

There are seven recurring terms in this study i.e., Maintenance Planning, Maintenance Strategy Criteria, Planned Preventive Maintenance, Planned Corrective Maintenance, Unplanned Maintenance, Maintenance Performance Measurement, and *Masjid kariah*. Table 1.2 lists the definition of each term used throughout this study.

Table 1.2
The Definition of Each Term Used in This Study

No.	Term	Description	Definition	Author/s	Relevance to Study
1.	Maintenance Planning (MP)	The systematic process of organizing maintenance activities	The formal process of identifying, scheduling and resourcing maintenance activities to maintain asset function, safety and lifecycle performance through defined tasks, schedules, budgets and resources.	Silva & Lordsleem Júnior (2025); Rios et al. (2025)	Essential for establishing the actionable schedule and budget layer of the proposed maintenance strategy framework for *Masjid kariah*, linking risk assessments to executed work, costs and etc.
2.	Maintenance Strategy Criteria (MSC)	Decision factors used to select appropriate maintenance approaches	The pattern or plan that integrated primary organisational goals, policies, and action sequences into a cohesive whole. It included action taken, the content of strategy, and the process by which activities are required to be decided and implemented	Moghadam & Besiktepe (2025); Kuya & Oberlin (2025)	Critical for converting strategic objectives into ranked choices and inputs for multi-criteria decision making models in the framework, addressing the specific constraints and priorities of community mosque facilities.
3.	Planned Preventive Maintenance (PPM)	Scheduled maintenance activities performed to prevent failures	Significant repair, structured, and carried out with the use of records to a pre-determined plan and is different from the day-to-day repair	BS3811 (1993); Silva & Lordsleem Júnior (2025); Yusof et al. (2025)	Fundamental component of the framework that enables *Masjid kariah* to maintain continuous

No.	Term	Description	Definition	Author/s	Relevance to Study
			service because it keeps buildings modern, safe, and comfortable		availability for worship and community activities while managing limited resources effectively through proactive maintenance scheduling.
4.	Planned Corrective Maintenance (PCM)	Scheduled repair work for identified defects	Repair or restoration work that is identified (non-urgent) and scheduled in advance to restore functionality before a critical failure occurs, performed on a controlled schedule rather than emergency mode.	BS3811 (1993); Yusof et al. (2025); Silva & Lordsleem Júnior (2025)	Important for the framework as it allows *Masjid kariah* committees to plan and budget for necessary repairs while avoiding disruption to religious and community activities through controlled scheduling.
5.	Unplanned Maintenance (UM)	Emergency repair work responding to unexpected failures	Immediate action is taken immediately to recover service or prevent further incidents from damage	BS3811 (1993); Galvão et al. (2024); West et al. (2024)	Represents the type of maintenance the framework aims to minimize for *Masjid kariah*, as unplanned failures can significantly impact worship schedules and community activities while straining limited volunteer resources and budgets.
6.	Maintenance Performance Measurement (MPM)	Systematic evaluation of maintenance effectiveness	Maintenance performance measurement as a process to quantify	D. Galvão et al. (2024); West et al. (2024); Salisu	Essential for validating the effectiveness of the proposed

No.	Term	Description	Definition	Author/s	Relevance to Study
			the efficiency and effectiveness of post action in identifying the strength and the weakness of maintenance planning.	et al. (2025)	framework, enabling *Masjid kariah* committees to monitor maintenance performance, justify resource allocation, and continuously improve their maintenance practices.
7.	*Masjid kariah*	Community congregational mosque in Malaysia	Small local mosques with multiple functions in the village or a small community sustain the Muslim population in an area.	Yusof et al. (2025); Ibrahim & Deraman (2024)	The primary focus of this study - these community mosques require specialized maintenance planning that address their unique operational patterns, volunteer-based management, limited budgets, and critical role in community religious and social life.

These seven essential terms form the conceptual foundation of this research. Maintenance Planning refers to the systematic process of scheduling and allocating resources to ensure asset functionality and safety, while Maintenance Strategy Criteria (MSC) guide decision-making for selecting appropriate maintenance approaches. Planned Preventive and Planned Corrective Maintenance involve structured and scheduled activities aimed at preventing or addressing identified defects, whereas Unplanned Maintenance refers to reactive responses to unexpected failures that should be minimised. Maintenance Performance Measurement (MPM) evaluates the efficiency, effectiveness, and accountability of maintenance practices. Finally, *Masjid kariah* represents community mosques that rely on volunteer-based management and

limited resources, serving as the primary focus of this study in developing a performance-based maintenance planning framework.

1.10 Significance of Study

This study is significant as it provides a structured framework for performance-based maintenance planning that can guide multiple stakeholders involved in the management of *Masjid kariah* in Kelantan.

i. For State Islamic Authorities (e.g., MAIK, JAHEAIK):
The framework serves as a policy reference to standardize maintenance procedures and allocate financial resources more effectively across districts. It enables these authorities to evaluate mosque performance and prioritize funding according to maintenance needs and compliance with safety and health standards.

ii. For Mosque Committees (e.g., Nazir, Secretary, Treasurer):
The framework offers practical guidance on planning, scheduling, and assessing maintenance activities, ensuring that mosque facilities are maintained proactively rather than reactively. It also supports the development of record management and maintenance assessment practices aligned with BS3811 (1993).

iii. For Facility Managers and Technical Agencies (e.g., JKR, UPMD):
The framework provides a benchmark for performance evaluation to monitor maintenance works, ensuring that all mosque buildings meet safety and quality standards. It helps them align their technical assessment procedures with the proposed performance-based maintenance indicators. Additionally, the framework is in accordance with the principles outlined in MS ISO 41001:2018 (Facility Management – Management Systems – Requirements with Guidance for Use), which emphasizes the integration of people, place, process, and technology to enhance organizational effectiveness. This alignment ensures that the maintenance management of *Masjid kariah* is structured,

measurable, and consistent with global standards of facility management practice.

iv. For Researchers and Policymakers:
The study contributes to the body of knowledge by introducing an empirical framework linking maintenance strategies with performance indicators, which can be adopted or adapted for other community facilities in Malaysia.

By clarifying the respective responsibilities of these stakeholders, this study not only strengthens maintenance planning practices for *Masjid kariah* but also ensures that the developed framework is actionable, measurable, and sustainable in the long term.

1.11 The Structure of the Thesis

The outline for this study has been divided into seven chapters. Figure 1.3 shows the synopsis of each chapter in this study.

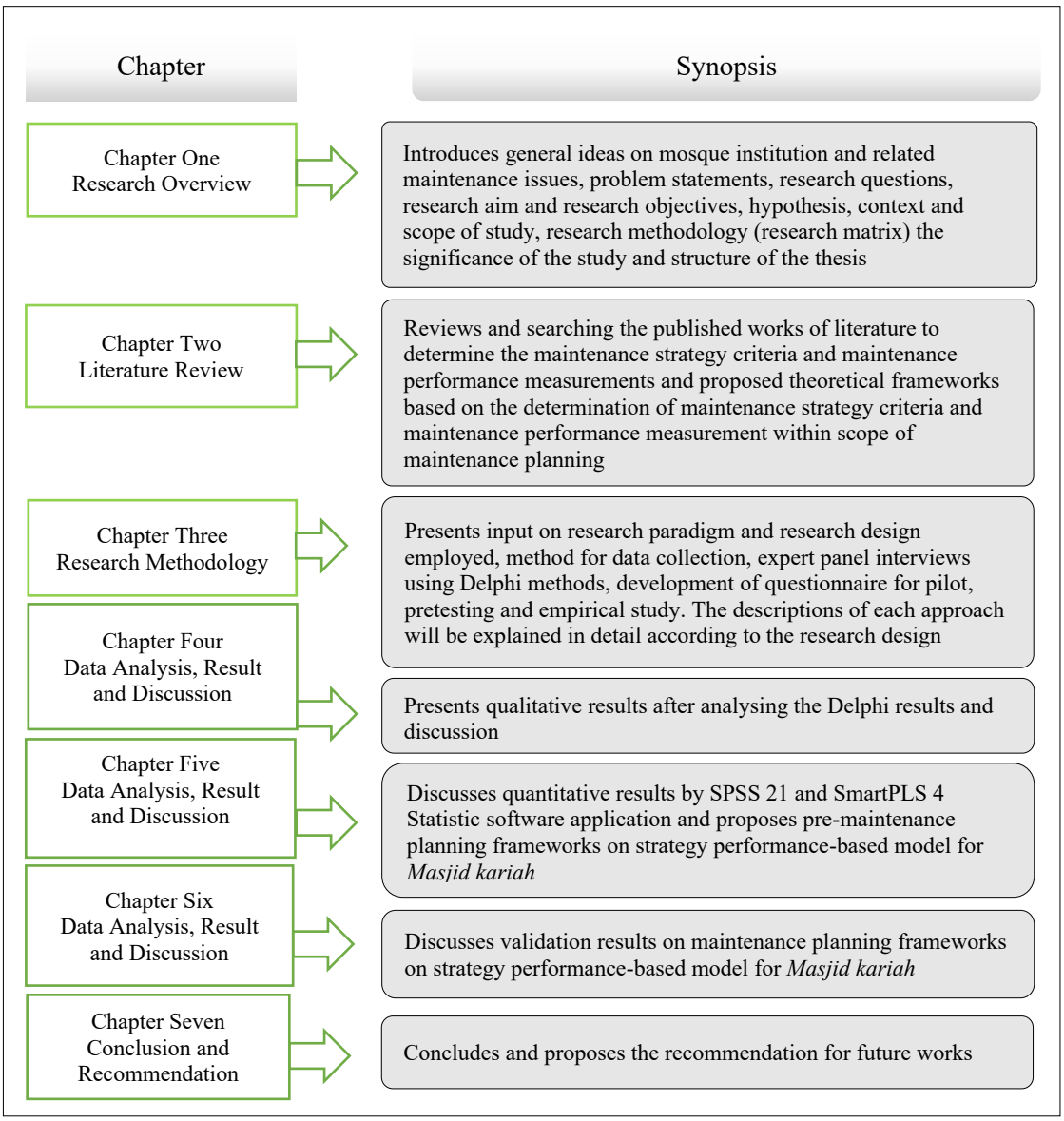

Figure 1.3 The Synopsis of Each Chapter in This Study

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

This chapter establishes the theoretical and empirical foundation for developing a maintenance planning framework for *Masjid kariah* in Kelantan. It critically reviews the evolution of building maintenance management, with particular emphasis on British Standard 3811:1993 (BS 3811) and MS ISO 41001:2018 Facility Management - Management Systems, which were adopted in Chapter One as the core reference standards for this study. These standards provide the primary lens through which Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM) are conceptualised, and they guide the identification of the key constructs used in the mosque maintenance planning framework.

In line with the research aim and objectives, the literature review is structured to move from broad theoretical foundations to the specific context of *Masjid kariah*. First, the chapter revisits the principles of maintenance management, including definitions, goals and objectives, policy, standards, regulations, and maintenance strategies, drawing on BS 3811 as the overarching framework. This section clarifies how planned preventive, planned corrective, and unplanned maintenance are positioned within a coherent maintenance management system, and why these three criteria are treated as the core maintenance strategy outcomes in this study.

Second, the chapter examines maintenance planning as a systematic and strategic process that links organisational objectives with asset performance. Contemporary definitions and models of maintenance planning are synthesised to highlight how planning functions as a bridge between maintenance strategy and day-to-day implementation, particularly in resource-constrained environments. This analysis is then extended to Maintenance Performance Measurement (MPM), where seven key indicators – Organisation Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation, and Safety and Health are discussed in relation to the clauses of MS ISO 41001:2018 and prior empirical studies. Together, these sections clarify how performance measurement acts as the independent variable

that drives decisions on maintenance strategy criteria in the conceptual framework of this research.

Third, the chapter contextualises these theoretical perspectives within the international and Malaysian literature on mosque maintenance. It compares *Masjid kariah* with other mosque typologies and with non-religious public facilities to identify the unique managerial, financial, and governance challenges faced by community mosques. Special attention is given to issues of reactive maintenance culture, fragmented responsibilities between religious authorities and technical agencies, and the absence of structured performance-based frameworks in existing practice. This critical synthesis helps to expose gaps in the current body of knowledge and demonstrates why an integrative framework grounded in BS 3811 and MS ISO 41001 is required for *Masjid kariah*.

Finally, the chapter culminates in the development of the study's conceptual framework, which links maintenance performance measurement (independent variable) to maintenance strategy criteria (dependent variable) within the mosque context. The framework is derived by systematically mapping theoretical models, empirical findings, and standard-based requirements, and by aligning them with the research questions and objectives formulated in Chapter One. The closing section summarises the main insights from the literature, highlights unresolved issues, and positions the subsequent chapters particularly the methodology and empirical analysis as logical continuations of the argument developed here.

2.2 Theoretical Foundation of Maintenance Management for Masjid Kariah

This section establishes the theoretical foundation that underpins the development of a maintenance planning framework for *Masjid kariah* in Kelantan. The discussion begins with the conceptualisation of mosques as community facilities and institutions, before moving to the core concepts of maintenance, building maintenance management, and facility management. It then elaborates on British Standard 3811:1993 as the classical building maintenance management code and MS ISO 41001:2018 as the contemporary facility management management-system standard. Finally, the section synthesises these two standards into an integrated theoretical foundation tailored to the context of *Masjid kariah*.

2.2.1 Concept of Mosque as Community Facility and Institution

As a community facility, the mosque comprises a range of spatial elements and building components that must function effectively to support religious and social activities. A mosque often has unique building elements such as the main prayer hall, mihrab, arches, galleries and a clear orientation towards the Kaaba. Facilities at the mosque should be accommodating to all users, including the elderly and differently abled individuals, so that access to prayer spaces, ablution areas and supporting amenities is safe, comfortable and dignified. Budi & Wibowo (2018) noted that the basic spatial components of a mosque consist of the main prayer hall, the mihrab and the roof, but contemporary community mosques, particularly *Masjid kariah*, typically incorporate a broader range of spaces.

In the context of *Masjid kariah*, the physical facility generally includes the mosque envelope and various supporting building services. The mosque envelope covers structural and architectural elements such as the prayer hall, mimbar, minaret, office, toilets, veranda, library, entrance, courtyard, ablution areas and ancillary structures for community use, while building services encompass mechanical and electrical systems such as ventilation, HVAC installations, water supply, plumbing and security systems like CCTV. These components collectively shape the functional performance, safety, comfort and image of the mosque as perceived by the community.

From a spatial planning perspective, Sapril et al. (2016) divided mosque facilities into inner and outer spaces. The inner space typically comprises the main prayer halls, multipurpose halls, toilets, offices and ablution areas, whereas the outer space includes landscaping, roads and parking areas. This configuration reinforces the role of the mosque as a community facility that accommodates not only ritual worship but also social interaction, education and welfare activities across different zones of the site. Understanding these spatial and functional characteristics is essential for designing an appropriate maintenance management system for *Masjid kariah*, as any deterioration in these spaces can directly affect user experience and the ability of the mosque to fulfil its institutional role.

Beyond its physical configuration, however, the conception of the mosque as a community facility and institution is also shaped by its religious significance, its distribution and hierarchy within the national context, and its specific role as a *kariah*-based community hub. Accordingly, the following subsections elaborate three

interrelated dimensions of mosque conceptualisation: (i) the significance of mosques in Islam as the House of Allah and centre of Muslim life, (ii) the landscape and institutional hierarchy of mosques in Malaysia, and (iii) the specific characteristics of *Masjid kariah* as a community place. This layered understanding provides the institutional context within which maintenance management and facility performance for *Masjid kariah* are examined in later sections.

2.2.1.1 The Significance of Mosques in Islam

The significance of the mosque in Islam is historically rooted in its role as a foundational institution established by the Prophet Muhammad ﷺ in Madina. The Prophet's Mosque functioned as the nascent community's primary centre for worship, education and communal governance, making it the first and most critical institution to be developed (Shaikh & Nazir, 2023). As Muslim polities expanded, early mosques routinely assumed administrative, military and public functions, so much so that the construction of a mosque often became the initial institutional priority in new settlements (Andino-Pavlovsky, 2023). Through these roles, congregational worship, religious rites, teaching circles and mechanisms for consultation and dispute resolution were all anchored within the mosque, embedding it deeply in the social and political fabric of early Muslim society (Shaikh & Nazir, 2023; Andino-Pavlovsky, 2023).

Contemporary scholarship shows that mosques continue to embody this historic centrality while adapting to changing socio-cultural contexts. Recent studies highlight that mosques still operate as powerful religious and civilizational symbols, articulating Muslim identity and communal belonging in both majority- and minority-Muslim settings (Umar, 2024). At the same time, modern campus and urban mosques increasingly offer diversified functions, such as *daʿwa* activities, community education, youth programmes, public lectures and open learning spaces, reflecting a renewed civic and educational role that resonates with their classical multifunctional character (Purwanto et al., 2019).

In addition, emerging work on mosque-based economic and social initiatives underscores the potential of mosques to act as local development hubs. Through the management of *zakat* and *wakaf*, microfinance schemes and cooperative enterprises, mosques are being positioned as platforms for socio-economic empowerment and welfare provision (Saputra & Mulyadita, 2025). Taken together, the historical and

contemporary evidence confirms that the mosque is not only a sacred space for ritual worship but also a dynamic community institution with religious, educational, civic and socio-economic functions. This multi-dimensional significance justifies the need to view mosque facilities – particularly *Masjid kariah* as critical community assets whose physical condition and maintenance directly influence their capacity to fulfil these roles.

2.2.1.2 The Landscape of Mosques in Malaysia

Malaysia is a multiracial country that upholds the right to freedom of religion. According to the Constitution of Malaysia (1957), Article 3, the freedom of religion indicates that Islam is the religion of the federation, whereas other religions can be practised in peace and harmony. Article 3 is parallel to Article 11, which specifies that everyone in Malaysia has the right to practice his or her religion. The latest Statistics (2021) indicated that the Muslim population in Malaysia comprised 61.30% of the total population, which was the most densely populated, followed by 19.80% Buddhists, 9.2% Christians, 6.3% Hindus, and the remaining 3.4% were other religions.

Places of worship are spread throughout Malaysia, as they serve specific purposes for the respective religions. For example, a mosque is for the Muslim population, a church is for the Christian population, a monastery is for the Buddhist population, a Hindu temple is for the Hindu population, and others are for the rest of the minority religious populations. The primary purpose of a place of worship, as implied by the name, is for worshipping the respective gods according to specific religions. According to Sullivan (2018), from the perspective of Christianity, the church serves its worshippers as a safe place for self-purification and other matters concerning important religious issues. Meanwhile, Rasdi (2014) noted that the mosque symbolises the essential elements of Islamic architecture and built environment. This institution, according to Budaiwi (2011), is the heart of the Muslim community, as they would use it for the five prayer periods a day, for a duration of between 45 and 60 minutes.

Linguistically, the term "*Masjid*" is a Malay word derived from the basic Arabic word, "Sajada," which means a place for "sujud" or the act of prostrating (Hamid et al., 2015; Wahab et al., 2017). The mosque is generally designed with a simple rectangular floor plan where the long edge is aligned towards the *qibla*, the direction of Makkah (Atmaca & Gedik, 2019). The importance of mosque is well-recognised in Islam because it is repeatedly mentioned in the Quran; the word "*Masjid*" is mentioned 28

times, excluding repetitions of the words *"masjidun"* 20 times, *"masaajida"* six times, and *"masjidan"* two times (M. Ismail, 2003). The Quran defines a mosque as the "House of Allah," which is a place where the name of Allah is always invoked and glorified. The main goal of the mosque is to provide a safe facility for Muslims to worship Allah S.W.T., as described in the Quran, Surah Al-Jinn, 72:18:

وَأَنَّ ٱلۡمَسَٰجِدَ لِلَّهِ فَلَا تَدۡعُواْ مَعَ ٱللَّهِ أَحَدٗا١٨ [الجن: 18]

«And [He revealed] that the mosques are for Allah, so do not invoke with Allah anyone else (18) »

The mosque's function as a place of worship is also mentioned in Surah An-Nur, verse 36 and Surah At-Taubah, verses 17 to 18, as shown below:

فِي بُيُوتٍ أَذِنَ ٱللَّهُ أَن تُرۡفَعَ وَيُذۡكَرَ فِيهَا ٱسۡمُهُۥ يُسَبِّحُ لَهُۥ فِيهَا بِٱلۡغُدُوِّ وَٱلۡأٓصَالِ٣٦ [النور: 36]

« [Such niches are] in mosques, which Allah has ordered to be raised and that His name be mentioned therein, exalting Him within them in the morning and the evenings (36) »

مَا كَانَ لِلۡمُشۡرِكِينَ أَن يَعۡمُرُواْ مَسَٰجِدَ ٱللَّهِ شَٰهِدِينَ عَلَىٰٓ أَنفُسِهِم بِٱلۡكُفۡرِۚ أُوْلَٰٓئِكَ حَبِطَتۡ أَعۡمَٰلُهُمۡ وَفِي ٱلنَّارِ هُمۡ خَٰلِدُونَ١٧ [التوبة: 17]

«It is not for the polytheists to maintain the mosques of Allah [while] witnessing against themselves with disbelief. [For] those, their deeds have become worthless, and in the Fire, they will abide eternally (17) »

إِنَّمَا يَعۡمُرُ مَسَٰجِدَ ٱللَّهِ مَنۡ ءَامَنَ بِٱللَّهِ وَٱلۡيَوۡمِ ٱلۡأٓخِرِ وَأَقَامَ ٱلصَّلَوٰةَ وَءَاتَى ٱلزَّكَوٰةَ وَلَمۡ يَخۡشَ إِلَّا ٱللَّهَۖ فَعَسَىٰٓ أُوْلَٰٓئِكَ أَن يَكُونُواْ مِنَ ٱلۡمُهۡتَدِينَ١٨ [التوبة: 18]

«The mosques of Allah are only to be maintained by those who believe in Allah and the Last Day and establish prayer and give zakat and do not fear except Allah, for it is expected that those will be of the [rightly] guided (18) »

These verses have fundamentally emphasised that the mosque needs to be well maintained. Therefore, as a facility, the management of a mosque should clean it efficiently. An authentic hadith has also explained the importance of mosques:

> *The place that is most loved by ALLAH S.W.T. in the country is the mosque and the most hated by ALLAH S.W.T. is the markets (Al-sijistani Bab Al-Masajid fi al Daur)*

This hadith signifies that Allah S.W.T. loves mosques very much but hates the markets. Mosques of all levels are loved by Allah S.W.T., thus, the facilities at these mosques should be in good working condition, safe, comfortable, and organised so that Muslims can comfortably perform their prayers and congregational activities. Due to the high population of Muslims, mosques are the most prevalent place of worship that can be found in almost any location throughout Malaysia. A mosque is also one of the most significant places that could hold various Islamic ceremonies and rituals. Nevertheless, nowadays, certain people underestimate the roles of a mosque, and would consider it as a place only for performing prayers (Abdullah et al., 2017).

The mosque represents the establishment of a Muslim community in a *kariah*. It is the focal point that could shape the characteristics of the Muslim society. Since the historical Islamic period, mosques hold a very significant role in the life of the Muslim community. Traditionally, a mosque would be seen as the ultimate centre for a Muslim community, where religious belief, social activities, and community integrations would take place under one roof (Nizarudin, 2017). It is frequently used for gatherings, organising various Islamic events, research and development, as a rehabilitation centre, an education centre, social development centre, and for hosting other programmes (Abdullah et al., 2017). Therefore, the mosque institution is an essential asset in the Muslim community that plays a variety of functions. It could also act as a means to identify the Muslim population in different countries (Abdul-Matin, 2010).

A mosque is one of the important institutions for Muslim communities, and is considered as a holy and revered (Mosque, 2018). Khalit (2011) mentioned that during the time of the Prophet, the mosque itself not only serves as a place for prayers and other religious rituals, but also as the centre for a multitude of activities held by the community. However, Yatim et al. (2011) denoted that the actual role of a mosque in Islam is not merely for prayers, but also the following: (1) a symbol of administration

and governance; (2) a knowledge centre of human development; (3) knowledge heritage; (4) parliament for the Islamic state; (5) source of news and information to be submitted to the state; (6) religious symbol; (7) mysticism; and (8) the basis of unity of the Ummah.

Statistics showed that 6,342 mosques, 17,601 surau (smaller prayer areas), and 670 surau Jumaat (areas designated for Jumaat prayer) have been registered with JAKIM (Jakim, 2021). Lussier (2019) denoted those places of worship could play different roles in religious societies, depending on the purpose they were meant to fulfil in a specific religious practice. One of the factors that attract people to visit mosques may include the excellent facilities that are important in maintaining the sanctity of the mosques (Mohd Taib et al., 2016).

2.2.1.3 Masjid Kariah as Community Place

Ahmad et al. (2020); Mohd Taib et al. (2016); Hamid et al. (2015) refer to *kariah* as an area where a group of Muslims share the same mosque that can sustain their community. Imamuddin et al. (1985) refer to *Masjid kariah* as a small society that shares a universal value in a common location that utilises the same available mosque within the same locality. *Masjid kariah* is a place for Muslims to hold their congregational prayers, as most mosques can be found in their neighbourhood.

As a place of worship, *Masjid kariah* must be kept clean, as mentioned in the following hadith:

> *Rasulullah ordered to build a mosque in the village and for the mosque to be cleaned and smell fragrant. (Al-Sijistani-Itikhadh al Masajid Fi al-Daur 455:1:122)*

As previously discussed, mosque is an integral part of the Islamic society. Prophet Muhammad ﷺ was instructed during his early da'wah to build a simple building, known as 'Masjid Quba'. This command showed the importance of a mosque, as it can serve as the starting point for establishing Islam both within the state and the society. Similarly, today's mosques serve the same purpose of instigating the development of Islam in the Muslim community and its ties with the society (Al-Krenawi, 2016).

2.2.2 Maintenance, Building Maintenance Management and Facility Management

This section introduces maintenance, building maintenance management and facility management in a structured manner to provide a clear foundation for the subsequent discussion on standard-based maintenance planning for *Masjid kariah*. The discussion is organised hierarchically so that each concept is presented at its appropriate level and its relevance to maintenance planning is made explicit. Maintenance is first explained as a core concept within the built environment literature, emphasising its evolution from routine repair activities towards a strategic function that sustains asset performance throughout the building life cycle. The section then focuses on building maintenance management by highlighting how maintenance principles are translated into organised managerial and operational processes, including planning, prioritisation, scheduling, supervision, budgeting, resource coordination and monitoring, which collectively guide how maintenance is executed in practice within organisations. The section further expands to facility management as a wider discipline that integrates physical assets with organisational objectives and user-oriented outcomes, where maintenance is understood as an essential function embedded within a broader system that also addresses service quality, safety and health, stakeholder needs and continuous improvement. By structuring the discussion in this sequence, the section differentiates the foundational concept of maintenance, the practical processes of maintenance management and the integrative scope of facility management, thereby strengthening the theoretical basis for the performance-based maintenance planning approach adopted in this study for *Masjid kariah* in Kelantan.

2.2.2.1 Concept of Maintenance

The concept of maintenance in the built environment has evolved from simple repair work to a strategic function that sustains asset performance throughout the building life cycle. Historically, early versions of British Standard BS 3811 (1964, 1974, 1984) defined maintenance as work undertaken to keep or restore facilities and their components to an acceptable condition. The revised BS 3811:1993 further refined the definition by emphasising maintenance as the combination of technical and administrative actions, including supervision, that are undertaken to retain an item in,

or restore it to, a state in which it can perform its required function (BSI, 1993). Classical contributions such as CICA (1989), Pitt (1997) and Löfsten (2000) similarly framed maintenance in relation to service life optimisation, value for money and performance at minimum cost. More recent studies conceptualise maintenance as planned and systematic actions that preserve the physical and functional integrity of facilities and their components across the asset life cycle (Hauashdh et al., 2020; Cruzan, 2020; Beşiktepe et al., 2020; Dzulkifli et al., 2021; Tijanić Štrok et al., 2022). This evolution reflects a shift from reactive breakdown-focused interventions towards proactive and resilience-oriented approaches, where maintenance capability is considered earlier within design and construction decisions (Amin, 2016).

Within mosque facilities, the meaning of maintenance extends beyond ad hoc repairs because the building is continuously used to support religious obligations and community functions. Maintenance therefore involves systematic actions that preserve the physical condition, functionality and reliability of key spaces and services, including prayer areas, ablution areas, building services and surrounding external works, so that the mosque remains safe, clean, and fit for use throughout its operational life. In this study, the concept of maintenance provides the foundational basis for understanding how maintenance work is defined and justified before it is translated into planning and management processes.

To consolidate the evolution of the concept, Table 2.1 summarises definitions of building maintenance reported in previous studies and standards. The discussion in the next section builds on this conceptual foundation by focusing on building maintenance management, where maintenance principles are operationalised through planning, coordination and implementation processes within organisations.

Table 2.1
Definitions of Building Maintenance

No.	Author(s)	Definition
1.	BS3811 (1964)	Work is undertaken to keep or restore every facility, i.e., part of the site, building, and contents, to an acceptable standard.
2.	BS3811 (1974)	Combination of any action carried out to retain an item in, or restore it to, an acceptable condition.
3.	BS3811 (1984)	Combination of all technical and associated administrative actions intended to retain an item in or restore it to a state in which it can perform its required function.
4.	CICA (1989)	Any intervention to make sure a facility reaches its optimal service life.
5.	BS3811 (1993)	The combination of all technical and administrative actions, including supervision works, intended to retain an item in, or restore it, a state in

No.	Author(s)	Definition
		which it can perform a required function.
6.	T. J. Pitt (1997)	Repair service for fabric protection tasks up to the standard that represents the value of money for the building.
7.	Löfsten (2000)	Maximising the performance of the facility at minimum cost; reduce the adverb effect of the breakdown.
8.	Hauashdh et al. (2020)	A systematic set of management and technical activities required to address maintenance issues, their causes and effects, and to ensure effective, efficient and economical building performance.
9.	Dzulkifli et al. (2021)	A systematic process and set of best practices, standards and guidelines to safeguard building elements and resources so that they operate safely and comfortably for users.
10.	Cruzan (2020)	Work undertaken to preserve an asset so that it continues to function above a minimum acceptable performance level throughout its design service life, without unforeseen major renewal or repair.
11.	Tijanić Štrok et al. (2022)	A set of activities required to preserve, protect and improve buildings so that they remain safe, functional and compliant with current standards throughout the use phase.
12.	Beşiktepe et al. (2020)	A fundamental practice within facility management that maintains building performance within specified standards, reduces risk of component failure and supports reliability and sustainability over the life cycle.
13.	Ashworth (2015)	Works required preserving the building and other items or equipment in a state of fitness for purpose.

As summarised in Table 2.1, definitions of building maintenance converge on the idea of coordinated technical and administrative actions aimed at sustaining asset functionality over time, while differing in the extent to which they highlight service life, cost efficiency, user requirements or operational reliability. The classical BS 3811 family provides the foundational vocabulary, whereas more recent definitions stress systematic, life-cycle-oriented and performance-driven perspectives that are highly relevant to contemporary facility types, including mosque buildings.

2.2.2.2 Building Maintenance Management

Building maintenance management builds on the concept of maintenance by focusing on how maintenance activities are organised, controlled and evaluated within an organisation. Contemporary frameworks position maintenance management as a strategic, organisation-level function that guides the effective and efficient utilisation of resources, systems and information to ensure facilities are kept operable to the standards required by users (Kadhim & Altaie, 2023; Ebekozien et al., 2023).

Recent literature emphasises maximising facility performance through systematic approaches that combine deterioration modelling with life-cycle cost analysis for long-term planning and budgeting (Annunen et al., 2022). Modern maintenance management is also understood as a strategic process that translates organisational objectives into policies, maintenance strategies, work programmes and performance targets, increasingly supported by digital technologies such as Building Information Modelling, condition-based maintenance systems and integrated information platforms (Amin, 2016; Annunen et al., 2022).

In the context of *Masjid kariah*, building maintenance management involves more than technical repairs because the mosque must consistently support religious obligations and community functions. It therefore includes planning, budgeting, prioritisation, supervision and monitoring of maintenance works by the mosque committee and relevant agencies to ensure that essential spaces and services remain safe, functional and fit for use throughout the operational life of the facility.

This managerial and operational emphasis provides the basis for performance-oriented maintenance planning, where maintenance decisions are guided not only by technical needs but also by service outcomes and resource constraints. The discussion in the next section expands further by introducing facility management as a wider discipline that integrates maintenance with organisational objectives and user-oriented outcomes.

2.2.2.3 Facility Management

Facility Management (FM) provides a broader conceptual lens by integrating buildings, infrastructure, people and processes to support the core activities of an organisation. In formal terms, ISO 41011:2017 defines facility management as "*an organizational function which integrates people, place and process within the built environment with the purpose of improving the quality of life of people and the productivity of the core business*" (ISO, 2017; IFMA, 2026). This definition is also adopted by the International Facility Management Association (IFMA), indicating broad professional recognition of facility management as a strategic organisational function rather than merely a technical support activity.

This definition is particularly important to the present study because it extends the understanding of maintenance beyond the narrow scope of physical repair works.

Rather than treating maintenance as an isolated technical task, the ISO definition positions facility management as an organisational function that connects the condition of the built environment with user well-being, operational effectiveness and service delivery. For *Masjid kariah*, this broader interpretation is highly relevant, as the mosque does not function solely as a physical building, but as a community-based institution that supports prayer activities, religious learning, social interaction and public welfare. Consequently, maintenance planning should not be limited to defect rectification alone, but should also consider how the mosque environment affects safety, comfort, accessibility, service quality and the overall experience of users.

Consistent with this perspective, facility management is widely understood in the literature as a holistic discipline that coordinates the physical workplace with people and organisational processes, drawing from business administration, architecture, behavioural sciences and information management (Atkin & Brooks, 2015). The introduction of MS ISO 41001:2018 further strengthened this perspective by codifying facility management as a management system that aligns facility-related processes with organisational objectives, stakeholder needs, risk management and continuous improvement (ISO, 2018), while empirical studies have demonstrated its application in diagnosing and guiding facility management systems across diverse building types (Ismaeil, 2023). Within this broader framework, maintenance is recognised as one of the core functions of facility management and should therefore be coordinated with space management, occupational safety and health, service quality, resource optimisation and, increasingly, digital integration through technologies such as the Internet of Things and artificial intelligence systems (Annunen et al., 2022; Ismaeil, 2023).

In this study, the facility management perspective therefore provides a stronger conceptual foundation for framing maintenance planning as a structured, performance-oriented and user-centred process, thereby bridging maintenance concepts, building maintenance management and the performance-based maintenance planning framework developed for *Masjid kariah*. The next subsections accordingly examine BS 3811:1993 and MS ISO 41001:2018 as the principal standards underpinning the framework adopted in this study.

2.2.2.4 Link to the Study Focus: Performance-Based Maintenance Planning

In the context of this study, performance-based maintenance planning is positioned as a structured approach that links maintenance decisions with measurable facility outcomes rather than relying solely on ad hoc responses to defects. Building on the maintenance concept and its translation into managerial and operational processes, the performance-based approach emphasises that maintenance planning should be guided by clearly defined performance requirements and indicators that reflect user needs and operational priorities in *Masjid kariah* facilities. This is particularly relevant because the mosque functions as a continuously used community facility, where maintenance effectiveness is not only reflected in the physical condition of building elements but also in service delivery outcomes such as service quality, and safety and health. Accordingly, performance-based maintenance planning in this study integrates systematic planning, prioritisation and resource allocation with performance measurement to support consistent functionality and user experience over the facility life cycle. This positioning provides the basis for adopting standard-based references, including BS 3811:1993 and MS ISO 41001:2018, to underpin a coherent maintenance planning framework for *Masjid kariah* in Kelantan.

In strengthening performance-based maintenance planning, the study requires an established standard that clarifies how maintenance management should be organised, controlled and monitored to achieve consistent performance outcomes. BS 3811:1993 provides such guidance through its building maintenance management code, and the subsequent section elaborates on its principles and applicability to the maintenance planning framework developed for *Masjid kariah* in this study.

2.2.3 British Standard 3811 (1993): Building Maintenance Management Code

British Standard 3811:1993 (BS 3811) is one of the earliest and most influential references in the field of maintenance and asset management, particularly for building-related applications. The standard provides a comprehensive glossary of terms used in terotechnology and formally defines maintenance as “the combination of all technical and administrative actions, including supervision, intended to retain an item in, or restore it to, a state in which it can perform a required function” (British Standards

Institution [BSI], 1993). This definition has been widely adopted in subsequent literature and standards because it positions maintenance not merely as a technical activity, but as a coordinated technical–administrative process that must be planned, organised and controlled across the asset life cycle. Contemporary studies on building maintenance continue to cite BS 3811 as the classical source for maintenance terminology and as a baseline for comparing newer, performance-based definitions.

A key conceptual contribution of BS 3811 is its distinction between actions undertaken "to keep" an item in a satisfactory state and actions undertaken "to restore" an item after failure. This distinction underpins later classifications of maintenance into planned and unplanned types, and into preventive and corrective categories. Planned maintenance encompasses activities that are scheduled or condition-based and designed to prevent failures or manage deterioration, while unplanned maintenance is triggered by unexpected breakdowns and is often associated with higher disruption and cost (Gackowiec, 2019; Weidner, 2023). Recent reviews show that most contemporary practice can be grouped around families of corrective, preventive, predictive or condition-based and risk-informed maintenance, with the choice of strategy shaped by asset criticality, risk tolerance, data availability and organisational capabilities (Gackowiec, 2019; Beşiktepe et al., 2020).

The conceptual vocabulary introduced in BS 3811 has been applied across a broad spectrum of maintenance territories, including communication systems, utility networks, processing plants, transportation infrastructure, manufacturing plants and buildings. Although each territory has its own operational context and technical requirements, the same core maintenance concepts such as planned versus unplanned, preventive versus corrective and combinations of strategy types – recur across these sectors, demonstrating the transferability of the BS 3811 framework (Gackowiec, 2019). Figure 2.1 illustrates this spectrum of maintenance territories in which the BS 3811 classification has been applied, highlighting that terminology originally developed for terotechnology remains relevant across multiple asset environments.

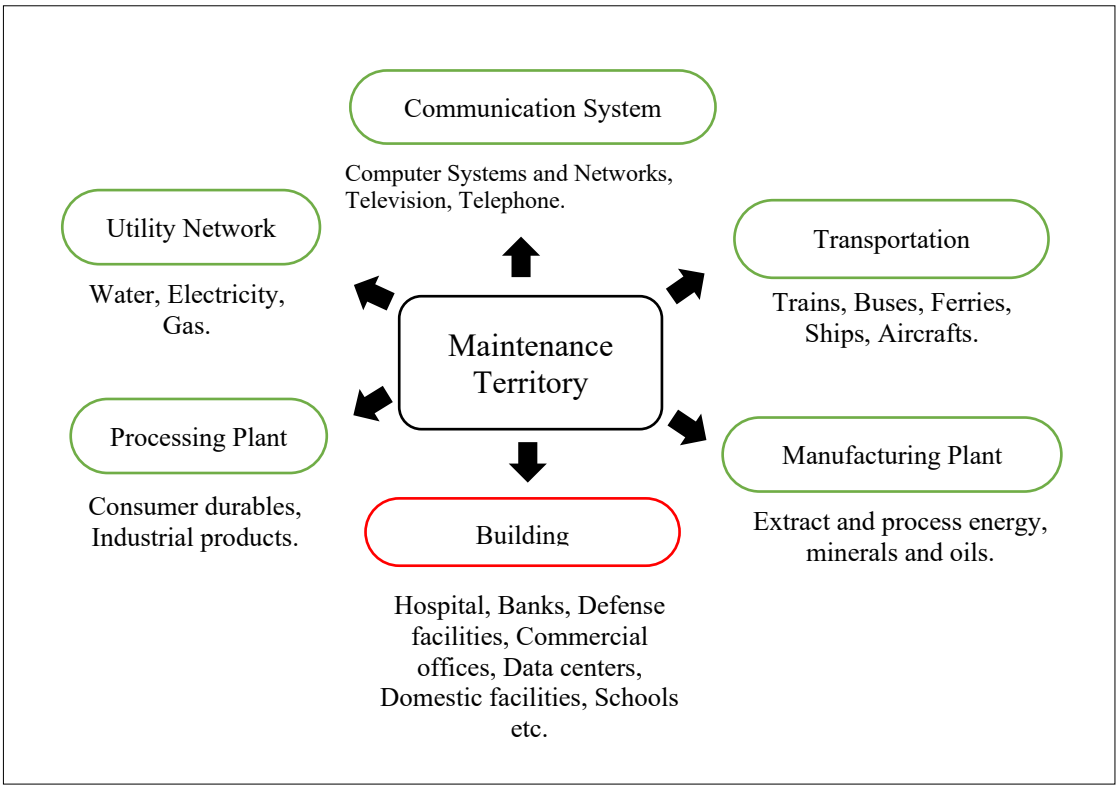

Figure 2.1 Spectrum of Maintenance Territories based on BS 3811 (Source: Adapted from BS 3811 and Selected Contemporary Studies i.e. Amin (2016))

In Malaysia, BS 3811 has been widely used as a reference point for building maintenance practice in public, institutional and commercial facilities. Empirical studies on Malaysian buildings consistently refer to BS 3811 when defining maintenance, distinguishing between preventive and corrective activities and structuring maintenance management frameworks. For example, systematic reviews of Malaysian building maintenance practice highlight BS 3811 as a key underpinning standard for classifying maintenance works and discussing the imbalance between planned and reactive maintenance in public facilities (Hauashdh et al., 2020; Dzulkifli et al., 2021). Research on maintenance decision-making within Malaysian facilities management further shows that maintenance criteria, risk, cost and performance are assessed using categories that directly reflect BS 3811 typologies, even when embedded within newer multi-criteria decision-making or performance-based frameworks (Beşiktepe et al., 2020; Ebekozien et al., 2022).

In the context of *Masjid kariah* in Kelantan, BS 3811 is particularly relevant because mosque committees and supporting agencies still tend to conceptualise maintenance in terms of basic categories such as preventive servicing, planned repairs

and emergency or breakdown works - categories that mirror the “to keep” and “to restore” distinction in the standard. Recent Malaysian studies on public and religious buildings report that limitations in budget, planning and technical capacity often lead to a higher proportion of unplanned, reactive works compared with systematic planned preventive and planned corrective maintenance (Hauashdh et al., 2020; Dzulkifli et al., 2021; Hassin et al., 2025).

Table 2.2
Maintenance Strategy Criteria based on British Standard 3811 (1993) in Maintenance Territories

No.	Maintenance Strategy		Author (s)	Maintenance Strategy Territories						
				Communication Networks	Utility	Processing	Transportation	Manufacturing Plant	Building
1.	Planned Preventive Maintenance (PPM)	a.	Horner et al. (1997)						*
		b.	Mostafa et al. (2015)					*	
		c.	Shin & Jun (2015)				*		
		d.	Arslankaya & Atay (2015)					*	
2.	Planned Corrective Maintenance (PCM)	a.	Horner et al. (1997)						*
		b.	Mostafa et al. (2015)					*	
		c.	Teixeira & Junior (2016)				*		
		d.	Guillén et al. (2016)					*	
		e.	Shin & Jun (2015)				*		
3.	Unplanned Maintenance (UM)	a.	Leahy et al. (2017)					*	
		b.	Le et al. (2018)						*

In this study, BS 3811 is therefore adopted as a classical theoretical foundation that shapes the conceptualisation of maintenance types and informs the subsequent selection of maintenance strategy criteria – planned preventive maintenance (PPM), planned corrective maintenance (PCM) and unplanned maintenance (UM) which are operationalised as the dependent variable in the proposed maintenance planning framework for *Masjid kariah* (Refer to Table 2.2 above). The broader organisational perspective on facility management and performance measurement is provided by MS ISO 41001:2018, which is discussed in the next subsection.

2.2.4 MS ISO 41001 (2018): Facility Management-Management System Standard

MS ISO 41001:2018 Facility management – Management systems – Requirements with guidance for use is the Malaysian adoption of ISO 41001:2018, recognised as the first global management-system standard dedicated specifically to facility management (FM) (International Organization for Standardization [ISO], 2018; Department of Standards Malaysia, 2021). The standard specifies requirements for establishing, implementing, maintaining and continually improving a facility management system (FMMS) so that an organisation can deliver effective and efficient FM services that support its core objectives, meet stakeholder needs and comply with applicable requirements in a consistent and sustainable manner (ISO, 2018). Because the requirements are non–sector specific, MS ISO 41001:2018 can be applied to a wide range of facilities, including offices, campuses, hospitals, public buildings and religious facilities such as mosques.

Structurally, ISO 41001 follows the High-Level Structure (HLS) used across contemporary ISO management-system standards, organising its clauses around organisational context, leadership, planning, support, operation, performance evaluation and improvement (ISO, 2018). These clauses are intended to be implemented through a process approach based on the Plan–Do–Check–Act (PDCA) cycle, as illustrated in the process-approach figure in the standard (Refer to Figure 2.2), thereby linking FM planning and operations with systematic monitoring and continual improvement (ISO, 2018). Recent facilities management literature shows that ISO 41001 is increasingly used as a reference point for defining the scope of FM, clarifying roles and responsibilities and integrating asset information, digital tools such as GIS/BIM and performance indicators within a coherent management system (Amos et al., 2019; Ismaeil, 2024; Lee et al., 2021).

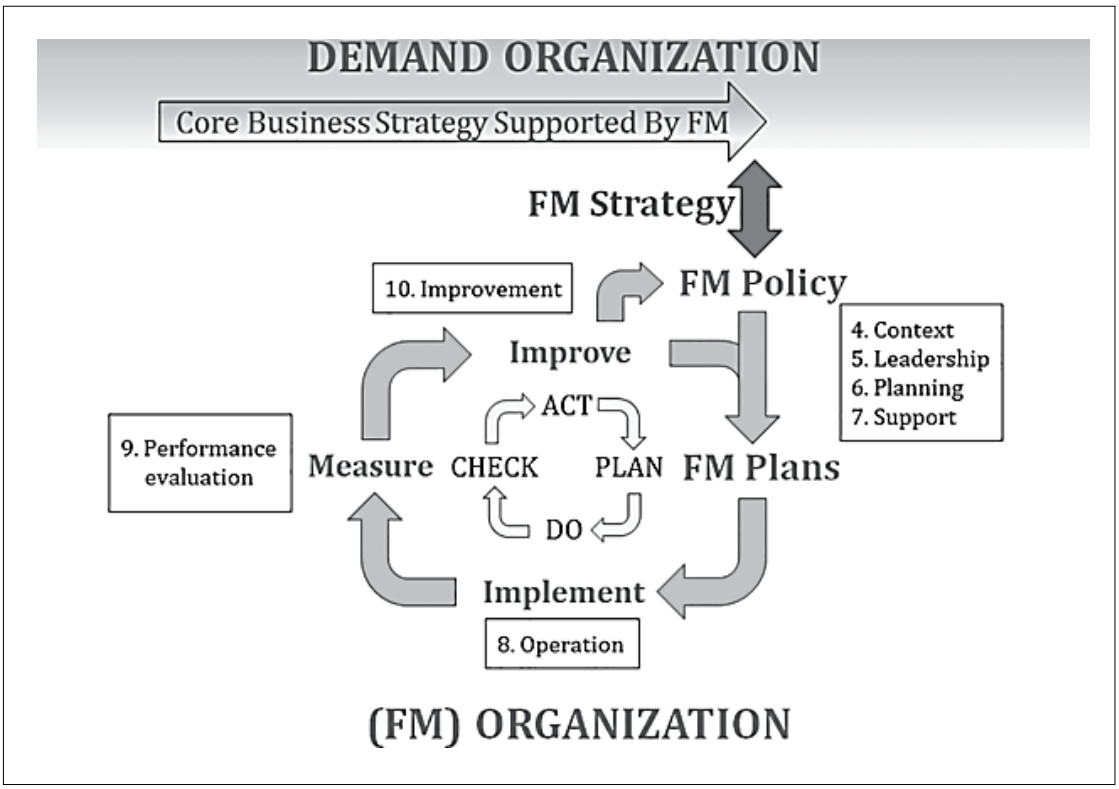

Figure 2.2 Process Approach Methodology in Facility Management
(Source: Adopted from ISO, 2018)

In Malaysia, ISO 41001:2018 has been formally adopted as MS ISO 41001:2018, published by the Department of Standards Malaysia as an identical national standard (ISO 41001:2018, IDT) (Department of Standards Malaysia, 2021). This has been further strengthened through MS ISO 41001:2018/Amd. 1:2024, which incorporates "climate action changes" into the FM management-system requirements, aligning FM practice with global and national climate and sustainability agendas (Department of Standards Malaysia, 2024). National guidance materials and training programmes promoted by Malaysian agencies and industry bodies present ISO 41001-based FMMS as a means of improving productivity, communication, safety and cost-efficiency in the management of buildings and infrastructure, particularly in the public and institutional sectors (Amos et al., 2019; Dzulkifli et al., 2021).

Facilities management scholarship also highlights ISO 41001's relevance for performance measurement. Reviews of FM performance measurement emphasise that FM indicators should be aligned with recognised standards and management-system frameworks, with ISO 41001 identified as a key reference for structuring FM processes

and metrics (Amos et al., 2019; Lee et al., 2021). In the Malaysian context, studies on building maintenance management recommend using ISO 41001 guidelines and the PDCA cycle as a conceptual basis for best-practice maintenance frameworks in public buildings (Dzulkifli et al., 2021). At the same time, recent work on digitalisation in FM links performance measurement and Industry 4.0 technologies (such as BIM and IoT) to ISO 41001 as a backbone for data integration and performance management in FM (Ismaeil, 2024; Lee et al., 2021).

In this study, MS ISO 41001:2018 provides the primary organisational and performance-based lens for conceptualising mosque maintenance and facility management. The clauses on organisational context and leadership inform the Organisation Management dimension, while the planning and operation clauses underpin **Planning and Scheduling, Financial Provision, Resource Allocation** and **Service Quality**. The performance evaluation and improvement clauses align closely with the **Assessment** and **Safety and Health** dimensions, particularly in relation to setting objectives, monitoring performance indicators and implementing corrective and preventive actions (ISO, 2018; Amos et al., 2019). Taken together, the seven Maintenance Performance Measurement (MPM) dimensions used in this research are derived and adapted from the principles and requirements embedded in MS ISO 41001:2018. By integrating this contemporary FM management-system standard with the classical maintenance vocabulary of BS 3811, the study develops a performance-based maintenance planning framework that is theoretically grounded, aligned with international FM practice and practically relevant to the management of *Masjid kariah* facilities in Kelantan. The following subsection (Section 2.2.5) therefore synthesises BS 3811 and MS ISO 41001:2018 into an integrated conceptual basis for *Masjid kariah* maintenance management and the development of the study's performance-based framework.

2.2.5 Integration of BS 3811 and MS ISO 41001 as the Theoretical Framework Foundation for Masjid Kariah Maintenance Management

The preceding subsections highlight two complementary but distinct perspectives on maintenance and facility management. BS 3811:1993 provides the classical vocabulary and typology for maintenance, distinguishing between actions undertaken to retain an item in a satisfactory state and actions undertaken to restore it

after failure, which underpin the differentiation between planned and unplanned maintenance as well as preventive and corrective categories (BS3811, 1993). This standard has been widely used to classify maintenance activities into strategy types and remains a key reference for building maintenance practice, including in Malaysian public and institutional facilities (Hauashdh et al., 2020; Dzulkifli et al., 2021). In the context of *Masjid kariah*, the BS 3811 typology is particularly useful for conceptualising Maintenance Strategy Criteria (MSC) as comprising planned preventive maintenance (PPM), planned corrective maintenance (PCM) and unplanned maintenance (UM), which together describe the degree to which mosque maintenance is proactive or reactive.

MS ISO 41001:2018, by contrast, provides a contemporary management-system view of facility management that emphasises organisational context, leadership, planning, support, operation, performance evaluation and improvement (ISO, 2018). Rather than defining individual maintenance types, ISO 41001 specifies how facility-related processes, including maintenance, should be structured, resourced, monitored and continually improved to support organisational objectives and stakeholder needs (Amos et al., 2019; Lee et al., 2021). In this study, the requirements and principles of MS ISO 41001:2018 are operationalised through seven Maintenance Performance Measurement (MPM) dimensions i.e. Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment and Safety and Health which represent the key organisational and process factors shaping mosque maintenance practice in Malaysia.

Integrating BS 3811 and MS ISO 41001 allows the present study to link what maintenance strategies are being adopted in *Masjid kariah* with how the wider facility management system is designed and performs. BS 3811 informs the definition of the Maintenance Performance Measurement (MPM) – PPM, PCM and UM which are treated as the dependent variable, reflecting the balance between proactive and reactive maintenance in mosque practice (BSI, 1993; Hauashdh et al., 2020). MS ISO 41001, on the other hand, underpins the seven maintenance performance measurement dimensions, which are conceptualised as independent variables that influence and explain the observed maintenance strategies (ISO, 2018; Amos et al., 2019; Dzulkifli et al., 2021). As illustrated in Figure 2.3, BS 3811 and MS ISO 41001 thus operate as two interlocking theoretical pillars: the former structures the maintenance strategy typology, while the latter provides a performance-based FM management-system framework

within which those strategies are planned, implemented and evaluated for *Masjid kariah*.

This integrated perspective is particularly relevant in the Malaysian mosque context, where maintenance is often constrained by limited budgets, fragmented planning and the absence of systematic performance measurement (Hauashdh et al., 2020; Dzulkifli et al., 2021; Hassin et al., 2025). By adopting BS 3811 to classify PPM, PCM and UM and MS ISO 41001:2018 to define the organisational and performance dimensions of mosque maintenance, the study is able to develop a performance-based maintenance planning framework that is both grounded in established standards and tailored to the operational realities of *Masjid kariah*. Figure 2.3 depicts this integration and provides the conceptual bridge to the subsequent sections, which elaborate the maintenance planning construct and the maintenance performance measurement dimensions in greater detail.

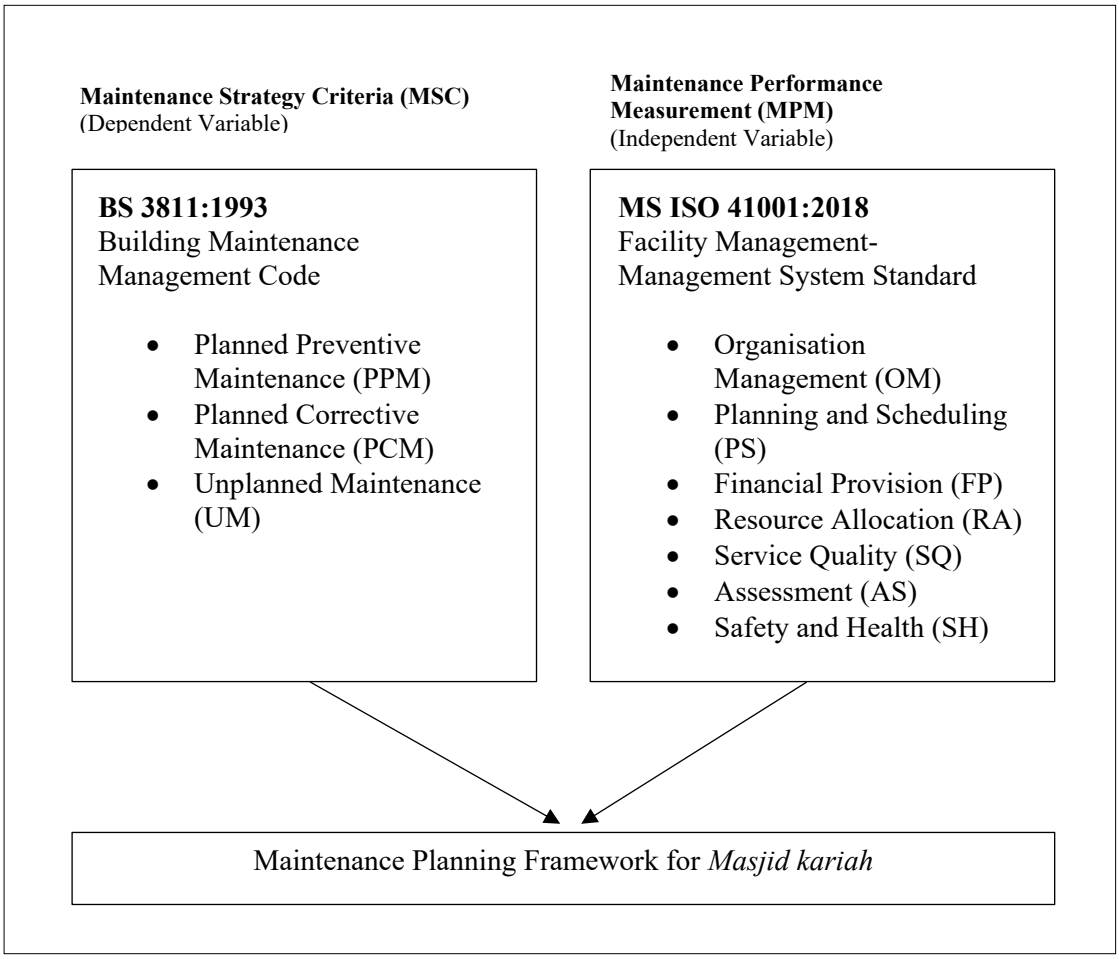

Figure 2.3 Theoretical Framework Foundation for *Masjid kariah* Maintenance Management

2.3 Maintenance Planning

Maintenance planning represents the critical bridge between theoretical concepts of maintenance management and the day-to-day execution of maintenance activities in real facilities. While BS 3811:1993 clarifies the terminology and categories of maintenance, and MS ISO 41001:2018 frames facility management as a structured management system, it is through maintenance planning that these principles are translated into concrete tasks, schedules, budgets and responsibilities. In this study, maintenance planning is understood as a systematic process of identifying, prioritising and resourcing maintenance works overtime so that mosque facilities remain safe, functional and able to support religious and community activities under conditions of limited resources and increasing performance expectations.

Contemporary literature reinforces that effective maintenance planning is no longer confined to preparing work orders or reacting to defects, but instead involves aligning maintenance activities with organisational objectives, risk profiles and life-cycle performance targets. Recent studies describe maintenance planning as an integrated process that links asset condition assessment, risk evaluation, cost forecasting and scheduling into a coherent decision-making framework that supports both preventive and corrective actions across the asset life cycle. In line with BS 3811, planning must account for the balance between planned preventive maintenance (PPM), planned corrective maintenance (PCM) and unplanned maintenance (UM), while MS ISO 41001 emphasises that such planning should be embedded within a wider facility management system that incorporates leadership, resource allocation, performance evaluation and continual improvement.

Within the mosque context, maintenance planning becomes particularly important due to the dual nature of mosques as sacred spaces and community facilities. For *Masjid kariah*, maintenance decisions are often made by volunteer-based committees operating under financial constraints, fragmented technical support and limited access to formal management tools. Empirical studies on mosque and public-facility maintenance in Malaysia show that, in the absence of structured planning, maintenance tends to be reactive, ad hoc and heavily reliant on community donations, resulting in backlogs of defects, safety risks and diminished user satisfaction (Hauashdh et al., 2020; Dzulkifli et al., 2021; Yusof et al., 2025). A performance-based approach to maintenance planning is therefore needed to enable *Masjid kariah* to move from

short-term, fault-driven responses towards proactive, prioritised and evidence-informed maintenance strategies.

In this study, maintenance planning is conceptualised around two key constructs derived from the theoretical foundations discussed earlier: Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM). MSC, grounded in BS 3811, captures the extent to which PPM, PCM and UM are applied as outcome strategies in *Masjid kariah*. MPM, informed by MS ISO 41001:2018, encompasses seven dimensions – Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment and Safety and Health that represent the organisational and operational conditions shaping maintenance planning decisions. Together, these constructs enable a performance-based understanding of how planning is carried out and how it can be improved to support a more balanced, proactive maintenance profile in *Masjid kariah*.

In line with this orientation, the subsections that follow deepen the discussion on maintenance planning. Section 2.3.1 clarifies the definition and role of maintenance planning in the built environment. Section 2.3.2 outlines the maintenance planning process and distinguishes between strategic, tactical and operational planning levels. Section 2.3.3 elaborates the Maintenance Strategy Criteria (MSC) as the dependent variables in this study. Sections 2.3.4 and 2.3.5 review international and Malaysian literature on maintenance planning for religious buildings, with specific attention to mosques and *Masjid kariah*. Finally, Section 2.3.6 highlights the unique characteristics of *Masjid kariah* compared to other mosque categories, thereby justifying the need for a tailored, performance-based maintenance planning framework in the Kelantan context.

2.3.1 Definition and Role of Maintenance Planning

Maintenance planning is a critical process that ensures the optimal performance and longevity of assets by systematically organizing, scheduling, and managing maintenance activities to enhance reliability, safety, and efficiency. According to Duffuaa et al. (2001), maintenance planning involves developing systematic strategies to prevent equipment failures and improve reliability. Similarly, Aju kumar et al. (2018) emphasize that maintenance planning focuses on aligning resources, tasks, and timelines to minimize downtime and operational disruptions. Wireman (2004)

highlights the importance of balancing preventive and predictive maintenance approaches to optimize asset utilization, while Pintelon (2008); Pintelon et al. (2006) argue that maintenance planning integrates cost, safety, and operational goals to achieve sustainable asset management. Mhonsiwa (2024) defines maintenance planning as a process of determining maintenance needs, aligning resources, and scheduling tasks to ensure optimal asset performance, highlighting the critical role of systematic and proactive planning. Recent definitions further emphasize this strategic role, with Kelly (2006) defining maintenance planning as "*the systematic process of identifying, scheduling, and organizing maintenance activities to ensure that equipment and assets operate efficiently, safely, and reliably*". Similarly, Tsang (2002) highlights the importance of identifying maintenance requirements, defining tasks, and allocating resources effectively to enhance long-term reliability. Collectively, these perspectives underscore that maintenance planning is a proactive, multidisciplinary effort aimed at ensuring operational efficiency and sustainability.

Maintenance planning also serves as a foundational element for aligning organizational objectives with asset performance, particularly in environments where reliability and safety are paramount. Al-Turki (2011) asserts that maintenance planning involves not only task scheduling but also the integration of risk assessment to prioritize activities based on criticality and resource availability. Garg & Deshmukh (2006) highlight the importance of decision-making frameworks in maintenance planning to balance cost efficiency with operational goals. Tsang (2002) emphasizes the role of technological tools, such as computerized maintenance management systems (CMMS), to enhance accuracy and responsiveness in maintenance planning. Kelly (2006) underscores the significance of involving cross-functional teams to ensure comprehensive and strategically aligned maintenance plans. These insights collectively emphasize that maintenance planning is a dynamic and strategic process that evolves with technological advancements and organizational needs.

Developing a maintenance planning framework tailored to *Masjid kariah* requires integrating these foundational principles with the unique operational, cultural, and spiritual dynamics of these religious institutions. Duffuaa et al. (2001) underscore the importance of systematic task organization to ensure reliability, which, for *Masjid kariah*, translates to maintaining facilities that uphold the sanctity and functionality required for religious activities. Hamdan et al. (2023) emphasize the alignment of resources and schedules, addressing the financial constraints mosques often face while

ensuring timely repairs and upkeep. Wireman (2013), Pintelon (2008), and the British Standard (2018) highlight the significance of balancing preventive and predictive maintenance approaches. For *Masjid kariah*, this might involve regular inspections of high-use areas like prayer halls and wudu (ablution) facilities, alongside predictive monitoring of critical systems such as electrical wiring or HVAC units.

To create a strategy performance-based maintenance framework for *Masjid kariah*, it is crucial to focus on identifying and prioritizing maintenance tasks that directly impact the core functions of the mosque, such as ensuring the optimal performance of sound systems for the call to prayer and reliable water supply for ablution. Garg & Deshmukh (2006) emphasis on cost-efficiency and decision-making frameworks is particularly relevant, given the financial constraints often faced by mosques. Tsang (2002) advocacy for CMMS tools can further enhance resource tracking and task scheduling. Kelly (2006) stresses the importance of involving key stakeholders, such as mosque committee members and volunteers, in the planning process to ensure the framework aligns with both strategic objectives and community values. By applying these principles, *Masjid kariah* can develop a robust maintenance framework that supports its spiritual activities while contributing to its role as a centre for education, community engagement, and social support.

2.3.2 Maintenance Planning Process and Levels (Strategic, Tactical, Operational)

Maintenance planning is not a single activity but a multi-level process that links organisational goals to day-to-day maintenance actions. The literature distinguishes between strategic, tactical and operational levels of planning, each with different decision horizons, responsibilities and information requirements (Waeyenbergh & Pintelon, 2002; Ding & Kamaruddin, 2015). At the strategic level, organisations define maintenance goals, policies and standards that express the overall direction for asset care. The tactical level translates these goals and policies into maintenance strategies, priorities, programmes and budgets. The operational level then converts tactical plans into specific work orders, inspections and repairs executed on site. For *Masjid kariah*, recognising these three levels is important because many current practices focus only on operational responses to defects, with limited attention to strategic and tactical

planning. The following subsections discuss each level in turn, drawing on the maintenance literature and adapting it to the mosque context.

2.3.2.1 Strategic Level Maintenance Planning

At the strategic level, maintenance planning is concerned with aligning maintenance activities with the overarching objectives of the organisation and the long-term performance of its assets. Earlier studies identify building policy and strategy, strategic management, facility management and performance management as critical dimensions for sustainable maintenance management that must be established before detailed planning can occur (Schraven et al., 2011; Kamaruzzaman, et al., 2016). In this sense, maintenance objectives specify the conditions to be achieved such as safety, functionality, statutory compliance, image and value retention while maintenance goals indicate the desired performance over time, for example minimising life-cycle cost or ensuring continuous service delivery. When maintenance objectives are clearly defined, they provide a basis for justifying maintenance performance measurement and for evaluating whether maintenance works are effective (Ismail, 2014).

A key strategic instrument is the maintenance policy, which has been described as a management framework that incorporates maintenance strategies to ensure that buildings are maintained properly (Seeley, 1987). Maintenance policy sets out the "ground rules" for decision-making by specifying the scope of maintenance responsibilities, the principles for allocating resources and the preferred mix of maintenance strategies to be adopted (BSI, 1993; Parida et al., 2015). It also clarifies the roles and responsibilities of the operation and maintenance team, thereby supporting a more coherent approach to maintenance planning (Kamaruzzaman, et al., 2016). In the absence of a clear policy, maintenance tends to be fragmented, personality-driven and vulnerable to short-term pressures, as shown in assessments of university facilities where the lack of a documented maintenance policy was ranked as a major weakness (Ugwu et al., 2018).

Strategic planning further relies on maintenance standards and regulations, which provide benchmarks for what constitutes an acceptable condition and level of service. Standards such as BS 3811 define acceptable maintenance levels and are often adapted to local organisational policies and resource constraints (BSI, 1993). In practice, acceptable standards in individual organisations may be higher or lower than

reference standards depending on available funding and risk tolerance, but they remain essential inputs for deciding what work must be planned and at what level of quality (Elyna Myeda et al., 2011; Rani et al., 2015). For *Masjid kariah*, the strategic level thus involves setting explicit maintenance objectives, formulating a written maintenance policy and adopting appropriate standards and regulatory requirements that reflect both religious obligations and community expectations.

2.3.2.2 Tactical Level Maintenance Planning

The tactical level translates strategic intentions into concrete maintenance strategies, programmes and resource plans. Here, the focus shifts from "what the organisation wants to achieve" to "how maintenance will be structured and prioritised" over the medium term. The literature emphasises that the development of a maintenance strategy is a crucial aspect of building maintenance management, as it guides the selection and combination of maintenance types i.e. planned preventive, planned corrective and unplanned maintenance – according to asset criticality and resource availability (Hafizi et al., 2010; Horner et al., 1997). A maintenance strategy is introduced to extend the life cycle of buildings and must therefore be supported by a tactical plan that specifies priorities, frequencies and methods of execution (Velmurugan & Dhingra, 2015).

Tactical maintenance planning involves assessing multiple maintenance strategy criteria to determine the most suitable mix of strategies for each building or system. Waeyenbergh & Pintelon (2002) argue that an easy-to-use structured approach is needed so that maintenance strategy helps to meet organisational objectives and can be modified when performance gaps are identified. This includes evaluating the consequences of failure, service criticality, condition data, access constraints and budget limits, and then deciding where to emphasise preventive actions, where corrective approaches are acceptable and where contingency plans are needed. Integrated strategies that combine different maintenance types have been found to be more successful than reliance on a single strategy, especially in complex facilities (Patidar et al., 2017).

At this level, maintenance planning also covers the preparation of medium-term maintenance programmes, including inspection schedules, work plans, budgeting and procurement. Tactical planners decide which defects or backlog items will be addressed

in the next budget cycle, how often key components will be inspected, and what level of outsourcing or in-house capability will be used. Studies emphasise that effective and efficient maintenance planning depends heavily on the appropriateness of the maintenance strategies selected and on the completeness of the maintenance requirement list managed by maintenance managers (Ding & Kamaruddin, 2015; Campbell & Reyes-Picknell, 2015). For *Masjid kariah*, the tactical level therefore includes deciding the balance between planned preventive and planned corrective works, translating maintenance policies into annual programmes and aligning mosque maintenance priorities with available funding from government allocations, *waqf* and community donations.

2.3.2.3 Operational Level Maintenance Planning

At the operational level, maintenance planning focuses on the day-to-day execution of maintenance activities on site. This involves converting tactical plans and maintenance strategies into specific work orders, job instructions, time schedules and resource assignments for technicians and service providers. Operational planning covers activities such as routine inspections, cleaning, minor repairs, safety checks, corrective actions following defect reports and emergency responses to failures. In practice, this level is where Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) are implemented through detailed task lists, checklists and service requests.

The literature indicates that operational planning requires accurate information on asset condition, access to spare parts and tools, and clear communication channels between users, maintenance staff and management (Olanrewaju et al., 2010; Campbell & Reyes-Picknell, 2015). Computerised maintenance management systems (CMMS) and other digital tools are increasingly used to register assets, schedule tasks, log work orders and track response times, thereby supporting more systematic operational control. However, in many public and religious facilities, operational planning remains largely manual and reactive, with maintenance teams responding to complaints and visible defects rather than following structured schedules (Hauashdh et al., 2020; Dzulkifli et al., 2021).

For *Masjid kariah*, operational maintenance planning typically involves mosque committee members, volunteers and external contractors coordinating routine activities such as cleaning, minor repairs, servicing of mechanical and electrical systems, and urgent works when defects threaten safety or worship activities. The effectiveness of this level depends on how well it is supported by the tactical and strategic levels through clear policies, priorities, budgets and performance indicators. In this study, the operational level is closely linked to the Maintenance Strategy Criteria (MSC) of PPM, PCM and UM, which reflect the actual pattern of maintenance activities carried out in *Masjid kariah* and are examined in detail in Section 2.3.3.

2.3.3 Maintenance Strategy Criteria (MSC) (Dependent Variables)

Within the broader maintenance planning process, a maintenance strategy describes the overall approach an organisation adopts to maintain its assets and achieve its maintenance objectives. Early authors emphasised strategy as a long-term plan that links organisational goals, policies and maintenance actions, ensuring that maintenance efforts are coordinated rather than ad hoc (Gallimore & Penlesky, 1988; Quinn, 1980). Subsequent definitions highlight maintenance strategy as a structured decision framework that specifies how different maintenance types and resources are combined to support reliability, safety and cost effectiveness over the asset life cycle (Akasah et al., 2009; Anwar & Hasnu, 2017; Velmurugan & Dhingra, 2015; Waeyenbergh & Pintelon, 2002). Table 2.2 summarises selected definitions of maintenance strategy from the literature, illustrating the evolution from narrow, cost-oriented views towards more integrated, performance-based conceptualisations.

Table 2.3
A List of Definitions of Maintenance Strategy

No.	Author(s)	Definition
1.	Quinn (1980)	The plan integrates an organisation's major goal, policies, and action sequences into a cohesive whole.
2.	Gallimore & Penlesky (1988)	The pattern or plan that integrated primary organisational goals, policies, and action sequences into a cohesive whole. A well-formulated strategy helps to marshal and allocate an organisation's resources into a unique and variables posture based on its relative internal competencies and shortcoming, anticipated changes in the environments, and contingent moves by intelligent components.
3.	Waeyenbergh & Pintelon (2002)	Direction on how the maintenance objective can be established and needs to be reviewed from time to time depending on the business requirement and changing the environment.

No.	Author(s)	Definition
4.	Akasah et al. (2009)	Rules for the sequence of planned maintenance work consists of general scheduling information, maintenance tasks, and maintenance plans as required.
5.	Velmurugan & Dhingra (2015)	Planned way to upkeep devices, which contains actions such as "identification, researching, and execution of many repairs, replace and inspect decisions".
6.	Anwar & Hasnu (2017)	The study of the strategy was included action is taken, the content of strategy, and the process by which activities are required to decide and implemented.

Across these definitions, several common elements can be identified. First, maintenance strategy is consistently described as long-term and goal-oriented, rather than a collection of isolated actions. Second, it is conceived as integrative, combining technical and managerial decisions on maintenance types, priorities, frequencies and resource allocation. Third, strategy is expected to be responsive and adaptable, allowing organisations to adjust their maintenance mix as asset conditions, risk profiles and budget constraints change. Building on this synthesis, the present study views maintenance strategy as the deliberate combination of maintenance actions and policies selected to achieve defined performance objectives for *Masjid kariah* facilities under real-world resource limitations.

Based on BS 3811:1993 and subsequent interpretations, maintenance strategies for buildings are commonly classified into planned and unplanned categories. Planned maintenance comprises preventive actions, which may be scheduled or condition-based, and planned corrective actions that are organised in advance, while unplanned maintenance comprises corrective actions carried out in response to unexpected failures and emergencies (British Standards Institution, 1993; Chanter & Swallow, 2008; Seeley, 1987; Wireman, 2012). Figure 2.4 presents an overview of these maintenance strategies for buildings based on BS 3811, highlighting the distinction between planned and unplanned maintenance and the position of preventive and corrective actions within this hierarchy.

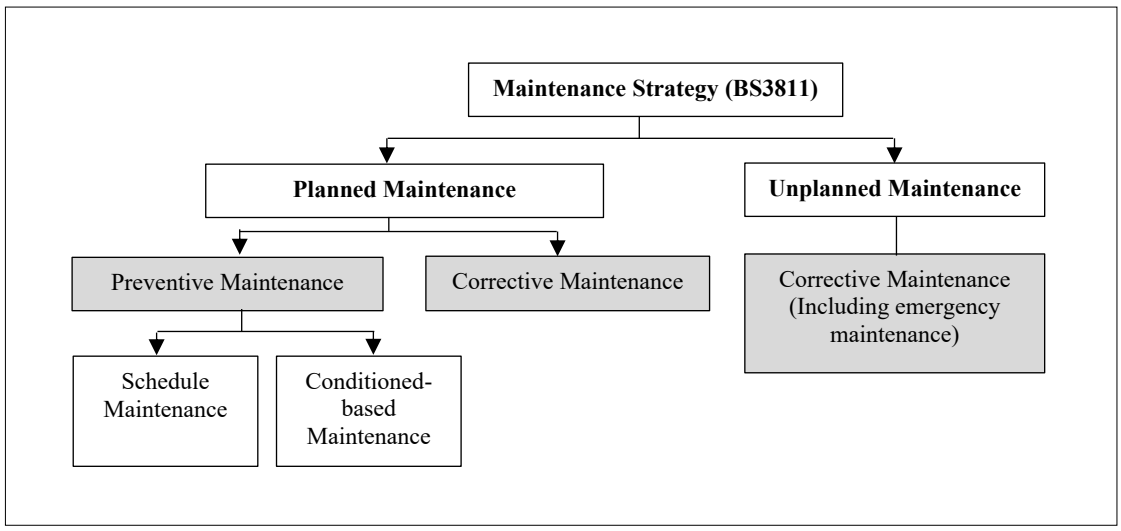

Figure 2.4 Overview of Different Maintenance Strategies for Buildings based on British Standard 3811. Source: BS3811 (1993); Chanter & Swallow (2008); Leong (2004); Mohammed & Wan Mat (1991); Seeley (1987); Wireman (2012, 2013).

Guided by this BS 3811 typology, the present study operationalises maintenance strategy through three core maintenance strategy criteria, namely Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM). BS 3811 distinguishes between actions undertaken to keep an item in a satisfactory state and actions undertaken to restore it after failure, which underpin the differentiation between planned and unplanned maintenance and between preventive and corrective categories (British Standards Institution, 1993). Contemporary maintenance literature shows that these three criteria recur as fundamental strategy types across different sectors and building types, and that the balance between them strongly influences reliability, service continuity and life-cycle cost (Beşiktepe et al., 2020; Gackowiec, 2019; Hauashdh et al., 2020).

In this study, the three strategy criteria – PPM, PCM and UM are collectively referred to as the Maintenance Strategy Criteria (MSC) and constitute the dependent variable in the proposed framework. A higher emphasis on PPM and PCM is interpreted as evidence of a more proactive, planned maintenance orientation, whereas a dominance of UM indicates a reactive pattern characterised by emergency works and breakdown responses. This interpretation is particularly relevant for *Masjid kariah*, where maintenance is often constrained by limited budgets and volunteer-based management structures, and where the current mix of planned and unplanned works provides an

important indicator of maintenance planning maturity (Dzulkifli et al., 2021; Hauashdh et al., 2020).

The following subsections therefore examine each of the three maintenance strategy criteria in turn. Section 2.3.3.1 discusses Planned Preventive Maintenance (PPM), Section 2.3.3.2 elaborates Planned Corrective Maintenance (PCM) and Section 2.3.3.3 explains Unplanned Maintenance (UM), with particular attention to their definitions, characteristics and implications for *Masjid kariah* maintenance planning.

2.3.3.1 Planned Preventive Maintenance (PPM)

Planned preventive maintenance is defined as significant structured repairs, which are carried out with the use of records to a pre-determined plan. This type of maintenance is different from the day-to-day repair service because it keeps buildings modern, safe, and comfortable (Izobo-Martins, 2014). The objective of planned preventive maintenance is to minimise the need for emergency repair or emergency maintenance work or prevent the occurrence of emergency works. It is well organised and carried out with forethought and control, as well as the use of records to a predetermined plan. According to Wang et al. (2007), planned preventive maintenance in practice consists of two forms, namely, periodic and predictive. The periodic form is time-based and a schedule is used to prevent any sudden failure, while the predictive form is not time-based, but condition-based maintenance and is carried out based on various measurement instruments.

Planned Preventive Maintenance is usually carried out at predetermined intervals of time to reduce the probability of failure or unsatisfactory maintenance performance of an item. This type of maintenance relies on the predicted possibility that the system, equipment, or even a part of it will break down in a specific period (Swanson, 2001). The goal of this strategy is to decrease the number of failures or any damages of the component or system in the building (Ruparathna et al., 2018). The basis of planned preventive maintenance is its reliability and accuracy in the rectification of the works. Among various maintenance strategies in building maintenance works, planned preventive maintenance is more challenging in terms of its effectiveness by employees (Loosemore & Hsin, 2001). Hence, this strategy is used to check the condition of the equipment used, and there would be several things to estimate when it should be scheduled.

Seeley (1987) described preventive maintenance as the work that is done to prevent the facility from failing, thus, able to operate within its expected lifespan. It is specific work carried at a given time on a given matter. This maintenance strategy involves routine and repetitive operations, such as replacement, inspection, servicing, and cleaning of equipment. According to BS3811 (1993), there are two types of planned preventive maintenance, which are planned preventive scheduled maintenance and planned preventive condition-based maintenance. Al-Najjar & Alsyouf (2003) reported that the key objective of this strategy is to reduce the number of failures by carrying out maintenance work either on a schedule or on a conditioned basis.

i. Planned preventive scheduled maintenance

Planned preventive scheduled maintenance is carried out within a given period under a predetermined schedule, such as a timeline, operations, and distance. This strategy is implemented to a predetermined time interval and multiple operations. By using this strategy, the life expectancy of the equipment can be scheduled for a replacement (BS3811, 1993).

ii. Planned preventive condition-based maintenance

Planned preventive condition-based maintenance starts with information on the condition of the defective items from regular or ongoing monitoring (BS3811, 1993). Hafizi et al. (2010) explained that this strategy is performed as a response to the facility's significant deterioration. Table 2.4 shows the criteria for the planned preventive maintenance strategy, which consists of scheduled maintenance and condition-based maintenance.

Table 2.4
Planned Preventive Maintenance Strategy Criteria

No.	Description	Criteria
1.	Planned Preventive Maintenance (Scheduled Maintenance)	Preventive maintenance is carried out under the plan, determined within a specified period (BS3811, 1993)
2.	Planned Preventive Maintenance (Condition-based Maintenance)	Maintenance is carried out in response to a significant deterioration in the facility (Kelly et al., 2005)

Overall, both planned preventive schedule maintenance and conditioned-based maintenance are carried out the same way.

2.3.3.2 Planned Corrective Maintenance (PMC)

Planned Corrective maintenance is the simplest type of maintenance strategy, whereby building elements or the services are used until they break down. In the event of a failure, maintenance work is carried out to repair damages to an item so that it can perform the required function. This maintenance strategy is widely used in building maintenance management, as it covers all activities, including replacement or repair of the elements.

According to Waeyenbergh & Pintelon (2002), this maintenance strategy is the oldest in the industry. This strategy is accomplished by repairing, replacing, or servicing damaged parts to an acceptable condition. However, the maintenance backlog that should have been planned would have to be made up. Any repair or replacement decision is made once a component has failed. According to Nilsson and Bertling (2007), this strategy is usually implemented after a breakdown and is intended to restore or repair an item to the appropriate state for it to perform its required function.

In conclusion, this maintenance strategy criteria emphasise maintenance activities related to restoring damaged items to their original state, and act as an immediate action that could prevent further damage or defect. Table 2.5 lists the definition of the planned corrective maintenance.

Table 2.5
Planned Corrective Maintenance

No.	Description	Criterion
1.	Planned Corrective Maintenance	Repair or replacement of damaged equipment (Lewis, 2000)

2.3.3.3 Unplanned Maintenance (UM) (Emergency Maintenance)

Unplanned maintenance involves work without proper planning. This maintenance strategy will only be used if the building itself suffers unexpected damage. Examples of unexpected damages may include natural disaster, or a fire caused by an accident that affects the building, or prolonged defective works that subsequently affect the overall structure and architecture of the building itself. This maintenance strategy is

implemented for unexpected repairs towards the buildings without any form of initial planning.

In other words, unplanned maintenance is a 24-hour operation implemented in an ad-hoc manner without any predetermined plan. In any situation, services are operated until their breakdown. Thus, the maintenance team will only respond to services with concern over life-threating issues. Ing (2008) has classified two circumstances that could lead to unplanned maintenance. The first circumstance could be due to maintenance habits, while the second circumstance could be the result of a sudden damage or defects, which maintenance management would not think to plan. These unexpected circumstances could result in high maintenance costs (Rani et al., 2015).

Emergency maintenance is an important maintenance action to be implemented immediately to prevent further damage or severe impact on the item. It deals with the works that must be initiated for safety and security reasons, otherwise it may result in the rapid deterioration of the function or structure of the item. Table 2.6 shows the unplanned maintenance strategy criterion (emergency maintenance).

Table 2.6
Unplanned Maintenance as Maintenance Strategy Criterion

No.	Description	Criterion
1.	Unplanned Maintenance (Emergency Maintenance)	Immediate action is taken immediately to recover service or prevent further incidents from damage (Leong, 2004)

Nonetheless, this maintenance strategy is unacceptable due to improper planning and inadequate compliance with the plan. In summary, the three Maintenance Strategy Criteria (MSC) – Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) – provide a structured lens for interpreting how mosque facilities are currently maintained and how proactive or reactive their maintenance profile is. However, the effectiveness of these strategies is also shaped by broader contextual factors, including governance structures, funding models and cultural expectations surrounding religious buildings. To situate *Masjid kariah* within a wider body of knowledge and to identify transferable lessons for improving maintenance planning, the next section reviews international literature on maintenance planning for religious buildings in different countries and faith traditions.

2.3.4 Maintenance Planning for Religious Buildings: International Perspectives

Religious buildings worldwide combine liturgical use, community functions, and heritage value, requiring maintenance strategies that reconcile frequent occupation with conservation imperatives and long-term performance goals. Unlike secular buildings where maintenance planning can prioritise efficiency and cost-effectiveness alone, religious facilities must balance spiritual significance, cultural authenticity, and active community use with technical and financial constraints (Matrone et al., 2023; Sabri & Olagoke, 2020). International comparative studies highlight that institutional fragmentation, funding shortfalls, and shifting social uses undermine routine upkeep unless governance and funding mechanisms are coordinated across multiple actors (Matrone et al., 2023; Tommasi et al., 2020). Religious sites often form part of broader urban heritage systems and may be underutilised or repurposed, creating maintenance backlogs distinct from commercial or residential assets; international cases demonstrate that these pressures lead to ad-hoc interventions and loss of fabric when governance structures are weak (Richard & Golkarian, 2023; Sabri & Olagoke, 2020). This section reviews international literature to identify transferable lessons on maintenance planning frameworks, funding models, technological tools, and community participation strategies that may inform the development of a contextually appropriate maintenance planning framework for *Masjid kariah* in Malaysia.

2.3.4.1 Funding and Governance Challenges

Governance fragmentation is a recurrent theme in international religious building maintenance literature and significantly reduces the effectiveness of coordinated maintenance planning, particularly where religious assets intersect urban heritage systems and involve multiple public bodies, religious authorities, and community stakeholders (Matrone et al., 2023; Bocasso et al., 2024). Funding constraints are identified as a primary driver of corrective rather than preventive maintenance in resource-limited contexts, producing deferred maintenance backlogs and accelerated deterioration of building fabric (Richard & Golkarian, 2023; Tommasi et al., 2020). Studies from Ethiopia, Ecuador, and Nigeria demonstrate that religious buildings in developing contexts face severe funding gaps, with reliance on irregular donations and limited access to government conservation grants (Richard & Golkarian,

2023; Barsallo & Achig, 2020; Sabri & Olagoke, 2020). Policy gaps exist where heritage legislation does not explicitly cover modern or community-level religious buildings, leaving custodians without access to conservation funding or clear intervention protocols (Sabri & Olagoke, 2020).

From these international experiences, several practical implications emerge for maintenance planning. First, integrating multi-agency roles into a single maintenance matrix can allocate responsibilities clearly and streamline approval processes (Matrone et al., 2023). Second, prioritising budget lines for preventive works and basic life-safety servicing can reduce the need for costly emergency retrofits later (Richard & Golkarian, 2023; Tommasi et al., 2020). Third, developing adaptable financial models that combine public grants, community contributions, and self-generated income streams may provide more sustainable funding for active religious sites (Sabri & Olagoke, 2020; Barsallo & Achig, 2020).

2.3.4.2 Maintenance Approaches and Technology Integration

International cases increasingly favour preventive and multidisciplinary frameworks that sequence survey, diagnosis, intervention, and monitoring activities rather than relying on episodic reactive repairs (Barsallo & Achig, 2020; Muñoz Moreno et al., 2022). The ICOMOS preventive conservation methodology, which structures maintenance planning through four phases—anamnesis (historical research), diagnosis (condition assessment), therapy (intervention planning), and control (monitoring) has been successfully applied in religious building contexts in Ecuador and other countries (Barsallo & Achig, 2020). Heritage-oriented Heritage Building Information Modeling (HBIM) and integrated HBIM-GIS platforms have been piloted to centralise geometric, material, and maintenance data, enabling interoperable task scheduling, condition mapping, and stakeholder access across multiple sites (Matrone et al., 2023; Nieto Julián et al., 2024).

Key practical tools and outcomes from international experience include the use of HBIM platforms to provide unified asset databases for planning inspections, quantifying interventions, and linking interventions to schedules and cost estimates (Matrone et al., 2023; Nieto Julián et al., 2024). Scan-to-HBIM workflows support detailed condition surveys (auscultation) and parametric tagging of decay types, improving clarity for technicians and conservators (Nieto Julián et al., 2024). Artificial

intelligence (AI) and fuzzy logic systems have been applied to standardise in-situ visual inspection scoring and reduce inter-expert variability during condition assessments, thereby aiding prioritisation of maintenance actions (Muñoz Moreno et al., 2022; Carpio et al., 2021). For operational implementation, adopting HBIM-enabled asset registries for active-use facilities can support routine preventive maintenance cycles rather than focusing exclusively on large-scale restoration projects (Matrone et al., 2023). Additionally, rule-based or fuzzy decision-support systems can assist in triaging inspections when specialist resources are limited (Muñoz Moreno et al., 2022; Carpio et al., 2021).

2.3.4.3 Community Participation and Conservation Balance

Community stewardship plays a vital role in religious building maintenance internationally, often supplying volunteer labour, fundraising, and routine care activities, but it can also prioritise functional alterations over fabric conservation without proper guidance and governance frameworks (Sabri & Olagoke, 2020; Barsallo & Achig, 2020). Participatory projects that reactivate religious buildings as community resources have improved daily maintenance regimes and created social value that supports long-term conservation planning (Bocasso et al., 2024; Barsallo & Achig, 2020). Shared stewardship models that formalise volunteer roles and schedule simple preventive tasks help protect building fabric while maintaining functional use (Barsallo & Achig, 2020; Ibrahim & Deraman, 2024). Protection-use frameworks that set objective habitability parameters reconcile liturgical needs with conservation constraints for occupied religious complexes (Millán-Millán & Cabeza-Lainez, 2022).

Contextual adaptation is vital for success: effective revitalisation programmes combine technical conservation expertise, institutional support, and community-led revenue generation or programming activities to sustain ongoing maintenance (Bocasso et al., 2024; Richard & Golkarian, 2023). Where community capacity is limited, targeted training programmes, small grant schemes, and simplified monitoring checklists can help maintain performance standards without requiring extensive specialist input (Matrone et al., 2023; Richard & Golkarian, 2023). Table 2.7 summarises key international maintenance planning approaches for religious buildings.

Table 2.7
International Maintenance Planning Approaches for Religious Buildings

No.	Country/ Region	Building Type	Maintenance Approach	Key Features	Reference
1.	Italy/Switzerland (Sacri Monti)	UNESCO chapel complexes	Integrated HBIM-GIS platform	Multi-LOD 3D models; spatial database; interoperability among stakeholders; preventive maintenance scheduling	Matrone et al. (2023)
2.	Ecuador (Susudel)	Colonial chapel	ICOMOS preventive conservation phases	Four-phase methodology: anamnesis, diagnosis, therapy, control; community participation; stakeholder role definition	Barsallo & Achig (2020)
3.	Spain (Seville)	Historic church	Art-Risk 3.0 fuzzy logic software	Vulnerability assessment; preventive action prioritisation; post-restoration monitoring	Muñoz Moreno et al. (2022)
4.	Chile	Masonry churches	Expert-panel digital inspection with fuzzy scoring	Reduced inter-expert uncertainty; standardised condition assessment; preventive planning support	Carpio et al. (2021)
5.	Malaysia (Kuala Lumpur)	Historic mosque (Masjid Jamek)	Qualitative case study of maintenance practices	Identified reliance on corrective maintenance; limited personnel and budget constraints	Ibrahim & Deraman (2024)
6.	Nigeria (Yorubaland)	Colonial-era churches	Mixed methods: surveys, interviews; protection-use model	Legal gap identification; institutional constraint analysis; balanced protection-use management proposal	Sabri & Olagoke (2020)

No.	Country/ Region	Building Type	Maintenance Approach	Key Features	Reference
7.	Ethiopia (Lalibela)	Rock-hewn churches	Qualitative conservation assessment	Environmental exposure analysis; funding gap identification; capacity-building recommendations	Richard & Golkarian (2023)
8.	Italy (Molfetta)	Cathedral	Scan-to-HBIM workflow (TLS/SfM)	Point-cloud semantic segmentation; deterioration database; auscultation and intervention planning	Nieto Julián et al. (2024)

2.3.4.4 Synthesis and Transition to Malaysia Context

International experience demonstrates that effective maintenance planning for religious buildings combines preventive frameworks, interoperable digital records, hybrid funding models, and organised community stewardship to sustain active use without compromising heritage values (Matrone et al., 2023; Muñoz Moreno et al., 2022; Barsallo & Achig, 2020). However, most documented tools and frameworks target high-profile heritage-listed sites with significant technical and financial resources; there is limited evidence on transferring HBIM systems, AI-assisted inspection tools, and formal governance models to small, community-managed places of worship that lack dedicated technical staff or stable budgets (Matrone et al., 2023; Ibrahim & Deraman, 2024). Translating these international lessons to the *Masjid kariah* context will require simplified digital templates, scalable preventive maintenance schedules, and locally appropriate funding and governance mechanisms that integrate mosque committees with municipal or state religious authorities. This identified gap motivates the focus of the next section on Malaysian mosque maintenance realities and how international best practices might be adapted to the specific institutional, cultural, and resource contexts of *Masjid kariah* in Kelantan.

2.3.5 Maintenance Planning for Mosques in Malaysia and Masjid Kariah

The international literature on religious facilities shows that maintenance planning is strongly shaped by local governance structures, funding mechanisms and community expectations (see Section 2.3.4). In Malaysia, these influences are particularly evident in the case of mosques, which function simultaneously as sacred spaces and community facilities and are administered within a distinctive Islamic institutional framework. While some larger state and national mosques benefit from formalised maintenance arrangements and professional facility management support, many community mosques (*Masjid kariah*) rely heavily on volunteer committees, public donations and ad hoc decision-making, which can undermine the consistency and effectiveness of maintenance planning (Hauashdh et al., 2020; Dzulkifli et al., 2021).

To understand how a performance-based maintenance planning framework can be developed for *Masjid kariah*, it is therefore necessary to situate these mosques within the broader Malaysian context. This involves, first, recognising the physical characteristics and maintenance needs of mosque facilities, second, examining the regulatory and institutional arrangements that govern their development and upkeep, and third, analysing how maintenance planning is actually practiced at the community level. Accordingly, Section 2.3.5.1 outlines the main features of mosque facilities in Malaysia and the implications for maintenance needs; Section 2.3.5.2 reviews the regulatory and institutional framework that shapes mosque maintenance; and Section 2.3.5.3 focuses specifically on maintenance planning practices and key issues in *Masjid kariah*, providing the empirical and contextual foundation for the framework proposed in this study.

2.3.5.1 Mosque Facilities and Maintenance Needs in Malaysia

Mosques in Malaysia are characterised by a combination of distinctive spatial elements and building services that together support both ritual worship and wider community activities. Typical mosque facilities include the main prayer hall, mihrab, arches, galleries, verandas, courtyards and circulation areas, all of which must be properly oriented towards the Kaaba to ensure the validity of congregational prayer (Budi & Wibowo, 2018). In addition to these core worship spaces, many mosques

incorporate supporting facilities such as offices, libraries, multipurpose halls, educational rooms, storage spaces and areas for social or welfare activities. These spatial components form the physical basis of mosque operations and determine the scope of maintenance planning required to keep the facilities functional, safe and welcoming for users of different ages and abilities, including the elderly and persons with disabilities.

From a building perspective, mosque facilities may be broadly divided into the building envelope and building services. The envelope typically comprises structural and architectural elements such as the prayer hall structure, roof, façade, minaret, mimbar (pulpit), veranda, floor finishes, doors and windows, together with external works including parking areas, walkways, landscaping, boundary walls, external lighting and site drainage (Mazlan et al., 2018). Building services usually encompass the mechanical and electrical systems that support the comfort and functionality of the mosque, including lighting, fans or HVAC systems, public address and sound systems, water supply and plumbing, ablution facilities, toilets, fire protection systems and closed-circuit television (CCTV). Some authors further distinguish between inner spaces (e.g. prayer halls, multipurpose halls, offices, ablution areas and toilets) and outer spaces (e.g. courtyards, landscaping, roads and parking areas), emphasising that both sets of spaces generate different but interrelated maintenance demands (Sapril et al., 2016).

These diverse components give rise to a wide range of maintenance needs. Structural and architectural elements require periodic inspection, cleaning, repairing and replacement to prevent defects such as water ingress, cracking, spalling, slippery floors or damaged finishes. Building services demand regular servicing, testing and calibration to ensure that lighting, sound systems, water supply, sanitation and fire safety systems remain reliable, particularly during peak usage times such as Friday prayers and religious festivals (Mustafa et al., 2011). Previous studies note that, if maintenance works are not planned and executed systematically for both building conditions and building services, mosques can experience accelerated deterioration, higher life-cycle costs and increased safety risks for worshippers (Mazlan et al., 2018; Mustafa et al., 2011). In the Malaysian context, where many mosques operate under resource constraints and rely on community contributions, these characteristics underline the importance of structured maintenance planning that recognises the full range of mosque facilities and their associated maintenance needs. This provides the

background for examining how maintenance for mosques is provided and governed institutionally in Malaysia, as discussed in the next subsection.

In summary, the physical diversity and escalating maintenance needs of mosque facilities in Malaysia highlight the importance of a coherent governance structure to coordinate funding, technical standards and operational responsibilities. The next subsection therefore examines the regulatory and institutional framework that governs mosque development and maintenance before zooming in on how these arrangements influence planning practices in *Masjid kariah*.

2.3.5.2 Regulatory and Institutional Framework for Mosque Maintenance

Malaysia's mosque maintenance system operates within a multilayered regulatory environment that combines national legislation, state Islamic enactments and administrative guidelines. In addition to legislation and Islamic enactments, Malaysia's mosque maintenance environment can also be referenced against national public-asset administrative guidelines issued by Jabatan Kerja Raya (JKR). For example, the *Garis Panduan Pengurusan Operasi dan Penyenggaraan* (GPOP) provides a structured operations and maintenance workflow which covering governance roles, CMMS-based records, and the setting of service targets (SLA) and performance indicators (KPI) within the Operations and Asset Maintenance (OPA) phase, aligned with the Government Asset Management policy and procedural framework, namely the *Dasar Pengurusan Aset Kerajaan* (DPAK), *Manual Pengurusan Aset Menyeluruh* (MPAM) and *Tatacara Pengurusan Aset Tak Alih Kerajaan* (TPATA). In parallel, the *Garis Panduan Pengurusan Ruang* (GPPR) supports the same OPA phase by guiding systematic space management and space audits, which also underpin building performance assessment requirements under TPATA.

At the federal level, the Street, Drainage and Building Act 1974 (Act 133) and the Local Government Act 1976 (Act 171) provide the statutory basis for building safety, inspections and public facility upkeep, while state Islamic religious councils (SIRC/MAIN) and the Department of Islamic Development Malaysia (JAKIM) issue specific policies and procedures for mosque development and management. Together with standards such as BS 3811 and MS ISO 41001:2018, these instruments are intended to provide an integrated framework for planning, implementing and monitoring mosque maintenance across the country.

The state government has passed state enactments to administer and manage mosques. Table 2.8 lists the Islamic enactments, sections, and provisions of each state in Malaysia in relation to the provision of mosque maintenance. There are four types of provisions based on states: (1) maintenance of the mosque and compound (Federal Government, Selangor, Negeri Sembilan, Sabah, Johor, Sarawak, Perak, Pahang, Melaka, and Penang); (2) repair and supervision of mosque (Kelantan); (3) maintenance of mosques (Kedah); and (4) maintenance and repairs of mosques (Perlis).

Table 2.8
Islamic Enactments Related to Provision of Mosque Maintenance by State

State	Enactment	Part/Heading	Section	Provision (Section)	Source (s)/ References
Federal Government	Administration of Islamic Law (Federal Territories) Act 2003 (Act 505)	Part VII Mosque	74 (1-4)	Maintenance of the mosque and compound.	L. O. MALAYSIA (1993)
Selangor	Administration of the Religion of Islam (State of Selangor) Enactment 2003 (Enactment No. 1/2003)	Part VII Mosque	99 (1-5)	Maintenance of the mosque and their compound.	Selangor (2003)
Negeri Sembilan	Administration of the Religion of Islam (State of Negeri Sembilan) Enactment 2003 (Enactment No. 10/2003	Part VII Mosque	99 (1-4)	Maintenance of the mosque and their compound.	Sembilan (2003)
Kelantan	Council of the Religion of Islam and Malay Custom Kelantan Enactment 1194 (Enactment No.4/1994)	Part IV Mosque	83 (1-4)	Repair and supervision of mosque.	Kelantan (1994)
Sabah	Majlis Ugama Islam Negeri Sabah Enactment 2004 (Enactment No.5/2004)	Part IV Mosque	61 (1-5)	Maintenance of the mosque and their compound.	Sabah (2004)
Kedah	Administration of Islamic Law (Kedah Darul Aman) Enactment 2008 (Enactment No. 5/2008)	Part V Mosque	62 (1-5)	Maintenance of Mosques.	Kedah (2008)
Perlis	Administration of Muslim Law Enactment Enactment 1963 (Enactment No. 3/1964)	Part VII Mosques	76 (1-3)	Maintenance and repairs of Mosques.	Perlis (1963)
Johor	Administration of the Religion of Islam (State of Johor) Enactment 2003 (Enactment No. 16/2003)	Part VII Mosque	99 (1-5)	Maintenance of the mosque and their compound.	Johor (2003)
Sarawak	State Religious Council Islam Sarawak Ordinance 2001 (Chapter 41)	Part VI Establishment of Lembaga Hal Ehwal Islam Dan Adat Melayu, Lembaga Masjid-Masjid, etc.	59 (1&2)	Maintenance of mosque and compounds.	Sarawak (2001)
Perak	Administration of the Religion of Islam (Perak) Enactment 2004 (Enactment No. 4/2004)	Part VII Mosques	88 (1-5)	Maintenance of the mosque and their compound.	Perak (2004)
Pahang	Administration of Islamic Law Enactment 1991 (Enactment No. 3/1991)	Part VI Mosques	90 (1-4)	Maintenance of the mosque and compound.	Pahang (1991)
Melaka	Administration of the Religion of Islam (State of Malacca)	Part VII Mosques	87 (1-5)	Maintenance of the mosque and their compound.	Melaka (2002)

State	Enactment	Part/Heading	Section	Provision (Section)	Source (s)/ References
	Enactment 2002 (Enactment No. 7/2002)				
Penang	Administration of the Religion of Islam (State of Penang) Enactment 2004 (Enactment No. 2/2004)	Part VII Mosques	99 (1-5)	Maintenance of the mosque and their compound.	Penang (2004)
Terengganu	Administration of Islamic Religious Affairs (Terengganu) Enactment 1422H/2001M (Enactment No. 2/2001)	Part VI Mosques	83 (1-5)	Maintenance of the mosque and their compounds.	Terengganu (2001)

Nowadays, a mosque is not only a place for worshipping Allah S.W.T., but also a place for the community that provides religious education and welfare services, including zakat collection and distribution, endowment (*waqf*) collection, and Sadaqah distribution for the needy (Ahmad et al., 2020). Karim (2016) opined that the development of a mosque in each district or residential area was primarily intended to supplement Muslims' need for conducting congregational prayers.

As a centre of the surrounding communities, mosques in Malaysia are administrated by a group of committee members. The administration of mosques in the Malaysian context consists of mosque officers and committee members who manage these mosques under Majlis Agama Islam Negeri (MAIN, State Islamic Council). There are also multiple stakeholders, such as political bodies, private sectors, government sectors, non-governmental organisations, and others that could affect the maintenance strategies for each mosque due to the differences in management. However, not every mosque is registered under MAIN. Therefore, the committee members need to manage each *Masjid kariah* under their supervision by themselves.

Figure 2.5 shows that there are two types of mosques administration in Malaysia; one is under state governance and the other is under federal (Wilayah Persekutuan) governance. Both administrations are similar, with the only difference is that mosque committee members are placed under the Sultan or Yang Di Pertuan Negeri of the state governments, while for federal governance, mosque committee members are placed under the Yang Di Pertuan Agong.

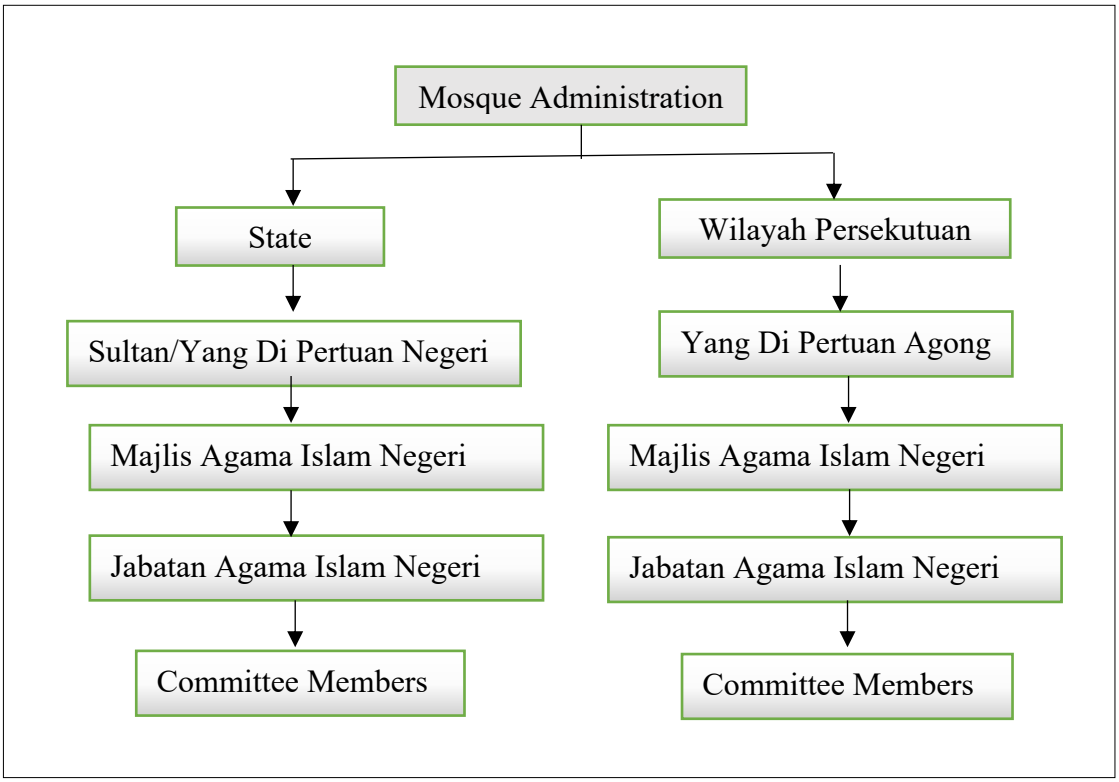

Figure 2.5 Types of Mosque Administration in Malaysia

Source: Asharaf et al. (2012)

There are three criteria that should be fulfilled by the *Masjid kariah* committee members in handling these facilities, namely, physical, *imarah*, and management of the mosque itself. According to (Mohamad, 2019a), and Mustari and Jasmi (2008), committee members of a *Masjid kariah* need to maintain the mosque based on their designated responsibilities.

The expectations and requests from mosque committee members need to be managed efficiently to avoid conflict of interest among stakeholders. However, the Kelantan Council of Religion and Malay Custom (Majlis Agama Islam dan Adat Istiadat Melayu Kelantan, MAIK) Enactment 4 of 1994, Division IV - MASJID, Section 80, states that "*Majlis hendaklah menjadi pemegang amanah masjid*," which can be translated as the Council shall be the trustee of the mosques. Thus, MAIK is responsible for all management-related activities at *Masjid kariah*, and Jabatan Hal Ehwal Agama Islam Kelantan (Islamic Religious Affairs Department) would execute the instructions given by MAIK in the state of Kelantan Darul Naim (ENAKMEN, 1994).

Seshadhri & Paul (2018) stated that an ideal direction in measuring the effectiveness of maintenance performance should be carried out by stakeholders, expert groups, and end users. Several stakeholders are responsible for managing all mosque s in each state in Malaysia. There are two types of mosques administration in Malaysia, which are divided into state and federal administrations, as follows:

i. Sultan/Yang Di Pertuan Negeri: Sultan or Yang Di Pertuan Negeri is the head of all Islamic managements in their respective states, including the State Islamic Councils, according to Section 8, the Administration of the Religion of Islam (State of Selangor) Enactment 2003.

ii. State Islamic Council (Majlis Agama Islam Negeri, MAIN): All mosques and surau are under the supervision of MAIN. For example, MAIS in Selangor is responsible for making policies for the Muslim agenda, including maintenance management, as spelled out in Section 103 of the Administration of the Religion of Islam (State of Selangor) Enactment 2003.

iii. State Islamic Department (Jabatan Agama Islam Negeri, JAIN): All states in Malaysia have their own JAIN to manage and plan all related Islamic affairs and developments for the ummah. For example, the Islamic department in Kelantan Darul Naim is known as Jabatan Hal Ehwal Agama Islam Kelantan (JAHEAIK). All policies provided by MAIK will be implemented by JAHEAIK. The principal duties of JAINs are planning and executing MAIN's policies and regulations.

iv. District Islamic Office (Pejabat Agama Islam Daerah, PAID): PAID is responsible for managing all activities and management of mosques in their district. A maintenance officer would be responsible under the District Mosque Management Unit (Unit Pengurusan Masjid Daerah, UPMD). The main objective of PAID is to manage and propose a physical development project to MAIK and supervise all mosques in their district.

v. Committee Members: According to Sulong (2017), the maintenance performance of *Masjid kariah* is dependent, to a large degree, on the dedication of the officers and committee members of the *Masjid kariah* itself.

> *Narrated by Abu Hurairah: A black person, a male or a female, used to clean the mosque and then died. The Prophet ((ﷺ) did not know about it. One day the Prophet (ﷺ) remembered him and said, "What happened to that person?" The people replied, "O Allah's Messenger (ﷺ)! He died." He said, "Why did you not inform me?" They said, "His story was so and so (i.e., regarded him as insignificant)." He said, "Show me his grave." He then went to his grave and offered the funeral prayer.(al-Bukhari, Book 23, 1337)*

This hadith showed that Prophet Muhammad ﷺ was very concerned about a member of the congregation who cleaned the mosque to the point that he visited the cleaner's grave and offered the funeral prayer. This hadith clearly showed that the person who maintains the mosque is a significant person to the mosque institution itself. As of now, committee members are not only responsible of cleaning the mosque, their roles and responsibilities are also wider in managing the mosque. Razak et al. (2014) denoted that mosque committee members could consist of representatives from MAIN or other agencies. They could be either voluntary or appointed to be responsible of ensuring that the mosque administration is conducted accordingly.

Committee members are a group of people who are responsible for managing the activities in *Masjid kariah*. Adil et al. (2013) denoted that in Malaysia, the development of a mosque would be the responsibility of its committee members. However, each state in Malaysia has different methods of appointing mosque committee members. For the state of Kelantan Darul Naim, JAHEAIK has the power to appoint mosque committee members in their state. In contrast, MAIS is responsible for delegating management works to committee members of each *Masjid kariah* registered under them. Rahman & Salim (2010) denoted that these works would be divided among committee members so that they can accomplish these tasks accordingly.

Overall, this regulatory and institutional landscape establishes clear lines of authority on paper, but implementation at the community level remains uneven, particularly for *Masjid kariah* that depend heavily on volunteers and donations. These structural conditions shape the way maintenance planning is actually practiced on the

ground, and they provide the backdrop for analysing specific practices and persistent issues in *Masjid kariah*, as discussed in the next subsection.

2.3.5.3 Maintenance Planning Practices and Issues in Masjid Kariah

Despite the presence of formal regulations and institutional mandates, maintenance planning in *Masjid kariah* is predominantly reactive, fragmented and weakly aligned with performance-based standards. Empirical studies report that community mosques often prioritise short-term repairs driven by user complaints and available donations rather than systematic condition assessments, scheduled preventive works or long-term asset management plans (Ab Muin et al., 2016; Muin, 2017; Zolkepli & Latiffi, 2021; Yusof et al., 2025). Building on the regulatory context outlined in Section 2.3.5.2, this subsection critically reviews existing maintenance planning practices and key issues affecting *Masjid kariah* in Malaysia.

Every maintenance planning for any building has its own goals and objectives. According to Hafizi et al. (2010), the development of the goals and objectives of building maintenance by an organisation would be the main key in determining the effectiveness of building maintenance. Previous research on building maintenance planning have covered various types of buildings, such as public schools (Lavy & Bilbo, 2009), Malaysian university campuses (Olanrewaju et al., 2010), banks (Olajide & Afolarin, 2012), government office buildings (Ali et al., 2016), and hostels (Wahab & Basari, 2015) to study their maintenance goals and objectives. However, studies focusing on the maintenance goals and objectives of *Masjid kariah* have been lacking.

Ahmad et al. (2020); Mohd Taib et al. (2016); Hamid et al. (2015) refer to *kariah* as an area where a group of Muslims share the same mosque that can sustain their community. Imamuddin et al. (1985) refer to *Masjid kariah* as a small society that shares a universal value in a common location that utilises the same available mosque within the same locality. *Masjid kariah* is a place for Muslims to hold their congregational prayers, as most mosques can be found in their neighbourhood.

As a place of worship, *Masjid kariah* must be kept clean, as mentioned in the following hadith:

> *Rasulullah ordered to build a mosque in the village and for the mosque to be cleaned and smell fragrant. (Al-Sijistani-Itikhadh al Masajid Fi al-Daur 455:1:122)*

As previously discussed, mosque is an integral part of the Islamic society. Prophet Muhammad ﷺ was instructed during his early da'wah to build a simple building, known as "Masjid Quba'. This command showed the importance of a mosque, as it can serve as the starting point for establishing Islam both within the state and the society. Similarly, today's mosques serve the same purpose of instigating the development of Islam in the Muslim community and its ties with the society (Al-Krenawi, 2016).

Financial provision is a critical performance dimension in the maintenance planning of *Masjid kariah* because building maintenance costs can escalate significantly if financial resources are not properly managed and aligned with maintenance needs. From a maintenance perspective, financial provision generally covers operating and capital-related expenses such as utilities, custodial services, repairs, and replacement of building components, where budgets and actual costs must be carefully balanced to support long-term building performance (Lavy et al., 2010). In the context of mosques, funding typically comes from two main sources: institutional grants and community-based contributions. Mosques commonly receive grants from the State Islamic Religious Councils (MAIN/SIRC), while in Kelantan specifically, Majlis Agama Islam dan Adat Istiadat Melayu Kelantan (MAIK) is responsible for allocating a maintenance budget to each mosque. These institutional allocations are often complemented by public contributions such as individual or corporate donations and cash waqf (endowment), which are intended to support administration and maintenance activities (Yasoa et al., 2019; Adnan, 2015). However, previous studies have indicated several real-world issues, including insufficient budget, funds that are not properly channelled to maintenance activities, and a tendency for some mosque committees to "park" funds in banks rather than using them to address actual maintenance needs (Razak et al., 2014; Yasoa et al., 2019). These challenges directly affect budget adequacy, fund allocation, and fund efficiency, which in turn influence the effectiveness and timeliness of maintenance works, the quality of services delivered to mosque users, and the overall performance of *Masjid kariah*. Consequently, this study conceptualises financial provision in terms of three interrelated aspects – adequacy of budget, fund efficiency, and fund allocation – as they reflect the practical funding structures and real issues faced in planning and implementing maintenance for *Masjid kariah*.

Yasoa et al. (2019) implied that to ensure the mosque would be administered properly and that all planned activities would be carefully managed, the background of

the committee members could play a significant role in their appointment. *Masjid kariah* committee usually comprises five (5) to 10 members, who are responsible for the day-to-day administration of the mosque. At a mosque, two management parties would be involved in managing the activities. The first party consists of the Officers, namely, *Imam Besar* (the main person to lead congregational prayers), *Imam*, *Bilal* (calls for prayer), *Khatib* (delivers the sermon), and *Siak* (superintendent), with the primary responsibility of performing all religious-related duties in their respective mosque and *kariah* (Omar et al., 2017), while the other party consists of the remaining mosque committee members.

Ahmad et al. (2018) denoted that the appointment of mosque committee members could be different in each state in Malaysia. For the state of Kelantan Darul Naim, the appointment of committee members is managed by JAHEAIK under Section 87 of ENAKMEN (1994). Both officers and committee members have different responsibilities, but each person can hold both position of an officer and committee member. Division VI of the Administration of the Religion of Islam (State of Selangor) Enactment Negeri (2003) states that MAIS, through mosque committees, is responsible for making sure that all mosques are well maintained. Table 2.9 shows a list of mosques committee members and their responsibility in relation to maintenance, as stated in "Kaedah-Kaedah Pegawai Masjid dan Jawatankuasa Kariah (Negeri Selangor) 1995" (Rules for Mosque Officials and Kariah Committees (Selangor State), 1995).

Table 2.9
List of Mosque Committee Members and Their Respective Responsibility

No.	Committee Members	Responsibility
1.	Chairman/Nazir	Lead the committee team in managing the mosque including mosque's management, allocation of the fund, maintenance, facilities, and property of the mosque.
2.	Chairman/Deputy Nazir	Responsible for clarifying the committee and management tasks for in his/her Kariah.
3.	Secretary	Run the guide the committee members of each *Masjid kariah* in case the chairman or Nazir is not around.
4.	Deputy Secretary	Help mosque officers and committee members to ensure all the committees are working under their responsibility.
5.	Treasurer/Accountant	Called for the meeting and minuting the meeting.
6.	Bureau of Education and Da'wah	Attend the Mosque Parish Committee Meeting. Assist the Chairman, Secretary and Treasurer to carry out the functions and

No.	Committee Members	Responsibility
		Mosque Parish Committee duties.
7.	Bureau of Welfare/ Economic and Development.	Attend the Mosque Parish Committee Meeting. Assist the Chairman, Secretary and Treasurer to carry out the functions and Mosque Parish Committee duties.
8.	Bureau of Finance	Attend the Mosque Parish Committee Meeting. Assist the Chairman, Secretary and Treasurer to carry out the functions and Mosque Parish Committee duties.
9.	Bureau of Cheerfulness	Attend the Mosque Parish Committee Meeting. Assist the Chairman, Secretary and Treasurer to carry out the functions and Mosque Parish Committee duties.

Source: Enakmen Pentadbiran Agama Islam Negeri Selangor 2003, Bahagian VI Negeri (2003)

Sinclair (1996) has emphasized the need for employee participation in the development of maintenance performance measurement. Mosque stakeholders who are committee members must participate in the maintenance planning of *Masjid kariah*. One of the successful attributes of a mosque institution lies in the committee members because they could affect the actual performance output while engaging in maintenance works. Mohamad (2019b) denoted that committee members need to play a role in managing the administration of their mosque, including supervise the cleanliness and hygiene of the mosque itself. Figure 2.6 shows the organisational structure of mosque committee members.

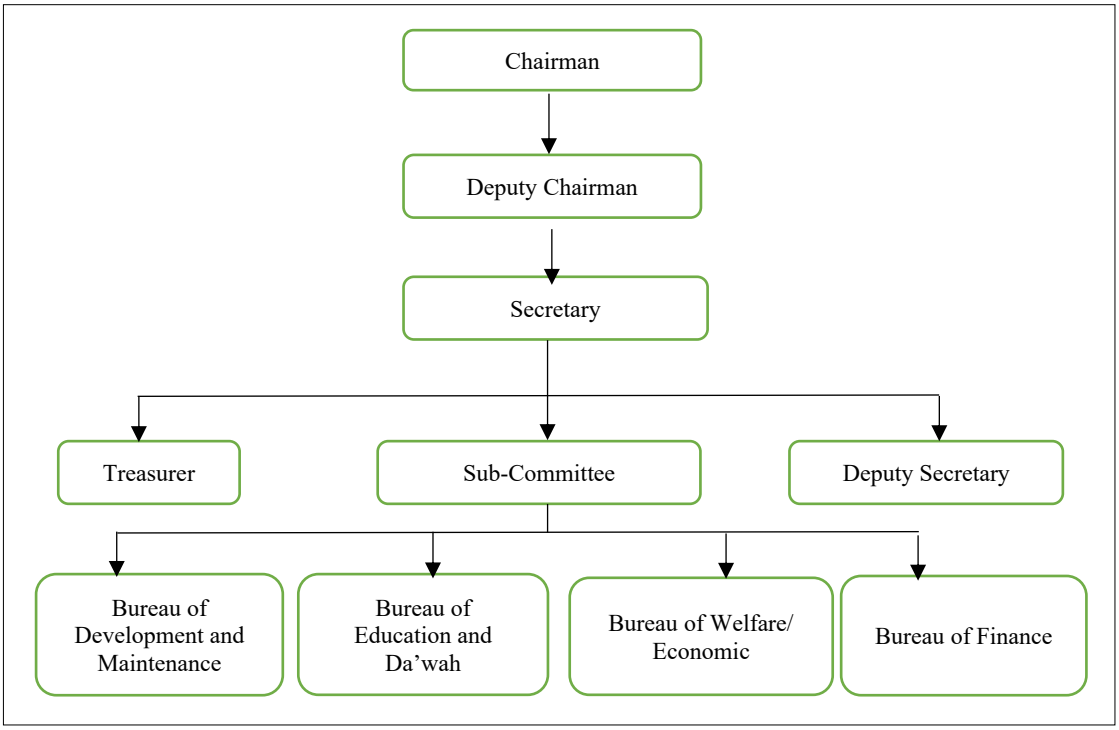

Figure 2.6 The Organisational Structure of Mosque Committee Members

Source: Adaptation from Mustari & Jasmi (2008, Pp.88)

As previously discussed, a maintenance strategy consists of planned preventive maintenance, planned corrective maintenance, and unplanned maintenance. The main challenge in a maintenance strategy is to ensure that the maintenance activities are effectively delivered to address any unforeseen problem that could arise in *Masjid kariah*. Table 2.10 shows the logical approach of the maintenance strategy criteria.

Table 2.10
Logical Approach of Maintenance Strategy Criteria

No.	Description	Criteria
1.	Preventive maintenance	Regularly maintained
2.	Predictive maintenance	Maintained just before it fails
3.	Corrective maintenance	Maintained when failed

Source: Adapted from Olanrewaju & Abdul-Aziz (2015)

The effectiveness of a maintenance strategy could be known, if one or more of its criteria could be identified and evaluated using maintenance performance measurements for these *Masjid kariah*. However, challenges could be faced in the implementation of building maintenance management for this institution. Table 2.11

reviews the issues related to planned preventive maintenance, planned corrective maintenance, and unplanned maintenance.

Table 2.11
Issues Related to Planned Preventive Maintenance, Planned Corrective Maintenance, and Unplanned Maintenance, as Reported by Previous Studies

No.	Maintenance Strategy	Arguments and Problems
Planned Preventive Maintenance		
1.	Planned Preventive Scheduled Maintenance	*N/A*
2.	Planned Preventive Condition-Based Maintenance	Need decision support system (Al-Najjar, 1997)
Planned Corrective Maintenance		
1.	Planned Corrective Maintenance	*N/A*
Unplanned Maintenance		
1.	Unplanned Maintenance (Emergency Maintenance)	*N/A*

Note: *N/A: Not Applicable*

Swanson (2001) has empirically investigated the link between maintenance strategy and maintenance performance measurements. This study found that there was a strong positive relationship between aggressive maintenance and proactive maintenance with building maintenance performance measurement. Horner et al. (1997) concluded that there was a need to integrate the three types of maintenance strategy criteria, as not all items would be significant to all buildings when measuring performance. Moreover, the application of condition monitoring strategies would not always be cost-effective. However, De Silva et al. (2012) reported that compared to corrective maintenance actions, preventative maintenance actions were often abandoned in most circumstances. Therefore, it is recommended to develop a measurement using maintenance strategy to test the maintenance performance for this institution.

Taken together, the review of mosque facilities, institutional arrangements and current practices shows that maintenance planning for mosques in Malaysia is shaped by a complex interaction of physical, regulatory and organisational factors. Malaysian mosques comprise diverse building envelopes and services that generate wide-ranging maintenance needs, yet these needs are governed through a multi-layered framework of federal legislation, state Islamic enactments and religious institutions whose mandates are often fragmented and unevenly implemented. At the level of *Masjid kariah*, maintenance planning is further constrained by limited budgets, dependence on

donations, volunteer-based committees and a tendency towards reactive, complaint-driven responses rather than structured preventive planning. These conditions help to explain the dominance of unplanned works and the difficulty of sustaining planned preventive and corrective programmes in many community mosques.

For the present study, these insights underscore the need for a maintenance planning approach that is both sensitive to the governance realities of *Masjid kariah* and aligned with recognised maintenance and facility-management standards. In particular, they justify the focus on Maintenance Strategy Criteria (PPM, PCM and UM) as key outcomes and on performance-based dimensions derived from BS 3811 and MS ISO 41001 as the organisational levers through which mosque maintenance can be improved. The next section (Section 2.3.6) therefore synthesises the preceding literature on maintenance planning and mosque maintenance and distils the key implications for this study, providing a conceptual link to the development of the performance-based maintenance planning framework for *Masjid kariah*.

2.3.5.4 Mosque hierarchy and community-mosque landscape in Malaysia

The position of *Masjid kariah* within Malaysia's wider mosque system can be clarified by linking two complementary lenses: (1) broader typologies and classifications of mosques in Islamic scholarship and (2) Malaysia's formal administrative hierarchy of mosque institutions. Rasdi (2014) synthesised several strands of scholarship and distinguished between general, Qur'anic and hadith-based classifications of mosques. Under the general classification, five categories of Muslim places of worship are commonly distinguished – sacred mosques, community mosques, *madrasah, musalla* and memorial places. The Qur'anic classification identifies sacred, universal, tribal and memorial mosques (including mosques without a physical building), while the hadith-based classification differentiates mosques by period and function. Taken together, these traditions consistently position "community mosques" as a distinct category within the wider institutional landscape of mosque typologies (Rasdi, 2014). Figure 2.7 shows these classifications and provides a conceptual baseline for interpreting how community-based mosques, including Masjid kariah, are situated within broader mosque typologies.

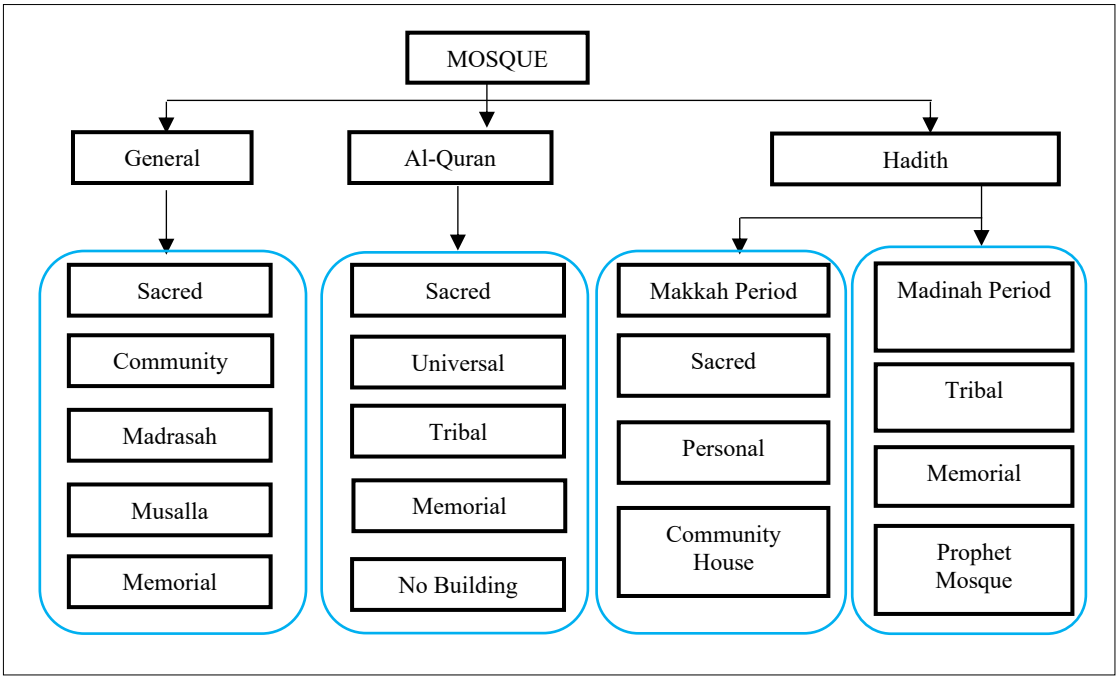

Figure 2.7 Classification of Mosques

Source: Rasdi (2014)

Complementing this conceptual framing, the Malaysian literature has also defined mosques according to typology, scale and function. Table 2.12 compiles selected definitions of mosque categories (including national, state and district mosques, *jamek* mosques, and *surau*), highlighting how mosque types are differentiated by catchment, functional scope and institutional role. Table 2.13 further refines these definitions by presenting Islamic places of worship according to their level within the settlement hierarchy, capacity of users, area and primary functions – ranging from global-level mosques through national/state/city mosques down to local community mosques and prayer rooms. While these classifications clarify that *Masjid kariah* is typically associated with a smaller capacity and neighbourhood-level catchment, classification alone does not fully explain the operational realities that shape service delivery and upkeep at the community-mosque tier.

Table 2.12
Definitions of Mosque (*Masjid*)

No.	General	Typology	Definition(s)	Author(s)
1.	Principle	National Mosque	Main mosque for each country.	Al-bakri (2019)
2.	Community Mosque	State Mosque	Centre of the city with good infrastructure and landmark area.	Al-bakri (2019); Mustari & Jasmi (2008); Serageldin (1990)
		Government Mosque	*N/A*	*N/A*
		District Mosque	A strategic place located in the district with good infrastructure and facilities.	Al-bakri (2019); Mustari & Jasmi (2008)
		Masjid kariah	Small local mosques with multiple functions in the village or a small community.	Ahmad et al. (2020); Mustari & Jasmi (2008); Serageldin (1990)
		Jamek Mosque	Small local mosques with multiple functions in the village or a small community.	Al-bakri (2019)
3.	*Surau*	*Surau*	Prayers are built with a small congregation in a place or a village.	Al-bakri (2019)
		Surau Jumaat		
		Madrasah		
		Musalla		
		Prayer Room		

Note: *N/A*: Not Applicable
Source: Adaptation from Ibrahim et al. (2009); Imam (2000); JPBD (2011)

Table 2.13
Definition of the Mosque (*Masjid*)

No.	Islamic Worship Place	Level	Hierarchy settlement	The Capacity of Mosque User	Area	Functions
1.	Kaabah and Majid An-Nabawi	Universal	All	Large (2,000-Above)	More Than 10 Hectare	Muslim House of Worship and Social. Integration Centre.
2.	National Mosque	National	Capital City/Capital City	Large (2,000-Above)	10 Hectare	
3.	State Mosque	State	National/State Federal Territory	Large (2,000-Above)	3-5 Hectare	
4.	District Mosque	District/Colony	Main Settlement Centre	Large (2,000-Above)	1.5-3 Hectare	
5.	Kariah, Sub-district, Town, Village, Jamek, Residential Mosque	Sub-District, Town, Village and Residential	Town/Village Settlement/ Neighbourhood Area	Medium (201-2,000)	0.25- 1 Hectare	
6.	Surau, Madrasah, Musalla, Prayer Room	Support mosque in every level of settlement	Small Neighbourhood/ Villages/ Commercial Area Commercial Areas	Small (3-200)	0.2 Hectare	*Surau*: a small-sized place of worship and religious education centre. *Madrasah*: A religious education with student accommodation. *Musalla*: a mini-sized place of worship only. *Prayer room*: praying space for family.

Source: Adapted from Ibrahim et al. (2009); Imam (2000); JPBD (2011)

Malaysia's institutional hierarchy provides a more practice-oriented understanding of the community-mosque landscape. Jakim (2021) provides a more operational hierarchy of mosque categories. As illustrated in Figure 2.8, the highest level is occupied by the *Kaabah* and the Prophet's Mosque, followed by the National Mosque at the country level, State Mosques, District Mosques and, finally, community mosques, which include *Masjid kariah*, Jamek mosques, City mosques, Residential mosques and *Surau Jumaat*. Community mosques are predominantly waqf institutions that receive financial support from individuals, educational institutions, government agencies and non-governmental organisations and are intended to serve the daily worship and religious needs of local communities – this hierarchy indicates that *Masjid kariah* occupies a neighbourhood-scale institutional position and functions as the principal mosque interface for local communities, whereas higher-order mosques (national/state/district) typically carry broader jurisdictional roles and symbolic functions (Zulkifli Mohd Al-Bakri, 2018).

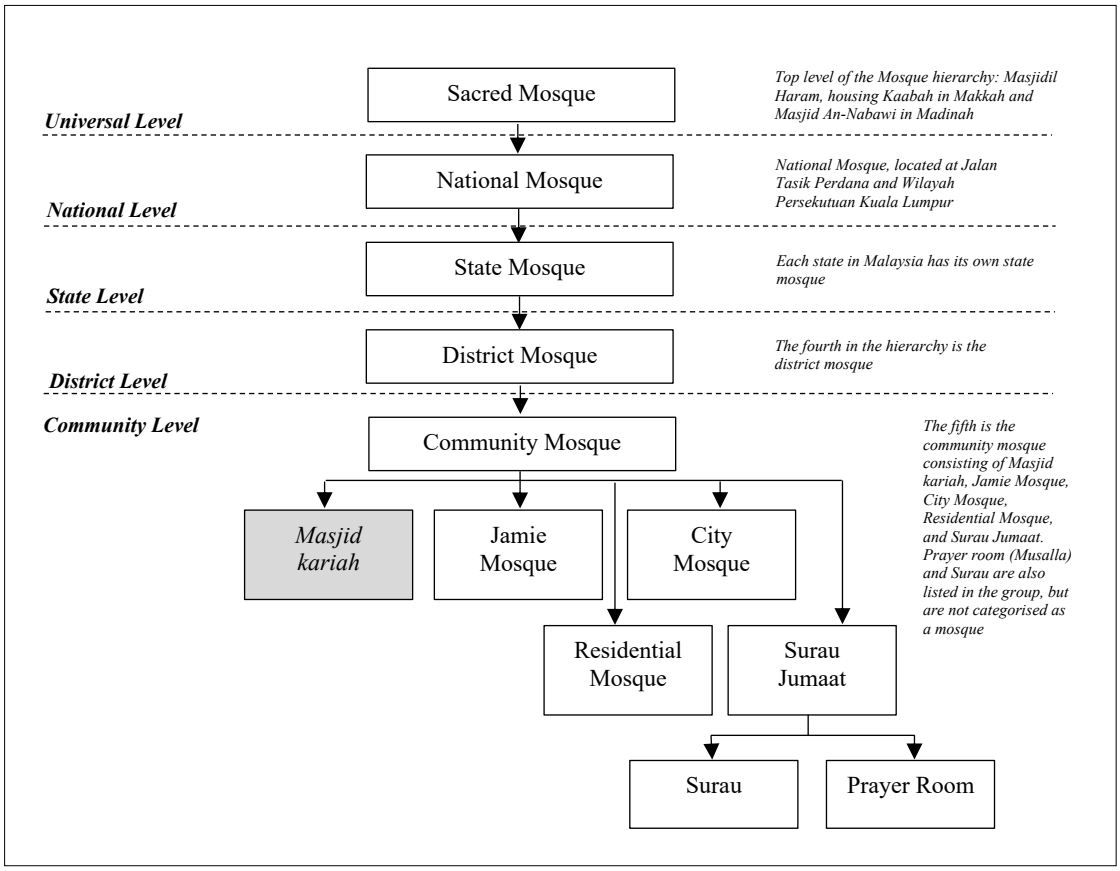

Figure 2.8 Different Levels of Mosque, Source: Jakim (2021)

Beyond hierarchical positioning, the scale of the community-mosque infrastructure demonstrates why *Masjid kariah* is analytically significant. Jakim's data show that *Masjid kariah* constitutes the dominant component of community mosques in Malaysia, with 6,153 *Masjid kariah* out of 6,351 community mosques (Jakim, 2021). This dominance exceeds other mosque counts reported in the same dataset and indicates that *Masjid kariah* represents the most extensive nationwide layer of mosque service provision. Table 2.14 summarises the total number of different community mosque types and highlights the disproportionate share represented by *Masjid kariah*.

Table 2.14
Total Number of Different Types of Community Mosque (*Masjid*)

No.	Type of Community Mosque	Total
1.	Government Mosque (*Masjid Kerajaan*)	8
2.	State Mosque (*Masjid Negeri*)	15
3.	District Mosque (*Masjid Daerah*)	175
4.	*Masjid kariah*	6,153
	Total:	**6,351**

Source: Jakim (2021)

The state-level distribution further reinforces this national footprint. The number of *Masjid kariah* varies across states (Jakim, 2021), reflecting differences in settlement patterns, administrative arrangements and community infrastructure demands. For example, high totals are recorded in Sabah (1,023) and Johor (782), with substantial counts also evident in Perak (608), Kelantan (573) and other states. This distribution implies that performance and maintenance conditions at the *Masjid kariah* level are likely to produce system-wide effects on perceived mosque service quality, safety and health across Malaysia. Table 2.15 presents the total number of *Masjid kariah* by state and provides a baseline context for interpreting why community-mosque maintenance planning warrants focused investigation.

Table 2.15
List of the Total Number of Masjid Mukim or *Masjid kariah* in Each State in Malaysia Sources

No.	***Masjid kariah* in Malaysia**	Total
1.	Sabah Negeri Dibawah Bayu	1023
2.	Johor Darul Ta'zim	782
3.	Perak Darul Ridzuan	608
4.	Kelantan Darul Naim	573
5.	Pahang Darul Makmur	569
6.	Kedah Darul Aman	564
7.	Terengganu Darul Iman	457

No.	*Masjid kariah* in Malaysia	Total
8.	Selangor Darul Ehsan	397
9.	Sarawak Bumi Kenyalang	357
10.	Negeri Sembilan Darul Khusus	279
11.	Pulau Pinang	203
12.	Melaka Bandar Bersejarah	181
13.	Perlis Indra Kayangan	97
14	Wilayah Persekutuan Kuala Lumpur	63
	Total *Masjid kariah* in Malaysia:	**6153**

Source: Jakim (2021)

Collectively, Figures 2.7 and 2.8 and Tables 2.12 until 2.15 establish two important points. First, *Masjid kariah* is conceptually recognised as a community-based mosque category within broader Islamic typologies and Malaysian mosque definitions. Second, it is institutionally positioned at the community tier yet constitutes the dominant numerical segment of Malaysia's mosque infrastructure. These conditions justify treating *Masjid kariah* as a critical unit of analysis for maintenance planning research. Building on this contextual positioning, the next subsection (Section 2.3.6) shifts from typological classification toward the operational uniqueness of *Masjid kariah* compared to higher-order mosques – particularly in relation to governance arrangements, staffing capacity, resource structures and their implications for systematic maintenance planning.

2.3.6 Unique Characteristics of Masjid Kariah compared to Other Mosque Categories in Malaysia

From an administrative perspective, *Masjid kariah* is distinctive within Malaysia's mosque hierarchy. While National, State and some District mosques tend to operate under more formalised management structures – often with dedicated staff and closer/direct oversight by state religious authorities, *Masjid kariah* is typically administered by local mosque committee members under the oversight and regulatory supervision of State Islamic Religious Councils (MAIN/SIRC), Department of Islamic Development Malaysia (JAKIM) and District Religious Offices. Figure 2.5 (p. 75) summarises the types of mosque administration in Malaysia, illustrating how the Sultan or Yang di-Pertuan Negeri, State Islamic Religious Councils, State Religious Departments and District Religious Offices occupy higher levels of authority, with *Masjid kariah* committees forming the operational interface with local communities

(Asharaf et al., 2012). In practice, these committees are often volunteer-based – comprising the *imam, bilal, siak* and appointed committee members and are responsible for day-to-day administration, including planning and overseeing maintenance works, even though they may have limited technical or managerial training (Bahrom, 2008; Ahmad et al., 2020). This committee-led execution under state oversight also means that governance routines (e.g., documentation discipline and internal controls) can vary across mosques depending on committee capacity and continuity (Islamiyah, 2019; Zain et al., 2020).

Functionally, *Masjid kariah* differs from higher-tier mosques because of its strong neighbourhood orientation and continuous interaction with the same local congregation. Definitions by Hamid et al. (2015), Mohd Taib et al. (2016) and Ahmad et al. (2020) describe *Masjid kariah* as community-based mosques located within mukim or neighbourhood boundaries, providing spaces for daily congregational prayers, Friday prayers, religious education, welfare and social activities. Beyond ritual functions, *Masjid kariah* plays a central role in community cohesion, social support and local identity (Karim, 2016). As a result, the physical condition of *Masjid kariah* – cleanliness, safety, accessibility and comfort – is continuously visible to regular users and becomes closely linked to perceptions of religious propriety and institutional credibility. Maintenance shortcomings therefore tend to be experienced repeatedly and interpreted not only as technical deficiencies but also as indicators of declining service trust and community confidence (Remly et al., 2019; Hatta & Saad, 2021).

Thus, these typological, quantitative, administrative and functional features make *Masjid kariah* uniquely significant and uniquely vulnerable from a maintenance-planning perspective. *Masjid kariah* constitutes the most numerous mosque category in Malaysia and carries intense daily usage and community expectations, yet it often operates within a resource-constrained operational ecology characterised by limited technical capacity, heavy reliance on volunteer-based management, and donation-driven financing that can restrict the feasibility of systematic preventive maintenance compared to higher-order mosques (Ahmad et al., 2020; Ahmad & Ahmad, 2020; Nordin, 2023). For this study, these characteristics justify focusing specifically on *Masjid kariah* in developing a performance-based maintenance planning framework. They also underscore the need to link the Maintenance Strategy Criteria (PPM, PCM and UM) and ISO 41001-derived performance dimensions to the lived operational realities of *Masjid kariah* rather than generalising from better-resourced mosque

categories. This contextual grounding provides a critical bridge to the subsequent sections on maintenance performance measurement and the construction of the study's conceptual framework.

To clarify what makes *Masjid kariah* "distinct" beyond typological labels, this section synthesises Malaysian evidence (2019–2025) into six analytical themes that directly condition maintenance-planning feasibility. The themes move from upstream institutional determinants (governance and staffing) to resource mechanisms (funding), to operational execution (maintenance planning practices), and finally to downstream outcomes (service performance and hierarchical positioning). This thematic structure makes explicit how the "uniqueness" of *Masjid kariah* is produced through interacting organisational and resource constraints rather than through mosque classification alone.

2.3.6.1 Theme 1: Governance and Administration Structure

Masjid kariah governance typically operates through a dual-layer arrangement in which State Islamic Religious Councils (ISRC) hold statutory trusteeship and oversight authority, while local mosque committees and mosque officers execute day-to-day administration and operational decisions (Mohamed et al., 2023; Yasoa et al., 2019). In practice, the *Nazir* and *Jawatankuasa Kariah* manage core administrative routines i.e. financial management, record keeping, programme coordination and basic facility decisions – within the boundaries set by state religious institutions (Mohamed et al., 2023; Sulaiman & Kamarudin, 2025). While this committee-led structure can enhance local responsiveness, it also produces variation in governance quality and compliance routines across mosques because committee capacity and continuity are not uniform (Mohamed et al., 2023; Yasoa et al., 2019). Empirical evidence highlights recurring governance weaknesses such as inconsistent transparency, weak internal controls and uneven standardisation of reporting practices, which can undermine accountability and documentation reliability (Islamiyah, 2019; Zain et al., 2020). During crisis contexts such as COVID-19, state authorities demonstrated their capacity to tighten operational discretion through SOP enforcement, indicating that local autonomy remains conditional under hierarchical governance (Sulaiman & Kamarudin, 2025). Governance indices and maqasid-based performance frameworks have been proposed to strengthen standardisation and accountability, but their implementation remains uneven across mosque contexts (Ahmad & Ahmad, 2020; Hatta & Saad, 2021).

Critical implication for "uniqueness": *Masjid kariah* is distinctive because governance variability is structurally embedded in committee-led execution under state oversight. Systematic maintenance planning requires stable documentation (asset registers, inspection records, work logs, procurement records), predictable decision protocols and auditable accountability; however, evidence indicates uneven internal controls and reporting routines across mosques (Islamiyah, 2019; Zain et al., 2020). Consequently, maintenance frameworks that presume consistent governance maturity risk poor transferability at the *Kariah* level. A *Kariah*-focused approach must therefore be designed to function under variable committee capacity while strengthening minimum governance routines that support maintenance predictability and traceability (Ahmad & Ahmad, 2020; Mohamed et al., 2023).

2.3.6.2 Theme 2: Staffing Structure and Human Resource Constraints

Masjid kariah staffing commonly consists of a limited number of paid roles supported by volunteers and committee members. Typical roles include the *imam, bilal* and administrative officers such as the Nazir/secretary, with much operational work supported by appointed committee members (Mohamed et al., 2023; Yasoa et al., 2019). Compared to higher-order mosques that are more frequently described as having diversified committees and broader access to specialist support, *Masjid kariah* often depends on volunteer labour and committee-appointed roles, which can limit sustained administrative and technical follow-through (Hatta & Saad, 2021; Mohamed et al., 2023). A widely reported constraint is the shortage or absence of dedicated technical and maintenance personnel, alongside shortages of skilled labour relevant to building upkeep (Ahmad & Ahmad, 2020). Routine maintenance is frequently dependent on committee competence and surrounding community support, while specialised works typically require external contractors subject to fund availability (Nordin, 2023). Previous studies also highlight variability in management competence and financial administration, supporting calls for training and capacity-building for committee members and mosque officers (Mohamed et al., 2023; Yasoa et al., 2019).

Critical implication for "uniqueness": The *Kariah* context is distinctive because it features a persistent technical-capacity gap: inspection discipline, defect diagnosis, prioritisation quality and contractor supervision often depend on volunteer competence and availability rather than dedicated technical staff (Ahmad & Ahmad, 2020; Nordin,

2023). This structural condition explains why preventive routines are difficult to sustain despite being recommended in maintenance frameworks. Therefore, maintenance planning for *Masjid kariah* must be capacity-sensitive—relying on simplified routines (basic inspection checklists, defect categorisation, minimal documentation and clear responsibilities) rather than presuming professional technical staffing (Ahmad & Ahmad, 2020; Mohamed et al., 2023).

2.3.6.3 Theme 3: Funding Mechanisms and Financial Sustainability

Funding for *Masjid kariah* is predominantly community-based, relying heavily on Friday collections, voluntary donations (*infaq* or *sadaqah*), *waqf* or *cash waqf* contributions and proceeds from mosque activities (Hasan et al., 2019; Islamiyah, 2019; Nordin, 2023). While allocations through zakat or occasional state grants may occur, studies frequently indicate that funding volumes and predictability are constrained for sustained planning at *Kariah* level (Islamiyah, 2019; Yasoa et al., 2019). Case evidence highlights variability in fund management practices and internal controls, with finances often channelled toward immediate operational needs and urgent repairs (Nordin, 2023; Yasoa et al., 2019). This reality has encouraged proposals for income diversification (investments, rentals, commercial initiatives) to strengthen sustainability and reduce exposure to donation volatility (Hasan et al., 2019; Nordin, 2023). Comparative discussions generally describe higher-order mosques as better positioned to access institutional channels, broader donor bases and stronger funding buffers that facilitate more stable planning contexts (Mohamed et al., 2023; Yasoa et al., 2019). Limited and unpredictable funding at *Kariah* level is repeatedly associated with restricted maintenance budgets, delayed works and maintenance backlogs (Ahmad & Ahmad, 2020; Nordin, 2023).

Critical implication for "uniqueness": *Masjid kariah* is distinctive because donation-dependent revenue volatility structurally constrains long-horizon maintenance planning. When cashflow is episodic and buffers are limited, preventive maintenance is consistently disadvantaged relative to urgent repairs and daily operational expenditures, which encourages reactive maintenance behaviour (Ahmad & Ahmad, 2020; Nordin, 2023). Therefore, *Kariah* maintenance planning must embed financially realistic mechanisms – phased programming, prioritisation rules and modest reserve formation

– rather than assuming stable institutional allocations or continuous professional contracts (Islamiyah, 2019; Mohamed et al., 2023).

2.3.6.4 Theme 4: Maintenance Planning Capacity and Practices

Maintenance practices in *Masjid kariah* are frequently described as reactive and committee-driven, with preventive schedules not consistently institutionalised at the *Kariah* level (Ahmad & Ahmad, 2020; Nordin, 2023). The literature attributes this to combined constraints involving limited financial resources, shortage of skilled labour, lack of dedicated maintenance personnel and uneven organisational capacity for systematic planning (Ahmad & Ahmad, 2020; Nordin, 2023). Common facility issues include structural defects, roof and electrical problems, and general upkeep, with backlogs linked to insufficient budgeting and limited technical oversight (Ahmad & Ahmad, 2020; Nordin, 2023). A key Malaysian contribution is the expert-driven identification of ten validated elements for *Masjid kariah* maintenance planning, integrating maintenance strategies (PPM, PCM and corrective or unplanned maintenance) with organisational management, planning and scheduling, financial provision, service quality, assessment, resource allocation and safety and health dimensions (Ahmad & Ahmad, 2020). However, evidence indicates implementation remains uneven due to capacity limitations, contractor dependence subject to funds, and financial or governance control weaknesses that reduce predictability and monitoring quality (Nordin, 2023; Zain et al., 2020). Some contexts also require sensitivity to traditional architectural elements and materials, which may demand conservation-related knowledge not readily available at committee level (Ahmad & Ahmad, 2020).

Critical implication for "uniqueness": The distinctive issue at *Masjid kariah* level is an implementation gap rather than a conceptual gap. Planning elements have been articulated and validated in Malaysia, yet committee-led execution realities and resource volatility constrain routine adoption (Ahmad & Ahmad, 2020; Nordin, 2023). Accordingly, a *Kariah*-focused framework must be performance-based but operationally light – translating standards into feasible routines (inspection cadence, defect prioritisation logic, minimal documentation and clear role accountability) that committees can sustain within volunteer-led constraints (Ahmad & Ahmad, 2020; Zain et al., 2020).

2.3.6.5 Theme 5: Service Performance and Community Engagement

Masjid kariah service performance encompasses worship and community engagement functions, including education, youth activities, welfare initiatives and community gatherings (Hatta & Saad, 2021; Remly et al., 2019). Evidence indicates that active committees and consistent programming can strengthen community satisfaction and donor support, reinforcing service delivery and financial sustainability (Ismail et al., 2024; Nordin, 2023). A survey involving Nazir in Selangor reported high levels of local activity, suggesting that many *Masjid kariah* remain vibrant despite resource constraints (Mohamed et al., 2023). Nevertheless, service quality and programming capacity vary across mosques and remain sensitive to leadership quality, volunteer availability and financial strength (Hatta & Saad, 2021; Nordin, 2023). Scholars have proposed maqasid-based performance frameworks and governance indices to standardise performance measurement, yet adoption remains uneven and comparable metrics across mosque tiers are limited, with much evidence being case-based or state-level (Ahmad & Ahmad, 2020; Hatta & Saad, 2021).

Critical implication for "uniqueness": *Masjid kariah* is distinctive because it combines high community embeddedness with high performance sensitivity to local capacity. Strong volunteerism can sustain active service delivery, but outcomes can shift substantially with changes in leadership and resources (Mohamed et al., 2023; Nordin, 2023). This intensifies the maintenance–service relationship: visible facility defects can quickly affect perceived safety, comfort and credibility due to frequent use and close community scrutiny (Ahmad & Ahmad, 2020). Hence, maintenance planning should leverage community ownership while instituting baseline safeguards for safety, accountability and technical quality so that community participation complements minimum technical standards (Ahmad & Ahmad, 2020; Hatta & Saad, 2021).

2.3.6.6 Theme 6: Comparative Positioning within Malaysia's Mosque Hierarchy

Malaysia's mosque system is organised into *Masjid kariah, Masjid Daerah, Masjid Negeri* and *Masjid Nasional*. However, Malaysian literature provides limited standardised quantitative comparisons of physical characteristics, staffing numbers and budget ranges across mosque categories, with many studies focusing on governance and qualitative descriptions rather than systematic metrics (Hatta & Saad, 2021; Mohamed

et al., 2023). Despite these limitations, comparative discussions consistently portray *Masjid kariah* as operating under higher constraint conditions – greater governance variability, thinner technical staffing and higher exposure to funding volatility – relative to higher-order mosques (Islamiyah, 2019; Mohamed et al., 2023; Yasoa et al., 2019). Table 2.16 consolidates the available Malaysian evidence on governance, staffing, funding and maintenance differences while explicitly acknowledging where comparative metrics remain insufficient.

Critical implication for "uniqueness": *Masjid kariah* occupies a distinct position where high service expectations are managed under lower organisational capacity. The lack of standardised comparative data is not merely an academic limitation; it signals weak benchmarking capacity that can constrain differentiated policy and maintenance governance across mosque tiers (Hatta & Saad, 2021; Mohamed et al., 2023). As a result, *Masjid kariah* should not be treated as a scaled-down version of higher-order mosques; it is a distinct facility-management context requiring implementable, auditable and low-burden maintenance routines compatible with committee-led governance (Ahmad & Ahmad, 2020; Mohamed et al., 2023).

Table 2.16
Comparison of *Masjid kariah* with *Masjid Daerah, Negeri* and *Nasional* based on Malaysian Evidence (2019–2025)

No.	Dimension	*Masjid kariah*	*Masjid Daerah / Masjid Negeri / Masjid Nasional*	Evidence quality (Malaysia 2019–2025)
1.	Governance structure and administration	Day-to-day operations are commonly executed by local mosque committees (*Jawatankuasa Kariah*) and mosque officers (e.g., *Nazir*) under SIRC trusteeship and oversight; governance routines (documentation, disclosure, internal control strength) vary across mosques and states (Mohamed et al., 2023; Yasoa et al., 2019; Islamiyah, 2019; Zain et al., 2020).	More formalised administrative arrangements and stronger standardisation tendencies are reported in comparative discussions and case evidence, supported by closer institutional linkage to higher-level governance structures (Mohamed et al., 2023; Hatta & Saad, 2021).	Adequate (qualitative/ case-based)
2.	Legal status	Under the legal trusteeship of SIRCs (Mohamed et al., 2023; Yasoa et al., 2019).	Under the legal trusteeship of SIRCs (Mohamed et al., 2023; Yasoa et al., 2019).	Adequate

No.	Dimension	*Masjid kariah*	*Masjid Daerah / Masjid Negeri / Masjid Nasional*	Evidence quality (Malaysia 2019–2025)
3.	Staffing profile	Limited paid roles (e.g., *imam, bilal, Nazir* or administrative officer) with substantial reliance on volunteers or committee members; shortage or absence of dedicated technical or maintenance personnel is repeatedly highlighted (Ahmad & Ahmad, 2020; Mohamed et al., 2023; Nordin, 2023).	Greater access to diversified committee expertise and specialist support is more commonly described for higher-order mosques in Malaysian discussions, enabling stronger organisational capacity (Hatta & Saad, 2021; Mohamed et al., 2023).	Adequate (qualitative)
4.	Staffing numbers	Standardised staffing numbers are not consistently reported across Malaysian studies (Hatta & Saad, 2021; Mohamed et al., 2023).	Standardised staffing numbers are not consistently reported across Malaysian studies (Hatta & Saad, 2021; Mohamed et al., 2023).	Insufficient (standardised quantitative data)
5.	Primary funding sources	Predominantly community-based contributions (e.g., Friday collections, donations, waqf/cash waqf, activity proceeds); funding predictability is variable and often constrained (Hasan et al., 2019; Islamiyah, 2019; Nordin, 2023; Yasoa et al., 2019).	Described as having broader access to institutional channels and generally stronger funding buffers and/or diversified revenue contexts in Malaysian discussions (Mohamed et al., 2023; Yasoa et al., 2019).	Adequate (qualitative)
6.	Budget ranges	Standardised budget ranges (annual allocation or operating and maintenance budgets) are not consistently reported across Malaysian studies (Mohamed et al., 2023; Nordin, 2023).	Standardised budget ranges are not consistently reported across Malaysian studies (Mohamed et al., 2023; Nordin, 2023).	Insufficient (standardised quantitative data)
7.	Financial sustainability and controls	Vulnerability to revenue volatility; variability in internal controls and accounting practices is documented, with calls for strengthened governance and reporting (Islamiyah, 2019; Zain et al., 2020; Mohamed et al., 2023; Nordin, 2023).	Better disclosure and governance routines are more commonly reported in comparative case contexts, but evidence remains largely qualitative (Mohamed et al., 2023; Hatta & Saad, 2021).	Adequate (qualitative/ case-based)

No.	Dimension	*Masjid kariah*	*Masjid Daerah / Masjid Negeri / Masjid Nasional*	**Evidence quality (Malaysia 2019–2025)**
8.	Maintenance resources	Constrained financial and technical resources; reliance on volunteers for routine upkeep and contractors for specialised works when funds permit; shortage of skilled labour is repeatedly highlighted (Ahmad & Ahmad, 2020; Nordin, 2023).	More favourable conditions for resourcing planned works and supervision capacity are described in comparative discussions due to stronger organisational and funding contexts (Hatta & Saad, 2021; Mohamed et al., 2023).	Adequate (qualitative)
9.	Maintenance planning orientation	Predominantly reactive maintenance is repeatedly reported; preventive routines and formal scheduling are unevenly institutionalised at Kariah level (Ahmad & Ahmad, 2020; Nordin, 2023).	Structured planning routines are described as more feasible for higher-order mosques due to stronger governance and resourcing contexts; however, comparative metrics remain limited (Hatta & Saad, 2021; Mohamed et al., 2023).	Adequate (qualitative)
10.	Physical characteristics (Size / Capacity / Facilities)	Local orientation is consistently described, but standardised, comparable facility metrics are limited in the Malaysian literature (Hatta & Saad, 2021; Mohamed et al., 2023).	Larger-scale roles are consistently described, but standardised, comparable facility metrics are limited in the Malaysian literature (Hatta & Saad, 2021; Mohamed et al., 2023).	Insufficient (standardised quantitative data)
11.	Service scope and Programming	Core worship functions plus local programmes (education, welfare, youth/community activities); performance is sensitive to committee capacity, volunteers, and finances (Remly et al., 2019; Hatta & Saad, 2021; Mohamed et al., 2023; Ismail et al., 2024).	Broader representational roles and potentially wider programme scope are commonly described for higher-order mosques, supported by stronger organisational capacity in case evidence (Hatta & Saad, 2021; Mohamed et al., 2023).	Adequate (qualitative)
12.	Disclosure and accountability	Variability in transparency, internal controls, and reporting routines is reported across mosque contexts, affecting accountability (Islamiyah, 2019; Zain et al., 2020; Mohamed et al., 2023).	More standardised disclosure tendencies are described in comparative case discussions, though evidence is predominantly qualitative (Mohamed et al., 2023; Hatta & Saad, 2021).	Adequate (qualitative/ case-based)

No.	Dimension	*Masjid kariah*	*Masjid Daerah / Masjid Negeri / Masjid Nasional*	**Evidence quality (Malaysia 2019–2025)**

Note:
"Evidence quality" reflects the nature of available Malaysian studies for the stated dimension (2019–2025):
(i) *Adequate (qualitative/case-based)* = supported by Malaysian case studies, surveys, or governance/management analyses, but with limited nationally standardised comparability;
(ii) *Insufficient (standardised quantitative data)* = the reviewed Malaysian literature does not provide consistent, comparable quantitative metrics across mosque categories (e.g., staffing numbers, budget ranges, facility size/capacity).

Overall, the Malaysian literature indicates that *Masjid kariah* is operationally distinctive due to (1) governance variability within a dual-layer oversight model, (2) limited staffing and technical-capacity gaps, (3) donation-dependent funding volatility, (4) uneven institutionalisation of preventive maintenance, (5) service performance that is active but capacity-sensitive, and (6) a hierarchy position marked by high community demand under lower organisational capacity (Ahmad & Ahmad, 2020; Hatta & Saad, 2021; Islamiyah, 2019; Mohamed et al., 2023; Nordin, 2023; Yasoa et al., 2019). These characteristics justify focusing specifically on *Masjid kariah* (Kelantan) for developing a performance-based maintenance planning framework that is implementable under volunteer-led governance, financially realistic, and aligned with Maintenance Strategy Criteria (PPM, PCM and UM) and ISO 41001-derived performance dimensions. This section therefore provides the contextual justification for the subsequent discussion on maintenance performance measurement and the construction of the study's conceptual framework.

2.4 Maintenance Performance Measurement (MPM) (Independent Variables)

The previous sections have shown that maintenance planning for *Masjid kariah* is influenced by multiple factors, including the physical characteristics of mosque facilities, the regulatory and institutional context, and the current mix of planned and unplanned maintenance strategies. While these factors help to explain why maintenance is often reactive and fragmented, they do not on their own provide a structured way of assessing how well maintenance is being planned and implemented. For this purpose, a systematic approach to Maintenance Performance Measurement (MPM) is required. In this study, MPM is treated as a set of performance dimensions and indicators that enable

mosque authorities and committee members to evaluate the effectiveness, efficiency and reliability of maintenance planning and execution over time.

In the maintenance and asset management literature, performance measurement has evolved from narrow cost and downtime metrics towards broader, multi-dimensional frameworks that incorporate technical, financial, organisational and user-related aspects (e.g. Tsang, 1999; Parida & Kumar, 2006; Cholasuke et al., 2004). Maintenance performance is no longer understood solely in terms of minimising failures or maintenance expenditure, but also in terms of supporting service continuity, safety, user satisfaction, regulatory compliance and long-term asset value. Recent studies emphasise that performance measures must be explicitly aligned with maintenance objectives and strategies, so that organisations can monitor whether their chosen mix of preventive, corrective and reactive actions is delivering the desired outcomes (Amos et al., 2019; Beşiktepe et al., 2020).

Within facilities management, MPM is increasingly embedded in broader management-system frameworks. Contemporary Facility Management (FM) research highlights the importance of integrating performance indicators with standardised processes, information systems and stakeholder requirements, rather than treating them as isolated checklists (Amos et al., 2019; Lee et al., 2021). The introduction of ISO 41001:2018 reinforces this shift by positioning FM as a management system structured around organisational context, leadership, planning, support, operation, performance evaluation and improvement. From this perspective, MPM is not just about tracking technical failures, but about assessing how well the FM system as a whole supports safe, reliable and sustainable operation of facilities.

For mosque facilities, and particularly for *Masjid kariah*, the need for robust maintenance performance measurement is intensified by the combination of limited resources, volunteer-based management and high user expectations for cleanliness, safety and comfort. As discussed in Section 2.3.5, many community mosques in Malaysia still rely on complaint-driven responses and ad hoc decision-making, with little use of formal indicators to monitor maintenance performance. In the absence of clear performance dimensions, it is difficult for mosque committees, state religious authorities or policymakers to prioritise interventions, justify budgets or evaluate the impact of improved planning practices. A structured set of MPM dimensions tailored to mosque facilities can therefore provide a practical bridge between international FM standards and the everyday realities of *Masjid kariah*.

In line with this reasoning, the present study develops MPM as a multi-dimensional construct derived primarily from MS ISO 41001:2018 and adapted to the mosque context. Seven key dimensions are identified – Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment and Safety and Health – and are treated as independent variables that influence the Maintenance Strategy Criteria (PPM, PCM and UM) in *Masjid kariah*. Section 2.4.1 clarifies the concept and definition of MPM, Section 2.4.2 reviews the main theories and models of maintenance performance, Section 2.4.3 examines maintenance performance indicators in facility management with specific reference to MS ISO 41001:2018, and Section 2.4.4 discusses MPM for mosque facilities, leading to the formulation of the MPM dimensions used in this study.

2.4.1 Concept and Definition of Maintenance Performance Measurement (MPM)

The literature offers numerous definitions of performance and performance measurement in the maintenance context. Amaratunga (2001) describes maintenance performance measurement as a process of quantifying the efficiency and effectiveness of actions taken, while Moullin (2007) views performance as an assessment of how well an organisation is managed and the value it delivers to customers and stakeholders. From a planning perspective, measuring performance is essential for identifying gaps between current and desired performance levels and for signalling where improvement is needed (Wijesinghe & Mallawarachchi, 2019). As building maintenance has become a more prominent concern in the business environment, performance measurement has emerged as a key tool for ensuring that maintenance contributes meaningfully to organisational outcomes.

Within this context, performance measurement is frequently portrayed as an assessment mechanism for revealing the strengths and weaknesses of maintenance planning (Amaratunga & Baldry, 2002a). The results can be used to evaluate the effectiveness of implemented maintenance strategies and to guide future decisions. Parida et al. (2015) emphasise that maintenance performance measurement often relates maintenance expenditure and investment to the outcomes of maintenance activities, while Amaratunga & Baldry (2003) argue that performance measures should be simple, understandable and focused on improvement. When appropriately designed,

maintenance performance measurement enables organisations to pinpoint problematic areas in maintenance delivery particularly the contribution of maintenance to organisational goals and to demonstrate how maintenance supports overall business objectives (Elyna Myeda et al., 2011).

Scholars further stress the need to select variables and metrics that genuinely influence the maintenance execution system or planning framework. Cholasuke et al. (2004) note that experts advocate performance measures that capture factors directly affecting maintenance planning and implementation. Neely et al. (1995) define performance measurement as:

i. a process of quantifying the efficiency and effectiveness of an action;
ii. a metric used to quantify effectiveness and/or efficiency; and
iii. a set of metrics used to quantify both

In building maintenance, quantified performance measures allow facility managers to assess the effectiveness of existing operation and maintenance policies (Seshadhri & Paul, 2017), to develop indicators that offer a holistic view of facility performance (Lavy & Bilbo, 2009) and to ensure that maintenance performance and asset condition measures are aligned with organisational objectives (Parida et al., 2015). Although early performance measurement systems were often criticised for being incomplete or poorly adapted to the working environment (Dixon et al., 1990), subsequent work has shown that effective maintenance performance measurement plays a vital role in meeting business needs and can be operationalised through indicators related to schedule adherence, cost and functionality (Kutucuoglu et al., 2001; Parida & Kumar, 2006).

Building on these contributions, the present study understands Maintenance Performance Measurement (MPM) as a structured process and set of metrics used to quantify how efficiently and effectively maintenance planning and actions support organisational objectives and user needs. In the context of *Masjid kariah*, MPM is particularly important to assess whether limited financial and human resources are being translated into safe, reliable and well-maintained mosque facilities. It also provides a practical mechanism for operationalising the performance-evaluation and improvement requirements embedded in MS ISO 41001:2018 within a mosque environment. The following subsection (Section 2.4.2) therefore reviews key theories and models of

maintenance performance that inform the development of the MPM dimensions used in this study.

2.4.2 Theories and Models of Maintenance Performance

To provide a theoretical basis for maintenance performance measurement in this study, two key models of building maintenance performance are adopted: the General Maintenance Management Model developed by Tsang et al. (1999) and the Performance Measurement Model proposed by Cholasuke et al. (2004). Together, these models explain how maintenance strategies are planned and implemented across an organisation and how performance can be systematically evaluated through multiple managerial and operational dimensions.

2.4.2.1 General Maintenance Management Model (Tsang et al., 1999, Pp.694)

Tsang et al. (1999) present a general maintenance management model that links maintenance strategy to implementation through a structured set of activities and feedback loops. The model emphasises that maintenance management is not limited to day-to-day repair work but involves a continuous cycle of planning, execution and performance review. Six key components are highlighted: preventive maintenance (PM), predictive maintenance (PdM), corrective maintenance (CM), reliability-centred maintenance (RCM), maintenance planning and scheduling (MPS) and maintenance performance measurement (MPM). As illustrated in Figure 2.9, these components interact within a feedback system in which performance information is used to adjust maintenance strategies and planning decisions. The model is particularly relevant for this study because it explicitly positions maintenance performance measurement as an integral element of maintenance management, rather than as a separate, after-the-fact activity:

i. Preventive Maintenance (PM)
   Regularly scheduled inspections and maintenance tasks are aimed at preventing equipment failures. Maintenance activities in PM include lubrication, adjustments, cleaning, and parts replacements. Benefits:

reduces unplanned downtime, extends equipment life, and improves safety.

ii. Predictive Maintenance (PdM)

PdM utilises condition-monitoring tools and techniques to predict equipment failures before they occur. These techniques include vibration analysis, thermography, and oil analysis. Benefits: enhances maintenance planning, reduces unnecessary maintenance, and improves equipment reliability.

iii. Corrective Maintenance (CM)

CM is used to repair and restore equipment after a failure has occurred, which typically involves troubleshooting, diagnosis, and replacement of the failed components. Benefits: addresses unexpected breakdowns, ensures equipment functionality, and is essential for critical failures.

iv. Reliability-centred Maintenance (RCM)

RCM is a structured approach for determining the most effective maintenance strategies based on equipment reliability data and failure modes. It focuses on critical equipment and functions, aiming to improve their reliability and performance. Benefits: optimises maintenance efforts, reduces costs, and enhances system reliability.

v. Maintenance Planning and Scheduling (MPS)

MPS involves detailed planning and scheduling of maintenance activities to ensure efficient resource utilisation, which includes work order management, resource allocation, and timeline coordination. Benefits: improves maintenance efficiency, reduces downtime, and enhances overall productivity.

vi. Maintenance Performance Measurement (MPM)

MPM utilises key performance indicators (KPIs) to monitor and evaluate the effectiveness of maintenance activities. Common KPIs include mean time between failures (MTBF), mean time to repair (MTTR), and

maintenance cost as a percentage of asset value. Benefits: provides insights into maintenance performance, identifies areas for improvement, and supports continuous improvement efforts.

Figure 2.9 shows the overview of the General Maintenance Management Model.

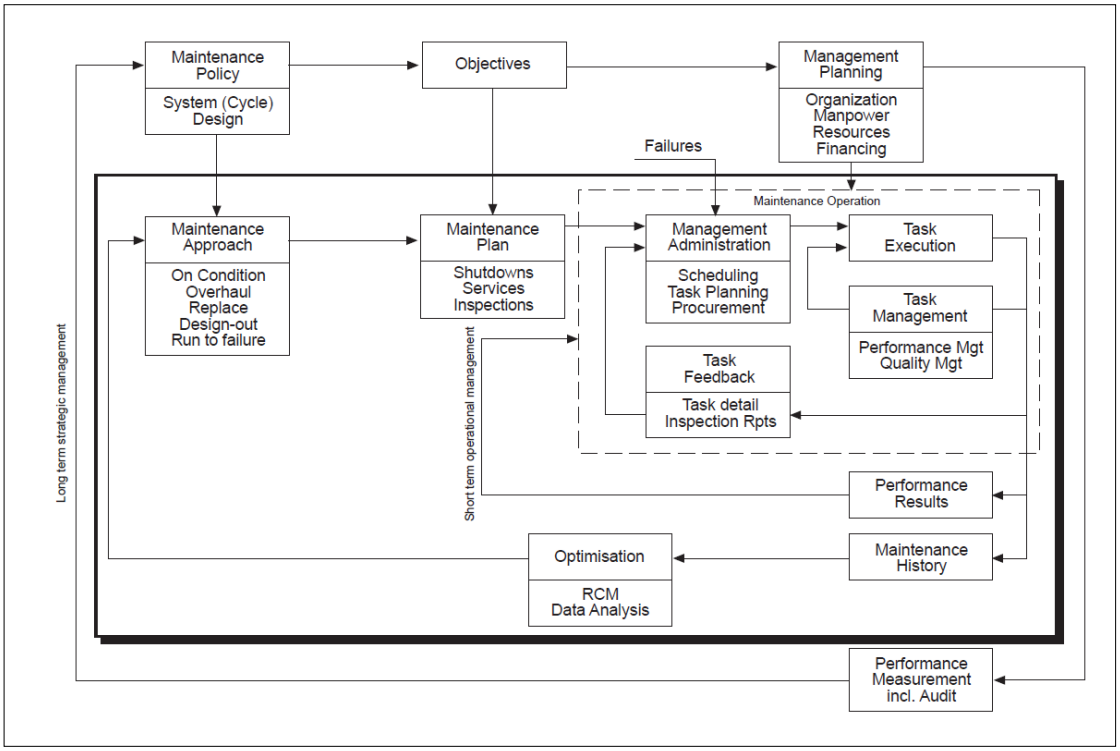

Figure 2.9 General Maintenance Management Model

The General Maintenance Management Model presented by Tsang et al. (1999) provides a comprehensive framework for optimising maintenance activities, enhancing equipment reliability, and supporting overall operational efficiency.

2.4.2.2 Performance Measurement Model (Cholasuke et al., 2004)

While Tsang et al. focus on the overall maintenance management process, Cholasuke et al. (2004) develop a more detailed framework for assessing maintenance performance. Their performance measurement model identifies nine interrelated aspects that influence the effectiveness of maintenance: policy deployment and organisation, maintenance approach, task planning and scheduling, information management and CMMS, spare-parts management, contracting-out practices,

continuous improvement, financial aspects and human resource management. As shown in Figure 2.10, these aspects form a comprehensive structure within which performance indicators can be developed and monitored. The model underscores that maintenance performance is shaped not only by technical activities but also by organisational arrangements, information systems, financial controls and human capabilities:

i. Policy Deployment and Organisation

Objective: To ensure that maintenance policies and objectives are clearly defined, communicated, and aligned with organisational goals. Key aspects: (1) clear maintenance strategy and policies; (2) organisational structure that supports maintenance activities; and (3) communication of maintenance objectives and policies across the organisation.

ii. Maintenance Approach

Objective: To adopt appropriate maintenance approaches (preventive, predictive, or corrective) to enhance equipment reliability and performance. Key aspects: (1) use of preventive and predictive maintenance strategies; (2) integration of reliability-centred maintenance (RCM) practices; and (3) regular review and optimisation of maintenance approaches.

iii. Task Planning and Scheduling

Objective: To efficiently plan and schedule maintenance tasks to minimise downtime and maximise resource utilisation. Key aspects: (1) detailed maintenance planning and scheduling processes; (2) effective prioritisation of maintenance tasks; and (3) minimisation of equipment downtime through optimal scheduling.

iv. Information Management and CMMS

Objective: To utilise information management systems, including Computerised Maintenance Management Systems (CMMS), to track and manage maintenance activities. Key aspects: (1) implementation and use of CMMS for maintenance tracking; (2) accurate and timely data

entry and management; and (3) use of data analytics to improve maintenance decision-making process.

v. Spare Part Management

Objective: To ensure the availability of necessary spare parts to support maintenance activities without causing delays. Key aspects: (1) efficient inventory management of spare parts; (2) strategic sourcing and procurement of critical components; and (3) minimisation of stockouts and overstock situations.

vi. Contracting Out Maintenance

Objective: To effectively manage outsourced maintenance activities to complement in-house capabilities. Key aspects: (1) clear contracting policies and procedures; (2) selection and management of reliable contractors; and (3) monitoring and evaluation of contractor performance.

vii. Continuous Improvements

Objective: To foster a culture of continuous improvement in maintenance practices to enhance performance and efficiency. Key aspects: (1) implementation of continuous improvement initiatives; (2) regular review and assessment of maintenance processes; and (3) encouragement of innovation and adoption of best practices.

viii. Financial Aspects

Objective: To monitor and control maintenance costs to ensure cost-effective maintenance operations. Key aspects: (1) budgeting and financial planning for maintenance activities; (2) cost tracking and analysis; and (3) identification and implementation of cost-saving opportunities.

ix. Human Resources Management

Objective: To develop and manage the skills and competencies of maintenance personnel to ensure high performance. Key aspects: (1)

training and development programmes for maintenance staff; (2) performance evaluation and feedback mechanisms; and (3) employee engagement and motivation strategies.

Figure 2.9 shows the Performance Measurement Model.

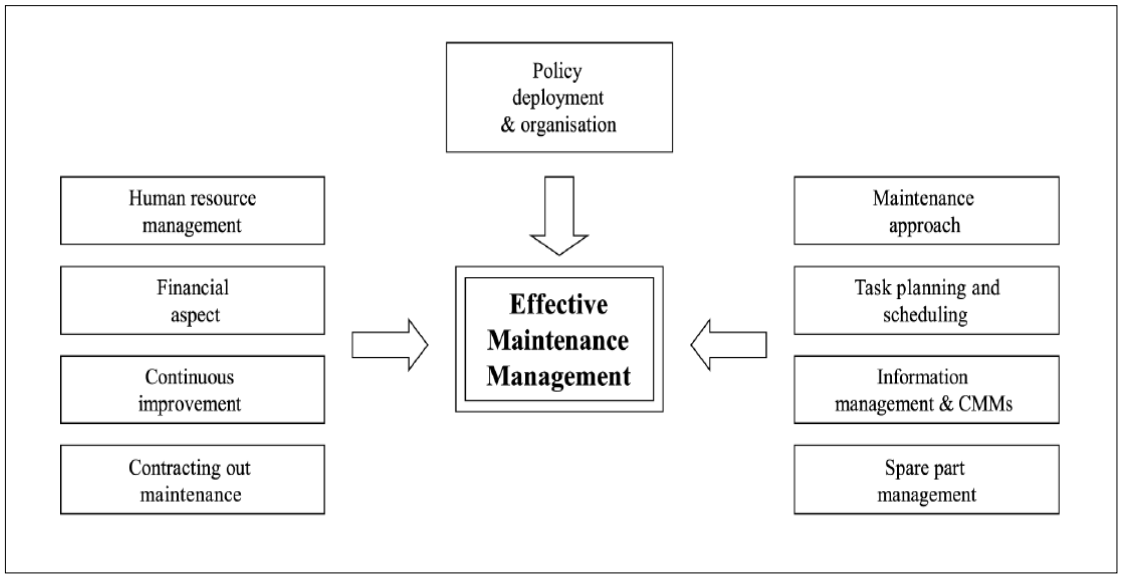

Figure 2.10 Performance Measurement Model

In the context of manufacturing organisations in the United Kingdom, as studied by Cholasuke et al. (2004), these attributes have been used to benchmark and assess maintenance performance, which provided valuable insights into best practices and areas needing attention. By systematically addressing these nine areas, organisations could achieve more reliable and efficient maintenance operations, contributing to overall business success.

Taken together, the models by Tsang et al. (1999) and Cholasuke et al. (2004) provide complementary perspectives on maintenance performance. The former explains how different maintenance strategies and activities are organised within a management cycle, while the latter specifies the organisational and operational dimensions along which performance should be assessed. For the present study, these models inform the development of Maintenance Performance Measurement (MPM) dimensions that capture both strategic and operational aspects of maintenance planning in *Masjid kariah*. They also align closely with the management-system view of facility management embedded in MS ISO 41001:2018. Building on these theoretical

foundations, the next section (Section 2.4.3) reviews previous maintenance performance frameworks and indicators, with particular attention to how they can be adapted to mosque facilities and integrated with ISO-based facility management principles.

2.4.3 Maintenance Performance Indicators in Facility Management (Link to MS ISO 41001:2018)

Within the wider field of facilities management, a substantial body of empirical work has developed specific frameworks and indicators for maintenance performance measurement. Muchiri et al. (2011) argue that performance measurement is a fundamental principle of maintenance management because the outputs of measurement are essential for managing maintenance work and identifying performance gaps. Similarly, Kaplan & Norton (1992), Neely et al. (1995) and Kennerley & Neely (2003) emphasise that performance measurement provides a critical link between maintenance strategies and performance outcomes, enabling organisations to align maintenance planning with broader strategic Facilities Management (FM) objectives. In the building and facility context, Shohet & Nobili (2016) highlight that building performance requirements can be defined through the outcomes of maintenance processes, and that performance indicators are frequently used to prioritise maintenance interventions.

Over time, a variety of maintenance performance frameworks have been proposed to operationalise these ideas. Early work drew on wider management approaches such as the Balanced Scorecard to incorporate financial, customer, internal process and learning perspectives into maintenance performance assessment (Brown, 1996; Sherwin, 2000). Subsequent frameworks focused more specifically on maintenance within FM, including Ben-Daya et al.'s (2009) model of maintenance productivity, Parida & Chattopadhyay's (2007) seven maintenance performance criteria, Campbell & Jardine's (2001) six-criteria framework and Jonsson's (1997) manufacturing-oriented model. These studies collectively demonstrate a shift from narrow cost and downtime measures towards multi-dimensional indicator sets that capture technical reliability, cost effectiveness, customer satisfaction, safety, environmental concerns and organisational learning.

More recent FM studies have refined these indicator sets into concrete Key Performance Indicators (KPIs) and linked them explicitly to ISO-based governance. Case studies on building and hospital estates show that commonly used maintenance KPIs include Mean Time Between Failures (MTBF), Mean Time to Repair (MTTR), maintenance cost per asset, asset availability, response or repair time and downtime, which are used to benchmark performance trends and support planning and budgeting decisions (Martínez-Corral & Carnero, 2024). Empirical applications of ISO 41001:2018 in hospital and industrial facility management report improved equipment reliability and availability when maintenance KPIs are aligned with ISO 41001 requirements, integrated with Computerised Maintenance Management Systems (CMMS) and monitored through dashboards that support trend analysis, root-cause investigation and continuous improvement cycles (Fotovatfard & Heravi, 2021). Practically, Malaysia's Public Works Department (JKR) guidance reinforces this ISO-aligned key performance indicator (KPI) and computerised maintenance management system (CMMS) orientation by outlining maintenance KPI development and the use of CMMS for recording, scheduling, and performance monitoring within the operations and asset maintenance (OPA) phase. These studies also highlight the growing role of digitalisation, sensor data and Industry 4.0 tools in automating KPI collection and enabling condition-based maintenance strategies (Ng et al., 2023).

In MS ISO 41001:2018, FM is organised as a process-based management system that aligns the core business strategy of the demand organisation with FM strategy, policy and plans through a Plan–Do–Check–Act (PDCA) cycle. The standard emphasises context analysis, leadership, planning and support, followed by operation, performance evaluation and continual improvement, with performance indicators embedded throughout this cycle. This process-approach methodology is illustrated in Figure 2.11, which shows how FM strategy and policy are translated into FM plans and operations and how measurement and performance evaluation feed back into improvement actions.

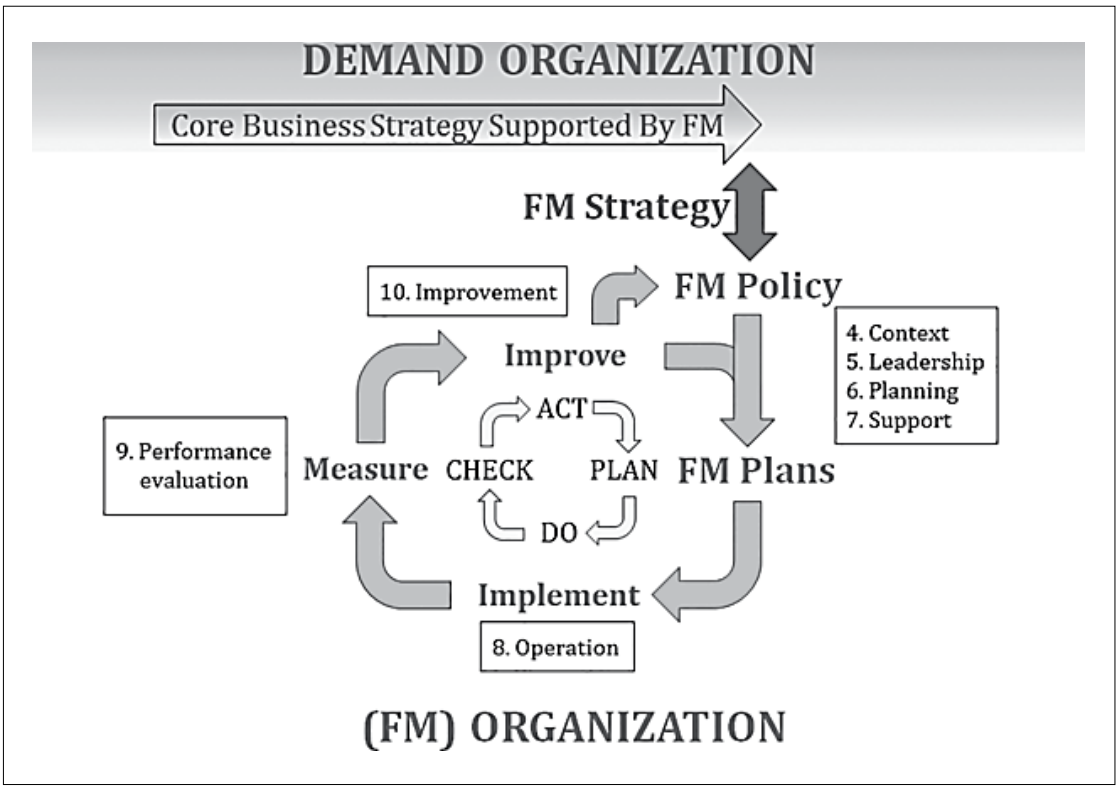

Figure 2.11 Process Approach Methodology in Facility Management
(Source: Adopted from ISO, 2018)

Table 2.17 in this chapter summarises key maintenance performance measurement frameworks and studies in the FM domain, detailing their purposes, classifications of performance measures, measurement methods and empirical contexts. The table shows that maintenance performance has been investigated in diverse facility settings i.e. manufacturing plants, infrastructure systems, hotels, public housing, healthcare estates and other service facilities using a range of approaches including Balanced Scorecard–based models, benchmarking frameworks, multi-criteria decision-making tools and survey-based indicator sets (e.g. Alexander, 1994; Shahin et al., 2012; Pitt et al., 2016; Arumsari & Rarasati, 2017). Across these contexts, a recurring concern is how to measure maintenance performance in a way that is both cost-effective and practically meaningful (Parida & Kumar, 2006), with studies repeatedly underscoring the importance of integrating strategic and operational dimensions, understanding user needs and keeping performance information visible and easy to interpret (Kim et al., 2005; Amaratunga & Baldry, 2003; Zairi, 2012).

For FM, these developments suggest that effective maintenance performance indicators must extend beyond technical reliability and cost to include organisational, financial, user-related and safety dimensions, and that they should increasingly be supported by digital data integration and CMMS-based analytics. This perspective is consistent with the management-system view of FM articulated in MS ISO 41001:2018, which requires organisations to establish, monitor and review performance measures as part of a structured FM system encompassing leadership, planning, support, operation, performance evaluation and improvement. In the context of the present study, the reviewed FM-based frameworks, KPI practices and ISO 41001 applications provide a rich pool of potential dimensions and indicators that can be adapted to mosque facilities. Drawing on these sources, the research synthesises maintenance performance measurement into seven key dimensions – Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (F), Resource Allocation (RA), Service Quality (SQ), Assessment (AS), and Safety and Health (SF) – which are then tailored to the specific context of *Masjid kariah*. The next section (Section 2.4.4) elaborates how these ISO-informed dimensions are interpreted and operationalised for mosque facilities in Malaysia.

Table 2.17
The Maintenance Performance Measurements Formulated in Previous Studies

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
1.	Gallimore & Penlesky (1988)	Frameworks for developing a maintenance strategy	(1) Purpose (2) Flexibility (3) Safety	Literature Review	Manufacturing Company	Maintenance Management	Must deal with the mix maintenance strategy to obtain desire service level.
2.	Kaplan & Norton (1992)	Companies' strategy	(1) Financial Perspective (2) Customer Perspective	*N/A*	*N/A*	*N/A*	*N/A*
3.	Brown (1996)	(3) Internal Business Perspective (4) Innovation and Learning (5) Public responsibility (6) Operational level	(1) Balance Scorecard (BSC)	General Company	Shareholder and organisations	The balanced scorecard puts the strategy at the centre to achieve the goals of the organisations	*N/A*
4.	McKone & Weiss (1998)	Review all maintenance models for maintenance management	(1) Financial Perspective (2) Customer Perspective	*N/A*	*N/A*	*N/A*	*N/A*
5.	Tsang (1998)	(3) Internal Business Perspective (4) Innovation and Learning (5) Public responsibility (6) Operational level	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
6.	Tsang et al. (1999)	Maintenance-investment decision for TPM	(1) Equipment Improvement (2) Inspection and Replacement Interval (3) Predicting Quality and Equipment Performance (4) Design Lifespan	Literature Review	Two Manufacturing Company in Sweden	Practitioner and Academician	apply operations management research methodologies to TPM to put.
7.	Bevilacqua & Braglia (2000)	It on a firmer scientific footing than provided by the frameworks	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
		currently described in the numerous practitioners' books					
8.	Sherwin (2000)	Strategic maintenance performance management process	(1) Financial (2) Customer (3) Internal Process (4) Learning and Growth	Balance Scorecard (BSC)	Mining, steel, petrochemical, utilities, and public transportation industries	*N/A*	The efficacy of maintenance strategy should be review periodically and the respective stakeholder should be responsible for conducting the periodic review.
9.	Amaratunga (2001)	BSC Approach to managing maintenance operations	(1) System Audits (2) Operational Efficiencies (3) Value-based Performance Measurement (4) System Audit (5) Data Envelopment Analysis	Balance Scorecard (BSC)	Industrial company	*N/A*	Performance of maintenance operations can be enhanced when stakeholders behave in an orchestrated manner that will ensure the availability of production assets.
10.	Kutucuoglu et al. (2001)	Analytical hierarchy process for selecting maintenance strategy	(1) Safety (2) Machine Importance for the Process (3) Maintenance Cost (4) Failure Competency (5) Downtown Length (6) Operating Condition	Analytical hierarchy process	API Oil Refinery IGCC Plant	*N/A*	HP technique makes it possible to approach the decision-making problem in a completer and more thorough.
11.	Swanson (2001)	Maintenance strategies and their relationship with plant maintenance performance	*N/A*	*N/A*	Metalworking Industries	*N/A*	*N/A*
12.	Tsang (2002)	Strategic Maintenance dimension	(1) Service Delivery Options, (2) Organisation and Works	Balance Scorecard (BSC)	Maintenance engineering	*N/A*	Two factors permeated these

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
			Structure (3) Maintenance Methodology (4) Support Systems				strategic dimensions: human factors and information flow.
13.	Anderson & McAdam (2004)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
14.	Cholasuke et al. (2004)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	the currency of benchmarking and performance measurement needs a radical and indeed innovative.
15.	Hui & Tsang (2004)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
16.	Parida et al. (2005)	Total maintenance effectiveness	(1) Health and Safety (2) Environment (3) Learning and Growth (4) Customer Satisfaction (5) Employee Satisfaction (6) Maintenance Task (7) Equipment	*N/A*	*N/A*	*N/A*	*N/A*
17.	Alsyouf (2006)	*N/A*	*N/A*	Balance Scorecard (BSC)	*N/A*	*N/A*	*N/A*
18.	Marquez & Gupta (2006)	*N/A*	(1) The functionality required of enablers such as it to abet maintenance (2) The Distinctive Capabilities extended by modern maintenance engineering (3) The Critical Requirement of relationship Competencies in Maintenance	*N/A*	*N/A*	*N/A*	It would be interesting to deal with the problem of "customizing" maintenance organisation structures according to evolving business strategies as product mix, supply chain scenarios, technologies, or

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
							product development opportunities change.
19.	Parida & Kumar (2006)	*N/A*	(1) Health and Safety Environment (2) Learning and Growth (3) Customer Satisfaction (4) Cost Related (5) Equipment Related (6) Maintenance Task (7) Employee Satisfaction	*N/A*	*N/A*	*N/A*	*N/A*
20.	Parida (2007)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
21.	Parida & Chattopadhyay (2007)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
22.	Söderholm et al. (2007)	Maintenance process model	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
23.	Aditya & Kumar (2009)	Maintenance performance measurement based on organisational effective model	(1) Employee Satisfaction (2) Health, Safety & Environment (3) Customer Satisfaction (4) Learning, Growth & Innovation (5) Maintenance Task (6) Cost Related (7) Equipment Related	*N/A*	*N/A*	*N/A*	*N/A*
24.	Crespo Márquez et al. (2009)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
25.	Abdul-Lateef (2010)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
26.	Olanrewaju et al. (2010)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
27.	Elyna Myeda et al. (2011)	Key aspect of performance measurement	(1) Functional Management Service Delivery (2) Technical Maintenance Services (3) Image of Building	Mixed methods: (1) Interview and (2) questionnaire	Office buildings in Malaysia	End user of office maintenance buildings in Malaysia	The performance measurement to be practical and suitable to measure the effectiveness of maintenance service delivery of office buildings.
28.	Olanrewaju et al. (2011)	Value maintenance management model	*N/A*	*N/A*	Malaysian University Campuses	*N/A*	*N/A*
29.	Nik-Mat et al. (2011)	*N/A*	(1) Functional (2) Technical (3) Image Characteristics	Interviews, case studies and observation	*N/A*	1)Maintenance Manager 2) End-users High-rise Office Building	A positive correlation between the performance of maintenance management and the system applied.
30.	Salonen & Bengtsson (2011)	Strategic maintenance management	*N/A*	Maintenance key performance indicator	Manufacturing industry	*N/A*	*N/A*
31.	Zawawi et al. (2011)	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
32.	Olanrewaju (2012)	Quantitative analysis	(1) Defective Items	Literature Review and survey questionnaire approach	550 university buildings users, derived from a convenience sample from five universities	Students	20 defects were found to be very critical to the building users. Based on the findings, it was concluded that resources be directed towards defects that affect security, safety, and comfort. Research limitations /implications – Th.
33.	Barberá et al. (2012)	House of maintenance	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
34.	Mohit & Azim (2012)	Residential Satisfaction	(1) Physical Features (2) Service Provided (3) Public Facilities (4) Social Environment	SPSS (Cross-tabulation, correlation analysis, and regression analysis)	Public Housing, Hulhumale Maldives	Resident of Hulhumale	The study infers that merely providing houses does not ensure the success of existing house developments and policies.
35.	Harun et al. (2013)	maintenance management model	*N/A*	*N/A*	Sports facilities	*N/A*	*N/A*
36.	Ibem & Aduwo (2013)	*N/A*	*N/A*	Cross-sectional survey	Public Housing Estate, Nigeria	*N/A*	*N/A*
37.	Chemweno et al. (2015)	Asset maintenance maturity model	*N/A*	*N/A*	*N/A*	*N/A*	*N/A*
38.	Rani et al. (2015)	Explore the relationship between maintenance Strategy with end-user satisfaction	*N/A*	Kendall's correlation analysis	Healthcare Facilities	18 Hospitals (questionnaire and survey) Facility manager and end-users	Small significant level Management needs to investigate types of maintenance strategies implemented previously and plan according to building requirements.
39.	Shafiee (2015)	Multicriteria decision making (MCDM) Problem	(1) Economic Criteria (2) Social Criteria (3) Environmental Criteria	Secondary Data-classify Scheme	Publication	Journal paper, Conference paper, master and doctoral dissertation, text book	Professional in maintenance practice to find the model that suits their needs.
40.	Pitt et al. (2016)	Constraint and challenges of stakeholder to determine the strategies to overcome the maintenance works	(1) Availability of Skill Workers (2) Partial Outsourcing (3) Availability of Tools (4) Availability of Materials (5) Availability In-House	Structured Interview Online survey	Hotel in Sanyan, Hainan	50 Five Star Hotel 30 Hotel Operator 20 maintenance manager	Factors that affect hotel operators' and maintenance managers' decisions were identified and their influences

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
			Maintenance (6) Labour Training				quantified.
41.	Arumsari & Rarasati (2017)	Qualitative and Quantitative methodology	(1) Level damage and deterioration of quality of the building material (2) The level of building management services (3) The level of building occupants' involvement (4) The level of building maintenance budget availability	Case- Study	Public rented residential buildings, Jakarta	Building staff	Dominant factors in maintenance management, which influence the creation of slums condition in the public-rented residential building are the level of damage and quality deterioration of the building material and the level of building maintenance budget availability.
42.	Pun et al. (2017)	Fuzzy AHP-based decision support system	(1) Safety (2) Technical (3) Economic (4) Environment	Literature review	50-story commercial building in Kowloon district, Hongkong	ABC Company	FAHP provides a more realistic and reliable solution for the complex decision-making process.
43.	Shohet & Nobili (2017)	The key performance indicator for maintenance management	(1) Assess the maintenance performance of the facilities (2) Intra- and inter-benchmark the performance and efficiency (3) Establish a policy for the strategic and tactical maintenance management (4) Set priorities in the maintenance plan	Literature review	Case study of 42 Community clinics, Israel	Facility managers/maintenance managers	A set of seven hybrid KPIs can be used for the leading and lagging analysis of the planning and control. Of facility maintenance.
44.	Gandhare et al. (2018)	Maintenance performance management practice	(1) Policy Development and Organisation (2) Maintenance Approach (3) Task Planning &	Field visit, interview, and published report using cluster	Sugar Industry	Industrial expert	Maintenance performance is significantly and positively related to performance

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
			Scheduling (4) CMMS (5) Spare Part Management (6) Human Resource (7) Contracting Out (8) Financial (9) Continuous Improvement	analysis using multi regression analysis			approach, continuous improvement, financial approach, and spare part management.
45.	Mahfoud et al. (2018)	*N/A*	(1) Maintenance Planning (2) Maintenance Implementation (3) Maintenance Monitoring (4) Maintenance Improvement	Multi-criteria decision making. Literature review	Healthcare Domain	Medical professional	Developed optimization models still unable to completely cover the gap between academic research and application
46.	Voordt & Jensen (2018)	Measurement and benchmarking for performance at the workplace	(1) People-oriented (Satisfaction, Image, Culture, and Health & Safety) (2) Business Process-Related (Productivity, Adaptability, Innovation and Creativity, Risk) (3) Economic (Cost, the Value of Assets) (4) Social (Sustainability, Corporate Social Responsibility)	Literature review, interview with a practitioner	Corporate real estate and facility management	Facility manager	12 parameters seen a relevant measurement in measuring workplace performance benchmarks.
47.	Gopikrishnan & Topkar (2019)	Building maintenance attributes	(1) Physical Condition (2) Space (3) Indoor Air (4) Illumination (5) Safety and Security (6) Accessibility (7) Air, Noise and Water (8) Waste Disposal	Survey Instrument	Construction industry	Occupants, manager, and supervisor	The choice of correct attribute data is easy for the respondent to answer the questions. The response of the users that obtain for the performance is likely to be more objective by using the

No.	Author(s)	Model/Frameworks/ Purpose of measure	Classification of Maintenance Performance Measures	Methods of Measurement / Instruments	Context	Respondents	Result/ Findings
			(9) Drainage (10) Finishes (11) Amenities (12) Aesthetics (13) Parking				specific attribute performance measurement.
48.	Hauashdh et al. (2020)	Issues, affect and way forward to the building maintenance practice	(1) Maintenance Organisation Performance (2) Maintenance Service Performance (3) Building Performance	Systematic Literature Review	Building maintenance issues	Scopus and Web of Science	Review building maintenance issue systematically and indicate 4 main performances to cater (1) effective management (2) technical capability (3) development of human resources (4) cost optimisation.

Note: *N/A:* Not Applicable

2.4.4 Maintenance Performance Measurement (MPM) for Mosque Facilities

The application of Maintenance Performance Measurement (MPM) to mosque facilities requires sensitivity to both the technical characteristics of mosque buildings and their religious and community functions. As discussed earlier, mosques consist of a combination of structural and architectural elements i.e. prayer halls, roofs, floors, façades and external works – and building services including lighting, sound systems, water supply, sanitation and fire protection. For *Masjid kariah*, these components are heavily used on a daily basis and are managed under resource and capacity constraints. Previous studies on mosque maintenance therefore emphasise that performance assessment must go beyond general building indicators to reflect how well the mosque supports safe, comfortable and dignified worship and community activities (e.g. Ab Muin et al., 2016; Mazlan et al., 2018; Zolkepli & Latiffi, 2021).

From a technical perspective, maintenance performance for mosque facilities can be considered in terms of building condition and service condition. Building-condition assessment focuses on the physical state of structural and architectural elements, including the presence of defects such as roof leakage, dampness, cracking, spalling, slippery floor finishes or deteriorated external areas. Condition surveys and rating systems are commonly used to identify defect patterns, prioritise repairs and estimate the resources needed to restore elements to an acceptable level of functionality and appearance. For mosques, these assessments are closely linked to user safety and comfort; poorly maintained prayer halls, ablution areas or external walkways can compromise both the spiritual atmosphere and the physical wellbeing of worshippers. In performance measurement terms, these aspects are captured through indicators related to the adequacy of organisation management, planning and scheduling of inspection and repair works, and the effectiveness of resource allocation to building-envelope maintenance.

Service-condition assessment focuses on the reliability, responsiveness and quality of mosque building services. Key systems include artificial lighting, fans or HVAC, public address systems, water supply and plumbing, toilets and ablution facilities, fire detection and protection, and security systems such as CCTV. Performance indicators in this domain typically consider equipment reliability, frequency and duration of service interruptions, response and repair times, maintenance cost per system and, increasingly, energy efficiency and environmental comfort. For

mosque facilities, the continuous and peak-time operation of these services – especially during Friday prayers and religious festivals – means that failures are immediately visible to users and can undermine the perceived quality of mosque management. These aspects relate particularly to the planning and scheduling, financial provision, resource allocation and service quality dimensions of MPM.

In addition to technical and service conditions, maintenance performance for mosque facilities must also incorporate assessment, safety and health perspectives. Assessment dimension refers to the procedures and tools used to monitor maintenance performance, including the use of checklists, condition-rating scales, user feedback, complaint records and periodic audits by mosque committees or state religious authorities. Safety and health encompass compliance with building and fire regulations, provision of safe access routes, adequate lighting, ventilation and hygiene in toilets and ablution areas, as well as adherence to Islamic principles regarding cleanliness and the dignity of the mosque environment. These dimensions are particularly salient for *Masjid kariah*, where worshippers often include children, elderly people and persons with disabilities, and where the mosque functions as a focal point for community gatherings, education and welfare activities.

Building on the general FM and ISO 41001 perspectives outlined in Sections 2.4.1–2.4.3, the present study therefore conceptualises MPM for mosque facilities as a multi-dimensional construct comprising seven interrelated dimensions: Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment, and Safety and Health. Together, these dimensions capture how mosque committees and relevant authorities organise, finance, implement and monitor maintenance in ways that sustain building and service conditions while safeguarding user wellbeing and fulfilling religious expectations. In subsequent sections, these mosque-specific MPM dimensions are operationalised into measurable indicators for *Masjid kariah* and linked to the Maintenance Strategy Criteria (PPM, PCM and UM) in the proposed conceptual framework. The relationships between the three Maintenance Strategy Criteria (Planned Preventive, Planned Corrective and Unplanned Maintenance) and the selected maintenance performance measurement elements identified from the literature are illustrated in Figure 2.12. Building on the relationships summarised in Figure 2.12, the next section develops the overall maintenance planning framework for *Masjid kariah* by grouping these elements into

seven MPM constructs and linking them to the Maintenance Strategy Criteria (PPM, PCM and UM).

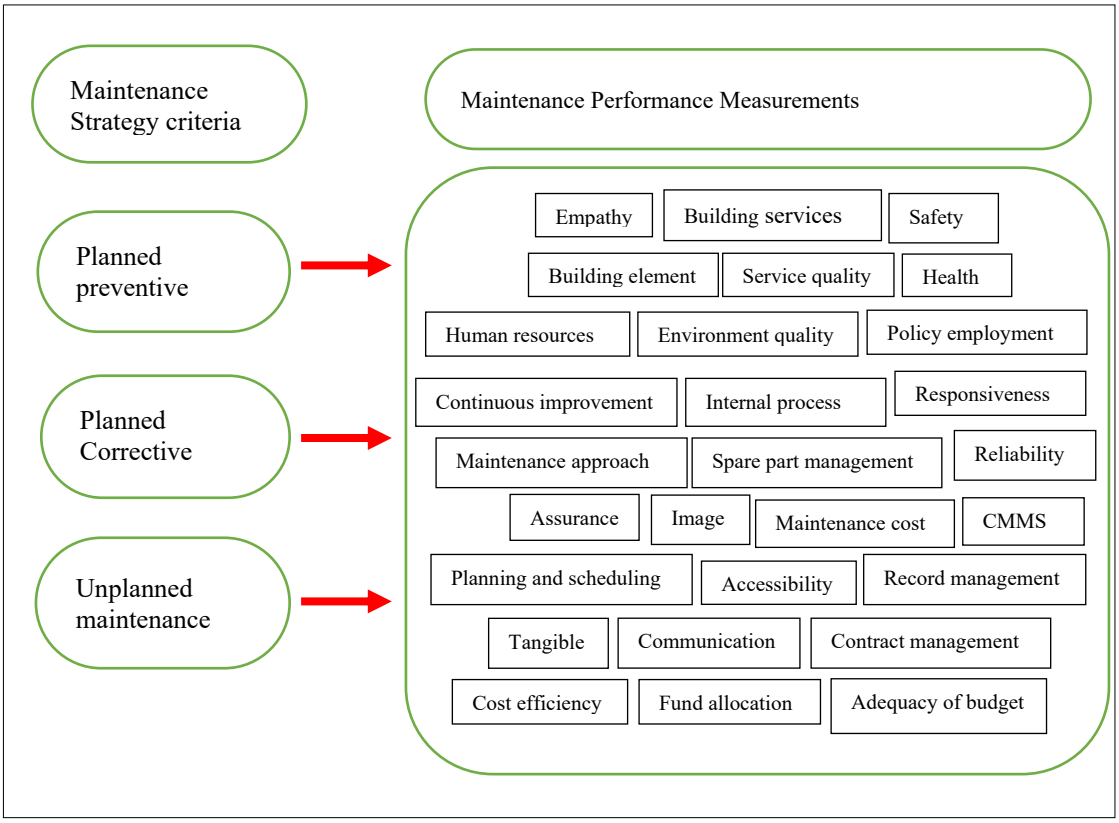

Figure 2.12 Relationships between Maintenance Strategies and Selected Maintenance Performance Measurements

2.5 Development of Maintenance Planning Framework for Masjid Kariah

The literature review has shown that maintenance planning for *Masjid kariah* is influenced by multiple, interrelated factors: the physical and functional characteristics of mosque facilities, the regulatory and institutional arrangements governing mosque management in Malaysia, and the current balance between planned and unplanned maintenance strategies. At the same time, Maintenance Performance Measurement (MPM) has evolved from simple cost and downtime indicators to multi-dimensional frameworks embedded within facility-management systems such as MS ISO 41001:2018. However, existing studies offer limited guidance on how these developments can be translated into a coherent, performance-based maintenance planning framework tailored specifically to community mosques (*Masjid kariah*),

which are numerous, resource-constrained and largely managed by volunteer committees.

This section therefore develops a conceptual framework for maintenance planning in *Masjid kariah* that integrates maintenance management theory, MPM, and the mosque-specific context reviewed in earlier sections. The framework is built on three key components: (i) the underpinning theories that justify the structure of the model; (ii) the Maintenance Strategy Criteria (MSC) – Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) – which act as outcome variables; and (iii) the seven Maintenance Performance Measurement (MPM) dimensions – Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Resource Allocation (RA), Service Quality (SQ), Assessment (AS), and Safety and Health (SH) which function as Independent variables. Subsequent subsections explain the theoretical foundations, describe the outcome and predictor variables, and formulate the hypothesised relationships that form the basis of the proposed maintenance planning framework for *Masjid kariah*.

2.5.1 Underpinning Theories for the Framework

The proposed framework is grounded in established maintenance management and performance measurement theories, particularly the general maintenance management model of Tsang et al. (1999) and the performance measurement model of Cholasuke et al. (2004), complemented by contemporary facilities management and MS ISO 41001:2018. Tsang et al. conceptualise maintenance management as a continuous cycle that links maintenance strategy to implementation through planning, execution and feedback. Their model highlights six key components – preventive maintenance, predictive maintenance, corrective maintenance, reliability-centred maintenance, maintenance planning and scheduling, and maintenance performance measurement – and emphasises that performance information should be fed back to refine maintenance strategies and plans. This systems view underlines the central role of performance measurement as an integral part of the maintenance management process rather than a separate, after-the-fact activity.

Cholasuke et al. (2004) complement this perspective by identifying the organisational and operational aspects that shape maintenance effectiveness. Their performance measurement model specifies nine aspects i.e. policy deployment and

organisation, maintenance approach, task planning and scheduling, information management, spare-parts management, contracting-out, continuous improvement, financial aspects and human resource management – which together provide a comprehensive structure for assessing maintenance performance. This model demonstrates that maintenance outcomes are not determined solely by technical activities, but also by management structures, information systems, financial controls and human capabilities.

These two models resonate strongly with the process-based management approach of MS ISO 41001:2018, which organises facility management as a Plan–Do–Check–Act (PDCA) system linked to organisational context, leadership, planning, support, operation, performance evaluation and improvement. Within ISO 41001, performance measurement is embedded in the "Check" and "Act" stages and is expected to inform continual improvement of FM processes, including maintenance. Taken together, Tsang et al.'s maintenance management cycle, Cholasuke et al.'s performance measurement aspects and the ISO 41001 FM system provide the theoretical justification for conceptualising Maintenance Performance Measurement (MPM) as a multi-dimensional construct that influences maintenance strategies. In this study, these insights are distilled into seven MPM dimensions (OM, PS, FP, RA, SQ, AS and SH), which represent the organisational levers through which *Masjid kariah* can move from reactive, ad hoc maintenance towards more proactive, performance-based maintenance planning.

The integration of these three theoretical foundations is summarised in Figure 2.13. The general maintenance management model of Tsang et al. (1999) provides the overall maintenance cycle and highlights performance measurement as feedback to planning and strategy. The performance measurement model of Cholasuke et al. (2004) identifies the organisational and operational aspects that shape maintenance effectiveness, while MS ISO 41001:2018 frames facility management as a process-based system built around performance evaluation and continual improvement. In this study, these foundations are combined to derive the seven Maintenance Performance Measurement (MPM) dimensions and the Maintenance Strategy Criteria (PPM, PCM and UM) that together form the proposed maintenance planning framework for *Masjid kariah*. In addition, BS 3811:1993 provides the foundational classification of maintenance work into planned preventive, planned corrective and unplanned

maintenance, which is adopted in this study to operationalise the Maintenance Strategy Criteria (MSC).

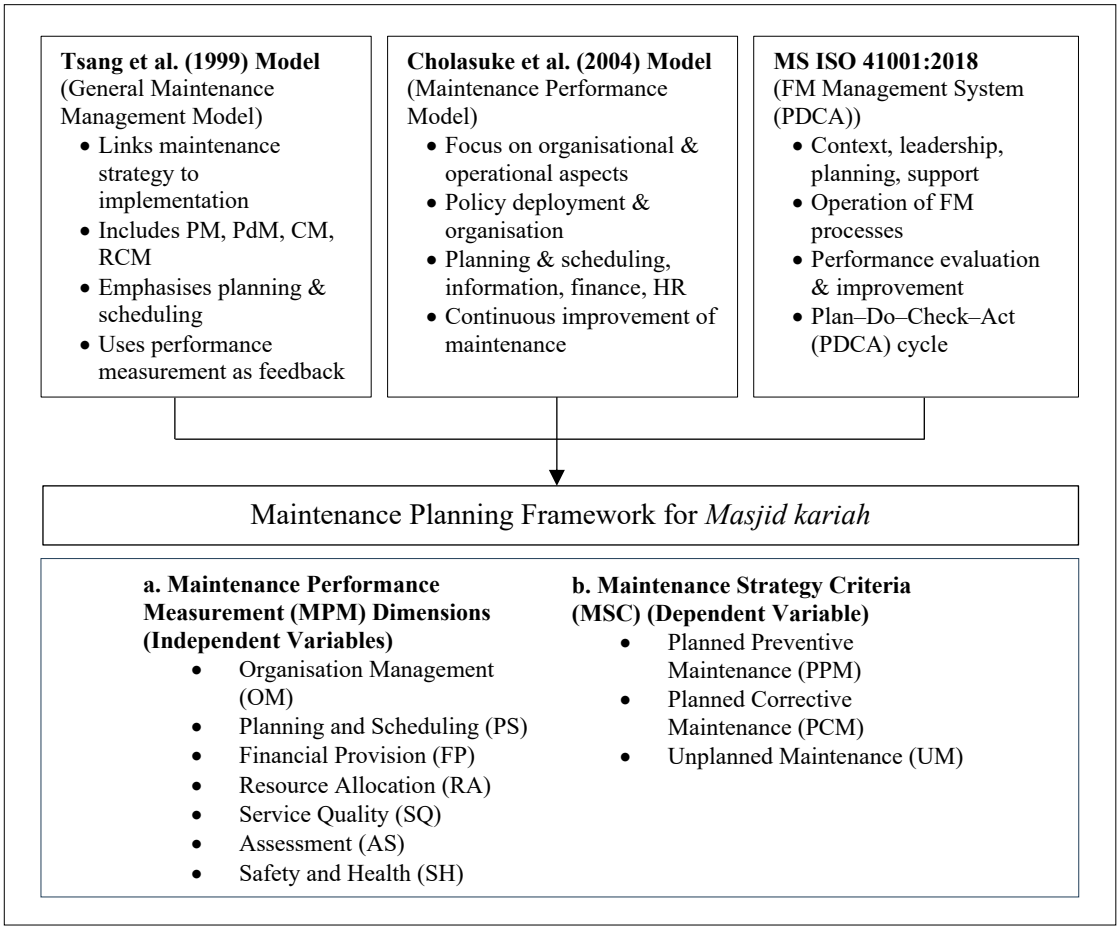

Figure 2.13 Theoretical Foundations of the Maintenance Planning Framework for *Masjid kariah*

2.5.2 Maintenance Strategy Criteria (PPM, PMC, UM) as Dependent Varibles

In this study, the outcome of maintenance planning in *Masjid kariah* is captured through Maintenance Strategy Criteria (MSC) derived from BS 3811:1993. BS 3811 provides a widely used classification of maintenance work into planned and unplanned categories and further distinguishes between planned preventive, planned corrective and unplanned maintenance. Adopting this structure, the present framework defines MSC as comprising three strategy types: Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM). Together, these three criteria describe the overall pattern of maintenance activities carried out in *Masjid kariah* and serve as the dependent variables in the proposed model.

PPM refers to maintenance actions that are scheduled in advance and undertaken before a failure occurs, either on a time-based or condition-based basis. Typical PPM activities in mosque facilities include routine inspections, cleaning, lubrication, minor repairs and replacements of components at predetermined intervals or when condition thresholds are reached. The purpose of PPM is to slow down deterioration, reduce the likelihood of unexpected failures, extend asset life and ensure that critical spaces such as prayer halls, ablution areas and circulation routes remain safe and functional. A higher level of PPM is generally associated with more mature and systematic maintenance planning, as it requires forward planning, budgeting and clear assignment of responsibilities.

PCM, by contrast, consists of corrective actions that are identified in advance through inspections, condition assessments or user reports, and then scheduled and resourced in a controlled manner. In the context of *Masjid kariah*, PCM may include repair of roof leaks identified during condition surveys, rectification of electrical defects discovered during statutory inspections or refurbishment works planned on the basis of observed wear and tear. Although PCM is reactive in the sense that it responds to detected defects, it is still considered planned because the work is organised, prioritised and carried out according to a predefined programme rather than as an ad hoc response. Effective use of PCM allows mosque committees to address emerging problems in a timely manner while coordinating works with available budgets and minimising disruption to religious activities.

UM encompasses corrective actions that are not scheduled in advance and are undertaken in response to sudden failures, emergencies or urgent user complaints. Examples include emergency repairs to failed lighting or sound systems during congregational prayers, immediate rectification of burst pipes or blocked sewers, or ad hoc patching of damaged floor finishes that pose safety risks. While some level of UM is unavoidable, a high proportion of unplanned work is often symptomatic of weak inspection regimes, inadequate preventive programmes, insufficient budgeting or poor coordination among stakeholders. UM tends to be more costly and disruptive than planned work because it is carried out under time pressure, may require premium labour or materials and can compromise user safety and satisfaction.

Within the proposed maintenance planning framework for *Masjid kariah*, the relative emphasis on PPM, PCM and UM is used as an indicator of the quality and maturity of maintenance planning. A strategy profile dominated by PPM and PCM

suggests that maintenance is being managed in a proactive and performance-based manner, whereas a profile dominated by UM indicates continued reliance on breakdown-driven and complaint-based responses. The seven Maintenance Performance Measurement (MPM) dimensions described in Section 2.5.3 – Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment, and Safety and Health – are therefore hypothesised to influence the distribution of maintenance work across these three strategy criteria.

2.5.3 Maintenance Performance Measurement Dimensions as Independent Variables

Drawing on the theories and empirical studies reviewed in Sections 2.4 and 2.5.1, this study conceptualises Maintenance Performance Measurement (MPM) as a set of organisational and operational dimensions that represent the internal capabilities of *Masjid kariah* to plan, implement and monitor maintenance. In line with Tsang et al.'s (1999) general maintenance management model, Cholasuke et al.'s (2004) performance measurement model and the process-based approach of MS ISO 41001:2018, these dimensions capture how maintenance is embedded within the broader facility management system rather than being treated as purely technical activities. They are therefore treated as independent variables that influence the pattern of maintenance strategies – Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) – in *Masjid kariah*.

Based on the synthesis of maintenance and FM literature, case studies of mosque maintenance and the requirements of MS ISO 41001:2018, seven MPM dimensions are identified for Masjid Kariah: Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Resource Allocation (RA), Service Quality (SQ), Assessment (AS), and Safety and Health (SH). OM reflects governance structures, roles, communication and stakeholder involvement in mosque maintenance. PS concerns the existence and quality of inspection programmes, work plans and prioritisation procedures. FP represents the adequacy, stability and transparency of maintenance budgets. RA addresses the availability and deployment of human resources, tools, contractors and materials. SQ focuses on user-oriented outcomes such as cleanliness, comfort, reliability of building services and responsiveness to

complaints. AS captures the mechanisms used to monitor and review maintenance performance, including condition surveys, KPIs, audits and feedback systems. SH encompasses compliance with statutory requirements, risk control and the protection of worshippers' wellbeing in line with both regulatory and Islamic expectations.

Together, these seven dimensions form a coherent representation of the maintenance performance environment within which *Masjid kariah* operate. Conceptually, stronger performance in these dimensions is expected to support a higher emphasis on PPM and PCM and to reduce reliance on UM, by enabling mosque committees to plan works proactively, secure and manage resources, respond effectively to user needs and continuously learn from performance information. In the proposed framework, MPM thus functions as the main explanatory construct linking organisational practices to maintenance strategy outcomes. The following subsections (2.5.3.1–2.5.3.7) elaborate each dimension in detail, specifying its conceptual definition, justification from the literature and relevance to the maintenance planning framework for *Masjid kariah*.

2.5.3.1 Organisation Management (OM)

Organisation Management (OM) is one of the critical constructs for the implementation of a maintenance strategy (Waeyenbergh & Pintelon, 2002). Wireman (2005) claimed that several crucial issues were affecting the maintenance management work of an organisation, and the most vital one was organisation and staffing. Every organisation needs to manage all building maintenance activities to ensure that they can be implemented properly and achieve their maintenance goals. Those in charge of the organisation need to clearly understand the concepts, methods, and activities in building maintenance management. Ramly (2002) reported that maintenance must reach a high level of efficient management because the current building problems are different from the needs and care of buildings in the past and will be changing in the future.

One of the critical factors highlighted by Waeyenbergh & Pintelon (2002) was the management skills required for maintenance control tasks, as well as human resources. According to Smith (2002), an effective building maintenance can be achieved based on well-organised management, qualified maintenance staff, and a strong organisational structure. Therefore, the dimension for organisation management

used in this study consisted of policy deployment, human resource management, and continuous improvements.

i. Policy Deployment

A policy is a set of guidelines and rules used as reference for carrying out related activities in an agency or entity to fulfil the need of related groups. Therefore, the deployment of a policy for maintenance management is the key to determine the level of maintenance strategy criteria. This dimension is a strategy for aligning an organisation's resources towards achieving its objectives. Adenuga et al. (2010) claimed that policy deployment could ensure the effectiveness of the maintenance works in a building. It could also reflect the maintenance performance of a suitable maintenance strategy in expanding the lifespan and economical aspect of building elements and services. Policy deployment should align with the needs and requirements of the organisation. Rozita (2006) asserted that buildings would perform lower than user's expectation due to the implementation of poor maintenance policy.

Lee & Scott (2009) proposed three elements for formulating a maintenance policy, which were the choice of maintenance strategy, identification of maintenance standard, and allocation of maintenance resources. A maintenance policy is very much concerned with maintenance strategy, standards, and resources, since these three categories are the main pillars in formulating maintenance policy. Wordsworth and Lee (2001) have highlighted that the British Standard 3811 policy was a suitable strategy for deciding on the maintenance works. Table 2.188 shows a list of different maintenance policies.

Table 2.18
Maintenance Policies

No.	Maintenance policy	Criteria
1.	Policy to the building user	Building users should be aware of the maintenance works or repair significant damages.
		Building users should make sure the building itself in good condition.
		Building users should make sure the building is safe.
		Building users can use the building if the activity does not interrupt the function of the building.
2.	Policy to the organisation	The organisation should manage all the staff in the maintenance department.
		Preventive maintenance shall be done to the building to prevent any damage or defect according to a suitable

No.	Maintenance policy	Criteria
		timeline of the building maintenance works.
		The organisation should make sure maintenance staff prepare all the reports.
		Servicing works should be done for every building.
		The organisation shall ensure that maintenance governance, records management (e.g., CMMS), and performance monitoring (KPI/SLA) are guided by Malaysia's administrative guidelines (e.g., JKR GPOP/GPPR).
3.	Policy to the procurement	The organisation can decide either maintenance works can involve an external party or an in-house contractor.
		The organisation should choose a suitable contractor for maintenance works.
		Contract works for maintenance buildings should cover all costs, time, quality, and service.
4.	The policy of review and response	All the works must be recorded.
		Any routine works must be recorded.
		All report must be evaluated to know the building performance.

Therefore, policy deployment is important to ensure that maintenance function aligned with the overall goals and objectives of the organisation's management. In this case, the deployed policy could improve the efficiency and effectiveness of maintenance works and subsequently lead to better overall performance of *Masjid kariah*.

ii. Human Resource Management

Human resource management can be defined as the selection, allocation, development, and assessment of employees (including contractor personnel) to fulfil organisational requirements by defining their roles, duties, and accountabilities. The provision of sufficient human resources to carry out tasks related to building maintenance is the responsibility of the maintenance organisation. Skilled and semi-skilled workers should be recruited by the human resource management. The task of skilled workers is to ensure that every part or element of the building is well maintained, while semi-skilled workers would assist them. De Groote (1995) opined that human resource management was one of the performance measurements recommended to improve maintenance works.

Management performance is a factor oriented by human resources, and according to Ali (2013), every human resource in the organisation should manage all

maintenance activities to be successful and achieve the maintenance standard. From the perspective of *Masjid kariah*, Jabatan Agama Islam Negeri (State Department of Islamic Religion) is solely responsible for providing enough human capital or maintenance personnel to carry out activities relating to building maintenance. Therefore, professional, skilled, and semi-skilled employees should ensure that any facility at the *Masjid kariah* is well-maintained and accessible. Sapril et al. (2016) conveyed that engaging a skilled facilities management professional is one of the approaches that would help support the mosque management system and keep the mosque's function and facilities in top conditions.

The organisation should be responsible to provide adequate manpower to carry out maintenance tasks. Hence, the responsible person in charge should clearly understand the concept and methods in maintenance planning for the respective buildings. Qualified personnel with relevant knowledge and rules are among the most important criteria in terms of maintainability. Organisational goals and top management may have an impact on building maintenance management (Lee & Scott, 2009).

iii. Continuous Improvement

Continuous improvement would help identify the structure that the organisation must accomplish to create long-term learning and growth. This element could ensure that the committee members are knowledgeable in maintenance management to manage the maintenance work at *Masjid kariah*. The lack of knowledge among committee members in maintenance management could lead to less attention given or deficiency in managing the maintenance works. Ncamiso et al. (2022) implied that work experience and knowledge in maintenance played major roles in influencing the building maintenance systems. The mosque committee members must understand the maintenance works incurred in maintenance planning for the works to be managed effectively. Ahmad et al. (2018) denoted that mosque committee members need sufficient training and exposure, as their positions could not necessarily guarantee their efficiency in managing the mosque.

The purpose of training is to allow the staff to be multi-trained, highly motivated, and ready to execute all duties efficiently without relying on others. Education can be offered to improve the abilities of staff and their expertise in their organisations. As previously mentioned, building maintenance strategies are based on British Standard

3811. Hence, it is vital for the maintenance management of *Masjid kariah* to offer training and adequate education for workers regarding each criterion of maintenance strategy and the performance used to evaluate them. Therefore, committee members of *Masjid kariah* should be required to undergo training to better understand maintenance works. Ibrahim et al. (2009) recommended that mosque officials be exposed to basic knowledge on maintenance via short courses for them to be more effective in managing maintenance works. This approach could also ensure that the properly trained staff would be able to perform maintenance task efficiently.

2.5.3.2 Planning and Scheduling (PS)

Planning and scheduling of maintenance refer to the planning, arranging, controlling, and optimising the required works within a specific timeframe (Hauashdh et al., 2022). Maintenance planning and scheduling should be periodically implemented according to the needs of the physical condition of the buildings and their respective systems to ensure successful maintenance. Planning and scheduling in maintenance management works could help the maintenance team or organisation to manage and prioritise their maintenance works using the allocated budget and resources for each work. Therefore, successful planning and scheduling could indirectly reduce maintenance expenses. The best strategy to prevent an accumulation of maintenance work is to properly plan and schedule the works either by weekly, monthly or yearly basis (Hauashdh et al., 2022).

However, shortcomings in planning and scheduling maintenance works could prevent the maintenance works from achieving the objectives of the organisation. According to Hafizi et al. (2010), maintenance planning involves three stages, namely, short-term planning (less than two years), medium-term planning (two to five years), and long-term planning (five to ten years).

Basiran (2002) explained that the planning and scheduling aspect of maintenance management was one of the factors that could result in ineffective maintenance works. Zawawi et al. (2011) orated that there were probable improper procedures and planning that the maintenance team could be applying, which would affect the facilities and services provided. Therefore, the dimension of maintenance approach used in this study comprised maintenance approach, record management, and communication.

i. Maintenance Approach

Any maintenance approach used in maintenance management could greatly affect the performance of the maintenance works. There are two types of contractual arrangements for managing maintenance works, which are in-house contractors and outsourced contractors. Failure to implement efficient and effective maintenance approaches is likely to cause various maintenance problems, especially during maintenance planning. Effective maintenance management is solely related to the implementation of a suitable maintenance approach. Several approaches can be used by the committee members of *Masjid kariah* to manage maintenance works. Each maintenance criterion needs to be checked to determine that the maintenance works is done periodically and on time, as required. With the right maintenance approach, the work that needs to be done would be done in a neat and orderly fashion during the maintenance process of the building.

Masjid kariah is a place of worship for Muslims and a place for conducting Islamic programmes. Therefore, maintenance management needs to ensure that maintenance works for either the physical element or service element are properly scheduled as not to disturb prayer times or any programme organised at this institution. Hence, the selected maintenance approach needs to provide a sequence of tasks to ensure that these tasks are efficiently performed. The timeline and duration of each task is extremely important in the planning process because each *Masjid kariah* has specific prayer times and programmes.

ii. Records Management

Yatim et al. (2011) reported that records management must play a significant role in any organisation because many issues could arise due to improper record keeping. Meanwhile, Radzuan et al. (2011) noted that the purpose of a condition survey would be to obtain an independent professional's opinion on the condition of a building. This survey could be based on the condition of the buildings, the cost of the maintenance works, as well as reports on the finishes, services, and major fixing and fitting. Every maintenance activity must be recorded for review should any problem arise in the future to fit the purpose of maintenance planning. The files for records management need to

be managed effectively. Maintenance strategies can be recorded in various inventories of materials and maintenance equipment.

iii. Communication

Every person in the organisation should communicate about the different forms of work to be completed to meet the organisational goals based on the following chains of command: superiors delegate roles to their subordinates; subordinates would report findings or make recommendations to their supervisors; members of the organisation would decide ways to accomplish the maintenance goals. Kreps (1990) defined communication in the context of an organisation as the members collecting, submitting, and interpreting important information about their organisation and the changes that are happening within it. DeCotiis & Summers (1987) opined that clear communication regarding organisational intentions, activities, and performance, as well as a sense of cohesion among employees, may boost organisational commitment. Mazlan et al. (2018) denoted that one of the challenges in mosque maintenance management is a lack of understanding of maintainability and of the maintenance process. According to Madlock & Booth-Butterfield (2008), when staff use behavioural maintenance techniques to interact with subordinates, their interactions may be strengthened. One of the effective methods for efficient maintenance works would be the frequency of communication among members of the maintenance department. Therefore, the committee members of *Masjid kariah* should communicate efficiently with the maintenance staff and other shareholders throughout the maintenance process.

2.5.3.3 Financial Provision (FP)

The maintenance cost of every building could be high if it is not properly managed. Financial provision is one of the critical performance measurements in maintenance planning of *Masjid kariah*. Financial usually refers to budgets and costs, and for a maintenance strategy to work, there is a need for a compromise between these two. Financial from a maintenance perspective is often regarded as necessary expenses that fall under the operating budget. In general, maintenance cost is inclusive of the costs of operating, utility, occupancy, custodial, janitorial, and capital. Lavy et al. (2010) combined maintenance cost with the expenditure of building elements, and its

service users to the building systems and components. This combination could help managers identify building problems associated with depreciation, space utilisation, and productivity to achieve long-term organisational goals.

Yasoa et al. (2019) mentioned that a mosque would receive funds or financial support from two types of sources. The first type is grants from the State Islamic Council and the second type is donations from individuals or corporate entities. All financial supports are to be used for the administration and maintenance costs at the mosques. Maintenance costs would usually refer to the adequacy of budget, fund allocation, and cost efficiency of the maintenance management works. Maintenance costs in many instances are influenced by the effectiveness and efficiency in which the work is performed. Therefore, the dimension for financial provision used in this study consisted of the adequacy of budget, fund efficiency, and fund allocation.

i. Adequacy of Budget

An appropriate budget should be prepared and planned based on the anticipated cost of the maintenance works in compliance with the system or equipment to be used and its specifications. Mosques are getting their maintenance budget from related authorities, such as Majlis Agama Islam Negeri (State Islamic Council) and Jabatan Kerja Raya (JKR, Public Works Department). Mosques is also involved in fundraising efforts through donations, organised activities, and corporate organisations. However, Razak et al. (2014) reported that these funds have been unproperly channelled to the related activities at these mosques, which affected the adequacy of their maintenance budget.

According to Blessing et al. (2015), maintenance budget is a cost projection on the cost of labour, equipment, materials, and other items required to be identified in the work schedule. This budget should include fundings for adequate key maintenance needs in the direction of supporting the delivery of the required service to an acceptable standard, as established in the organisation's maintenance policy. Therefore, the adequacy of the budget is important to ensure that proper maintenance works can be done, as well as to manage any urgent need for maintenance works. However, the primary concerns regarding maintenance cost are budget constraint and overrun (Ali et al., 2016). This is because an inadequate budget will affect the maintenance works, for example, poor quality of work (Gallimore & Penlesky, 1988).

As stated by Kamaruzzaman et al. (2016), building maintenance is vital for ensuring the facilities, buildings, and equipment are within their best possible condition. Au-Yong et al. (2014a) affirmed that the cost of building maintenance would be constantly rising due to inadequate maintenance planning budgets. Paulo et al. (2013) stated that maintenance works would often be delayed due to inadequate budget from property owners, which would then lead to increased amounts of building deteriorations. An adequate budget is required to procure maintenance resources, which include labour, time, cost of cleaning materials, and equipment (Frank Taillandier et al., 2011). Adnan (2015) noted that the maintenance budget for mosques would normally be from cash waqf (endowment), which is donations given by the public. This author further reported that unlike the National Mosque and district mosques, *Masjid kariah* mostly receive their fund from the State Islamic Council. In Kelantan Darul Naim, Majlis Agama Islam & Adat Istiadat Melayu Kelantan (MAIK) is responsible for allocating the maintenance budget for each mosque.

ii. Fund Efficiency

Fund efficiency is the ability to use available financial resources effectively to achieve the desired level of maintenance for the organisation. In this case, it may involve minimising costs, while maximising the value of maintenance activities at *Masjid kariah*. Thus, proper budget control is required to ensure an effective and productive building maintenance management, and subsequently, avoiding budget limitation issues and cost overruns. Hence, proper maintenance management and budgeting would be a great opportunity to incur savings for the maintenance fund. Therefore, fund allocations must be sufficient to warrant that the maintenance works are within control. The maintenance team should also be supervised to ensure that the allocation of the maintenance fund is utilised well. However, Yasoa et al. (2019) argued that a majority of mosques did not utilise their fund effectively and they were more inclined to park their fund in banks or any financial institution.

iii. Fund Allocation

Fund allocation is essential in ensuring that maintenance planning can be managed. Ali (2013) stated that maintenance allocation without enough budget would

cause delays and could lead to more damages in the future. Ncamiso et al. (2022), in their study, denoted those financial constraints could be due to the lack of budget allocation for building maintenance. This restraint could become a major challenge in future planned or unplanned maintenance works if an evaluation is not carefully conducted before allocating funds for these works. Adequate fund allocation could motivate maintenance workers to meet the required maintenance standard. There is a need to have a balance between both budget and cost in any maintenance planning (Azlan, 2009). Mong et al. (2018) recommended that due to the lack of resources and poor states of buildings, maintenance is often necessary. Therefore, building management must apply the right budgeting approach to balance the distribution of funds with the demands of upkeep, regardless of the difficulties faced by the finance department to categorise maintenance costs.

A lack of funds allocation could affect maintenance planning. Parida & Kumar (2006) reported that maintenance performance measurements rely on financial measures to support maintenance planning and execution. The allocation of maintenance funds is also vital in promoting the overall maintenance management. Ahmad et al. (2018) collected data from every mosque in Malaysia from 1999 and have determined that the average maintenance allocation for these mosques was 27.75% of the total expenses. Asharaf et al. (2012) have divided fund allocation into three types of expenses, namely, administration, social, and business, which included maintenance expenses. Among these expenses, the administration expense subsumed the most allocated funds.

2.5.3.4 Service Quality (SQ)

Service quality plays an important part in the satisfaction of those who use the facilities. Service quality towards customer satisfaction is among the strategic elements required in any organisation. Zawawi et al. (2010) have highlighted that the central issue in maintenance management was concerning low service quality. They have justified that excellent maintenance management could be achieved, if it can match the expected requirements of the users. Moreover, according to Douglas (1996), any defect or failure of a building, system, or equipment would affect the satisfaction of the users. In this study, service quality sought to measure the impact and satisfaction levels of mosque users from the perspective of the committee members. Service quality was measured

based on committee members' perception towards maintenance management and the current views on *Masjid kariah*. Lavy et al. (2010) collected responses to environmental and physical satisfaction among users. Waeyenbergh & Pintelon (2002) remarked that the ideal approach to achieve effective maintenance management would be to have an acceptable upkeep that fits user expectations as close as to be expected under the circumstances.

Service quality was first developed by Parasuraman et al. (1988) as a generic instrument known as SERVQUAL to measure the service quality with a focus group. The five dimensions of service quality used in this study were reliability, assurance, tangibility, empathy, and responsiveness, as further explained as follows:

i. Reliability

Reliability refers to the attribute to perform the promised services accurately and dependably. Parasuraman & Berry (1990) defined reliability as the punctuality of an organisation in delivering its talents. In the scope of this study, reliability referred to the promise of the maintenance strategy criteria on the service outcome and the core service attribute to the reliability dimension. This attribute has been adapted to measure user satisfaction in various situations, including for non-profit groups (Shandiz, 2015).

ii. Assurance

Assurance, in this study, referred to the ability of the maintenance strategy to provide fast and efficient maintenance service. Parasuraman et al. (1990) defined assurance as the knowledge and courtesy of employees and their ability to convey trust and confidence. However, in this study, this dimension was focused on the maintenance strategy criteria, which related to the ability of the maintenance strategy to offer assurance that the maintenance service has been carried out.

iii. Tangibility

Tangibility, in this study, was in relation to the attention paid by the maintenance team to the committee members of the mosque. Parasuraman et al. (1993) defined tangible as the appearance of physical facilities, equipment, personnel, and

communication. Mosque committee members could derive their perception based on their experiences by comparing the service provided with the attribute of tangibility, in terms of physical elements.

iv. Empathy

Empathy is defined as caring, individualised attention provided to the customer. This dimension was added to reflect the trust and confidence felt by the Muslims during prayers, which could increase their loyalty to come to the mosque. This dimension was included in the people's emotional elements (Parasuraman et al., 1993). Empathy, in this study, corresponded to the attention given by the maintenance team to the committee members' complaints.

v. Responsiveness

Responsiveness, in this study, referred to the ability of the maintenance team in using maintenance strategy criteria to perform their duty. Table 2.19 and Table 2.20 show the lists of service quality and dimensions of SERVQUAL, respectively.

Table 2.19
Service Quality

No.	Attribute	Definition
1.	Reliability	Ability to perform the promised service dependably and accurately.
2.	Assurance	Employee knowledge and courtesy.
3.	Tangible	The appearance of physical facilities, equipment personnel, and written materials.
4.	Empathy	Good communication.
5.	Responsiveness	Willingness to help and provide service promptly.

Source: Parasuraman et al. (1994)

Table 2.20
Dimension of SERVQUAL

No.	Dimension	Explanation	Elements
1.	Reliability	Consistency of performance and dependability, accuracy in billing, keeping records correctly, performing the service right at the designated time.	Reliability

No.	Dimension	Explanation	Elements
2.	Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence.	Assurance
3.	Tangibles	Physical evidence and representations of the service, appearance of Personnel in service facility.	Tangibles
4.	Empathy	Caring and individualized attention that the firm provides to its customers.	People's emotion
5.	Responsiveness	Willingness or readiness of employees to provide service, timeliness of service.	People's emotion

Source: Parasuraman et al. (1994)

2.5.3.5 Assessment (AS)

The condition of a *Masjid kariah* may consists of tangible aspects of building elements and services that relate to the behaviour of the building fabric and physicality, such as structural works, architectural works, facades, space utilisation, heating, lighting, energy efficiency, and maintainability. Ramly (2003) stated that a building is an asset that needs effective maintenance to maintain its condition. Without adequate maintenance management, the condition of the building will slowly deteriorate. A physical assessment of the building's age, along with its condition, is a dominant variable for evaluating maintenance works (Azlan, 2009). The condition of a building comprises its elements and services, which would include mechanical and electrical works. Each component works independently with another aspect to support the performance of an operating system (Muhey, 2012). Furthermore, financial sources should be secured based on the building's condition, according to the operational standards of JAKIM. The maintenance performance of *Masjid kariah* should consider different perspectives, such as from users and mosque committee members. Therefore, the assessment dimension in this study comprised the assessment of building condition, service condition, and statutory obligation.

i. Assessment of Building Conditions

Mosques are usually carpeted and the interior is often decorated. The use of chemicals for treating the interior of a mosque, as well as pollutants from cleaning materials, can be a significant hindrance to environmental sustainability. Some of these aspects require awareness of the maintenance team to choose environment-friendly and less harmful materials, which an architect might be able to advise the clients and the maintenance management team.

As a physical asset, components of a mosque will gradually deteriorate, adversely affecting the maintenance performance of its function. The associated main deterioration factors found by Hashim (2006) were the size of the building and the users' standards in maintaining buildings in Malaysia. Ahmad et al. (2018) mentioned that budget allocation needs to be reviewed from time to time according to the conditions and requirements of the mosque itself. The universal elements of a mosque design may comprise an entrance, ablution areas, prayer halls, the *mihrab* (a niche in the wall that indicates the qibla; the direction of the Kaaba in Makkah), a *mimbar* (similar to a pulpit), domes, a porch, and a courtyard. Therefore, building conditions need to be assessed as a basic measurement for making management and maintenance decisions when planning maintenance works. Matos et al. (2021) denoted that assessment of building conditions could be applied to measure the assets' performance during the lifecycle of the building, which consequently could maintain the conditions of the building effectively.

ii. Assessment of Service Conditions

Common building services in mosques may include electrical systems, HVAC systems, fire protection systems, water supply systems, sewerage systems, plumbing and sanitary systems, security system, CCTV systems, information and communication systems, and water treatment systems. Al-Homoud et al. (2005) reported that mosques has higher energy usages and energy expenditures per capita compared to other buildings. Therefore, these service conditions need to be frequently assessed to prevent any malfunction. This type of assessment is to ensure that the mosques are providing services that offer welcoming and comfortable atmosphere for the worshippers.

iii. Assessment of the Laws and Regulations

In every building, all maintenance works should comply with the related regulations and laws. Thus, the assessment for the physical elements and equipment at a *Masjid kariah* itself should follow the related regulations and laws.

2.5.3.6 Resource Allocation (RA)

Resource allocation is defined as the allocation, distribution, and monitoring of financial, human, time, and technical resources to support the intended goals and objectives. However, resource allocation in this study was focused on four areas of management, namely, contract-out management, spare part management, tools and equipment management, and information management.

i. Contract-out Management

Watson (1998) concurred that outsourcing maintenance operations could result in less hassle, lower overall system costs, better and quicker work, better exposure to outside specialists, greater versatility in adopting new technology, and greater emphasis on strategic asset management issues. The contractual part should have the completed documentation including a list of items to be priced, the manual, and the drawing related to maintenance management. Tsang (2002) found that outsourcing would be more cost effective in examining the possibility of commercialising skills rather than maintaining an exceptional non-core capacity to support the purpose of repair works. The decision to outsource maintenance labour or hire in-house personnel could be influenced by the maintenance department's policy. When determining whether to completely or partly outsource maintenance works, the evaluation cannot be based solely on monetary estimates, since they would be of little use when assessing the risks involved (Newman, 2006).

ii. Spare part Management

The primary goal of spare part management is to supply parts for a range of processes and activities as required, so the number of stored components and inventory management would remain constant. Proper spare part management can save costs in the long term. Most organisations would manage their spare parts well to prevent any delay in their maintenance operations. Some spare parts should be available in the inventory, especially when executing a planned corrective maintenance. However, Ncamiso et al. (2022) argued that there have been shortages of spare materials in the local market, making it difficult to procure the exact same parts. Therefore, buying spare parts from the outside market might be costly and ordering the required spare parts could sometimes be delayed. This delay could affect the maintenance department's productivity.

Thus, upgrading inventory is critical for an organisation's working capital management. Furthermore, a delayed arrangement of low-cost spare part stocks could cause maintenance production to be halted for an extended period. A distinct method of dealing with overseeing spare parts is needed to determine the ideal quantities of items required for a stock (Mong et al., 2018). Therefore, it is important to have access to the necessary spare parts and tools to perform maintenance work.

iii. Tools and Equipment Management

It is important to understand the classification of tools and facilities, as well as to compare the advantages of outsourcing with using an in-house workforce. In terms of equipment repairs, in-house personnel should be completely utilised. Differentiating each equipment based on its technical condition and impact on financial results is an essential component of a maintenance management system. Equipment differentiation is required to prioritise funds, and to take the appropriate maintenance and repair steps for each equipment based on its usage (Au-Yong et al., 2014b). Fund prioritisation is only possible when equipment units are properly rated in terms of their importance to the organisation. When categorising and assessing equipment, the main challenge is to consider the needs of the entire group, as what is critical to one department may not be critical to the organisation.

iv. Information Management

Ncamiso et al. (2022) reported that to ensure that the maintenance department would deliver a good service, an efficient software system is needed. This system could contain their maintenance operation, which could help them make budget allocation decisions. In recent years, the Computerised Maintenance Management Systems (CMMS) have become increasingly popular among building maintenance managements (Mong et al., 2018). CMMS was first introduced to store data and monitor information, such as planned and unplanned maintenance activities, scheduling activities, maintenance history, supplier spare parts, purchase orders, and financial flow. According to Cato & Mobley (2002), the CMMS is defined as "an integrated set of computer programmes and data files designed to provide its user with a cost-effective mean of managing massive amount of maintenance, inventory control, and purchasing data".

Mong et al. (2018) clarified that the collected data cost money to compile, plan, share, and refresh. Currently, the CMMS promotes efficient building maintenance for daily works. Since the CMMS is designed to store the compiled data and information for all maintenance activities, systems, and equipment, it can also be used for preparing the annual budget, planning and scheduling, and preparing reports. Wireman (2012) has highlighted the utilisation of the CMMS as to facilitate the collection, processing, and analysing of data. Dzulkifli et al. (2021), on the other hand, reviewed maintenance issues based on building maintenance management practices and recommended the inclusion of a computerised maintenance management system to ensure that the employees know what is going on to prevent missing or inaccurate information.

2.5.3.7 Safety and Health (SH)

The primary objective of developing buildings is to fulfil the needs of occupants by providing a conducive, safe, comfortable, healthy, and secured environment for different activities that range from work, study, leisure, family life, and social interactions. Yan et al. (2017) described environment performance towards health and safety as systematic and integrative management systems that was developed in the 1980s. In most maintenance management systems, safety and health are considered as common elements in performance measurement. Alner & Fellows (1990) explained

some of the main purposes of building maintenance as follows: (i) to ensure that the building is safe to use; (ii) to meet the legal requirement; (iii) to extend the physical life of the building; and (iv) to maintain the quality of the building. Significant economic losses could slowly occur if environmental sustainability issues continue to be ignored (Adewunmi et al., 2012). The requirement of a comfortable environment is paramount for a mosque, as it is a place of worship. Thus, to maintain an optimum indoor and outdoor environment for performing prayers, a proper maintenance strategy must be implemented. Rasdi & Utaberta (2012) opined that most mosques are environmentally sustainable because of their vernacular style, in terms of their materials and construction.

Masjid kariah is a prayer place that is contingent on safety and health concerns. Hence, safety and health are the sub-attributed factors for environmental elements as part of maintenance performance measurements. The safety and health components in this research signified the protection offered to the worshippers and visitors from any threat of accidents and illness while in a *Masjid kariah*. Lewis (2000) emphasised that maintenance management is responsible for monitoring the safety and health of the worshippers and visitors, as well as the maintenance of each facility under their supervision. The environment in this study referred to users' and committee members' health and safety issues from the perspective of maintenance activities. Therefore, the two dimensions for the environment construct were safety and health.

i. Safety

Safety is an intangible dimension. According to Miles & Syagga (1987), maintenance works were essential to ensure the safety of a building. In this case, safety is more concerned with the building itself, which consists of the structure, architecture, and building services. Safety would be among the most critical factors in maintenance performance measurement. Alner & Fellows (1990), and Lee & Scott (2009) opined that safety is a crucial part of strategy planning to ensure that the building and its associated services are in good condition, fit for use, and comply with the law and all statutory requirements. Safety elements should be maintained to prevent possible harm to users. Lewis (2012) and Lewis et al. (2010) claimed that maintenance management is responsible for the safety elements in maintenance planning. Ramly (2002) opined that the level of safety must be controlled, increased, and reviewed simultaneously to

prevent unwanted harms. Zawawi (2009) forecasted that the impact of a collapsed building at the workplace cannot be estimated.

Safety in this study referred to the protection offered to the people who use a building and its facilities from any accident, injury, or death during operation and maintenance activities. The condition of the building should be frequently checked to prevent danger. However, inefficient maintenance management could become one of the factors that lead to accident, injury, or death. Ramly (2002) emphasised that the condition of the building must be constantly checked and inspected to ensure that it is free from hazards. Therefore, maintenance activities at any *Masjid kariah* should be carried out in a safe manner to protect the safety of the workers and most importantly, the worshippers.

ii. Health

A healthy environment should be pleasant and welcoming to the users. This attribute could bring people closer to the religious ideal, community, spirituality, peace, and consequently, influence their attachment (Mutalib & Razali, 2013). The presence of mosques around the country stands for faith and hope. Having a well-maintained mosque may open the hearts of non-Muslims and Muslims alike to a greater understanding of the Islamic faith. Thus, a healthy environment could become one of the factors that make the mosque a friendlier place. A healthy environment focusses on the form and condition of the drainage system, clean water system, air ventilation system, and artificial ventilation. However, a mosque may also face the "sick building syndrome". The ventilation systems in *Masjid kariah* could be compromised if they are contaminated with toxins. Morris & Dennison (1995) reported that the ventilation system in buildings is the main factor of the sick building syndrome.

Maintenance performance measurement has been widely recognised as an assessment process for identifying the strengths and weaknesses of maintenance activities and evaluating the effectiveness of existing maintenance strategies (Amaratunga & Baldry, 2002a; Au-Yong et al., 2014b). Studies show that selecting appropriate maintenance strategies requires careful consideration of multiple performance attributes, yet many organisations still lack systematic approaches and cost-effective measurement systems (Parida & Kumar, 2006; Pun et al., 2017).

Researchers have proposed various groupings of indicators – covering technical condition, cost efficiency, service functionality, user satisfaction, organisational capability, safety and learning – reflecting the diversity of facilities and purposes being evaluated (e.g. Brown et al., 1994; Coetzee, 1998; CEN, 2007; Ku & Kim, 2019). Expert panels emphasise that performance elements must first be clearly characterised and organised into coherent constructs before meaningful measurement and benchmarking can take place (Cholasuke et al., 2004; Liu, 2009). In the context of mosque facilities, this implies that maintenance strategy criteria in *Masjid kariah* cannot be selected or evaluated without a structured set of performance dimensions aligned with the institution's goals and constraints. Guided by the literature and the specific needs of *Masjid kariah*, this study therefore consolidates maintenance performance measurement into seven constructs – organisation management, planning and scheduling, financial provision, resource allocation, service quality, assessment, and safety and health – which define the scope of maintenance performance to be examined and form the independent variables in the proposed maintenance planning framework. The way in which these seven constructs are operationalised into dimensions and observable attributes is summarised in Figure 2.14, which shows the hierarchical structure used to develop the Maintenance Performance Measurement (MPM) instrument for *Masjid kariah*. Based on a comparative review of previous maintenance and facilities management studies, the elements of Maintenance Performance Measurement (MPM) relevant to mosque facilities were extracted and mapped across key references. Table 2.21 summarises this comparative analysis and shows how the elements grouped in this study – Organisation Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation, and Safety and Health – are supported by prior research.

Table 2.21
Comparative Analysis of Maintenance Performance Measurement (MPM) Elements Extracted from Previous Research

Maintenance Performance Measurement	References																																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Organisation Management							+								+																									+			
Policy Deployment			+						+						+												+				+	+		+			+			+	+	+	
Human Resources Management	+		+						+																+								+						+	+	+	
Continuous Improvement				+	+	+		+	+	+		+		+		+							+		+	+	+				+		+				+			+	+	+	
Planning and Scheduling									+	+					+							+					+					+	+			+	+				+	+	+
Maintenance Approach	+		+							+		+		+								+	+			+				+			+		+							+
Record Management														+							+	+	+			+																	
Communication																									+	+											+						
Financial Provision	+	+		+	+	+		+	+			+	+															+			+									+		+	
Adequacy of Budget										+													+								+	+									+		
Fund Efficiency																							+									+									+		
Fund Allocation																+							+		+							+	+									+		
Service Quality				+	+	+	+	+		+				+			+	+									+	+	+			+											
Reliability		+									+	+							+	+	+	+												+										
Assurance		+									+	+							+	+	+	+												+										
Tangible		+									+	+							+	+	+	+												+										
Empathy		+									+	+							+	+	+	+												+										
Responsiveness		+									+	+							+	+	+	+												+										
Assessment																																						+	+					
Assessment to Building Condition													+					+	+		+			+			+	+	+	+								+	+					+
Assessment to Services Condition													+					+	+		+			+			+	+	+	+								+	+					+
Resource Allocation						+									+																+												
Contract-out Management	+								+																+								+			+				+	+	+	
Spare part Management									+																				+			+				+				+	+	+	+
Tools and Equipment			+											+																		+	+	+						+	+	+
Information Management (CMMS)	+		+						+						+							+										+			+					+	+	
Environment														+																													
Safety		+								+		+		+		+	+		+	+					+						+	+					+		+			
Health		+								+		+		+		+	+														+	+					+	+	+			

References: 1. Upshall (1991): 2 Horner et al. (1997): 3. Jonsson (1997): 4 Tsang (1998): 5. Tsang et al. (1999): 6. Amaratunga & Baldry (2002a): 7. Amaratunga & Baldry (2002b). 8. Amaratunga & Baldry (2003): 9 Cholasuke et al. (2004): 10. Parida et al. (2005): 11. Baharum et al. (2007): 12. Söderholm et al. (2007): 13. Lee et al. (2008): 14. Aditya & Kumar (2009): 15. Idrus et al. (2009): 16 Parida & Kumar (2009)17. Hafizi et al. (2010): 18 Lavy et al. (2010): 19. Elyna Myeda et al. (2011): 20. Nik-Mat et al. (2011):21 Yatim et al. (2011): 22. Zawawi et al. (2011): 23 Barberá et al. (2012): 24. Jaafar et al. (2013): 25 Harun et al. (2013): 26. Au-Yong et al. (2014a): 27. Husaini et al. (2014): 28. Lavy et al. (2014a): 29. Lavy et al. (2014b): 30. Lavy et al. (2014): 31. Chemweno et al. (2015): 32. Kalumbu et al. (2016): 33. Omar et al. (2016): 34. Sapril et al. (2016) 35. Yoon & Cha (2016): 36. Omar et al. (2017): 37. Phogat & Gupta (2017): 38. Seshadhri & Paul (2017): 39. Adam & Latief (2018): 40. Gandhare et al. (2018):41. Gala Mong et al. (2018) : 42. Seshadhri & Paul (2018): 43.Hidayatullah et al. (2022).

Figure 2.14 The Constructs, Dimensions and Attributes Applied in This Study

2.5.4 Relationships between Variables and Hypotheses (H1-H7)

The proposed maintenance planning framework assumes that the way *Masjid kariah* organises, plan, finance, resource and monitor their maintenance activities will shape the pattern of maintenance strategies adopted, as reflected in the balance between Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM). In this study, these three strategy types are grouped as the Maintenance Strategy Criteria (MSC) and treated as dependent variables, while the seven Maintenance Performance Measurement (MPM) constructs - Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Resource Allocation (RA), Service Quality (SQ), Assessment (AS), and Safety and Health (SH) – are treated as independent variables. The overall relationships are depicted in the conceptual framework in Figure 2.15, where the seven MPM dimensions are shown on the left-hand side, converging towards the MSC construct on the right, which is represented by its three components (PPM, PCM and UM). Table 2.22 summarises the MSC dependent variables and their definitions based on BS 3811 and the maintenance literature, while Table 2.23 (together with Figure 2.14 in previous section on constructs, dimensions and attributes) summarises the seven MPM constructs, their key dimensions and supporting references used to develop the measurement instrument.

Table 2.22
Matrix of Dependent Variables and References

No.	Maintenance Strategy criteria	Author (s)
1.	A- Planned Preventive Maintenance	BS3811 (1993). Kelly et al. (2005).
2.	C- Planned Corrective Maintenance	Lewis (2000).
3.	D- Unplanned Maintenance	Leong (2004).

Table 2.23
MPM Construct, Measurements, Methods of Measurement and Respondents Involved

Items	MPM Construct	What should be measured	Method of Measurement	Respondent (Empirical)	Assessment
1.	Organisation Management	Policy Deployment	Survey Based data	Committee Member of *Masjid kariah*	Measure agreement level of maintenance policy.
		Human Resources Management	Survey Based data	Committee Member of *Masjid kariah*	Measure agreement level of human resources management.
		Continuous Development	Survey Based data	Committee Member of *Masjid kariah*	Measure agreement level of continuous development.
2.	Planning and Scheduling	Maintenance Approach	Survey Based data	Committee Member of *Masjid kariah*	N/A
		Record Management	Survey Based data	Committee Member of *Masjid kariah*	N/A
		Communication	Survey Based data	Committee Member of *Masjid kariah*	N/A
3.	Financial Provision	Adequacy of Budget	Survey Based data	Committee Member of *Masjid kariah*	Measure the adequacy of the budget.
		Fund Efficiency	Survey Based data	Committee Member of *Masjid kariah*	Measure the efficiency of fund.
		Fund Allocation	Survey Based data	Committee Member of *Masjid kariah*	N/A
4.	Service Quality	Reliability	Survey Based data	Committee Member of *Masjid kariah*	Measure the satisfaction level of reliability.
		Assurance	Survey Based data	Committee Member of *Masjid kariah*	Measure the satisfaction level of assurance.
		Tangible	Survey Based data	Committee Member of *Masjid kariah*	Measure the satisfaction level of tangible.
		Empathy	Survey Based data	Committee Member of *Masjid kariah*	Measure the satisfaction level of empathy.
		Responsiveness	Survey Based data	Committee Member of *Masjid kariah*	Measure the satisfaction level of responsiveness.
5.	Assessment	Assessment to Building Condition	Survey Based data	Committee Member of *Masjid kariah*	N/A
		Assessment to Building Services	Survey Based data	Committee Member of *Masjid kariah*	N/A
		Statutory Obligation	Survey Based data	Committee Member of *Masjid kariah*	N/A
6.	Resource Allocation	Contract out management	Survey Based data	Committee Member of *Masjid kariah*	Measure the agreement of contract out management.
		Spare part Management	Survey Based data	Committee Member of *Masjid kariah*	Measure the agreement of spare part management.
		Tools and Equipment	Survey Based data	Committee Member of *Masjid kariah*	Measure the agreement of tools and

Items	MPM Construct	What should be measured	Method of Measurement	Respondent (Empirical)	Assessment
					equipment.
		CMMS	Survey Based data	Committee Member of *Masjid kariah*	Measure the suitability of CMMS.
7.	Safety & Health	Safety	Survey Based data	Committee Member of *Masjid kariah*	Measure the safety level of maintenance strategy towards maintenance performance.
		Health	Survey Based data	Committee Member of *Masjid kariah*	Measure the healthy level of maintenance strategy towards maintenance performance.

Note: *N/A*: Not Applicable

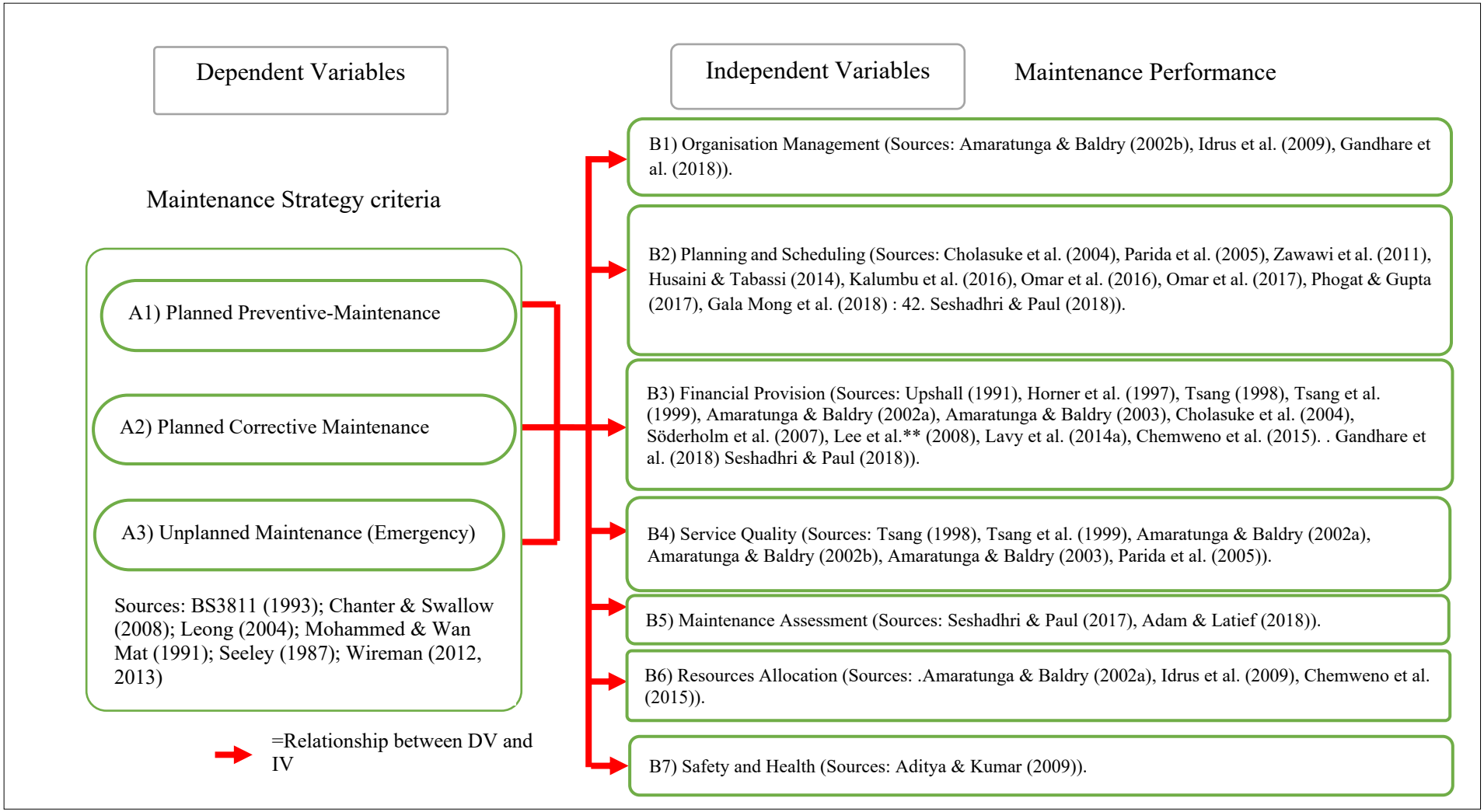

Figure 2.15Relationship between Variables (Conceptual Framework 1)

Conceptually, stronger performance in each MPM dimension is expected to enable mosque committees and relevant authorities to plan maintenance more proactively, allocate sufficient and timely resources, deliver better service outcomes and systematically monitor results, thereby increasing the relative emphasis on PPM and PCM and reducing the reliance on UM. Conversely, weaknesses in any of these dimensions are likely to be associated with more reactive, complaint-driven maintenance patterns. Drawing on the theoretical models of Tsang et al. (1999), Cholasuke et al. (2004), the ISO 41001 process approach and the mosque-maintenance literature reviewed in Sections 2.2–2.4, the following hypotheses are formulated to capture the expected relationships between the seven MPM constructs and the MSC outcomes for *Masjid kariah* in Kelantan:

- **H1**: There is a significant relationship between Organisation Management (OM) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

- **H2**: There is a significant relationship between Planning and Scheduling (PS) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

- **H3**: There is a significant relationship between Financial Provision (FP) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

- **H4**: There is a significant relationship between Resource Allocation (RA) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

- **H5**: There is a significant relationship between Service Quality (SQ) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

- **H6**: There is a significant relationship between Assessment (AS) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

- **H7**: There is a significant relationship between Safety and Health (SH) and Maintenance Strategy Criteria (MSC: PPM, PCM, UM) for *Masjid kariah*.

Figure 2.16 shows the relationship between variables.

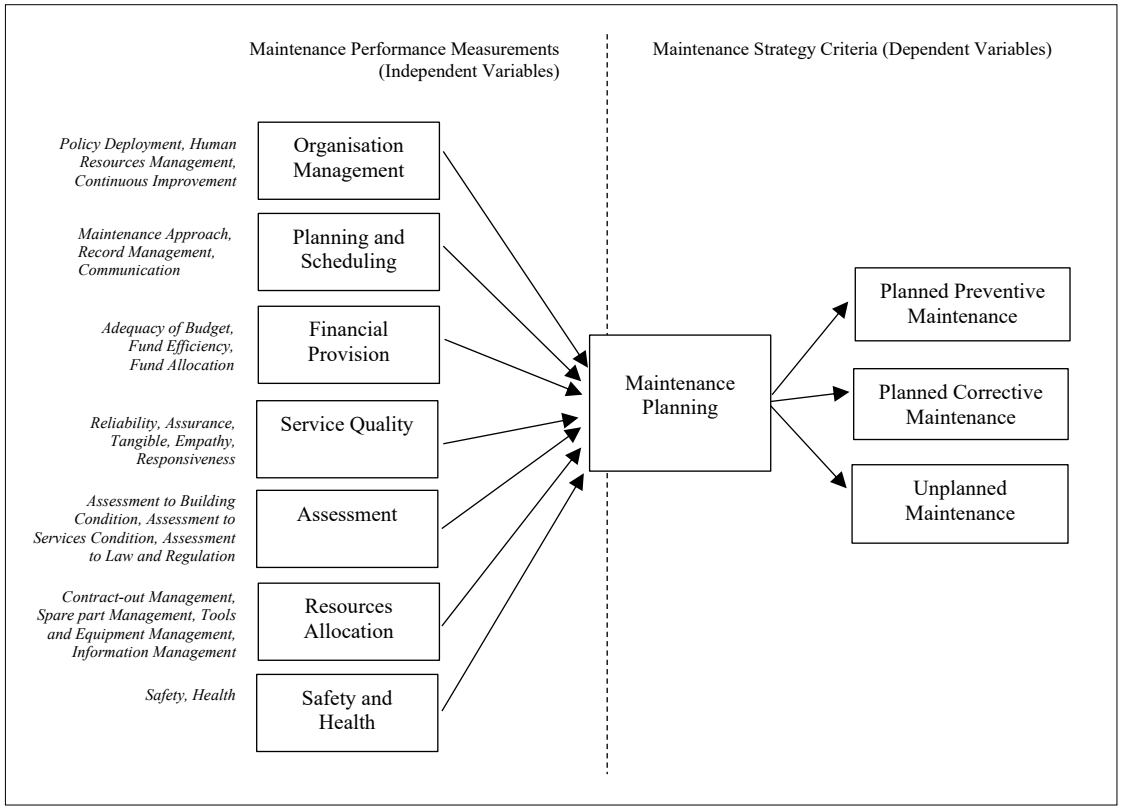

Figure 2.16 The Development of the Conceptual Framework, with Key Elements in Maintenance Planning for *Masjid kariah* from the Malaysian Perspective (Conceptual Framework 2)

This framework and the associated hypotheses form the basis for the research design, measurement development and data analysis procedures discussed in the next chapter 3 in this study - these hypotheses translate the conceptual framework into testable propositions that will be examined using the quantitative methods. The overall structure of the relationships between the seven MPM dimensions and the three

Maintenance Strategy Criteria (PPM, PCM and UM) is summarised in Figure 2.16. They also provide a direct link between the literature-based constructs and the empirical analysis, clarifying how each dimension of maintenance performance measurement is expected to influence the maintenance planning outcomes in *Masjid kariah*.

2.5.5 Original Contributions of the Proposed Framework

The proposed maintenance planning framework for *Masjid kariah* offers several original contributions to the body of knowledge on building maintenance and facilities management. First, it integrates BS 3811 and MS ISO 41001:2018 within a single mosque-oriented model. BS 3811 is used to structure the Maintenance Strategy Criteria (MSC) into Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM), while ISO 41001 provides the process-based facility management perspective that underpins the seven Maintenance Performance Measurement (MPM) dimensions. This integration extends previous maintenance frameworks by explicitly linking classical maintenance strategy classifications with contemporary FM management-system thinking in a religious building context.

Second, the framework develops a mosque-specific MPM construct for *Masjid kariah*. Through a detailed synthesis of maintenance and FM literature and empirical evidence on mosque maintenance, the study consolidates maintenance performance into seven dimensions – Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment, and Safety and Health—supported by clearly defined dimensions and attributes. These constructs reflect not only technical and economic considerations but also user experience, safety, health and religious expectations, thereby tailoring mainstream maintenance performance concepts to the unique characteristics of *Masjid kariah* in Malaysia.

Third, the framework formalises the relationships between MPM dimensions and MSC as testable hypotheses (H1–H7), positioning maintenance planning for *Masjid kariah* as a performance-based system rather than a purely reactive practice. By modelling MSC as dependent variables influenced by the seven MPM dimensions, the study provides a structured basis for empirical testing using quantitative methods and for diagnosing which aspects of mosque maintenance management require improvement. This relational structure, illustrated in the conceptual framework figure,

offers a practical tool for mosque committees, state religious departments and policymakers to evaluate current maintenance practices and to design targeted interventions that shift the balance from unplanned to more preventive and planned corrective maintenance.

Collectively, these contributions move beyond descriptive accounts of mosque maintenance by offering a theoretically grounded, empirically operationalised and context-sensitive framework for performance-based maintenance planning in *Masjid kariah*. In summary, the proposed framework consolidates the theoretical foundations, maintenance strategy criteria and mosque-specific performance dimensions into a coherent model for performance-based maintenance planning in *Masjid kariah*. The next section (Section 2.6) synthesises the reviewed literature and highlights the remaining research gaps that this framework and the subsequent empirical investigation are designed to address.

2.6 Synthesis of Literature and Research Gaps (RO1)

The preceding sections have reviewed the theoretical foundations of maintenance management, the evolution of maintenance planning processes and strategies, and the development of multi-dimensional maintenance performance measurement within facilities management. BS 3811:1993 provides the classical categorisation of maintenance strategies into planned preventive, planned corrective and unplanned maintenance, while MS ISO 41001:2018 frames facility management as a process-based management system that integrates organisational context, leadership, planning, operation, performance evaluation and improvement. Studies on mosque facilities in Malaysia and abroad further demonstrate that mosques function not only as places of worship but also as community institutions that require systematic planning, adequate resources and robust performance monitoring to remain safe, functional and responsive to users' needs. Despite this growing body of knowledge, the review reveals several theoretical and empirical gaps that constrain the development of maintenance planning framework specifically tailored for *Masjid kariah*.

2.6.1 Theoretical Gaps in Maintenance Management and Mosque Studies

From a theoretical standpoint, maintenance management literature has largely focused on generic building types i.e. offices, hospitals, campuses and industrial facilities where maintenance strategies and performance indicators are framed around cost, downtime, reliability and service efficiency (Campbell & Jardine, 2001; Parida & Kumar, 2009; Lavy & Bilbo, 2009). While models by Tsang et al. (1999) and Cholasuke et al. (2004) conceptualise maintenance as an integrated cycle linking strategy, planning, execution and performance feedback, these frameworks are seldom adapted to religious buildings, particularly community mosques managed by volunteer committees. Existing mosque-related studies tend to describe facility conditions, user satisfaction, or general maintenance issues without embedding them within a comprehensive maintenance-management or facility-management theory.

In addition, there is limited integration between traditional maintenance strategy classifications (e.g. BS 3811's planned preventive, planned corrective and unplanned maintenance) and contemporary facility-management standards such as MS ISO 41001:2018 in the context of mosque facilities. Most studies treat maintenance strategy and performance measurement as separate topics, rather than as interdependent components of a single management system. This separation makes it difficult to explain theoretically how organisational, financial; safety and service-quality dimensions influence the balance between preventive and reactive maintenance in mosque settings.

Mosque studies also rarely conceptualise *Masjid kariah* as a distinct institutional category with its own governance structure, funding mechanisms and user expectations. Theoretical discussions often generalise across national, state and community mosques, overlooking the unique characteristics of *Masjid kariah* such as heavy reliance on local donations, voluntary committees and state religious councils. Consequently, there is a gap in theory regarding how mainstream maintenance and FM concepts should be adapted to the specific socio-religious, regulatory and organisational context of *Masjid kariah* in Malaysia.

These shortcomings highlight the need for a theoretically grounded framework that explicitly links BS 3811 maintenance strategy criteria with ISO 41001-oriented performance dimensions and that is tailored to the institutional realities of *Masjid kariah*. Such a framework should conceptualise maintenance planning as a

performance-based system in which mosque-specific organisational, financial and safety factors drive maintenance strategy choices and outcomes.

2.6.2 Empirical Gaps in Maintenance Planning and Performance of Masjid Kariah

Empirically, previous research on building maintenance has produced numerous case studies on schools, university campuses, banks, government offices and residential facilities, providing useful insights into maintenance goals, policies and performance indicators (Lavy & Bilbo, 2009; Olanrewaju et al., 2010; Ali et al., 2016). However, the review indicates that empirical studies focusing specifically on *Masjid kariah* remain limited and fragmented. Existing mosque-related studies have often examined physical conditions, user satisfaction, or individual aspects such as maintenance funding or technical defects in isolation, with few attempts to integrate these findings into a holistic maintenance planning framework for community mosques.

Furthermore, many empirical works rely on descriptive assessments or qualitative observations without systematically measuring maintenance performance through clearly defined indicators. Quantitative studies that do exist tend to adopt generic performance indicators from other building types without validating their relevance to mosque facilities, where religious functions, ritual cleanliness and community expectations may alter the relative importance of service quality, safety and health. There is also a lack of empirical work that simultaneously examines the three key maintenance strategy criteria – planned preventive, planned corrective and unplanned maintenance – in relation to organisational management, planning and scheduling, financial provision, resource allocation, assessment practices and safety-and-health conditions within *Masjid kariah*.

At the governance level, empirical evidence on how national and state regulatory frameworks (such as Acts 133 and 171, state Islamic enactments and MAIK's custodial roles) translate into day-to-day maintenance planning for *Masjid kariah* is scarce. Studies seldom evaluate whether existing inspection procedures, budget approvals and committee decision-making processes are aligned with performance-based planning principles or with ISO 41001-type continual-improvement cycles. This gap is particularly critical in Kelantan, where a large number of *Masjid kariah* operate under resource constraints and varying levels of technical capacity.

Taken together, these empirical gaps show that current knowledge does not yet provide a robust, evidence-based understanding of how maintenance strategies and performance dimensions interact in *Masjid kariah*. There is a need for empirical research that develops mosque-specific indicators, quantifies their relationships with maintenance strategies, and validates these relationships through rigorous data collection and analysis.

2.6.3 Justification for the Proposed Maintenance Planning Framework

The theoretical and empirical gaps identified above justify the development of a tailored maintenance planning framework for *Masjid kariah*. Conceptually, the framework responds to the absence of an integrated model that combines BS 3811 maintenance strategy criteria with MS ISO 41001:2018-oriented performance dimensions in a mosque context. By positioning Maintenance Strategy Criteria – Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) as dependent variables and the seven Maintenance Performance Measurement (MPM) dimensions – Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Resource Allocation (RA), Service Quality (SQ), Assessment (AS), and Safety and Health (SH) as independent variables, the framework embeds mosque maintenance within a coherent performance-based management system.

Empirically, the framework is justified by the limited availability of mosque-specific performance indicators and the lack of quantitative studies that link organisational and financial factors to maintenance strategy outcomes in *Masjid kariah*. By consolidating indicators from maintenance management, facilities management and mosque-maintenance literature, and adapting them to the *Masjid kariah* context, the framework provides a structured measurement model that can be operationalised through surveys and statistical analysis. This enables the identification of which dimensions most strongly influence the prevalence of preventive, corrective and unplanned maintenance, thereby offering practical guidance for prioritising interventions.

From a policy and practice perspective, the framework also addresses misalignments between national planning instruments, construction-industry FM strategies and the on-the-ground realities of mosque maintenance. By explicitly

incorporating the roles of MAIK, local authorities and mosque committees, the framework has the potential to support more transparent decision-making, better targeting of financial resources and clearer accountability for safety and health outcomes in *Masjid kariah*. It offers a practical tool for translating broad policy aspirations for sustainable and resilient community infrastructure into concrete maintenance plans and performance benchmarks at the mosque level.

In summary, the proposed maintenance planning framework for *Masjid kariah* is warranted because it fills theoretical gaps in maintenance and mosque studies, responds to empirical deficiencies in performance-based research on community mosques, and provides a context-sensitive model that can guide industry practitioners and policymakers. These research gaps and justifications form the foundation for the research methodology presented in the next chapter, which operationalises the framework into measurable constructs and testable hypotheses.

2.7 Summary

This chapter has reviewed the body of knowledge underpinning maintenance planning and performance management for mosque facilities, with specific attention to *Masjid kariah* in Malaysia. It began by clarifying the concept of mosques as community facilities and institutions, and by outlining key definitions and principles of maintenance, building maintenance management and facilities management. Within this conceptual foundation, BS 3811:1993 was introduced as the classical basis for categorising maintenance strategies into planned preventive, planned corrective and unplanned maintenance, while MS ISO 41001:2018 was presented as a contemporary facilities management standard that frames maintenance within a process-based management system. The chapter then examined maintenance planning processes and levels, maintenance strategies and their application in religious buildings, before focusing on the particular characteristics, regulatory setting and maintenance issues of mosques in Malaysia and *Masjid kariah*.

The discussion subsequently turned to the evolution of maintenance performance measurement (MPM), tracing how indicators have expanded from narrow cost- and failure-based metrics to multi-dimensional frameworks that incorporate organisational, financial, user-related, safety and health aspects. Empirical studies in

facilities management and mosque maintenance were critically reviewed to identify relevant MPM elements and to adapt them to the mosque context. From this synthesis, seven MPM dimensions were formulated for *Masjid kariah* – Organisation Management, Planning and Scheduling, Financial Provision, Resource Allocation, Service Quality, Assessment, and Safety and Health – and linked conceptually to the three Maintenance Strategy Criteria (MSC): Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM). These relationships were formalised in a conceptual framework and expressed as hypotheses H1–H7, positioning MPM dimensions as independent variables and MSC as dependent variables in a performance-based maintenance planning model for *Masjid kariah*.

Finally, the chapter synthesised the literature to highlight key theoretical and empirical gaps, including the limited adaptation of maintenance and FM theories to mosque institutions, the scarcity of mosque-specific performance indicators, and the lack of integrated, quantitative studies linking organisational and financial factors to maintenance strategy outcomes in *Masjid kariah*. These gaps justified the development of the proposed maintenance planning framework and its associated measurement model. Building on this foundation, Chapter 3 will describe the research methodology employed to operationalise the constructs and hypotheses developed in this chapter, including the research design, sampling procedures, instrument development and data analysis techniques.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

This chapter presented the research methodology used in this study. The first section describes the research paradigm used in this study. The second section discusses the research design that consisted of appropriate methodologies applied in this research and the flow of methodologies applied for each objective.

The subsequent section explains the research approach and data analysis starting from literature review, exploratory factor analysis, confirmatory factor analysis, descriptive statistical analysis, and inferential statistical analysis. In Phase I: Qualitative Methods; stage I, existing literature was reviewed from secondary data, such as books, journals, theses, acts, articles, websites, and archived documents. Then stage II semi-structured interviews with an expert panel were analysed using the Delphi method using two round study approach. In Phase II: Quantitative Methods; content validation, pilot survey, the reliability of the questionnaire was tested for use in the final questionnaire. Then, the collected data were analysed to investigate the respondents' answers using test hypothesis and correlation relationship to determine the strength of the relationships among the independent and dependant variables. Lastly, in Phase III; Framework Development and Validation, the selection ranking scores between maintenance strategy criteria and maintenance performance measurement selected using the frequency distribution analysis. The final output was proposed to explain suitable frameworks for maintenance performance for *Masjid kariah*.

At the end, discussion on hypothesis development and proposal of flowchart of research process prior to a summary of this chapter is presented.

3.2 Research Paradigm

A research paradigm provides the philosophical foundation that shapes the researcher's worldview, guiding decisions on ontology, epistemology, and methodology (Creswell & Creswell, 2018). This philosophical stance determines how researchers perceive reality (ontology), how they acquire knowledge (epistemology), and how they apply appropriate research strategies and techniques (methodology). A

clear understanding of these assumptions allows the researcher to select methods that are coherent with the study's objectives and research design.

This study adopts the pragmatism paradigm, which is appropriate for addressing the complex and multifaceted nature of mosque maintenance planning by integrating both qualitative and quantitative approaches. Pragmatism emphasizes the practical consequences of research outcomes rather than adhering strictly to a single philosophical position (Morgan, 2014). It allows the researcher to combine inductive reasoning to generate insights from qualitative data with deductive reasoning to test hypotheses derived from those insights. Pragmatism therefore bridges the gap between theory and practice, ensuring that research findings are both contextually relevant and empirically validated. Figure 3.1 shows the research onion.

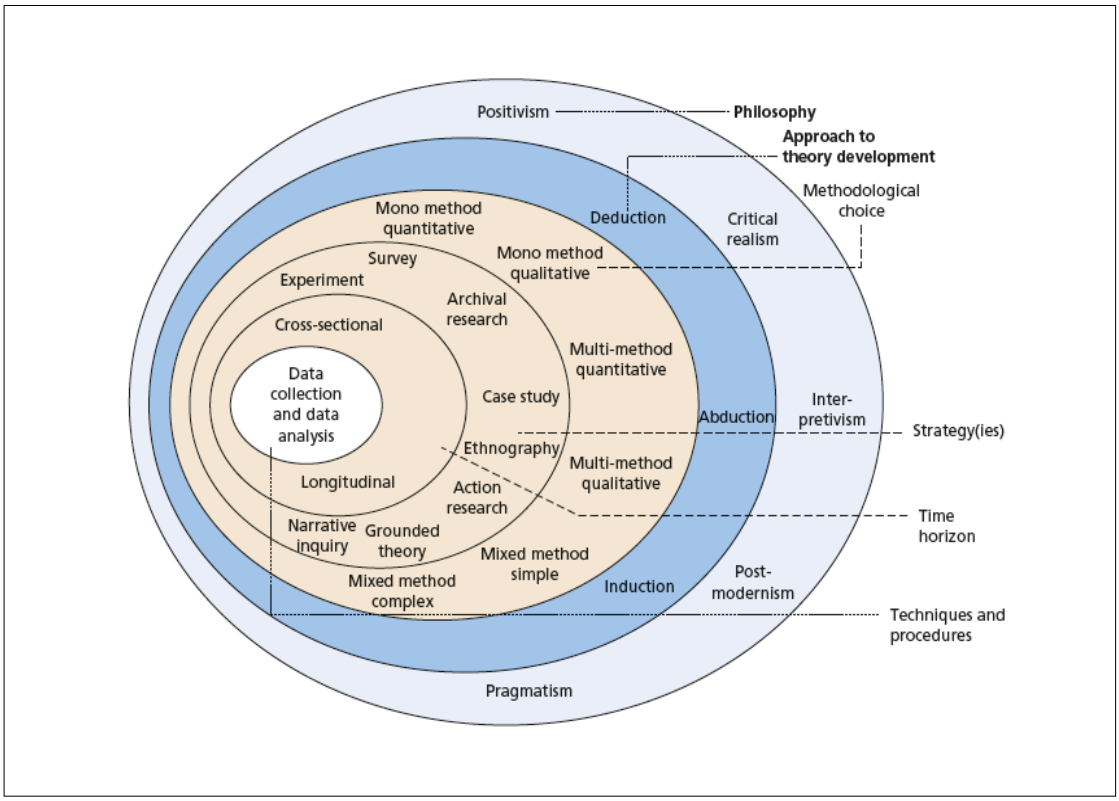

Figure 3.1 The Research Onion (Saunders et al., 2019)

As illustrated in Figure 3.1, the Research Onion by Saunders et al. (2019) provides a structured approach to designing a coherent research process. It demonstrates how philosophical assumptions influence methodological choices, research strategies, and techniques for data collection and analysis. The outermost layer reflects the

researcher's worldview, while the inner layers represent methodological decision-making that progressively narrows toward data collection and analysis. Within this framework, pragmatism situates itself as a flexible and outcome-oriented philosophy, encouraging methodological pluralism to address both exploratory and confirmatory dimensions of inquiry.

i. For the philosophy layer, pragmatism is applied to enable both qualitative and quantitative methods, aligning with the need to validate maintenance strategy criteria and performance measurement attributes among *Masjid kariah* in Kelantan. For the approach to theory development, this study employs induction followed by deduction (Creswell & Clark, 2017; Teddlie & Tashakkori, 2009). The inductive approach is used in the qualitative phase to develop theory from observations and expert insights, while the deductive approach is used in the quantitative phase to test relationships and hypotheses statistically (Collis & Hussey, 2013).

ii. In the methodological choice layer, this research adopts a Mixed Methods approach that integrates qualitative and quantitative data collection sequentially (Creswell & Creswell, 2014). This study specifically applies an Exploratory Sequential Mixed Methods Design, beginning with qualitative exploration (inductive phase) to identify maintenance strategy criteria and performance measurement variables through expert validation (RO1–RO2). This is followed by a quantitative phase (deductive) to empirically assess and validate these constructs via a questionnaire survey (RO3), culminating in the integration and framework validation phase (RO4).

iii. For the strategy layer, this study employs both case study and survey strategies within the framework of the Exploratory Sequential Mixed Methods Design. The case study approach focuses on *Masjid kariah* in Kelantan State, allowing the researcher to explore maintenance-related issues, performance indicators, and stakeholders' perspectives in real-life settings through qualitative inquiry. Subsequently, the survey strategy is used to collect quantitative data from a broader sample of *Masjid kariah* committees to statistically validate the identified constructs. Under the

pragmatic paradigm, the integration of case study and survey ensures that both contextual understanding and empirical generalization are achieved, reflecting methodological pluralism and practical applicability.

The adoption of pragmatism in this study is therefore particularly relevant as it supports the Exploratory Sequential Mixed Methods Design, integrating inductive and deductive logic to produce both theoretical and practical contributions. This philosophical orientation emphasizes that no single method can capture the complexity of real-world issues; hence, combining qualitative and quantitative evidence provides a more comprehensive understanding.

Accordingly, the pragmatic paradigm underpins this study by enabling methodological integration to achieve a practical and context-specific solution – a Performance-Based Maintenance Framework for *Masjid kariah* in Kelantan, Malaysia, which aligns directly with the research aim of developing a comprehensive framework for mosque maintenance planning. Under this philosophical stance, pragmatism allows the researcher to move flexibly between qualitative and quantitative methods to ensure that each Research Objective (RO) is addressed through the most suitable approach. Specifically:

i. RO1 and RO2 are aligned with the inductive (qualitative) phase, where pragmatism supports exploratory inquiry to identify issues, challenges, and relevant performance indicators for maintenance planning through expert insights and literature synthesis.

ii. RO3 corresponds to the deductive (quantitative) phase, where the pragmatic paradigm enables empirical testing and statistical validation of the identified indicators among *Masjid kariah* in Kelantan.

iii. RO4 represents the integration phase, where pragmatism facilitates the synthesis of both qualitative and quantitative findings to develop a practical, evidence-based maintenance planning framework consistent with the study's aim.

Therefore, pragmatism provides the philosophical bridge linking exploratory understanding with empirical validation, ensuring that the study's outcomes are both theoretically grounded and practically applicable. The adoption of mixed methods guided by the Research Onion (Saunders et al., 2019) reinforces the coherence between the paradigm, research aim, and methodological implementation – culminating in a framework that responds effectively to real-world maintenance challenges faced by *Masjid kariah* in Kelantan. Table 3.1 shows the overview of research phases under the pragmatic paradigm.

Table 3.1
The Overview of Research Phases under the Pragmatic Paradigm

No.	Phase	Research Focus	Linked Objectives (ROs)	Methodological Orientation	Pragmatic Justification
1.	Phase I – Qualitative Exploration	Identify issues, challenges, and relevant performance indicators through expert validation and selected *Masjid kariah* case contexts.	RO1 & RO2	Inductive reasoning (Qualitative) → Understanding context, exploring key criteria through Delphi / expert panel.	Pragmatism supports exploration of real-world issues using qualitative insight to inform later quantitative testing.
2.	Phase II – Quantitative Survey Assessment	Empirically test and validate performance indicators using a structured questionnaire among *Masjid kariah* committees.	RO3	Deductive reasoning (Quantitative) → Hypothesis testing, statistical analysis to measure correlation and strength of relationships.	Pragmatism enables the use of quantitative tools to validate findings and ensure reliability and generalizability.
3.	Phase III – Framework Development and Validation	Integrate both qualitative and quantitative findings to develop a practical maintenance planning framework.	RO4	Integration phase (Mixed synthesis of findings)	Pragmatism combines inductive and deductive results to produce actionable, context-specific solutions aligned with real-world application.

3.3 Research Design

In this study, the case study and mixed method designs have been employed.

3.3.1 Case Study and Survey

Yin (2009) described a case study as a method that focuses on gathering detailed information about a specific object, event, or activity. In a case study, the "case" refers to the individual, group, organisation, event, or situation that the researcher is interested in. Unlike surveys or laboratory experiments, a case study emphasises depth and context (Johannesson & Perjons, 2014). It can focus on a single instance to emphasise depth, natural settings, relationships, and processes, which may involve multiple sources and methods.

The case study approach was deemed appropriate for the research aim and scope, which were focused on *Masjid kariah* from the Malaysian perspective. *Masjid kariah* chosen for this case study were in the state of Kelantan, Malaysia. Kelantan was selected as the location of this case study because it has 584 *Masjid kariah*, which was the third highest number of mosques in Peninsular Malaysia, following the state of Johor and Perak. As discussed in Chapter Two, this typology of mosque has the highest number of built among other types of mosques in the state of Kelantan. According to the Department of Statistics (2021), there are 10 districts in Kelantan. Thus, all districts were involved in this study.

The sample calculation used in this study was determined by the total number of mosques in Kelantan. A total of 584 *Masjid kariah* is listed by JAHEAIK within the 10 districts. The following *Masjid kariah* were selected using the multi-stage sampling method (NOS: Number of mosque): Kota Bharu (130 Nos), Pasir Puteh (65 Nos), Jeli (21 Nos), Machang (43 Nos), Gua Musang (39 Nos), Tanah Merah (44 Nos), Pasir Mas (91 Nos), Tumpat (45 Nos), Kuala Krai (50 Nos), and Bachok (56 Nos). When considering 10% of the total number of mosques from each district, this study was able to select 59 *Masjid kariah* as part of the case study, i.e., those in Kota Bharu (13 Nos), Pasir Puteh (7 Nos), Jeli (2 Nos), Machang (4 Nos), Gua Musang (4 Nos), Tanah Merah (4 Nos), Pasir Mas (9 Nos), Tumpat (5 Nos), Kuala Krai (5 Nos), and Bachok (6 Nos). Table 3.2 shows the selected 10% of *Masjid kariah* in the state of Kelantan, while Table 3.3 shows the demographics of these mosques. Figure 3.2 shows the tabulation of

Masjid kariah in 10 districts in Kelantan, while Plate 3.1 shows several images of *Masjid kariah* in these study areas.

Table 3.2
The Total Number of *Masjid kariah* in Kelantan within 10% Calculations

No.	District	Frequency	Percentage (%)	10% of Total *Masjid kariah*
1.	Kota Bharu	130	22.0	13
2.	Pasir Puteh	65	11.0	7
3.	Jeli	21	4.0	2
4.	Machang	43	7.0	4
5.	Gua Musang	39	7.0	4
6.	Tanah Merah	44	8.0	4
7.	Pasir Mas	91	16.0	9
8.	Tumpat	45	8.0	5
9.	Kuala Krai	50	9.0	5
10.	Bachok	56	10.0	6
	Total	**584**	**100.0**	**59**

Table 3.3
Demographics of *Masjid kariah* in Kelantan

No.	District	Sub-Urban/Mukim	*Masjid kariah* Name
1.	Kota Bharu (13)	1. Panji (1 Unit)	Masjid Mukim Paya Bemban
		2. Kubang Kerian (1 Unit)	Masjid As-Solihin Mukim Paya Rambai
		3. Ketereh (1 Unit)	Masjid Mukim Kok Lanas
		4. Bandar Kota Bharu (1 Unit)	Masjid Al-Hakim, Taman Tanjung Chat
		5. Kemumin (1 Unit)	Masjid Tok Haji Yahya
		6. Badang (1 Unit)	Masjid Al- Munir Badang
		7. Kota (1 Unit)	Masjid Al-Fattah
		8. Sering (1 Unit)	Masjid Mukim Sering
		9. Peringat (1 Unit)	Masjid Mukim Peringat
		10. Banggu (1 Unit)	Masjid Mukim Seterpa
		11. Kadok (1 Unit)	Masjid As-Saadah
		12. Limbat (1 Unit)	Masjid Mukim Parit Lama
		13. Pendek (1 Unit)	Masjid Mukim Kamel Hassan
		14. Salor (-)	-
		15. Dewan Beta (-)	-
2.	Pasir Puteh (7)	1. Semerak (1 Unit)	Masjid Mukim Telaga Papan
		2. Bukit Jawa (1 Unit)	Masjid Mukim Selising
		3. Limbongan (1 Unit)	Masjid Mukim Seri Gedombak
		4. Padang Pat Amat (1 Unit)	Masjid Mukim Padang Pak Amat
		5. Bukit Abal (1 Unit)	Masjid Mukim Bukit Abal
		6. Gong Datok (1 Unit)	Masjid Mukim Gong Datok
		7. Jeram (1 Unit)	Masjid Mukim Jeram
		8. Bukit Awang (-)	-
3.	Jeli (2)	1. Ayer Lanas (1)	Masjid Gemang
		2. Kuala Balah (1)	Masjid Ummul-Qura Jerimbong
		3. Jeli (-)	-
4.	Machang (4)	1. Ulu Sat (1)	Masjid Mukim Bukit Tiu
		2. Pulai Chondong (1)	Masjid Ezani
		3. Labok (1)	Masjid Ubudiah Labok
		4. Panyit (1)	Masjid Kemucut
		5. Pangkal Meleret (-)	-
		6. Temangan (-)	-
5.	Gua Musang (4)	1. Galas (2)	Masjid Mukim Ladang Sungai Terah
			Masjid Mukim Batu Papan
		2. Chiku (1)	Masjid Mukim Lebar
		3. Bertam (1)	Masjid Mukim Jerek
6.	Tanah Merah	1. Kusial (2)	Masjid Mukim Ulu Kusial

	(4)		Masjid Mukim Kampung Rambai
		2. Ulu Kusial (1)	Masjid Mukim Sokor Baru
		3. Jedok (1)	Masjid Mukim Kemahang 1
7.	Pasir Mas (9)	1. Rantau Panjang (1)	Masjid Mukim Kedai Lama
		2. Kubang Gadong (1)	Masjid Mukim Kubang Batang
		3. Pasir Mas (1)	Masjid Mukim Kubang Bemban
		4. Kangkong (1)	Masjid Mahmudi Tasek Berangan
		5. Gual Periok (1)	Masjid Mukim Gual Payung
		6. Bunut Susu (1)	Masjid Kampung Teliar
		7. Kubang Sepat (1)	Masjid Mukim Padang Embun
		8. Chetok (1)	Masjid Mukim Kubang Agol
		9. Lemal (1)	Masjid Mukim Kubang Panjang
		10. Alor Pasir (-)	-
8.	Tumpat (5)	1. Wakaf Bharu (1 Unit)	Masjid Mukim Wakaf Bharu
		2. Pengkalan Kubur (1 Unit)	Masjid Al Huda
		3. Tumpat (1 Unit)	Masjid Mukim Jubakar, Tumpat
		4. Kelaboran (1 Unit)	Masjid Mukim Kelaboran
		5. Geting (1 Unit)	Masjid As-Somadi
		6. Kebakat (-)	-
		7. Jalan Besar (-)	-
		8. Palekbang (-)	-
		9. Sungai Pinang (-)	-
		10. Kampung Laut (-)	-
		11. Kok Keli (-)	-
		12. Berangan (-)	-
		13. Bunohan (-)	-
		14. Terbak (-)	-
		15. Morak (-)	-
		16. Pasir Pekan (-)	-
9.	Kuala Krai (5)	1. Batu Mengkebang (2 Units)	Masjid Mukim Mekebang Baru
			Masjid Mukim Kg Keroh
		2. Guchil (1 Unit)	Masjid Jamek Annur
		3. Manek Urai (1 Unit)	Masjid Mukim Manik Urai
		4. Dabong (1 Units)	Masjid Mukim Kesedar Biak
10.	Bachok (6)	1. Perupok (1 Unit)	Masjid Mukim Kubang Golok
		2. Gunong (1 Unit)	Masjid Mukim Bakong Gunung
		3.Tanjong Pauh (1 Unit)	Masjid Mukim Tanjong Jering
		4. Mahlgai (1 Unit)	Masjid Mukim Alor Bakat
		5. Melawi (1 Unit)	Masjid Mukim Badak Melawi
		6. Tawang (1 Unit)	Masjid Mukim Sesenak
		7. Telong (-)	-
		8. Bekelam (-)	-
		Total	59 Masjids

The selection of case study areas, as outlined in Tables 3.2 and 3.3, was based on a purposive and representative sampling approach to capture the diversity of mosque characteristics across Kelantan. The justification for selecting these locations is threefold:

i. Administrative Representation: Each district selected corresponds to one of the ten administrative districts under the jurisdiction of Jabatan Hal Ehwal Agama Islam Kelantan (JAHEAIK). This ensures that every district's mosque governance structure and operational practice are represented in the analysis.

ii. Typological Variation: The selected *Masjid kariah* differ in terms of scale, location, and management type — covering urban, suburban, and rural contexts. For instance, Kota Bharu and Pasir Mas represent high-density urban areas with more complex facility usage, while Gua Musang and Jeli represent rural or peripheral mosques facing distinct maintenance challenges such as limited funding or manpower.

iii. Operational Criteria: Each selected mosque has an active committee structure (Nazir, Secretary, Treasurer, and supporting bureaus), regular congregational activities, and an established maintenance routine. These operational criteria ensure that the selected cases provide valid insights into actual maintenance management practices rather than theoretical or inactive settings.

By integrating these three criteria, the case study selection provides a balanced view of mosque maintenance realities in Kelantan. The approach also aligns with Yin's (2018) principle of replication logic in multiple-case study design, where each case contributes to understanding the phenomenon through contextual variation. Moreover, the survey component was designed to complement these case studies by expanding the data coverage to a broader sample of mosque committee members across all districts. This dual approach — combining qualitative insights from purposively selected case studies and quantitative validation through a structured survey — enhances the overall validity, reliability, and generalisability of the findings.

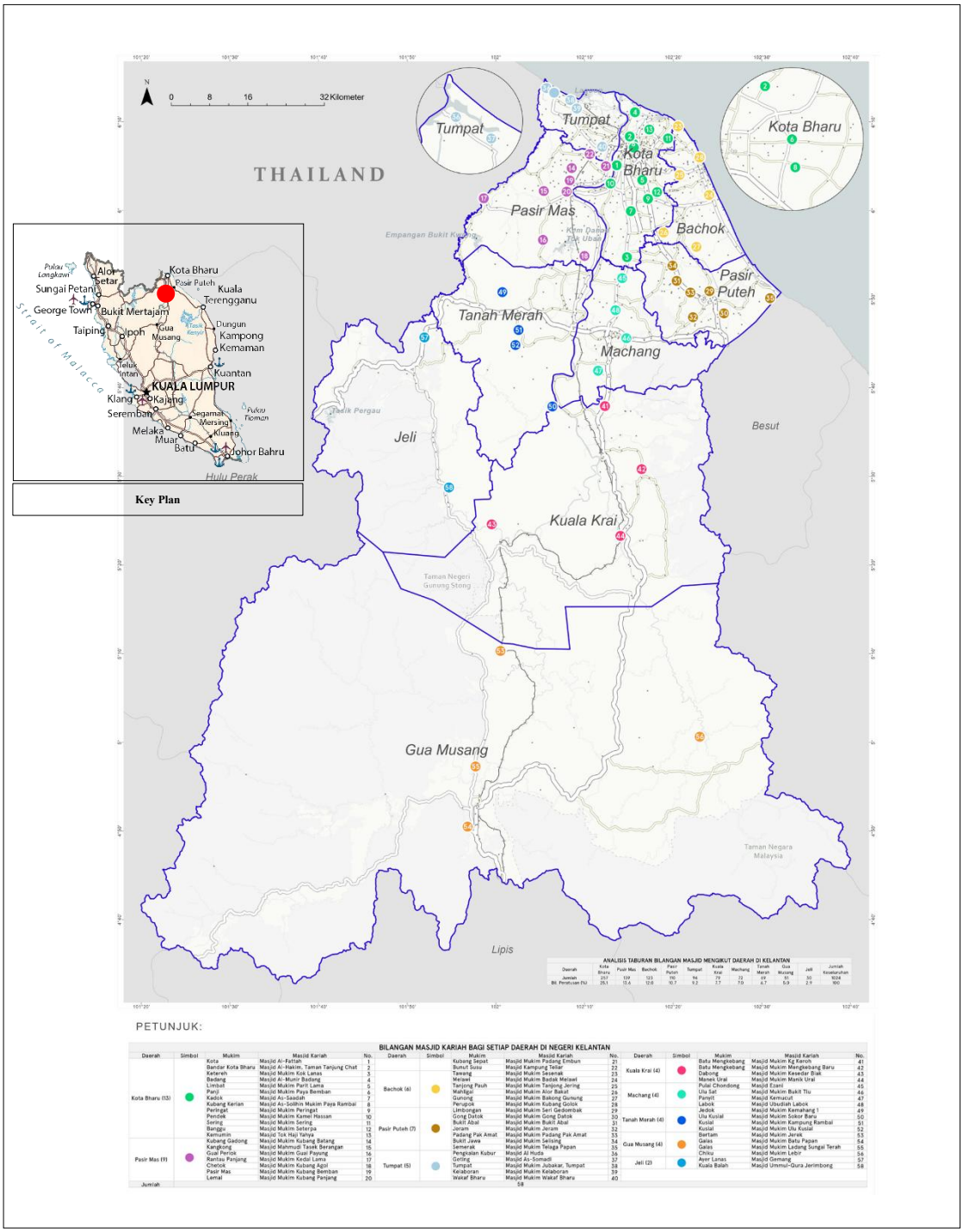

Figure 3.2 Tabulation of *Masjids* in the Study Areas

Masjid Mukim Paya Bemban,
Kota Bharu District

Masjid Mukim Telaga Papan,
Pasir Putih District

Masjid Gemang,
Jeli District

Masjid Mukim Mekebang Baru,
Kuala Krai District

Masjid Mukim Ladang Sungai Terah,
Gua Musang District

Masjid Ubudiah Labok,
Machang District

Masjid Mukim Kedai Lama,
Pasir Mas District

Masjid Mukim Wakaf Bharu,
Tumpat District

Masjid Mukim Tanjong Jering,
Bachok District

Masjid Mukim Sokor Baru,
Tanah Merah District

Plate 3.1 Images of Some of the *Masjids kariah* in the Study Areas

In addition to the case study approach, this study also employed a survey method to collect quantitative data from a larger population sample of *Masjid kariah* committee members across Kelantan. The survey approach was appropriate to complement the case study, allowing for broader generalisation and validation of findings obtained from the qualitative phase. The survey aimed to measure respondents' perceptions of maintenance strategy criteria (dependent variables) and maintenance performance measurements (independent variables) developed from the literature and Delphi method. The survey instrument was designed as a structured questionnaire consisting

of both demographic and construct-based sections, which were measured using a five-point Likert scale ranging from "1 = Strongly Disagree" to "5 = Strongly Agree."

The survey data provided quantitative support for the qualitative findings by testing the relationships among constructs using Partial Least Squares-Structural Equation Modelling (PLS-SEM) through SmartPLS software. This analytical approach enabled the researcher to verify the hypothesised model linking maintenance strategy and performance measurement in *Masjid kariah* maintenance planning.

A multi-stage sampling technique was adopted in this study. At the first stage, a stratified systematic sampling approach was applied to select 59 *Masjid kariah* (approximately 10% of the total 584 mosques) proportionally across all ten districts in Kelantan. This ensured balanced geographical representation and coverage of both urban and rural areas. At the second stage, purposive sampling was employed to select six committee members from each mosque – comprising the Nazir, Deputy Nazir, Secretary, Deputy Secretary, Treasurer, and Bureau of Development Officer. These individuals were chosen because they are directly responsible for the planning, implementation, and supervision of mosque maintenance activities. This combination of probability sampling (for mosque selection) and purposive sampling (for respondent selection) strengthened the representativeness and validity of the dataset, aligning with recommendations by Sekaran & Bougie (2016) and Creswell & Creswell (2018) for mixed sampling in applied social research.

3.3.2 Mixed Method: Exploratory Sequential Design

This study adopted an Exploratory Sequential Mixed Methods Design under the pragmatic paradigm to support the development and validation of a Performance-Based Maintenance Planning Framework for *Masjid kariah* in Kelantan, Malaysia (Creswell & Creswell, 2014; Sekaran & Bougie, 2016). The design is appropriate because the study required (1) qualitative exploration and construct refinement to clarify what should be measured in mosque maintenance planning, followed by (2) quantitative validation to test the refined constructs empirically, and finally (3) integration to translate validated evidence into a defensible and usable framework (Creswell & Creswell, 2014). This logic ensures that the quantitative instrument and the resulting framework are grounded in context-specific evidence rather than relying on assumed measurement structures.

At the design level, the exploratory sequential logic moves from inductive exploration to deductive testing, and then to integrative synthesis. The qualitative strand functions inductively to identify and refine constructs and indicators based on evidence patterns and expert insights, while the quantitative strand functions deductively to evaluate measurement adequacy and test hypothesised relationships using statistical procedures (Lam et al., 2010; Bell et al., 2018). This sequencing strengthens methodological rigour by reducing construct ambiguity, because the instrument administered at scale is refined through expert validation and pre-testing before full empirical testing is conducted.

For clarity, this study distinguishes between phases and stages. Phases refer to the three methodological components of the exploratory sequential design (Phase I–III), whereas stages refer to the five operational steps (Stage 1–5) used to implement each phase. Figure 3.3 summarises the design at the phase-level (Phase I: qualitative exploration; Phase II: quantitative validation; Phase III: integration). Figure 3.4 presents the stage-by-stage flow of data collection (Stage 1–5), while Figure 3.5 visualises the complete research process flow, integrating phases, stages, objectives and outputs.

Phase I: Qualitative Exploration (Stage 1–Stage 2). As indicated in Figure 3.4, Stage 1 involved a Critical Literature Review to identify preliminary constructs and indicators for Maintenance Strategy Criteria and Maintenance Performance Measurements relevant to mosque maintenance planning. Stage 2 then implemented a two-round Delphi process using semi-structured expert interviews (10 experts) to validate, refine and prioritise the constructs generated from Stage 1 through consensus-based assessment, strengthening content relevance and construct coherence prior to quantitative testing. This qualitative phase establishes the conceptual foundation for the study by strengthening content relevance and construct coherence before quantitative testing, thereby supporting RO1 and RO2 (Creswell & Creswell, 2014).

Phase II: Quantitative Validation (Stage 3–Stage 4). Following the qualitative refinement in Phase I, Phase II proceeded with instrument validation and empirical testing, as depicted in Figure 3.4 and integrated in Figure 3.5. Stage 3 focused on instrument validation and pilot testing, including Content Validity Index (CVI) procedures (6 expert panels) and a pilot survey (30 respondents) to improve item clarity, relevance and wording before the main administration. Prior to the main data collection, a pilot study was conducted to examine the reliability and clarity of the instrument. The data obtained were analysed using Exploratory Factor Analysis (EFA) to identify the

underlying factor structure, followed by Confirmatory Factor Analysis (CFA) to assess construct validity and internal consistency. Through this analytical process, the influence of seven latent constructs –Organisational Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation, and Safety and Health on the overall maintenance planning framework was evaluated. Building on the pilot outcomes, Stage 4 implemented the main questionnaire survey (354 committee members across 59 *Masjid kariah*), followed by quantitative analysis and hypothesis testing to confirm the measurement structure and evaluate the proposed relationships required to address RO3.

Phase III: Integration and Framework Finalisation (Stage 5). The final phase corresponds to Stage 5, as shown in Figure 3.5, where findings from Phase I and Phase II were synthesised to formulate the proposed Performance-Based Maintenance Planning Framework. This was followed by final confirmation through expert review (5 expert panel) to ensure coherence, practicality and defensible alignment with the validated constructs. This integration phase is essential in exploratory sequential logic because it converts validated evidence into an actionable output rather than leaving findings as disconnected qualitative and quantitative results (Creswell & Creswell, 2014). This phase addresses RO4.

To maintain traceability between the design and the research objectives, the stages are aligned as follows: Stage 1 addresses RO1, Stage 2 and Stage 3 address RO2 (construct refinement and instrument validation), Stage 4 addresses RO3 through the main survey and quantitative testing, and Stage 5 addresses RO4 through integration and framework finalisation. Overall, the exploratory sequential design provides a disciplined pathway from construct identification to empirical validation and finally to framework development, consistent with the requirements of a performance-based maintenance planning study in the *Masjid kariah* context.

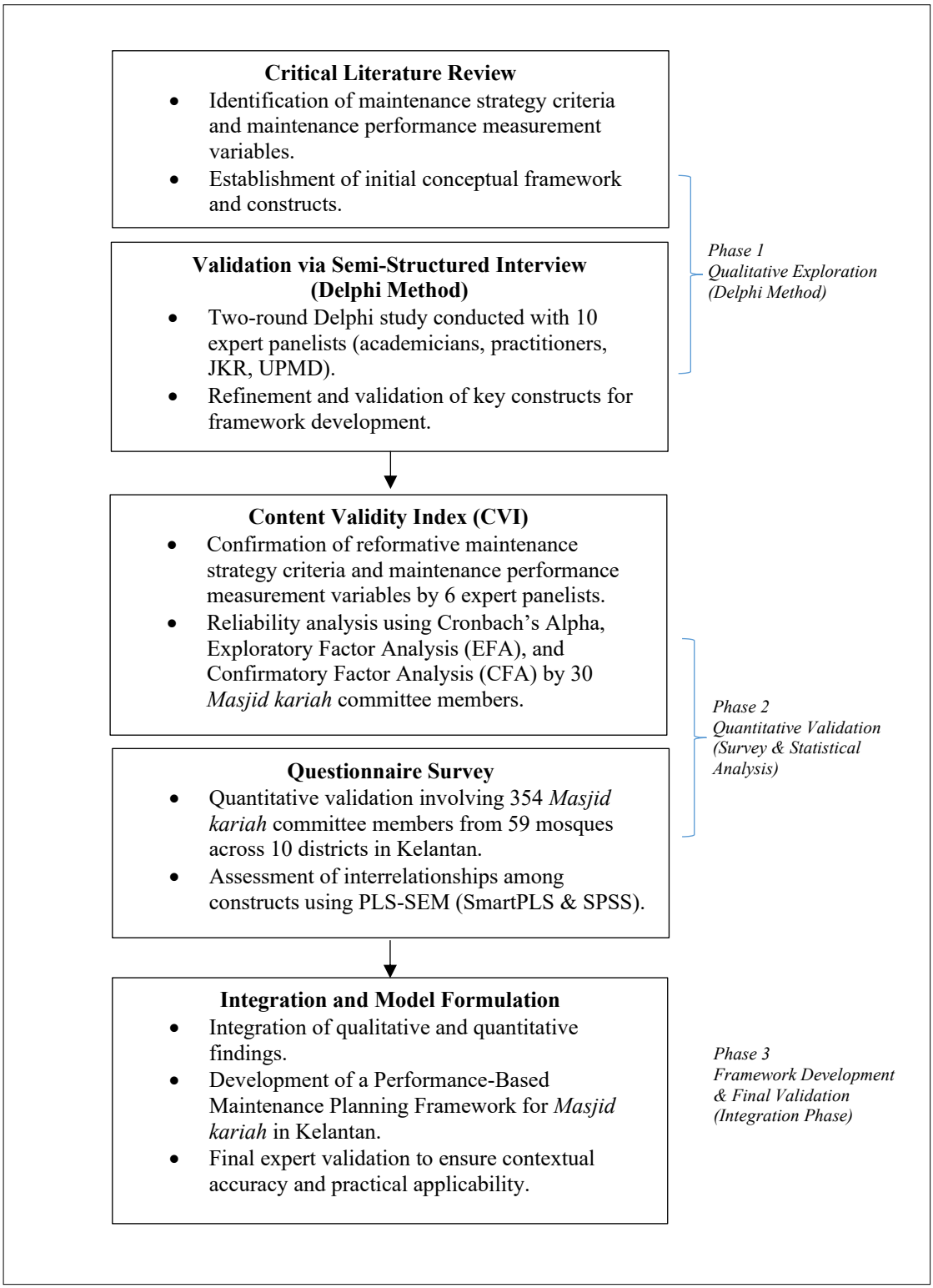

Figure 3.3 The Flow of Data Collection in This Study (by Phase)

Source: Adapted from Frameworks by Creswell & Creswell (2014)

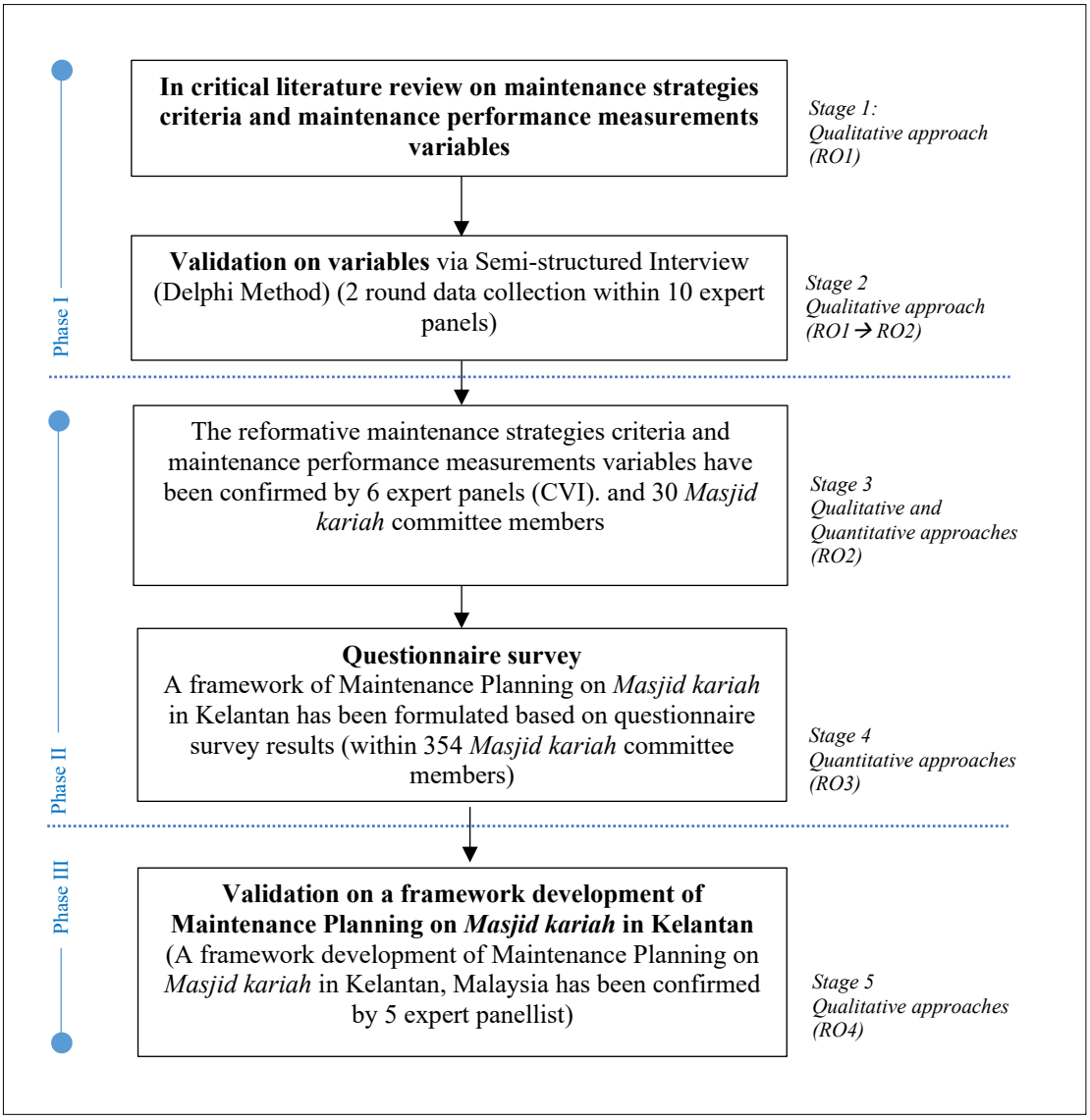

Figure 3.4 The Phase–stage Flow of Data Collection for the Exploratory Sequential Mixed Methods Design (by Stage)

Source: Adapted from Frameworks by Creswell & Creswell (2014)

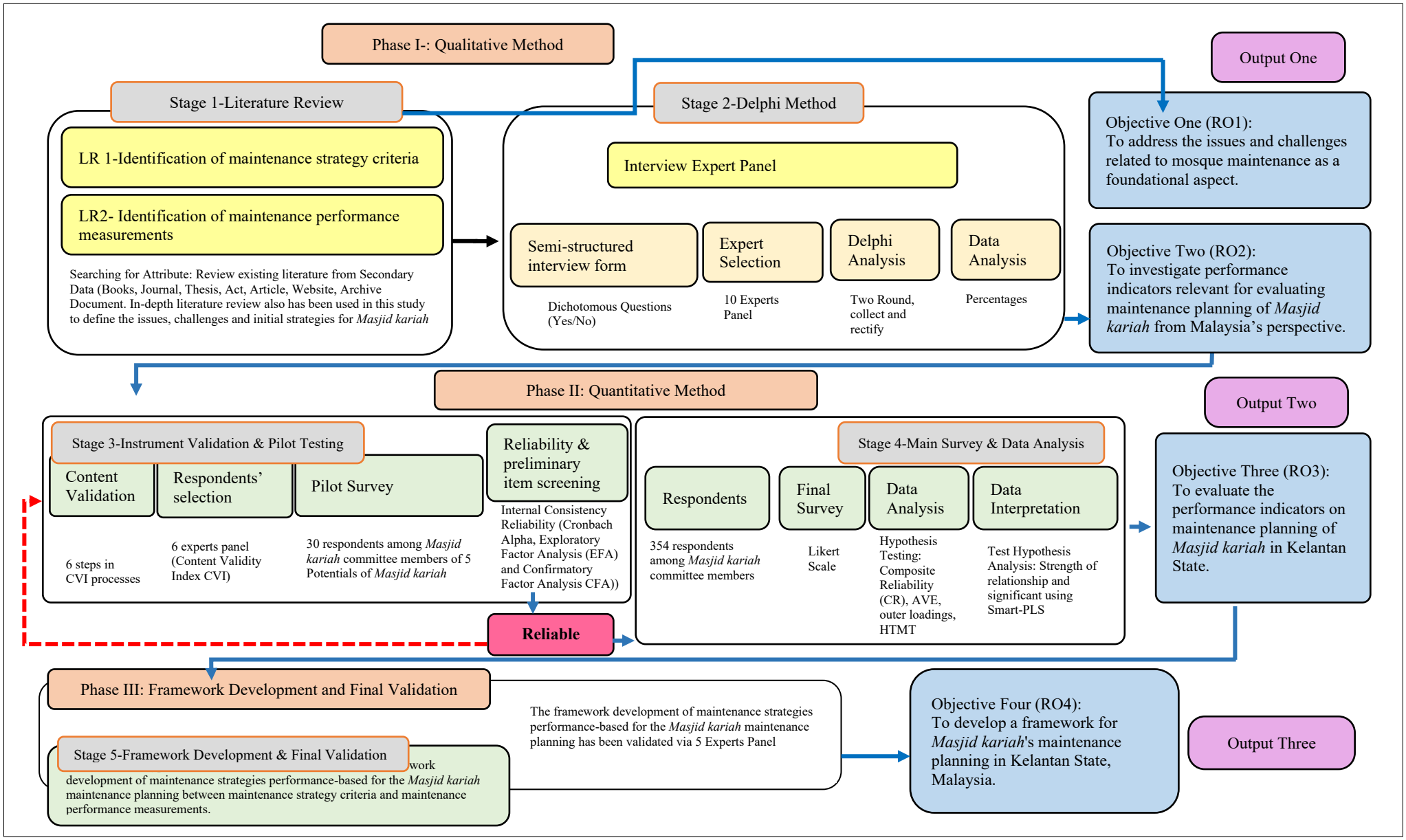

Figure 3.5 Flowchart of Research Process

The next section elaborates on the Research Approach, describing how each phase was implemented in detail through qualitative, quantitative, and integrative procedures.

3.4 Research Approach

There are three phases in this study i.e. Phase I: Qualitative Method, Phase II: Quantitative Method and Phase III: Framework Development and Final Validation.

3.4.1 Phase I: Qualitative Method

This phase represents the qualitative foundation of the research and was designed to fulfil Research Objective One (RO1) — to identify and understand the issues and challenges related to mosque maintenance as a foundational aspect — and Research Objective Two (RO2) — to investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective. The qualitative method was applied to explore real contextual issues, management practices, and performance gaps that influence mosque maintenance at the community level. It was strategically positioned as Phase I of an exploratory sequential mixed-method design to establish a solid conceptual basis before moving to the quantitative phase. The Delphi method was selected due to its structured approach in consolidating expert knowledge through iterative rounds of consensus, which is particularly effective in areas with limited prior empirical models (Hsu & Sandford, 2007; Linstone & Turoff, 2019).

Prior to distributing the empirical survey to selected committee members through multistage sampling, a semi-structured set of questions was prepared to gather initial opinions from the expert panel via the Delphi method. All expert responses were kept strictly confidential. In an assessment, Hise & McGinnis (1976) showed that expert panels are generally willing to provide honest answers to questions when confidentiality is assured. Accordingly, this study guaranteed that the data obtained from the experts would be treated as strictly confidential and used solely for academic purposes. The open-ended questions distributed to each expert consisted of nine pages of the interview survey for both the first and second Delphi rounds (see Appendix 5 and 6).

In this phase, the researcher conducted semi-structured interviews with experienced respondents associated with mosque maintenance management to identify key performance indicators and challenges influencing maintenance planning effectiveness for *Masjid kariah*. The Delphi method was applied to systematically consolidate expert inputs, improve construct clarity, and prioritise indicators based on consensus across rounds. Accordingly, the Delphi analysis was used to screen and refine the Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurements (MPM) indicators, ensuring that only the most relevant and context-appropriate constructs were retained for the subsequent survey instrument and quantitative modelling.

Hsu & Sandford (2007) noted that the Delphi approach is an effective method for gathering feedback from respondents with recognized expertise. Furthermore, the Delphi technique allows the use of modern communication technologies such as e-mail and online meetings to solicit and exchange expert information, ensuring validity by obtaining heterogeneity within the population regardless of geographical distance (Maxwell, 2013).

The design of the qualitative phase and Delphi process was therefore a critical component of this research. Semi-structured interviews were based on several open-ended questions that allowed flexibility for experts to express their understanding and suggestions, while maintaining comparability across interviews (Piaw, 2012). The purpose was to ensure that the key dimensions and challenges extracted from the literature could be verified and expanded by expert consensus.

The scope of this study was intentionally limited to seven Maintenance Performance Measurements (MPM) adapted from MS ISO 41001:2018 Facility Management – Management Systems, which provides a globally recognised framework for managing facility performance through leadership, planning, operational control, resource allocation, and continual improvement. These seven indicators — Organisational Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation, and Safety and Health — were derived directly from the core clauses of the standard (Clauses 5–9) that define facility management system requirements.

The rationale for limiting the scope to seven measurements lies in the comprehensive coverage of MS ISO 41001:2018, which integrates managerial, operational, and evaluative dimensions essential for assessing maintenance

performance. Including additional indicators beyond these seven would risk duplication and reduce the clarity and parsimony of the analytical model. Moreover, focusing on these seven domains ensures that the study remains aligned with internationally accepted facility-management principles while being adaptable to the context of community mosque maintenance in Malaysia, where organisational capacity, financial structure, and safety compliance differ significantly from commercial or institutional facilities.

Methodologically, the decision also follows the principle of parsimony in model development (Hair et al., 2017), which advocates for a concise yet representative set of constructs to ensure empirical reliability and conceptual clarity. This selection allows each measurement dimension to be operationalised and validated systematically across both the qualitative (Delphi) and quantitative (PLS-SEM) phases of this study. Hence, these seven performance indicators offer a balanced representation of strategic, operational, and evaluative factors that collectively underpin an effective maintenance-planning framework for *Masjid kariah*. in Kelantan State.

No specific number of interviews or sample size is universally required for the Delphi method; however, most studies employ between 10–30 experts for reliability. Table 3.4 summarises previous research that has utilized the Delphi method in maintenance-related and management-based studies. It shows that the number of Delphi rounds typically ranges between two and three, with sample sizes varying from 10 to 30 experts depending on research scope and complexity. This comparison demonstrates that the current study's design by using two Delphi rounds and an expert panel of 11 members is consistent with established practices and methodological standards in similar research contexts.

Table 3.4
Previous Study utilizing the Delphi Method in Maintenance Research

Authors	**Research Focus**	**Types of Delphi used**	**Rounds**	**Sample Size**
Kim et al. (2017)	To determine the priorities for intervention research on childhood obesity prevention.	Delphi methods	2	10
Chianchana (2022)	Develop an educational sustainability assessment model	Delphi methods	2	10
Yahaya et al. (2023)	Benchmark the ubiquitous learning behavior of students	Delphi methods	2	12
Dragostinov et al. (2022)	Develop a new Propensity to Trust scale	Delphi methods	2	28
Kondos et al. (2023)	Obtain expert consensus on	Delphi	2	10

Authors	Research Focus	Types of Delphi used	Rounds	Sample Size
	the essential elements required to make optimal MET stand-down decisions	methods		
Hoang et al. (2024)	Develop a scale for assessing the technology readiness of higher education institutions in Vietnam	Delphi methods	2	17
Delphi method used in this study				
This Study	RO2: To investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective	Delphi methods	2	10

The comparison in Table 3.5 indicates that the methodological design of this study specifically the use of two Delphi rounds and an expert panel of 10 participants align well with the practices adopted in previous studies. This enhances the credibility and methodological soundness of the present research approach.

A semi-structured interview using the two-round Delphi method was applied by allocating dichotomous questions ("Yes" or "No" responses) for the maintenance strategy criteria and open-ended comment sections for performance indicators. The aim was to gather rational and contextual explanations for each item proposed to the experts. The dichotomous questioning format, as proposed by Kalaian & Shah (2006), is suitable for analysing categorical Delphi survey data when the expert sample size is small (fewer than 30 participants). The selection of respondents (expert panel) followed purposive sampling principles to ensure subject-matter expertise and diversity of perspectives. The inclusion criteria were as follows:

i. Possession of academic or professional expertise in facilities management, mosque administration, or maintenance policy;
ii. A minimum of five years of experience in mosque or institutional maintenance;
iii. Demonstrated willingness and ability to participate in two iterative Delphi rounds; and
iv. Capability for critical reflection and constructive feedback.

A total of 10 experts were selected, comprising academicians, maintenance practitioners, and officers from Jabatan Kerja Raya (JKR) and Unit Pengurusan Masjid Daerah (UPMD). This composition ensured methodological triangulation by integrating theoretical, operational, and administrative perspectives. All participants were engaged through online platforms such as Google Meet and Microsoft Teams to accommodate geographical dispersion and to uphold the confidentiality principle of Delphi research (Okoli & Pawlowski, 2004).

The "Yes" or "No" responses were used to determine the acceptance of each proposed criterion and measurement as previously identified through the literature review. Experts were encouraged to justify their responses and to propose new items where necessary. Although Yadugiri (1986) described dichotomous formats as limiting respondents' creativity, this study found it advantageous due to its clarity, simplicity, and time efficiency. Moreover, experts were given the opportunity to provide qualitative remarks and recommendations for improvement, ensuring a balance between structured validation and interpretive richness.

Conducting two Delphi rounds was methodologically justified to strengthen consensus, reliability, and refinement across iterative rounds. The first round gathered broad expert insights and identified key challenges and candidate performance dimensions. The second round consolidated these findings by confirming priorities through group agreement and improving the clarity and relevance of retained indicators. This iterative refinement aligns with the recommendations by Adler & Ziglio (1996), enhancing the credibility and contextual fit of the constructs prior to quantitative testing.

The findings from this phase provided the foundation for developing and refining the quantitative instrument used in Phase II. By aligning expert consensus with literature-based constructs, this phase ensured that the identified issues (RO1) and performance indicators (RO2) were empirically grounded and contextually relevant to mosque maintenance planning in Malaysia. Table 3.5 below shows the summary of indication of relevancy used to validate the responses from the expert panel.

Table 3.5
Summary of Indication of Relevancy

Indication	Relevancy
Yes	Accepted
No	Not Accepted

3.4.1.1 The Sample Size of Expert Panel for Delphi Method

Sekaran & Bougie (2016) defined the expert panel as a group of people convened explicitly by the researcher to elicit expert knowledge and opinion about one particular issue. Sandelowski (1998) denoted that an expert is frequently seen as someone from outside the project, who has specialised knowledge and competence in qualitative techniques and who could certify the study as "good" and "true". This individual should be capable of providing knowledgeable and objective (or detached, dispassionate, and impartial) assessments regarding a project's workings and findings, as well as counteracting the subjectivity and contextual relativism that are both advantages and liabilities in qualitative research. Therefore, in determining how maintenance strategy could be selected and recorded, the expert must consider various criteria in the subject manner (Pun et al., 2017).

Skulmoski (2007), as citing Adler & Ziglio (1996), listed four criteria to meet the expert selection: (i) knowledgeable and experienced in the issue under investigation; (ii) has the capacity and willingness to participate; (iii) has sufficient time to participate in the Delphi method; and (iv) has effective communication skills. According to Gordon (1994), the key to a successful Delphi study lies in the selection of participants. These participants must be knowledgeable to contribute valuable ideas for the study. The main reason for expert participation is to learn from them during in-depth interviews. In this study, these experts were invited to identify the criteria of maintenance strategy and factors related to maintenance performance measurements. Ludwig (1997) denoted that the expert panel are respected individuals and well-known in their particular field.

The involvement of these experts played a pivotal role in the expert validation process. This session concentrated on the independent and dependent variables that have been extracted from the literature. Each interview was flexible because it consisted of close- and open-ended questions based on the respondents' contexts. This type of interview has helped this study to comprehend the literature and validate the extracted information.

This study conducted semi-structured, online interviews to obtain critical information from the expert panel. The respondents are as listed in Table 3.6. When collecting data from these interviews, Yatim et al. (2011) recommended that the interview process should involve officers from the *Masjid kariah*, as some clarifications would be needed, which could not be achieved in the questionnaire survey.

Table 3.6
Potential Respondents for Interview with Expert Panel

Item	Category of an Expert Panel	Position	Expert Panel Respondents	Total
Participants	Academician (Various Universities)	PhD Holder	4 × 1 Respondent	4
	Maintenance Practitioner	Manager/Principal	2 × 1 Respondent	2
	Jabatan Kerja Raya	Maintenance Officer	2 × 1 Respondent	2
	UPMD	Maintenance Officer	2 × 1 Respondent	2
			Total	**10**

The experts in this study were selected based on several categories of professions and their willingness to become a panellist in this study. The characteristics to be considered were the experiences of the expert panel in building and mosque maintenance, factual knowledge, certifications, and their willingness and availability as an expert panellist. During the interviews, they could freely express their thoughts on the criteria of maintenance strategies as dependant variables and maintenance performance measurement as independent variables.

In this study, the selection of the 10 expert panels was based on their professional experience and expertise in mosque facility maintenance, asset management, and local authority operations. In this study, the selection of the 10 expert panels was based on their professional experience and expertise in mosque facility maintenance, asset management, and local authority operations. This approach aligns with Delphi methodology, where panellists are selected based on subject-matter expertise relevant to the research problem. Ab Latif et al. (2017) highlight that there is no agreement on the "ideal" Delphi panel size and that, in a homogeneous group, 10 to 15 experts may be adequate, with good results achievable using small panels within this range. Furthermore, Skulmoski et al. (2007) demonstrate that Delphi studies have used a wide range of sample sizes depending on the research design, including small expert panels.

To assess and quantify the level of respondents' experience, a combination of years of service, professional background, and organizational position were considered. Each expert was classified into categories based on their working experience: (i) less than 5 years (novice level), (ii) 6–10 years (intermediate level), and (iii) more than 10 years (expert level). These data were collected through the background section of the semi-structured interview form and were later used to describe the profile of the Delphi respondents. This approach ensured that the consensus derived represented informed and experienced professional judgment. The details of 10 expert panellists involved in the interview portion of the Delphi method is tabulated in Table 3.7.

Table 3.7
Panel of Experts Involved in The Semi-structured Interviews

Expert Profile		Description	Experience in Building Maintenance	Experience in Mosque Maintenance	Willingness	Certification/ Years of Experiences in Maintenance
Academician (PhD Holder)						
1.	Associate Professor Dr Naseem Ameer Ali	Massey University, New Zealand	x	√	√	> 30 Years
2.	Sr Dr Mohd Saidin Bin Misnan	UTM Skudai, Johor Darul Takzim	√	√	√	> 30 Years
3.	Prof Dr Najib Bin Ibrahim	UiTM Selangor Darul Ehsan	√	√	√	> 30 Years
4.	Ir Dr Noor Nabilah Binti Sarbini	UTM Skudai, Johor Darul Takzim	√	√	√	> 10 Years
Maintenance Practitioner						
5.	Sr Anuar Bin Haron	K Builders Sdn Bhd	√	√	√	> 10 Years
6.	Nik Hud Bin Nik Yunoh	Maintenance Practitioner (Contractor Masjid Daerah Pasir Puteh, Kelantan)	√	√	√	> 20 Years
Jabatan Kerja Raya (JKR)						
7.	Cik Mardiyah Binti Zahidi	Engineer (HOPT JKR) (Bahagian Pembangunan)	√	x	√	>5 Years < 10 Years
8.	Puan Aznen Anizam Binti Ab Aziz	Maintenance Officer (Pembangunan JKR)	x	√	√	>5 Years < 10 Years
UPMD						
9.	Ustaz Haji Abdullah Bin Muhammad	Tuan Kadi Majlis Agama Islam Tanah Merah/ Unit Pengurusan Masjid Daerah	x	√	√	>5 Years < 10 Years
10.	Ustaz Haji Habil Bin Mohammad	Officer/Imam Tua JAHEAIK (Jajahan Jeli)	x	√	√	> 10 Years
Total: 10 Expert Panels						

3.4.1.2 Interview Process and Expert Validation Procedures for Delphi Method

The semi-structured interview questions were developed based on the literature review. The expert panel was given one set of questions, with the answer choices that could be a part of the conceptual framework of this research. The researcher has prepared a list of maintenance strategy criteria and maintenance performance measurements, with some remarks for the expert panel to comment and offer suggestions towards each element, criterion, and construct. The interview form was defined as a tool to collect information based on the participants' experience on the issues related to the topic to be investigated (McNamara, 1999). The purpose of applying qualitative methods in developing a questionnaire for this study was to filter the content of the instrument, as gathered from the existing literature, which would then be tested as an empirical questionnaire.

This study has three (3) dependent and seven (7) independent variables that were used to develop the questions in semi-structured questions. The questions purposely indicated possible Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurements (MPM) in maintenance planning of *Masjid kariah*. The performance measurements were constructed based on a previous analysis of literature for a similar subject. The developed questions were then given to 10 experts to propose relevant factors, which were later used as variables in this research. Subsequently, the attributes were revised and updated. Ultimately, the following filtering process was carried out to verify the questions:

The selected experts were contacted either personally, via email, Google Meet, Zoom, Microsoft Teams, or social media prior to the distribution of the questionnaire. Then, they were approached either personally or via an online meeting to ask if they were willing to participate in this research. After receiving their verbal consent to participate, the experts were given one month to submit their written consent. After receiving their consent, they were given the date for online meeting. During the interview sessions, the experts were asked to comment and share their views and opinions on any relevant issues yet to be covered by the questionnaire survey alongside answering the questions given. The additional comments were to include relevant attributes that the expert panel believed would be suitable as part of maintenance strategy criteria and maintenance performance measurements.

This method was chosen to allow the expert panel to express their opinions regarding the maintenance strategy criteria given to them and to obtain in-depth information about these variables:

i. The 1st round of Delphi analysis was employed to refine the initial attributes proposed in Chapter Two. The original frameworks were included in the questionnaire to all experts, by instructing them to provide "Yes" and "No" remarks, and last column in the questionnaire was for their comments and suggestions for each list of the elements. Subsequently, the researcher revised the initial attributes according to their opinions to be included in the final round of the interview session.

i. 2nd Round of Expert Panel Interview
After gathering all the results from the 1st round of Delphi analysis, the 2nd round was executed with the same expert panel to enhance the consistency and accuracy of measurements. The results obtained from the 1st round were reproduced to obtain their judgement for the best performing evaluation and to generate the final set of maintenance strategy criteria and maintenance performance measurement.

The 2nd round of expert panel interview was carried out to screen all unnecessary attributes and to rank them based on their importance. The experts were given another month to respond and complete the 2nd round of questionnaire. This time, there was no face to face or online meetings between the interviewer and the expert panel. However, their feedback was delayed up to six months during this 2nd round. Overall, the duration for both 1st and 2nd rounds was 11 months to complete.

3.4.2 Phase II: Quantitative Method

In this phase, a questionnaire will be used to collect quantitative data. The questionnaire underwent validation and reliability test.

3.4.2.1 Content Validity Index (CVI) for Questionnaire Validation

The Content Validity Index (CVI) is a commonly applied statistical tool used to evaluate whether a questionnaire or instrument effectively captures the concept it aims to measure. This section offers a detailed explanation of the CVI, outlining its calculation methods, potential limitations, and insights drawn from existing scholarly literature. The CVI quantitatively assesses how well a set of items reflects the intended construct, typically through evaluations by a panel of experts. These experts assess each item based on relevance, clarity, and representativeness. Ensuring high content validity through the CVI is essential, as it underpins the reliability and overall effectiveness of the instrument in research contexts (Almanasreh et al. 2019; Othman et al., 2024).

Six steps of content validation based on (Yusoff, 2019) are:

i. Step 1: Preparing content validation form
ii. Step 2: Selecting a review panel of experts
iii. Step 3: Conducting content validation
iv. Step 4: Reviewing domain and items
v. Step 5: Providing score on each items
vi. Step 6: Calculation CVI

Each step will be elaborated in the subsequent subchapters.

i. Step 1: Preparing content validation form

The first step in the content validation process involved the preparation of a structured content validation form to ensure clarity and consistency among the reviewing experts. The objective of this study was to examine the relationship between maintenance strategy criteria and maintenance performance measurements within the

context of *Masjid kariah* maintenance planning. Prior to distributing the questionnaire for pilot testing and linguistic validation, the draft instrument underwent expert content evaluation.

The content validation form included detailed instructions, domain definitions, and a four-point Likert scale designed to assess the relevance of each item to its respective domain. This scale, adapted from Yusoff (2019), ranged from 1 (not relevant) to 4 (highly relevant), and was intentionally constructed without a neutral midpoint to encourage decisive evaluations. Table 3.8 illustrates the rating scale used.

Table 3.8
Example of Instruction and Rating Scale in the Content Validation by the Experts

No.	Degree of relevance
1	The item is not relevant to the measured domain
2	The item is somewhat relevant to the measured domain
3	The item is quite relevant to the measured domain
4	The item is highly relevant to the measured domain

Source: Adapted from Yusoff (2019)

Each expert was provided with this form and instructed to independently assess the questionnaire items for their clarity, appropriateness, and alignment with the intended construct. In addition to numerical ratings, the form also allowed for qualitative feedback to further enhance the precision and contextual relevance of each item. This structured approach ensured that the subsequent instrument would be both theoretically grounded and practically suitable for use in assessing *Masjid kariah* maintenance planning dimensions.

ii. Step 2: Selecting a review panel of experts

The selection of a competent and representative panel of experts is a critical step in ensuring the validity of the questionnaire items. In this study, the expert panel was purposively selected based on their subject-matter expertise in mosque facilities management, building maintenance, Islamic built environment, and performance-based assessment. These individuals possessed substantial academic and professional experience relevant to the domains being measured.

A total of six experts were invited to participate in the content validation process. This number complies with the recommendations by Polit et al. (2007) and Yusoff (2019), who recommend a minimum of six experts for achieving a stable Content

Validity Index (CVI), particularly when applying an I-CVI threshold of 0.83 for item acceptance. Table 3.9 shows the number of experts and implication on the acceptable cut-off score of CVI.

Table 3.9
The Number of Experts and Implication on the Acceptable Cut-off Score of CVI

No.	Number of Experts	Acceptable CVI values	Source of recommendation
1.	Two experts	At least 0.80	Davis (1992)
2.	Three to five experts	Should be 1	Polit et al. (2007)
3.	At least six experts	At least 0.83	Polit et al. (2007)
4.	Six to eight experts	At least 0.83	Lynn (1986)
5.	At least nine experts	At least 0.78	Lynn (1986)

Source: Yusoff (2019)

The selected experts represented three stakeholder categories:

i. Two academicians from Universiti Teknologi MARA (UiTM), each holding a PhD and specialising in facilities management and mosque studies.

ii. Two maintenance officers from *Jabatan Hal Ehwal Agama Islam Kelantan* (JAHEAIK), located at Kompleks Islam Darul Naim, Jalan Sultan Yahya Petra, Kota Bharu, Kelantan.

iii. Two officers from the Unit Pengurusan Masjid Daerah (UPMD) under the Jabatan Agama Islam Kota Bharu, Kelantan.

Table 3.10 shows the potential expert panel for content validation using Content Validation Index (CVI).

Table 3.10
Potential Expert Panel for Content Validation

Category of Expert Panel	Position	Respondents	Total
Academician (Various Universities)	PhD Holder	2 × 1 Respondent	2
Maintenance Practitioner	Maintenance Officer	2 × 1 Respondent	2
UPMD	Maintenance Officer	2 × 1 Respondent	2
Total			6

The selection of the six experts was justified based on their qualifications, institutional affiliations, and professional experience directly related to mosque facility maintenance and performance-based assessment. The panel represented three stakeholder categories: academicians, maintenance practitioners, and mosque

management officers. This composition ensured triangulation of perspectives from policy, technical, and operational standpoints.

Each expert's experience was systematically assessed and quantified using three indicators: (1) years of professional experience, (2) area of specialization, and (3) organizational responsibility. Data on these indicators were obtained through the background information form administered prior to the content validation process. The academicians possessed between 10 and 20 years of research and teaching experience in facility management and maintenance studies, while the practitioners and officers reported 8 to 15 years of operational experience in mosque facility management within their respective institutions. This quantification approach enhanced transparency in expert selection and ensured that the instrument validation reflected informed professional judgment consistent with the study's objectives.

Their multidisciplinary backgrounds ensured that the content of the questionnaire was evaluated holistically, encompassing academic, administrative, and operational perspectives. Before the validation process, each expert attended a briefing session explaining the study objectives and was provided with a content validation package containing: (1) the draft questionnaire, and (2) the Content Validation Index (CVI) form using a four-point Likert scale, adapted from Yusoff (2019).

The content validation was conducted through face-to-face interviews facilitated by the researcher, allowing real-time engagement, clarification of item meanings, and immediate collection of both quantitative ratings and qualitative suggestions. This interactive setting also enabled deeper discussions concerning item clarity, contextual relevance, and terminology, thereby improving the reliability and contextual appropriateness of the final questionnaire instrument. The compiled panel feedback was subsequently analysed to determine the Item-level CVI (I-CVI) and Scale-level CVI (S-CVI), providing robust evidence for the content validity of the instrument in alignment with the recommendations of Polit & Beck (2007) and Yusoff (2019).

iii. Step 3: Conducting content validation

Following the selection and briefing of the expert panel, the content validation process was conducted through face-to-face interviews to ensure greater engagement, immediate feedback, and in-depth discussion. This approach enabled the researcher to

directly facilitate the review process, clarify any ambiguities in item interpretation, and capture both structured and spontaneous expert feedback in real time.

During the interview sessions, each expert was provided with the full validation package, including the questionnaire draft, operational definitions of constructs and domains, and the content validation form based on a four-point Likert scale (Yusoff (2019). The researcher acted as a facilitator throughout the session, guiding the experts in evaluating each questionnaire item in terms of its relevance, clarity, and representativeness to the intended construct.

Experts were requested to review each item independently and rate its relevance using the scale provided (1 = not relevant, 4 = highly relevant). In addition to numerical scoring, the experts were encouraged to share verbal and written comments regarding the wording, cultural appropriateness, and conceptual alignment of the items. This dual mode of feedback – quantitative and qualitative – strengthened the reliability of the evaluation and provided a rich foundation for refining the instrument.

The face-to-face setting also allowed for open dialogue among experts and the researcher, which contributed to a more nuanced understanding of certain terms, especially those rooted in religious or maintenance-specific contexts. Where necessary, real-time suggestions for rewording or item restructuring were discussed, recorded, and considered in the refinement process. The data collected during this step formed the basis for the subsequent calculation of the Content Validity Index (CVI), as detailed in Step 5.

iv. Step 4: Reviewing domain and items

The review of domains and questionnaire items was a crucial stage in the content validation process, marking the foundation for calculating the Content Validity Index (CVI). There are 63 items where the relevance of all items was assessed by six expert reviewers. Each domain was defined clearly and discussed with the experts during face-to-face validation sessions. The experts were asked to examine the items under each domain for clarity, relevance, redundancy, and construct alignment. Qualitative comments were encouraged to ensure that issues such as ambiguous wording, cultural sensitivity, or conceptual overlap could be addressed in the next stage. The objective of this step was to ensure that every item presented to the experts was conceptually sound and clearly aligned with the theoretical framework of maintenance planning for *Masjid*

kariah. The outcomes of this phase directly contributed to the scoring and item retention analysis that followed.

v. Step 5: Providing score on each item and Calculating CVI

After the review of domains, the experts rated each item using a four-point Likert scale (1 = not relevant, 4 = highly relevant). This allowed for the calculation of the Item-Level Content Validity Index (I-CVI) for each item, and the Scale-Level Content Validity Index (S-CVI/Ave) for the overall instrument. An item was considered valid if at least five out of six experts (I-CVI $\geq$ 0.83) rated it as either 3 or 4. Items with I-CVI values below the minimum threshold of 0.80 were removed from the final instrument. As a result of this scoring process:

i. 63 items were initially evaluated,
ii. 28 items with I-CVI < 0.80 were removed,
iii. 35 items were retained for further assessment.

This rigorous screening process ensured that only the most relevant and representative items were retained in the final draft of the instrument. (Refer to Appendix 9 shows the calculation on CVI in this study).

vi. Step 6: Response Process Evaluation and Final Item Retention

Following the content validation scoring, a further response process evaluation was conducted. This step focused on assessing the clarity of language, sentence structure, and comprehensibility of each item, ensuring that respondents could interpret them as intended. The expert panel evaluated the revised items to confirm that all retained items were linguistically coherent and culturally appropriate for the target population. At this stage, no items were eliminated as all 35 items were found to meet the minimum clarity and relevance standards. Therefore, the final set of items was confirmed for use in the next phase of instrument development, which included construct validation through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) – based on pilot survey within 30 respondents among *Masjid kariah* committee members.

vii. Summary on Content Validity Index (CVI) Process

The content validation process employed in this study followed a systematic six-step approach based on Yusoff (2019) to ensure the validity and relevance of the questionnaire items. Initially, a structured content validation form was prepared, incorporating domain definitions and a four-point Likert scale to guide expert evaluation. Subsequently, six experts with backgrounds in facilities management, mosque administration, and academic research were purposively selected to form the review panel. Face-to-face validation sessions were conducted to facilitate direct engagement with the experts, allowing the researcher to clarify conceptual intentions and capture immediate feedback. During these sessions, the experts reviewed each item for relevance, clarity, and representativeness, and provided both qualitative and quantitative input. Each item was then scored, and the Item-Level Content Validity Index (I-CVI) was calculated; items scoring below the acceptable threshold (I-CVI < 0.80) were removed, resulting in the elimination of 28 out of 63 initial items. Finally, a response process evaluation was conducted to assess the clarity and interpretability of the remaining items. All 35 retained items were found to be linguistically appropriate and contextually relevant, and thus were confirmed for use in the subsequent phase of construct validation. Therefore, the draft questionnaire was tested to assess the appropriateness of the items, wording, time taken, and any problems that might arise when respondents were responding to the questions (Saunders et al., 2016). Figure 3.6 shows the process of conducting Content Validity Index (CVI) in this study.

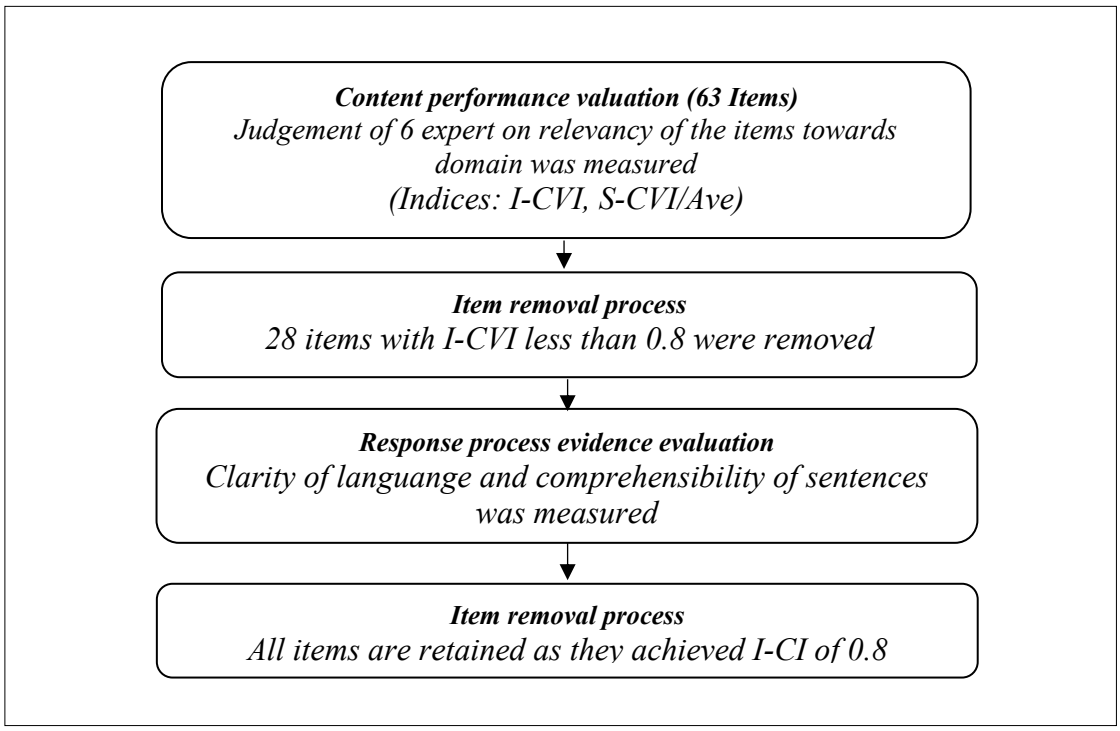

Figure 3.6 Process of Content Validity Index (CVI) in This Study

3.4.2.2 Pilot Survey for Reliability Test

A pilot survey was conducted to assess the reliability and clarity of the questionnaire instrument before its full-scale deployment. This initial testing involved 30 committee members from five selected *Masjid kariah* in the Kota Bharu district. The pilot study played a vital role in ensuring that the questions were well-structured, understandable, and appropriate for the target respondents, who consisted of mosque committee members with varying levels of academic and administrative backgrounds.

One of the primary objectives of this pilot survey was to evaluate the internal consistency of the instrument using Cronbach's Alpha for each construct. This process helped identify items with weak reliability or ambiguous wording, which were subsequently refined or removed to enhance the quality of the instrument (Khanal & Chhetri, 2024; Sharif-Alhoseini et al., 2012). The refinement ensured that the questionnaire was user-friendly and facilitated accurate responses among the committee members.

Although the pilot survey focused primarily on reliability testing, it also served as a preparatory phase for more advanced statistical validation techniques – enabled the

use of Exploratory Factor Analysis (EFA) to uncover the underlying factor structure of the constructs, followed by Confirmatory Factor Analysis (CFA) to validate the measurement model. These analyses are discussed in detail in subsequent sections. Therefore, the pilot survey not only enhanced the clarity and consistency of the instrument but also laid the foundation for the rigorous psychometric evaluation of its construct validity in the main phase of this research.

i. The Sample of Respondent for Pilot Survey

Thabane et al. (2010) denoted that generally, sample size calculation may not be required for pilot studies. The most important aspect is to indicate the respondents for the target study population. However, Bujang & Baharum (2017) mentioned that the minimum required size for a pilot study would be more than 10 but not exceeding 30 respondents.

To test the pilot survey, thirty (30) committee members from five *Masjid kariah* in Kota Bharu, Kelantan were selected as respondents from the original sample to examine how the questions might be received by the entire sample and to identify any potential problems. A similar sample set was distributed to the respondents. Table 3.11 lists the participants for the pilot study. The sample involved has been carefully selected, which has the same respondent characteristics as the entire target group.

Table 3.11
Participants for Pilot Survey

Category of Pilot Respondents	**Position**	**Respondents**	**Total**
Committee Members	1. Nazir	1 × 5 Respondents	5
	2. Deputy Nazir	1 × 5 Respondents	5
	3. Secretary	1 × 5 Respondents	5
	4. Deputy Secretary	1 × 5 Respondents.	5
	5. Treasurer	1 × 5 Respondents	5
	6. Bureau of Development	1 × 5 Respondents	5
		Total	30

ii. The Sample of Masjid Kariah for Pilot Survey

The selected *Masjid kariah* to be involved in the pilot study are as listed in Table 3.12 consist of five potential mosques.

Table 3.12
Potential *Masjid kariah* for Pilot Survey

District	*Masjid kariah* Name	Total
Kota Bharu	1. Masjid Mukim Paya Bemban	5 Potentials of *Masjid kariah*
	2. Masjid As-Solihin Mukim Paya Rambai	
	3. Masjid Mukim Kok Lanas	
	4. Masjid Al-Hakim, Taman Tanjung Chat	
	5. Masjid Tok Haji Yahya	

A pilot survey is an essential research process before final questionnaire is distributed to the respondents. The primary reason for conducting a pilot survey was to make sure the respondents could understand all the questions. Additionally, the refined attributes needed to be tested for reliability, which could provide the correct measurement for what it is supposed to measure. This is a vital part of this study to gain the initial respondents' opinions and advices on improving the quality of the final questionnaire, as well as to identify any error or unsuitable item. These steps would ensure that the final draft of the questionnaire survey could be clearly understood by the respondents.

The selection of respondents and locations for the pilot survey was based on purposive sampling to ensure representativeness and manageability within the research scope. The five *Masjid kariah* chosen in Kota Bharu were selected because they reflect diverse mosque typologies and operational scales — ranging from urban community mosques to sub-urban *kariah* mosques — that are directly administered under Jabatan Hal Ehwal Agama Islam Kelantan (JAHEAIK). This diversity allowed the researcher to test the instrument across various management contexts and physical conditions, ensuring that the questionnaire items were applicable to different categories of mosques.

The thirty (30) respondents were committee members representing six key administrative positions — Nazir, Deputy Nazir, Secretary, Deputy Secretary, Treasurer, and Bureau of Development — which mirror the hierarchical structure of a standard *Masjid kariah* committee in Kelantan. These roles were selected because they are directly involved in decision-making, maintenance planning, and financial management of mosque facilities. Hence, their feedback is crucial for evaluating the clarity, relevance, and practicality of the questionnaire items.

The combination of mosque diversity and committee role distribution strengthened the construct validity of the pilot phase by ensuring that the instrument was tested among actual practitioners with functional responsibility over maintenance activities. This purposive yet representative selection aligns with pilot study

recommendations by Thabane et al. (2010) and Bujang & Baharum (2017), who emphasize the importance of testing instruments within a realistic operational context before large-scale distribution.

iii. Translation Protocol

The questionnaire was written in English and translated into Bahasa Malaysia (Malay) to ensure that it was clear and understandable to the respondents most of the respondent converse in Malay language. Therefore, one Malay primary school teacher graduating with a bachelor's degree in Teaching English as A Second Language (TESL), named Puan Hasnah Binti Jaafar from Sekolah Kebangsaan Mulong 2, Kota Bharu and another Malay teacher, named Puan Ayunie Hazrina binti Che Razali, teaching at Sekolah Kebangsaan Dabong, Kuala Krai, who graduated from Universiti Kebangsaan Malaysia with Master of Arts (English Language Studies) were involved. Since they were both Bahasa Malaysia native speakers and skilled English teachers, they were both bilingual and qualified to perform the assigned translation task. The following tables show an example of the English version of the questionnaire going through forward translation into Bahasa Malaysia (Beaton et al., 2000). Table 3.13 shows the original policy deployment scale in English and Table 3.14 shows the policy deployment scale after it undergo a forward translation into Bahasa Malaysia.

Table 3.13
Policy Deployment Scale (Original in English)

1. DIMENSION

1A: Policy Deployment	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
(1) You agree that strategy below have clear written objective, goals and target in this mosque.					
Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

Table 3.14
Policy Deployment Scale (Forward Transalation into Bahasa Malaysia)

1. DIMENSI

1A: Penggunaan Dasar	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju
(1) Anda bersetuju bahawa strategi dibawah mempunyai objektif, matlamat dan sasaran bertulis yang jelas di masjid ini.					
Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

iv. Reliability Test: Final test for Questionnaire Survey Form

Reliability testing for questionnaire surveys is a critical step in ensuring that the data collected is consistent and dependable over time. This process involves evaluating whether the survey instrument consistently measures what it is intended to measure across different instances. Reliability testing is rooted in classical test theory, which posits that observed scores consist of true scores and error scores (Furr & Bacharach, 2007). The true score is the hypothetical average of an infinite number of independent measurements, while the error score accounts for random fluctuations. Reliability coefficients quantify the proportion of true score variance relative to the total observed score variance. Various methods and statistical tools are employed to assess the reliability of questionnaires, which can vary depending on the context and the specific constructs being measured. The following sections outline key aspects of reliability testing for questionnaires, drawing on insights from the provided research papers:

i. **Internal Consistency (Cronbach's alpha)**: This is often measured using Cronbach's alpha, which assesses the extent to which items within a questionnaire are correlated, thus measuring the same construct. A high Cronbach's alpha value indicates good internal consistency. Additionally, the complexity of the constructs being measured and the clarity of the questionnaire items can impact reliability outcomes. It is also essential to ensure that the questionnaire is valid, meaning it

accurately measures the intended constructs, as reliability alone does not guarantee validity (Taherdoost, 2016; Yuniarti, Makaginsar, Nia Irasanti, & Awalia Yulianto, 2022).

ii. **Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA)**: Among the most widely used methods are EFA and CFA. These methods are essential for assessing the consistency and validity of scales used in measuring latent constructs such as personality traits, cognitive abilities, and educational outcomes. EFA is a statistical technique used to identify the underlying factors that explain the correlations among a set of observed variables. It is an exploratory method, meaning it does not require a pre-specified model but rather uncovers the latent structure in the data (Kline, 2014). EFA is based on the common factor model, which assumes that the covariation among variables is due to one or more underlying factors. The goal of EFA is to reduce the complexity of a large number of variables by identifying a smaller number of factors that capture the essence of the data (Kline, 2014). Meanwhile, CFA is a statistical method used to test the validity of a hypothesized factor structure. Unlike EFA, CFA requires a pre-specified model and is used to confirm or reject hypotheses about the relationships between observed variables and latent constructs(Said, Badru, & Shahid, 2011). CFA is based on structural equation modelling (SEM), which allows researchers to test complex theoretical models. The method estimates the parameters of the model and evaluates how well the model fits the data (Said et al., 2011).

In line with the research aim of developing a maintenance planning framework for *Masjid kariah* in Kelantan, a reliability test was initially conducted using SmartPLS 4 software to assess the internal consistency of the measurement model before questionnaire survey fully conducted. The model comprised seven independent variables: (1) Organisational Management, (2) Planning and Scheduling, (3) Financial Provision, (4) Service Quality, (5) Assessment, (6) Resource Allocation, and (7) Safety and Health. Data were obtained from 30 *Masjid kariah* committee members during the pilot survey phase.

3.4.2.3 Final Questionnaire Survey Form Development

A set of questionnaires consisting of three sections (Sections A, B, and C) has been carefully designed to ensure that most of the issues related to maintenance strategy criteria and maintenance performance measurements of *Masjid kariah* have been included. Each section of the questionnaire contained instructions and guidance for the participants. Sekaran & Bougie (2016) distributed their questionnaire set in three ways, namely, personally administrated, mail questionnaires, and electronic questionnaires. This study, therefore, has similarly implemented the personally administrated questionnaire to obtain information from the participants. All questionnaire sets were distributed to each committee member of the mosques that have been selected.

The questionnaire approach was used in this study to collect primary data before determining the relationship between maintenance strategy criteria and maintenance performance measurements in maintenance planning of *Masjid kariah*. This type of survey is a systematic method of gathering information from the target population. To obtain results from the responses to the research questions, the information collected from the questionnaire survey have to be statistically analysed. Therefore, it has been strongly suggested to use a reliable instrument in ensuring that the questionnaire could conduct a measurement as it was intended to achieve and deliver reliable results. The questionnaire was then personally administrated to each participant via face-to-face interviews to enable the researcher to obtain a response from all respondents.

After the attribute factors for each independent and dependent variable have been validated by the expert panel, developed, and tested during a pilot survey, the final empirical questionnaire was distributed to the respondents. The empirical questionnaire distribution involved the quantitative phase using structured questionnaire surveys. As explained in the previous section, this survey method used stratified multistage random sampling in selecting the representative of a subgroup from the *Masjid kariah* in each district. The questionnaire sets were distributed to the *Masjid kariah* committee members, JAHEAIK staff, JKR staff, and UPMD staff. Their responses have been collected and analysed accordingly.

Table 3.15 shows the total number of items in the final questionnaire form. Each respondent was instructed to answer five questions in Section A-I, six questions in Section A-II, four questions in Section B, and 35 questions in Section C. Therefore, a total of 50 questions has been distributed to 354 committee members.

Table 3.15
Summary of Final Empirical Questionaire

Respondents	Aspects	Total Items	Number Items
354 Committee Members	Section A	Part I: *Masjid kariah* Demographic	Five Questions
		Part II: Committee Members Demographic	Six Questions
	Section B	Maintenance Strategy Implementation	Four Questions
	Section C	Relationship C1 (Organisation Management)	Six Questions
		C2 (Planning &Scheduling)	Six Questions
		C3 (Financial Provision)	Six Questions
		C4 (Service Quality)	Five Questions
		C5 (Maintenance Assessment)	Four Questions
		C6 (Resource Allocation)	Four Questions
		C7 (Safety and Health)	Four Questions
Total Questions			**50 Questions**

i. Scale Measurement and Categories

A descriptive study was carried out to extract information from the returned sets of questionnaires using the following measures: (1) three types of scale measurements (nominal, ordinal, and ratio/interval), (2) three measures of central tendencies (mode, median, and mean), and (3) two measures of dispersions (percentiles and standard deviation). Table 3.16 shows the measures of central tendencies dispersion, respective to the scale of measurements employed in this study.

Table 3.16
Categories of Measurements

Types of Scale	The measure of central tendency	Measure of Dispersion
Nominal	Mode	None
Ordinal	Median	Percentile
Ratio	Mean	Standard Deviation
Interval	Mean	Standard Deviation

Table 3.17 shows the description level of variables using the Likert scale. There were three levels of frequency involved, as per Pallant (2013).

Table 3.17
Description Level of Variables using the Likert Scale

Level	Frequency
1	(1.00-2.33)
2	(2.34-3.67)
3	(3.68-5.00)

Source: Pallant (2013)

Section A: Demographic Background

Table 3.18 shows the content of Section A in the questionnaire comprising the demographic backgrounds of *Masjid kariah* and of the respondents (mosque committee members).

Table 3.18
Initial Questionnaire: Section A

Section	Topic	Measurement items	Type of Scale
Section A	Demographic Background		
	i: *Masjid kariah* Demographic		
	1)	The name of *Masjid kariah*	Nominal
	2)	District	Nominal
	3)	Type of ownership	Nominal
	4)	Age of *Masjid kariah*	Nominal
	5)	Register with JAHEAIK	Nominal
	ii: Committee Members Demographic		
	1)	Position in mosque	Nominal
	2)	Ethnicity	Nominal
	3)	Gender	Nominal
	4)	Educational level	Nominal
	5)	Age	Nominal
	6)	Type of service	Nominal

This section of the questionnaire gathered general information, which has been divided into two subsections: the demographic backgrounds of the respondents and of *Masjid kariah*. Since the focus of this study was on *Masjid kariah* in the state of Kelantan Darul Naim, with the participation of each mosque's committee members, subsection (1) of Section A included the demographic data of the mosques. There were five questions in this subsection, which were the name of the mosque, the district, types of ownership, age, and registration with JAHEAIK. Subsection (2) included the demographic data of the committee members. The respondents' demographic backgrounds were collected using six questions that required them to provide their background information, starting with their position at the *Masjid kariah*, race, gender, educational level, age, and the type of service attached to them.

Section B: Maintenance Strategy Implementation

Section B of this questionnaire consisted of questions regarding the implementation of maintenance strategy for that particular *Masjid kariah*. Table 3.19 shows the four nominal scales for the four questions in this section. The measurement items were asking about the written strategy, the implementation of a maintenance strategy, who manages the maintenance works, and the frequency of maintenance.

Table 3.19
Initial Questionnaire: Section B

Section	Topic	Measurement items	Type of Scale
Section B	Maintenance Strategy		
	1)	Does *Masjid kariah* has a written building maintenance policy?	Nominal
	2)	Which maintenance strategy is used by this *Masjid kariah*? (Can choose more than one answer)	Nominal
	3)	Who performs the maintenance of this *Masjid kariah*?	Nominal
	4)	What is the frequency of maintenance for this mosque?	Nominal

Section C in the questionnaire was the main component to measure the relationships between maintenance strategy criteria and maintenance performance measurements using the Likert scale. The Likert scale was first established by Rensis Likert (1932) in a paper titled "A Technique for the Measurement Attitudes". Awang et al. (2016) denoted that the Likert scale is commonly used in survey research, especially in the fields of social science, management, and other disciplines. Primary and secondary data would be used to measure the respondents' attitude by asking the scale to which they agree with the statements given.

For this research, a five-point Likert scale with multiple items was used for measuring the independent and dependent variables. This Likert scale was adopted from Qing Li (2012) to determine the relationship between two variables. The five-point Likert scale was used to ensure that the respondents were able to decide on their level of agreement (either agree or disagree) or satisfaction (either satisfied or not satisfied) with the statement items given in the questionnaire. Based on a scale of five points, the respondents have the chance to choose just one point to indicate this level.

Section C: Relationship Between Maintenance Strategy and Maintenance Performance Measurements

Table 3.20 shows the questions in Section C, which consists of measurement of the relationship between maintenance strategy criteria and maintenance performance measurements. It comprised constructs and dimensions, types of scale, and sources adapted for each question.

Table 3.20
Initial Questionnaire: Section C

Section	Construct and Dimensions		Type of Scale	Adapt/ Adopt / New	Source
Section C	Relationship between maintenance strategy criteria and maintenance performance measurements				
C1) Organisation Management					
	A) Policy Deployment				
1	(1)	This maintenance strategy has clear written objectives, goals, and targets in this *Masjid kariah*.	Ordinal	Adapt	Tsang (2002)
2	(2)	This maintenance strategy uses an effective maintenance policy to be used in the management of maintenance in this *Masjid kariah*.	Ordinal	Adapt	Wireman (2005)
	B) Human Resources Management				
3	(1)	The maintenance organization provides sufficient manpower to conduct the task using this maintenance strategy.	Ordinal	Adapt	Márquez (2007)
4	(2)	This maintenance strategy ensures that any facility in the *Masjid kariah* is well maintained.	Ordinal	Adapt	Swanson (2001)
	C) Continuous Improvement				
5	(1)	This maintenance strategy provides adequate training and education for employees on each of the maintenance strategy criteria.	Ordinal	Adapt	Alsyouf (2009)
6	(2)	This maintenance strategy is exposed to basic knowledge through short courses related to the maintenance of *Masjid kariah*.	Ordinal	Adapt	Dhillon (2002)
C2) Planning and Scheduling					
	A) Maintenance Approach				
7	(1)	This maintenance strategy has an approach that can be used to manage maintenance work.	Ordinal	Adapt	Levitt (2011).
8	(2)	This maintenance strategy does not interfere with the prayer times and programs conducted in this *Masjid kariah*.	Ordinal	Adapt	Nawi et al. (2011)
	B) Record Management				
9	(1)	This maintenance strategy is recorded for future inspection or review in the event of problems with each operation of the maintenance activity.	Ordinal	Adapt	Komonen et al. (2011)
10	(2)	This maintenance strategy has effective file handling.	Ordinal	Adapt	Campbell & Reyes-Picknell (2015)
	C) Communication				
11	(1)	This maintenance strategy facilitates the means of communication to all parties involved.	Ordinal	Adapt	Parida & Kumar (2006)
12	(2)	This maintenance strategy communicates with the mosque committee members clearly	Ordinal	Adapt	Dhillon (2006)

Section	Construct and Dimensions		Type of Scale	Adapt/ Adopt / New	Source
		using this maintenance strategy.			
C3) Financial Provision					
	A) Adequacy of Budget				
13	(1)	This maintenance strategy allocates a budget in accordance with the maintenance plan for the maintenance of this *Masjid kariah*.	Ordinal	Adapt	Liyanage & Kumar (2003)
14	(2)	This maintenance strategy can identify payments to the maintenance needs of this *Masjid kariah*.	Ordinal	Adapt	Pintelon (2008)
	B) Fund Efficiency				
15	(1)	This maintenance strategy has the opportunity for fund savings.	Ordinal	Adapt	Amaratunga (2001)
16	(2)	This maintenance strategy is efficient in allocating allocated funds.	Ordinal	Adapt	Amaratunga & Baldry (2002a)
	C) Fund Allocation				
17	(1)	This maintenance strategy allocates maintenance funds for maintenance work in this *Masjid kariah*.	Ordinal	Adapt	Lee & Scott (2009)
18	(2)	This maintenance strategy can ensure that the allocation of available funds is commensurate with the set annual work.	Ordinal	Adapt	McKibbin, W. (2000).
C4) Service Quality					
	A) Reliability				
19	(1)	This maintenance strategy can perform services within schedule.	Ordinal	Adapt	Amaratunga (2001), Rausand, M. (2014).
	B) Assurance				
20	(1)	This maintenance strategy can ensure that maintenance services are performed efficiently.	Ordinal	Adapt	Amaratunga (2001)
	C) Tangible				
21	(1)	Maintenance staff provide maintenance services well through this maintenance strategy.	Ordinal	Adapt	Parasuraman et al. (1994)
	D) Empathy				
22	(1)	Maintenance staff pay special attention to complaints received through this maintenance.	Ordinal	Adapt	Parasuraman et al. (1994)
	E) Responsiveness				
23	(1)	Maintenance staff can assist and provide prompt services to *Masjid kariah* committee members using this maintenance strategy.	Ordinal	Adapt	Parasuraman et al. (1994)
C5) Maintenance Assessment					
	A) Assessment to Building Condition				
24	(1)	This maintenance strategy can preserve the physical elements of the building in this *Masjid kariah*.	Ordinal	Adapt	Shohet (2003); Shohet (2003)
	B) Assessment to Service Condition				
25	(1)	This maintenance strategy assesses the condition of the existing equipment and system in this mosque well.	Ordinal	Adapt	Elmualim et al. (2010)
	C) Assessment to Law and Regulation				
26	(1)	This maintenance strategy meets the requirements of building law in assessing the physical condition of this *Masjid kariah*.	Ordinal	Adapt	Triwijayanty & Sakti (2020)
27	(2)	This maintenance strategy meets the requirements of building law in evaluating the equipment system of this *Masjid kariah*.	Ordinal	Adapt	Smith, R. (2011).
C6) Resource Allocation					
	A) Contract-out Management				
28	(1)	This maintenance strategy has contract out to external parties.	Ordinal	Adapt	Hui & Tsang (2004)
	B) Spare part Management				

Section	Construct and Dimensions		Type of Scale	Adapt/ Adopt / New	Source
29	(1)	This maintenance strategy has a periodic spare parts schedule for repetitive maintenance.	Ordinal	Adapt	Kennedy (2002).
	C) Tools and Equipment				
30	(2)	This maintenance strategy sets out the tools that are of course and available.	Ordinal	Adapt	Triwijayanty & Sakti (2020)
	D) Information Management				
31	(1)	This maintenance strategy is suitable for using a maintenance management system (CMMS).	Ordinal	Adapt	Marquez & Gupta (2006)
C7) Safety and Health					
	A) Safety				
32	(1)	This maintenance strategy ensures that this maintenance provides safety from accidents due to falls, and tripping.	Ordinal	Adapt	Seshadhri & Paul (2018)
33	(2)	This maintenance strategy allows for the inspection of the *Masjid kariah* equipment system to avoid danger.	Ordinal	Adapt	Seshadhri & Paul (2018)
	B) Health				
34	(1)	This maintenance strategy can ensure that the *Masjid kariah* is free from the sick building syndrome.	Ordinal	Adapt	Satish et al. (2012)
35	(2)	This maintenance strategy can ensure cleanliness of maintenance area.	Ordinal	Adapt	Seshadhri & Paul (2018),

Johar et al. (2011) indicated that performance measurement could be measured based on the objective of the organisation. It should have five main characteristics, called SMART (specific, measurable, achievable, reasonable, and time). Therefore, an appropriate scale was used to measure the performance, as described in the previous chapter.

ii. Overall Content of Items in Questionnaire

Table 3.21 shows the overall distribution of questions in all sections in the empirical questionnaire.

Table 3.21
Overall Sections in the Distribution of Questions and Number of Items

Section	Questions	Number of Items
Section A	Section I: *Masjid kariah* Demographic	Five Questions
	Section II: Committee Members' Demographic	Six Questions
Section B	Maintenance Strategy	Four Questions
Section C	Relationship Between Maintenance Strategy and Performance Measurements	35 Questions
	Overall	50 Questions

Table 3.22 refers to the types of Likert scale and their categories, as included in Section C, comprising the agreement, adequacy, sufficiency, satisfaction, safety, and health.

Table 3.22
Types of Likert Scale Categories used in Section C

No.	Measurement items	Question/Likert scale categories			
		Agreement	Adequacy	Sufficient	Satisfaction
1	Organisation Management				
	1 Policy Deployment	*			
	2 Human Resources Management	*			
	3 Continuous Improvement	*			
2	Planning and Scheduling				
	1 Maintenance Approach	*			
	2 Record Management	*			
	3 Communication	*			
3	Financial Provision				
	1 Adequacy of Budget		*		
	2 Fund Efficiency			*	
	3 Fund Allocation		*		
4	Service quality				
	1 Reliability				*
	2 Assurance				*
	3 Tangible				*
	4 Empathy				*
	5 Responsiveness				*
5	Maintenance Assessment				
	1 Assessment of Building Condition	*			
	2 Assessment of Services Condition	*			
	3 Assessment of law and regulation	*			
6	Resource Allocation				
	1 Contract-out Management		*		
	2 Spare part Management		*		
	3 Tools and Equipment		*		
	4 Information management (CMMS)	*			
7	Safety & Health				
	1 Safety	*			
	2 Health	*			

3.4.2.4 Sampling Framework for Questionnaire Survey

The sampling framework in this study was designed to ensure that data collected through the questionnaire survey would be both representative and contextually grounded, capturing the actual practices and perceptions of mosque committee members who manage maintenance at the community level. The population of interest comprised all 584 *Masjid kariah* committees in Kelantan, officially registered under the Majlis Agama Islam dan Adat Istiadat Melayu Kelantan (MAIK). These mosques are distributed across ten administrative districts – Kota Bharu, Pasir Mas, Pasir Puteh, Bachok, Machang, Tanah Merah, Kuala Krai, Jeli, Gua Musang, and Tumpat. Each

committee represents a formal management body responsible for financial control, maintenance planning, and service quality, making them the most relevant decision-making units for this research.

Due to the large, decentralised, and hierarchically structured nature of this population, the study adopted a multistage sampling technique rather than a stratified random sampling approach. While stratified random sampling could theoretically provide proportional representation across districts, it assumes the existence of a complete and standardised list of individual respondents within each stratum. However, such an exhaustive list was not available because mosque committees operate independently under district-level supervision, and records of committee composition are managed differently across districts. Therefore, multistage sampling was methodologically and practically justified, as it accommodates the multi-layered structure of mosque administration and allows for efficient data collection within logistical constraints.

This decision also aligns with recommendations by Creswell & Plano Clark (2018) and Sekaran & Bougie (2019), who highlight that multistage sampling is particularly suitable for large-scale, geographically dispersed populations in which respondents are nested within organisational hierarchies. The hierarchical logic of this sampling method mirrors the real administrative structure of mosque governance in Kelantan – beginning with the district (Level 1) as the supervisory authority, followed by individual mosques (Level 2) as operational entities, and finally the committee members (Level 3) as individual decision-makers.

The multistage sampling process was implemented in three sequential stages. In Stage 1, all ten districts were selected as the primary clusters to ensure state-wide coverage and inclusion of diverse urban and rural settings. In Stage 2, approximately ten percent (10%) of *Masjid kariah* was randomly selected from each district using simple random sampling, resulting in a total of 59 participating mosques. This proportion was considered adequate to represent each district's variation in mosque characteristics, maintenance scope, and community size. In Stage 3, six committee members from each mosque were chosen to respond to the questionnaire. These respondents represented core administrative and operational positions such as Nazir, Imam, Secretary, Treasurer, and Bureau Members (including those responsible for development, maintenance, and welfare). This combination of roles ensured a multi-

perspective understanding of maintenance planning, decision-making, and performance evaluation.

The sample size determination was based on the formula proposed by Krejcie & Morgan (1970), which specifies that for a population of over 100,000 elements, a sample of 384 respondents is sufficient to achieve a 95% confidence level with a 5% margin of error. This calculation was corroborated using the Raosoft Sample Size Calculator (2004), which confirmed the same adequacy level for this study's confidence interval. Table 3.23 shows the determining sample size.

Table 3.23
Determining Sample Size from a Given Population

N	S	N	S	N	S
210	136	**1100**	285	**1000000**	384

(Sources: Krejcie & Morgan, 2016)

Based on this computation, 384 questionnaires were distributed across the selected mosques, and 354 valid responses were received, achieving a response rate of 92.2%. This response rate exceeds the acceptable benchmark for social science research (typically 70%), indicating strong engagement from the target population and the adequacy of the sampling framework. The hierarchical logic of the sampling process is illustrated in Figure 3.7, which depicts the progression from district-level selection to individual respondent identification.

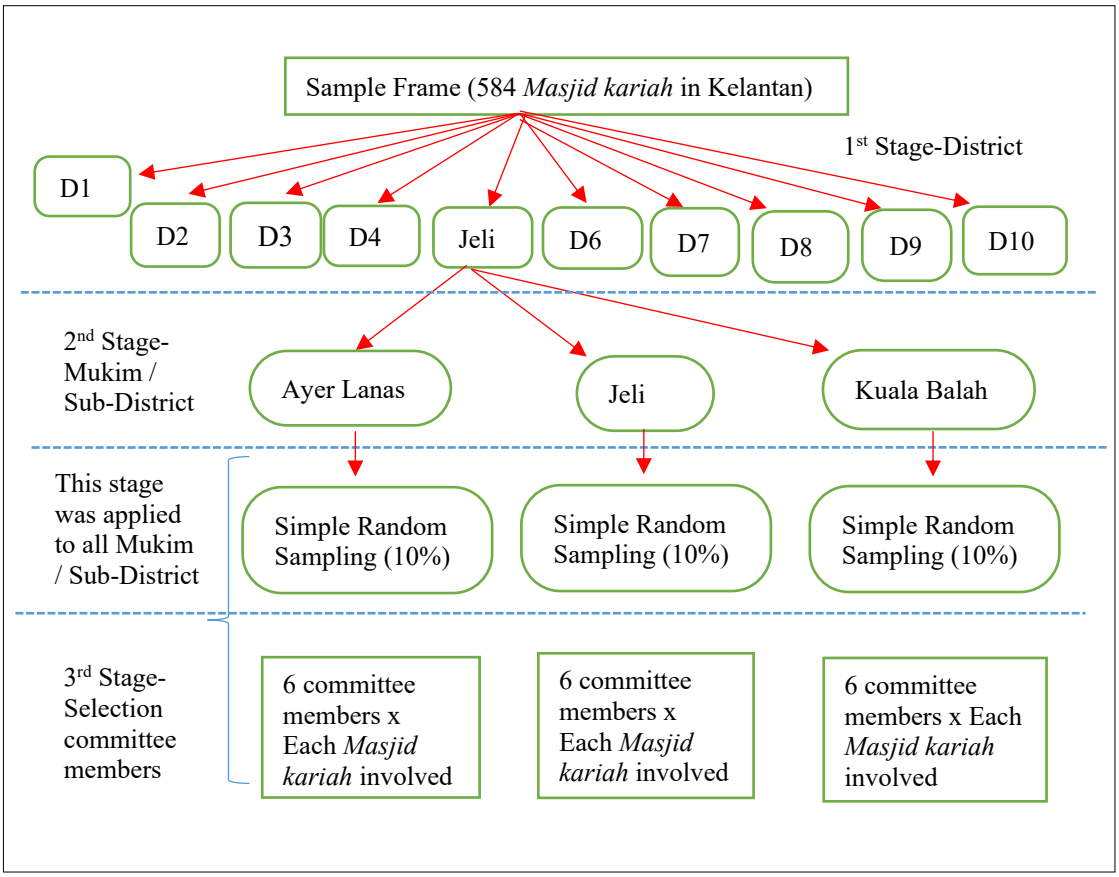

Figure 3.7 Tabulation for Multistage Sampling

In the first stage, all 10 districts in Kelantan were identified as the initial clusters. The district zoning structure was established for ease of coordination and to reflect the administrative jurisdiction of MAIK. In the second stage, each district was divided into several mukim (subdistricts), and ten percent (10%) of mosques were selected from each mukim using simple random sampling. Finally, in the third stage, six committee members from each mosque were selected to participate in the empirical survey. This step ensured that each mosque contributed multiple viewpoints across managerial, operational, and functional responsibilities, resulting in a balanced and comprehensive dataset.

The use of multistage sampling offered several advantages for this study. It enhanced representation by ensuring that every district and mosque size category (large, medium, and small) was proportionally included, while reducing sampling bias that might occur if only certain zones were chosen. It also provided logistical feasibility, as data collection could be coordinated with MAIK's administrative structure, minimising cost and time. The approach reflects what Sekaran & Bougie (2019) describe as an

optimal balance between randomness and manageability in organisational field research.

This framework further supports the principle of theoretical generalisation (Yin, 2018), which prioritises conceptual and contextual transferability rather than mere statistical inference. Because the study aimed to develop a Maintenance Planning. Framework, the focus was on capturing the diversity of maintenance practices rather than achieving a perfectly random sample of all committee members. Nonetheless, the proportional selection of mosques and respondents across all 10 districts allows cautious generalisation of findings to the broader population of *Masjid kariah* in Kelantan.

In conclusion, the multistage sampling framework used in this study represents a methodologically sound and contextually grounded strategy that ensures representativeness, reliability, and operational feasibility. By mirroring the actual structure of mosque governance and incorporating both theoretical and empirical justification, the design strengthens the validity of the subsequent quantitative analysis. The data obtained from this sample form a robust empirical basis for evaluating maintenance performance indicators and ultimately developing the Maintenance Planning Framework presented in Phase III of this study.

3.4.3 Phase III: Framework Development and Final Validation

Phase III represents the integration and synthesis stage of this research, where findings from both qualitative and quantitative phases were consolidated to develop a comprehensive Performance-Based Maintenance Planning Framework for *Masjid kariah* in Kelantan. Building upon the outcomes of Phase I (qualitative exploration) and Phase II (quantitative assessment), this phase translates validated constructs into a practical framework aligned with MS ISO 41001:2018 Facility Management – Management Systems and BS 3811:1993 Maintenance Management Terminology.

The development process involved structuring the seven Maintenance Performance Measurements (MPM) – Organisation Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation, and Safety & Health – against the three Maintenance Strategy Criteria (MSC) – Planned Preventive, Planned Corrective, and Unplanned Maintenance. The framework was

conceptualised to reflect the interrelationships between these constructs as tested in the PLS-SEM model, integrating both theoretical rigor and empirical validation.

In this phase, the Delphi panel experts who participated in earlier stages were re-engaged to review, refine, and validate the proposed framework. The validation process focused on assessing the framework's clarity, feasibility, and applicability in the operational context of *Masjid kariah* under the supervision of Majlis Agama Islam dan Adat Istiadat Melayu Kelantan (MAIK). Feedback from the experts ensured that the proposed model not only adheres to facility management standards but also accommodates local administrative, financial, and religious governance structures.

This final validation phase thus bridges the empirical evidence and practical application, ensuring that the developed framework functions as both a decision-support tool and a strategic guideline for mosque maintenance planning. It provides a systematic mechanism for mosque committees, technical agencies, and policy institutions to plan, monitor, and evaluate maintenance activities effectively. The validated framework serves as the culmination of this study, offering a replicable model for other states and community-based religious facilities across Malaysia.

3.4.3.1 Framework Development Process

This section explains the process of developing the maintenance planning framework for *Masjid kariah* in Kelantan. The framework was systematically developed through three sequential phases and five methodological stages under the exploratory sequential mixed-method design. The process began with identifying relevant constructs and indicators from the literature, validating them through expert consensus using the Delphi technique, and subsequently testing and integrating them into an empirically verified model.

i. Phase I: Identification of Constructs through Literature Review

The first phase involved a comprehensive review of literature, standards, and policy documents to identify key constructs and indicators relevant to *Masjid kariah* maintenance planning. The study employed Maintenance Strategy Criteria (MSC) derived from British Standard 3811 (1993) and Maintenance Performance Measurements (MPM) adapted from MS ISO 41001:2018 Facility Management – Management Systems.

i. The MSC represented three dependent variables:
   (1) Planned Preventive Maintenance,
   (2) Planned Corrective Maintenance, and
   (3) Unplanned Maintenance.

ii. The MPM comprised seven independent variables:
   (1) Organisational Management,
   (2) Planning and Scheduling,
   (3) Financial Provision,
   (4) Service Quality,
   (5) Assessment,
   (6) Resource Allocation, and
   (7) Safety and Health.

These constructs were further supported by critical reviews of journals, books, theses, proceedings, and government documents related to mosque management and facility maintenance. The synthesis of this literature produced the initial Conceptual Framework One (CF1), addressing Research Objectives One and Two (RO1–RO2). The relationships between the Maintenance Performance Measurements (MPM) and the Maintenance Strategy Criteria (MSC) are illustrated in Figure 3.8, which presents the initial conceptual framework developed from the literature review.

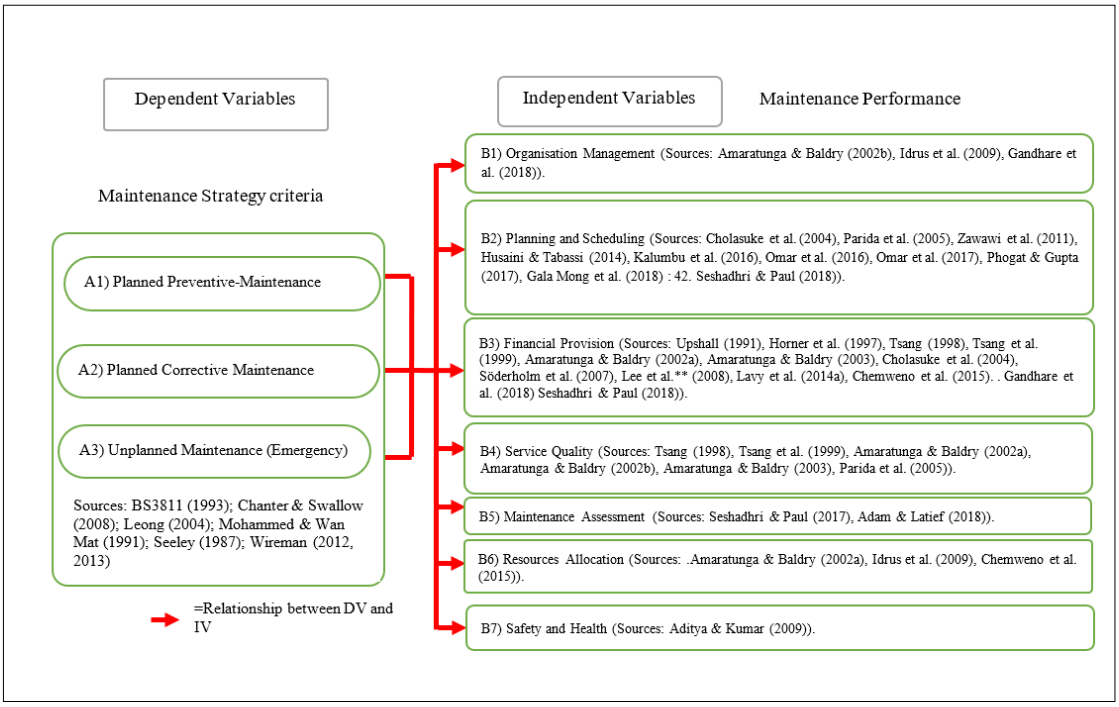

Figure 3.8 The Conceptual Framework One (CF1) Development, with Key Elements in Maintenance Planning for *Masjid kariah* from the Malaysian Perspective. Source: Adapted from British Standard 3811 (1993) and MS ISO 41001:2018

The conceptual framework shown in Figure 3.6 represents the initial theoretical relationships between the Maintenance Performance Measurements (MPM) (independent variables) and the Maintenance Strategy Criteria (MSC) (dependent variables). However, the indicators identified through this review required empirical validation to ensure contextual relevance and practical application within the *Masjid kariah* setting. Therefore, a Delphi validation process was conducted to refine and validate these indicators, as described in the following phase.

ii. Phase II: Validation and Refinement through Delphi Method

The second phase focused on validating the indicators derived from the literature. The Delphi Method was applied through two rounds of consultation with 10 expert panellists from academia, government agencies (JKR, UPMD), and industry practitioners. Experts assessed each indicator based on three criteria: relevance, clarity, and applicability to the mosque maintenance context. Indicators that achieved consensus (mean score ≥3.5) were retained, while ambiguous or redundant indicators were refined or removed. This phase produced Conceptual Framework 2 (CF2) — a refined and contextually validated structure of MSC and MPM constructs — ensuring that the framework reflected both theoretical soundness and practical relevance. This validation step addressed RO1 and RO2, reinforcing the internal validity and construct reliability of the study. Figure 3.9 shows the Conceptual Framework 2 (CF2).

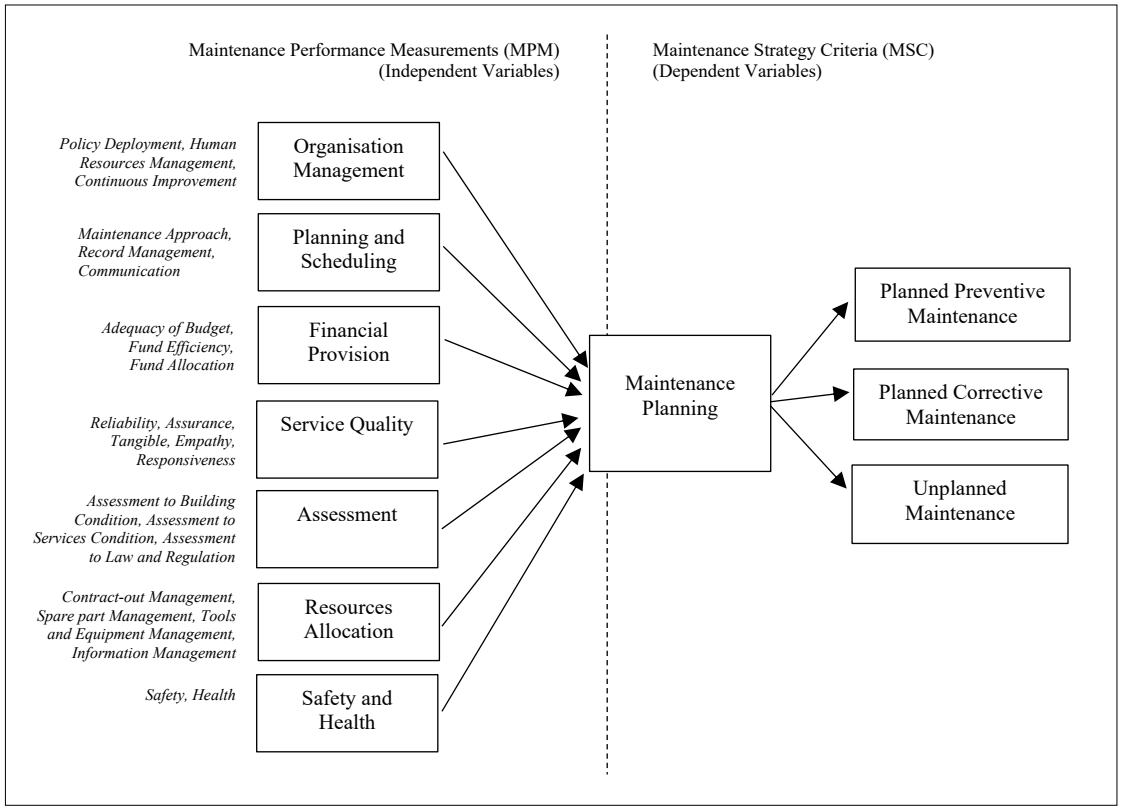

Figure 3.9 The Conceptual Framework 2 (CF2) Development, with Key Elements in Maintenance Planning for *Masjid kariah* from the Malaysian Perspective. Source: Adapted from British Standard 3811 (1993) and MS ISO 41001:2018

iii. Phase III: Hypothesis Development and Framework Integration

The third phase involved constructing a testable conceptual framework and developing hypotheses based on the validated constructs. Guided by past studies (Lam et al., 2010; Loosemore & Hsin, 2001; Wang et al., 2016), the refined framework proposed seven hypotheses linking the seven independent MPM variables to the MSC dimension, operationalised as *Masjid kariah* Maintenance Planning (MKMP).

The following hypotheses were proposed:

H1: Organisational Management (OM) significantly influences *Masjid kariah* Maintenance Planning (MKMP).
H2: Planning and Scheduling (PS) significantly influences MKMP.
H3: Financial Provision (FP) significantly influences MKMP.
H4: Service Quality (SQ) significantly influences MKMP.
H5: Assessment (AS) significantly influences MKMP.
H6: Resource Allocation (RA) significantly influences MKMP.
H7: Safety and Health (SH) significantly influences MKMP.

These hypotheses were later tested through Partial Least Squares Structural Equation Modelling (PLS-SEM) to determine the strength and direction of relationships among variables. The results from this quantitative phase were integrated with the Delphi findings to produce an empirically supported Performance-Based Maintenance Planning Framework. This final framework fulfilled Research Objectives Three and Four (RO3–RO4), establishing a model that combines strategic, operational, and performance elements of mosque maintenance. Figure 3.10 shows the Final Framework development.

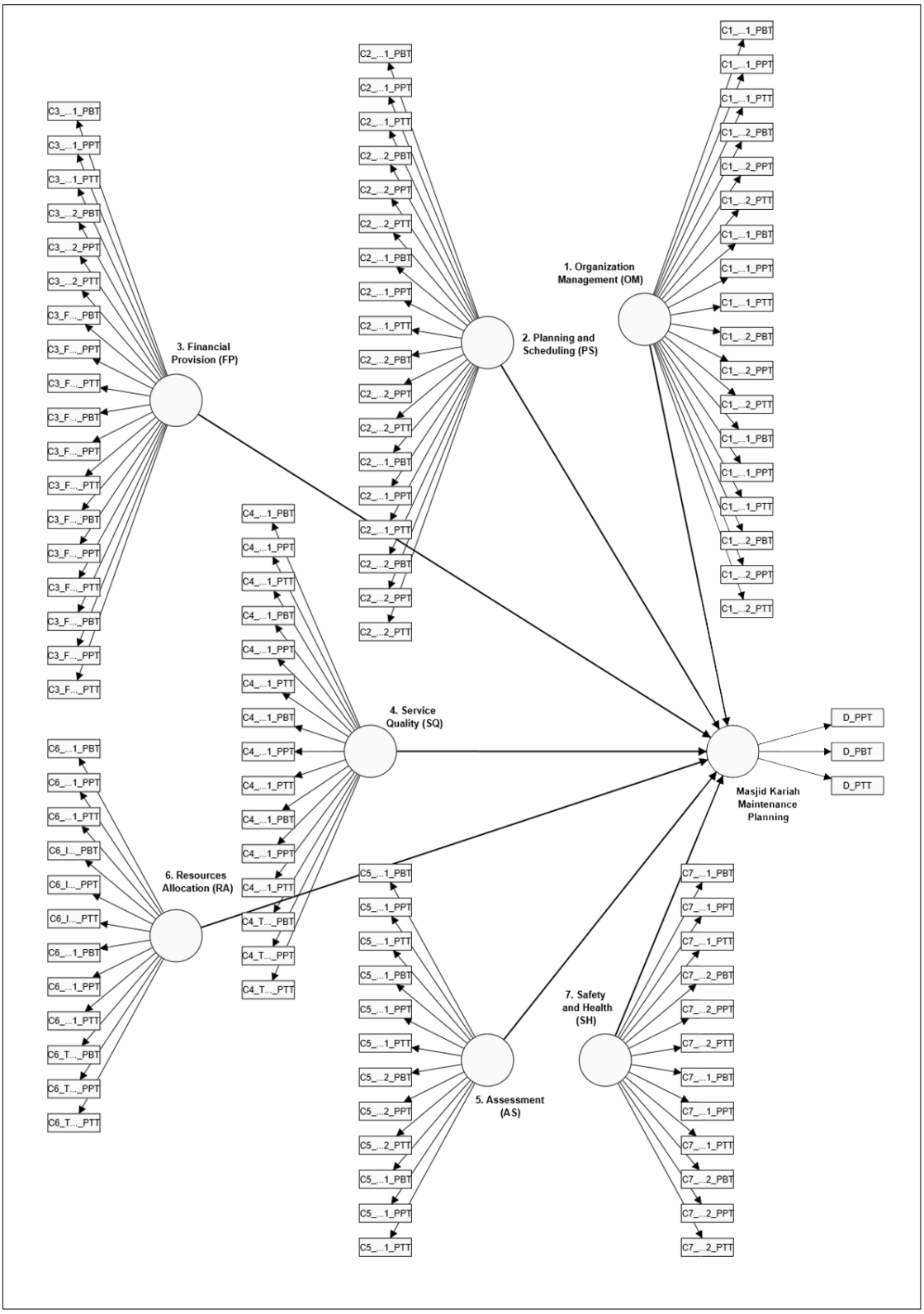

Figure 3.10 The Final Framework Development

In summary, the framework development process progressed through five stages embedded within three broader phases:

i. Identification of constructs through literature review,
ii. Validation and refinement via Delphi consensus,
iii. Conceptual framework construction,
iv. Hypothesis testing using quantitative analysis, and
v. Integration of findings into the final validated framework.

This structured process ensured methodological triangulation, enabling the framework to be both theoretically grounded and empirically validated for application in *Masjid kariah* maintenance management in Kelantan.

3.4.3.2 Validation of Framework Development

This section explains the validation process for the proposed Maintenance Planning Framework for *Masjid kariah* in Kelantan State, developed through the findings of RO1 to RO3. The validation aimed to ensure that the framework is conceptually robust, empirically grounded, and practically applicable in mosque maintenance management. This stage directly addressed Research Objective Four (RO4): To develop a framework for *Masjid kariah*'s maintenance planning in Kelantan State, Malaysia. The validation process was conducted using face-to-face semi-structured interviews and expert validation forms. The combination of these methods allowed for both structured and flexible feedback, enabling experts to evaluate the framework's accuracy, clarity, and relevance.

i. Semi-Structured and Face-to-Face Interviews

The validation process adopted a semi-structured interview approach involving face-to-face session with selected expert. This method allowed for an in-depth exchange of views and clarification of issues during discussions. According to Kumar (2005), face-to-face semi-structured interviews are effective for obtaining detailed qualitative insights, as they allow the interviewer to probe responses and observe non-verbal cues.

The Validation Form (refer to Appendix 15) was used as the main instrument for this process. It consisted of two sections:

i. Section A: Research Recommendations – A Framework of Maintenance Strategies for the *Masjid kariah*. *Experts were asked to review the framework structure, hypothesis relationships, and the strength of the linkages between Maintenance Strategy Criteria and Maintenance Performance Measurements*.
iii. Section B: Overall Feedback and Suggestions for Future Improvement. *Experts provided written comments and justification regarding framework clarity, practicality, and relevance to real mosque maintenance contexts*.

The face-to-face interview lasted approximately 15 to 30 minutes, conducted either in person at the experts' institution (industry practitioners and academicians). The researcher presented the framework diagram (Figure 1) and explained the hypotheses and performance relationships based on the findings from the quantitative phase. Expert was then invited to provide qualitative feedback through the validation form. All sessions were recorded (with prior consent) and transcribed for content analysis. The expert's written responses were also collected as supporting documentation for the validation process.

ii. Sampling Process

A purposive sampling technique was used to select experts who have specialized knowledge in building maintenance, facilities management, and mosque administration (Sekaran & Bougie, 2016). The selection was based on three inclusion criteria:

i. Minimum of five years of experience in mosque or facility maintenance management;
ii. Involvement in planning, policy, or performance evaluation related to mosque or public facilities; and
iii. Representation from academic, and private sectors.

In this study, the proposed framework underwent an expert review to assess the clarity, relevance, and comprehensiveness of its components. In interview-based qualitative validation, sample size should be justified based on the study aim, the specificity of expertise required, and the depth and breadth of feedback expected. The concept of information power indicates that a smaller number of participants may be adequate when the study aim is narrow and the selected participants hold highly specific expertise that directly matches the object being reviewed (Malterud et al., 2016). Empirical evidence further suggests that saturation can be reached with relatively small samples, although the point of sufficiency varies across study designs, the heterogeneity of participants, and the complexity of the phenomenon under investigation (Hennink et al., 2022). Given that interview-based studies frequently underreport or inconsistently report sample-size rationale, researchers are encouraged to explicitly state the reasoning used to establish sample sufficiency so that readers can evaluate adequacy, credibility, and transferability of the validation outcomes (Vasileiou et al., 2018).

Accordingly, this study adopted a minimum of five experts as a sufficient and defensible panel size to validate the framework. This decision is supported by established validation practice in which panels of five experts are commonly used to review and rate relevance and clarity of items or components, providing a balanced judgement while remaining practical for in-depth expert engagement. For example, prior validation studies explicitly report that at least five experts are identified for validation purposes (Maisham et al., 2019), that instruments were validated by five experts (Lau et al., 2023), and that five content experts reviewed items and rated their relevance across iterative rounds (Haidari & Uzun, 2019). Therefore, five experts from the private sector (consultant and facilities management professional) and the public sector (university academicians) were purposively selected to review and refine the framework prior to finalisation. The validation process was conducted in December 2025 and February 2026 through face-to-face interviews to enable detailed probing, clarification of expert suggestions, and component-by-component confirmation. Expert participation was formally documented using a validation form, including informed consent, area of expertise, and institutional affiliation, to strengthen transparency and auditability of the framework validation process.

i. Defining Experts

According to Beecham et al. (2005), an expert is a person who has held a position of professional responsibility and possesses specialized experience for several years in a specific domain. For this study, expert is defined as individual who:

i. Possess a minimum of five years of relevant experience in mosque or facility maintenance;
ii. Hold managerial, technical, or academic positions related to performance-based maintenance; and
iii. Have contributed to decision-making or policy development in mosque management or built environment sectors.

This combination of experience ensured that the feedback covered both theoretical and practical perspectives, enabling a comprehensive validation of the framework. Table 3.24 shows the list of experts' profile.

Table 3.24
The List of Experts and Profiles

No.	Expert Code	Sector/ Organisation	Designation	Year of Experience	Justification of Selection	Field
1.	EA-1	Consultant (Amas FM Consultant Sdn Bhd)	Director	10	Private Sector — extensive FM/building maintenance exposure; suitable to review practicality of implementation for community facilities	Facility Management & Building Maintenance (practice pengurusan bangunan; pengalaman FM & building maintenance)
2.	EA-2	Consultant (Vertex Central Industries Sdn. Bhd.)	Group Managing Director	9	Private Sector — senior industry practitioner (construction leadership) to validate feasibility of governance/financial-	Construction management / contractor (civil & structural) + construction project management

No.	Expert Code	Sector/ Organisation	Designation	Year of Experience	Justification of Selection	Field
					procurement controls and implementation realism	
3.	EA-3	Consultant (Perunding Ilham IZ (M) Sdn Bhd)	Managing Director	18	Private Sector — M&E building services specialist with mosque-related tender/site supervision exposure; strengthens technical-operational validation of services scope, budgeting, and contractor accountability	M&E building services (ACMV, fire protection, plumbing) + tender/contract management & site supervision (mosque facilities)
4.	EB-1	Universiti Kebangsaan Malaysia (UKM)	Registered Property Manager (RPM) registered with the Board of Valuers, Appraisers, Estate Agents and Property Managers (LPPEH/BOVAEP), Malaysia (Registration No.: PM2357)	12	Public Sector — academician/ practitioner background with registered property management credential; suitable to review governance feasibility, documentation discipline, and practical implementation of maintenance planning for community facilities.	Property Management / Facility & Building Maintenance (registered property manager; experience in property management + academia)
5.	EB-2	Universiti Teknologi	Senior Lecturer	27	Public Sector —	Town and Regional

No.	Expert Code	Sector/ Organisation	Designation	Year of Experience	Justification of Selection	Field
		MARA (UiTM)	(currently); former MBSJ officer with private-sector experience		academician with planning and local-authority exposure; strengthens theoretical and implementation scrutiny, especially governance continuity, stakeholder coordination, and operational realism for Masjid Kariah committees.	Planning; Physical Planning; Urban Environment; Low Carbon Cities; Sustainable Development
Note: EA – Industry Practician expert EB – Academician expert						

ii. Qualitative Content Analysis

The data gathered from the face-to-face interview and written validation forms were analysed using qualitative content analysis, following the procedures recommended by Rahman et al. (2021). This approach allowed for systematic coding and categorization of textual feedback to identify patterns, agreements, and recommendations among experts.

The analysis process was divided into three stages:

i. Data Reduction – compiling and cleaning expert feedback from validation forms and transcripts.
ii. Categorization – grouping feedback under key framework components such as strategy criteria, indicator relationships, and framework applicability; and
iii. Interpretation – synthesizing the findings to refine the framework and confirm its logical and practical soundness.

Results from the validation revealed that the expert largely agreed that the framework:

i. Addresses key challenges of mosque maintenance identified in RO1;
ii. Incorporates relevant and measurable performance indicators (RO2 and RO3); and
iii. Offers a comprehensive and implementable model for maintenance planning of *Masjid kariah* (RO4).

Based on experts' input, several modifications were made to enhance clarity, terminology, and indicator grouping. The final validated version of the framework is presented in Chapter 6, Section 6.3, showing a strengthened alignment between maintenance strategy criteria and performance measurements.

3.4.4 Summary of Research Design, Unit Analysis and Types of Analysis

This section provides a coherent summary of the overall research design, data collection process, unit of analysis, and types of analysis undertaken in alignment with the four Research Objectives (RO1–RO4). The study adopts an Exploratory Sequential Mixed-Method Design, which integrates qualitative and quantitative phases to systematically develop, test, and validate a Maintenance Planning Framework for *Masjid kariah* in Kelantan. Table 3.25 shows the timeline for data collection procedure. The entire research process was conducted in three sequential phases:

Table 3.25
Timeline for Data Collection Procedure

Timeline	Procedure
Phase I – Qualitative Exploration (RO1 & RO2)	
	Objective: To address the issues and challenges related to mosque maintenance as a foundational aspect (RO1) & To investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective (RO2). **Purpose:** To identify the issues, challenges, and key performance indicators related to maintenance planning of *Masjid kariah*. **Method:** In-depth literature review and expert validation through the Delphi Method (two rounds involving 10 experts from JKR, JAHEAIK, UPMD, and academia).

Timeline	Procedure
	Procedure: 1. **Round 1**: Semi-structured interviews and open-ended responses were analysed thematically. 2. **Round 2**: Responses were refined into structured items to achieve consensus using the Delphi technique. **Unit of Analysis:** 10 expert panels. **Type of Analysis:** Qualitative content analysis and consensus filtering using Delphi iterations. **Output:** Identification of seven maintenance performance measurement indicators and three maintenance strategy criteria.
Phase II – Quantitative Validation (RO3)	
October 2021 → November 2022	**Objective:** To evaluate the performance indicators on maintenance planning of *Masjid kariah* in Kelantan State (RO3). **Purpose:** To empirically test and validate the identified indicators and their interrelationships. **Method:** Structured questionnaire survey and statistical validation. **Procedure:** 1. **Content Validity Index (CVI)**: Six experts (two academicians and four maintenance officers) assessed item relevance. 2. **Pilot Survey**: Thirty (30) *Masjid kariah* committee members evaluated questionnaire reliability. 3. **Main Survey**: 354 committee members from 59 *Masjid kariah* across 10 districts in Kelantan participated. 4. **Unit of Analysis**: Committee members of *Masjid kariah*. 5. **Type of Analysis**: Reliability Analysis: Cronbach's Alpha, Composite Reliability, and Average Variance Extracted (AVE). 6. **Exploratory Factor Analysis (EFA)** to identify factor loadings and latent constructs. 7. **Confirmatory Factor Analysis (CFA)** using PLS-SEM and SPSS to validate measurement and structural models. **Output:** Validated relationships between maintenance strategy criteria and maintenance performance measurements.
Phase III – Framework Development and Final Validation (RO4)	
January 2023 → October 2023 → December 2025	**Objective:** To develop a framework for *Masjid kariah*'s maintenance planning in Kelantan State, Malaysia (RO4). **Purpose:** To integrate findings from both qualitative and quantitative analyses into a comprehensive, maintenance planning framework. **Method:** Framework synthesis and expert validation.

Timeline	Procedure
	Procedure: 1. **Integration of findings** from Phase I and Phase II to construct the proposed framework. 2. **Validation by the five experts** via face-to-face interviews and rating scales for practicality, clarity, and applicability. 3. **Unit of Analysis**: Five experts panel (3 industry practitioners and 2 academicians). 4. **Type of Analysis**: Descriptive frequency and percentage analysis for framework validation. **Output:** Final validated Maintenance Planning Framework for *Masjid kariah* in Kelantan.

Table 3.26 refers to an overall summary of the research design and types of analysis in each phase, which included each objective, method, unit analysis, and types of analysis. Each objective has their own method of analysis, unit analysis, and types of analysis in this study.

Table 3.26
Summary of Research Design, Unit Analysis and Types of Analysis

Phase	Research Objectives	Methods	Unit Analysis	Types of Analysis
Phase I: Qualitative Exploration	RO1 & RO2 – Identify issues, challenges, and performance indicators for mosque maintenance planning.	1. In-depth literature review 2. Delphi Method (Round 1 & 2 – Semi-Structured Interviews).	10 Expert Panels (Academicians, JKR, JAHEAIK and UPMD officers)	1. Content Analysis 2. Consensus Filtering (Delphi Round 1 & 2)
Phase II: Quantitative Validation	RO3 – Evaluate and validate relationships between maintenance strategy criteria and performance measurements.	1. Content Validation Index (CVI) 2. Pilot Study 3. Questionnaire Survey (using SPSS v28 & SmartPLS 4).	1. 6 Experts (2 Academicians + 4 Maintenance Officers) 2. 30 Pilot Respondents 3. 354 Committee Members of 59 *Masjid kariah* across Kelantan	1. Reliability Analysis (Cronbach's Alpha, CR, AVE) 2. Exploratory Factor Analysis (EFA) 3. Confirmatory Factor Analysis (CFA) 4. PLS-SEM Structural Model Assessment
Phase III: Framework Development and Final Validation	RO4 – Develop and validate the performance-based maintenance planning framework for *Masjid kariah*.	1. Framework Synthesis 2. Expert Validation Interview (Face-to-Face).	Five Experts Panel (Industry Practitioners and Academicians)	1. Descriptive Feedback Evaluation on Framework Applicability

In summary, the panel involved in this study during semi-structured question comprised of 10 experts from different categories, namely, academicians, practitioners, and staff at Jabatan Kerja Raya and Unit Penyelenggaraan Majlis Daerah. The content validation of the questionnaire was conducted by six panellists comprising two academicians and four maintenance staff to validate the questions, while the pilot survey involved thirty (30) *Masjid kariah* committee members as respondents to evaluate the reliability of the questionnaire. For the questionnaire survey, three hundred fifty-four (354) respondents were involved among the committee members of *Masjid kariah* in 10 districts within the state of Kelantan.

3.5 Data Analysis

In this study, data analysis was conducted based on the research objectives. There were three types of data analysis conducted in this study, as follows: (1) content analysis, (2) descriptive statistical analysis and (3) inferential statistical analysis. For Research Objective One (RO1), one analysis method was used, i.e., content analysis. For Research Objective Two (RO2), two analysis methods were used, i.e., content analysis and inferential statistical analysis. Meanwhile, for Research Objective Three (RO3), two analysis methods were used, i.e., descriptive statistical analysis and inferential statistical analysis, and for Research Objective Four (RO4), one analysis methods were used, i.e., content analysis. Table 3.27 shows the type of analysis that have been used in this study.

Table 3.27
Types of Data Analysis that have been Used in This Study

No.	Research Objective	Type of Data Analysis	Software/Tools Used
1.	Research Objective One (RO1)	1. Secondary Data Review (*Content Analysis*)	Depth Literature Review
2.	Research Objective Two (RO2)	1. Delphi Method (*Content analysis & descriptive consensus*) 2. Content Validity Index (CVI) (*Content Analysis*) 3. Exploratory Factor Analysis (EFA) (*Inferential Statistical Analysis*) 4. Confirmatory Factor Analysis (CFA) (*Inferential Statistical Analysis*)	Manual Calculation / Microsoft Excel & SmartPLS 4
3.	Research Objective Three (RO3)	1. Frequency & Percentage (*Descriptive Statistical*	SPSS v28 & SmartPLS 4

No.	Research Objective	Type of Data Analysis	Software/Tools Used
		Analysis) 2. Structural Equation Modelling (PLS-SEM) analysis (*Inferential Statistical Analysis*)	
4.	Research Objective Four (RO4)	Integration of Quantitative and Qualitative Findings (Triangulation and Expert Validation) (*Qualitative Content Analysis*)	Manual Calculation / Microsoft Excel

Note:
RO1: To address the issues and challenges related to mosque maintenance as a foundational aspect
RO2: To investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective
RO3: To evaluate the performance indicators on maintenance planning of *Masjid kariah* in Kelantan State
RO4: To develop a framework for *Masjid kariah*'s maintenance planning in Kelantan State, Malaysia

3.5.1 Content Analysis

There are four types of analysis in this section i.e. Basis for Data Analysis Techniques, Delphi Method, Content Validity Index (CVI) and Framework Validation.

3.5.1.1 Basis for Data Analysis Techniques

Content analysis uses secondary data collection from related sources, such as previous studies on the related topic, documents of various journals, books, theses, proceedings, government documents, and newspapers. This phase primarily corresponds to Research Objective One (RO1): to address the issues and challenges related to mosque maintenance as a foundational aspect. The content analysis was conducted to systematically review and synthesise existing literature on mosque maintenance, identifying recurring themes, issues, and indicators relevant to the development of the initial framework. This process established the theoretical basis for the study by defining the key Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM) constructs to be refined in the subsequent Delphi phase. This survey provided the data for further analysis for MSC and MPM based on the developed and testable hypotheses (Gan et al., 2017). This study proposed three initial attributes for maintenance strategy criteria and 22 initial dimensions for seven maintenance performance constructs. The probable attributes for maintenance strategy criteria and maintenance performance measurements have been extracted from the

literature. These proposed attributes were then finalised with the research supervisor before being sent to the expert panel.

3.5.1.2 Delphi Method

The Delphi method was adopted in this study to fulfil Research Objective Two (RO2): to investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective. The Delphi technique was selected because it offers a systematic, iterative, and consensus-driven approach for refining and validating expert opinions on the constructs and indicators identified from the literature review in Chapter 2.

This method is appropriate for exploratory studies that aim to achieve consensus among experts when empirical data are limited or when indicators require contextual adaptation. It allows experts to share professional judgment independently and anonymously, thereby reducing social pressure and dominance bias (Hsu & Sandford, 2007; Okoli & Pawlowski, 2004). The Delphi process enables the researcher to obtain a high level of reliability and validity through multiple rounds of feedback and revision, ensuring that each construct, dimension, and indicator reflects expert consensus and practical relevance within the Malaysian mosque maintenance context.

In this study, the Delphi method involved two rounds. The first round focused on refining the essential attributes of maintenance strategy criteria and maintenance performance measurements derived from the literature. A Google Form questionnaire was distributed to a selected panel of eleven experts consisting of academicians, mosque administrators, and maintenance practitioners. Each expert assessed the relevancy and clarity of the proposed indicators based on the study's conceptual framework. The second round was conducted to improve the consistency and accuracy of the expert judgments by re-evaluating the indicators using the results of the first round. The process continued until a sufficient level of consensus was achieved.

The Delphi method was deemed suitable because it supports the refinement and validation of a performance-based framework through the integration of expert knowledge. It has been successfully applied in previous research on building maintenance, facility management, and framework development (Ali & Chua, 2016; Muin et al., 2016; Ogunbayo et al., 2022). These studies demonstrated that Delphi is effective for validating constructs and establishing indicator relevance in contexts

where stakeholder experience and expert judgment are crucial. As shown in Figure 3.11, the Delphi process in this study followed eleven sequential steps from literature review, expert selection, question development, and iterative analysis until consensus was reached and a final validated set of indicators produced. The results were later verified through the Content Validity Index (CVI) and further confirmed during semi-structured interviews in Chapter 6.

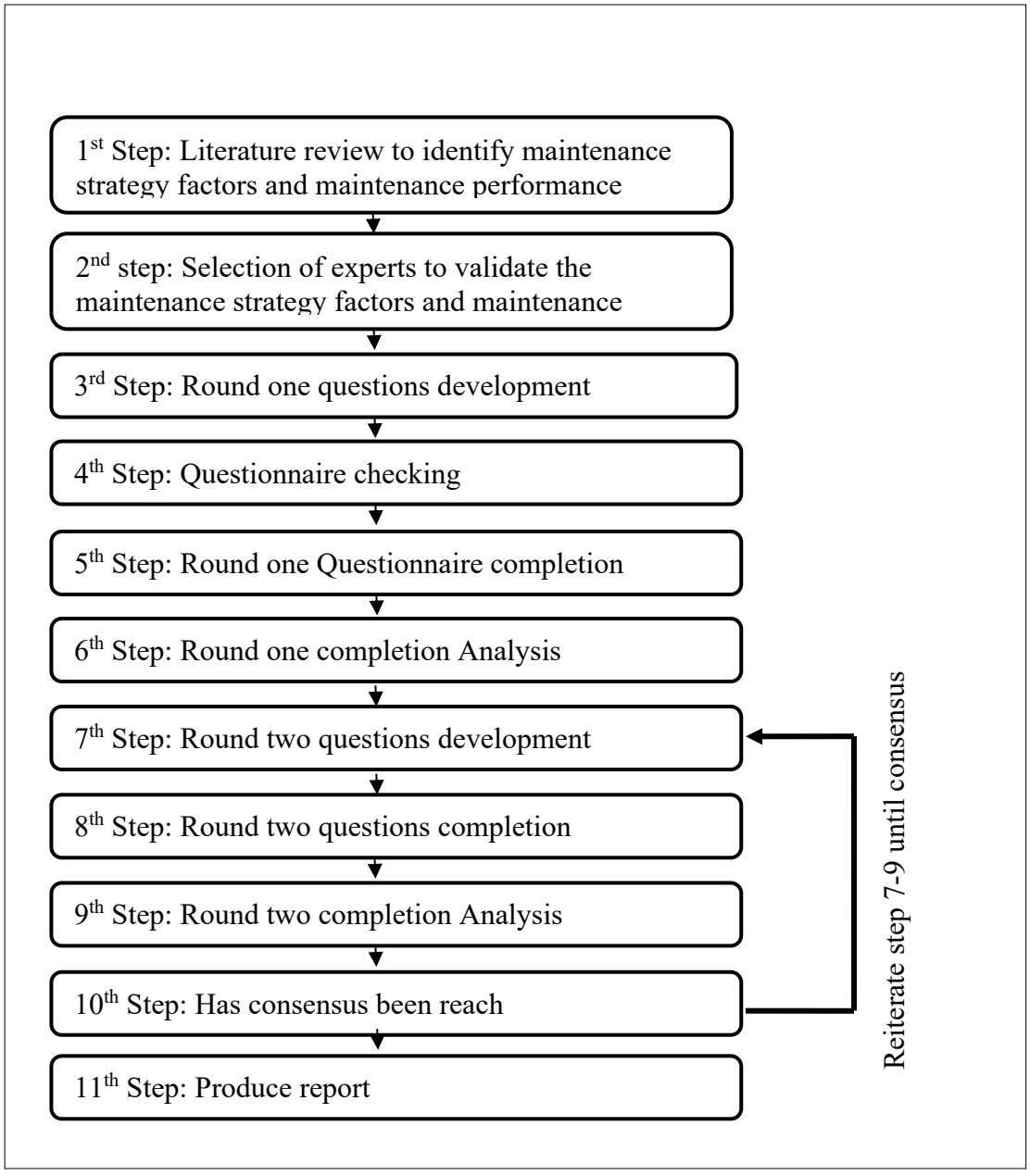

Figure 3.11 A Flowchart of the Delphi Process (Adapted from et al., 2022)

3.5.1.3 Content Validity Index (CVI)

The Content Validity Index (CVI) is a statistical tool used to evaluate whether a questionnaire effectively measures the intended constructs. It quantifies the degree to which the instrument's items are relevant, clear, and representative of the underlying concept as judged by a panel of experts (Almanasreh et al., 2019; Othman et al., 2024).

In this study, the CVI process was conducted to support Research Objective Two (RO2): to investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective. It served as a validation step to statistically confirm the relevance and clarity of the performance indicators and maintenance strategy criteria refined through the Delphi process. The CVI was carried out following Yusoff's (2019) six-step content validation framework: (1) preparing the content validation form, (2) selecting expert panels, (3) conducting validation sessions, (4) reviewing domains and items, (5) providing scores and calculating the CVI, and (6) evaluating the response process. A structured validation form with domain definitions and a four-point Likert scale (1 = not relevant to 4 = highly relevant) was developed and distributed to six experts representing academia, mosque administration, and maintenance practitioners.

Face-to-face validation sessions were conducted to allow direct discussion and immediate feedback. Experts evaluated each of the 63 items for relevance, clarity, and representativeness. The Item-Level Content Validity Index (I-CVI) and Scale-Level CVI (S-CVI/Ave) were computed to determine the adequacy of each item. Items scoring below the acceptable threshold of I-CVI < 0.80 were removed, resulting in 28 items being eliminated and 35 items retained for further assessment. A response process evaluation was then undertaken to confirm that the retained items were linguistically clear and contextually appropriate. The experts agreed that all 35 final items met the minimum clarity and relevance standards, thereby ensuring that the questionnaire was both theoretically grounded and empirically reliable for subsequent pilot testing. Consequently, the CVI process validated the refined performance indicators, ensuring their suitability for assessing mosque maintenance planning within the Malaysian context.

3.5.1.4 Framework Validation

The framework validation stage was conducted to ensure that the developed maintenance planning framework for *Masjid kariah* is theoretically robust and contextually applicable before its presentation in Chapter Six. This process corresponds to Research Objective Four (RO4): To develop a framework for *Masjid kariah*'s maintenance planning in Kelantan State, Malaysia.

The validation aimed to confirm that each component of the proposed framework including the Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurements (MPM) is logically coherent, relevant to mosque maintenance practice, and consistent with the study's objectives. This process adopted a qualitative validation approach using semi-structured expert interviews, which allowed experts to critically assess the framework's structure, content, and practical utility.

A purposive sampling technique was used to select the expert panel, comprising professionals and scholars with significant experience in building maintenance, mosque facility management, and related policy implementation. The experts were provided with a summary of the proposed framework and asked to evaluate it based on three main criteria, as suggested by Lynn (1986) and Yusoff (2019):

i. Relevance – whether the framework elements accurately represent mosque maintenance planning practices;
ii. Clarity – whether the terminology and linkages between constructs are understandable and logically presented; and
iii. Applicability – whether the framework can be practically applied within real mosque maintenance contexts.

Each interview was recorded and transcribed for qualitative content analysis, enabling thematic interpretation of expert feedback. The insights gathered during this stage were subsequently analysed and discussed in Chapter 6, leading to the refinement and confirmation of the final validated framework.

3.5.2 Descriptive Statistical Analysis

This section describes the quantitative analysis procedures used to address Research Objective Three (RO3): to evaluate the performance indicators on maintenance planning of *Masjid kariah* in Kelantan State. Two main stages of analysis were performed, namely data screening and cleaning before reliability testing, followed by frequency distribution analysis. These analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 28 to ensure data accuracy, normality, and reliability prior to further interpretation.

3.5.2.1 Data Screening and Cleaning before Reliability Test conducted

The acquired data have been checked for mistakes and missing values, and then, cleansed. Otherwise, any inference and interpretation drawn from such analysis could be erroneous. Therefore, the items involved were coded and keyed in the data into the Statistical Package for the Social Sciences (SPSS), version 28:

i. Normality Test

According to Tabachnick and Fidell (2001), a normality test refers to an assumption that all linear combinations of variables are distributed normally. Therefore, in this study, a normality test was conducted to underlie the data set to be normally distributed. Pallant (2013) indicated that a non-significant result (p-value > 0.05) would be shown as normal, while p-value < 0.05 is quite common for a sample size of more than 200 respondents. This test is essential in most multivariate analyses and is required in exploratory research (Hair Jr, Black, Babin, Anderson, & Tatham, 2010). The regression analysis in SPSS was assumed to be normally distributed. However, the major challenges in social sciences are the distribution of the data collection.

ii. Treatment of Outlier

An outlier is one of the aspects of the distribution score and the nature of the underlying relationship between the variables, which should be part of the initial process. Hair Jr et al. (2010) denoted that outliers could have extremely low or extremely high scores across the variables.

Pallant (2013) suggested various outlier treatment methods in the analysis and ways to detect or eliminate the outliers in a particular set of data. The Shapiro-Wilk and the Kolmogorov-Smirnov tests were used to evaluate the normality of the assumptions in this study.

iii. Replace Missing Value

To detect any missing response from the data, a frequency test was carried out for every variable. All sets of questionnaires returned were found to have no missing value from the respondents.

3.5.2.2 Frequency distribution

Frequency distribution analysis was conducted on the measured demographic factors, such as position level, marital status, gender, length of service, ownership of *Masjid kariah*, and age of *Masjid kariah*. This analysis has been useful for determining the frequency and percentage of respondent participation in this study. Meanwhile, the rank score analysis was used for validating the framework of maintenance planning for *Masjid kariah* in Kelantan. Table 3.28 shows the types of data and techniques used in this study.

Table 3.28
Types of Data and Techniques

Section	Items	Technique
A	Demographic Analysis respondent and *Masjid kariah*	Frequency Distribution Analysis
B	Implementation of Maintenance Strategy in *Masjid kariah*	Frequency Distribution Analysis
C	Relationship Between Maintenance Strategy criteria and Maintenance Performance Measurements	Frequency Distribution Analysis

3.5.3 Inferential Statistical Analysis

The inferential statistical analyses in this section correspond to Research Objective Two (RO2) and Research Objective Three (RO3). The Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed to refine and validate the underlying structure of the maintenance strategy criteria and performance indicators identified through the Delphi and CVI processes, thereby fulfilling RO2 - To investigate performance indicators relevant for evaluating maintenance planning of

Masjid kariah from Malaysia's perspective. Subsequently, the Partial Least Squares Structural Equation Modelling (PLS-SEM) was employed to test the hypothesised relationships between the validated constructs, corresponding to RO3 - To evaluate the performance indicators on maintenance planning of *Masjid kariah* in Kelantan State.

3.5.3.1 Exploratory Factor Analysis (EFA)

Goldberg & Velicer (2006) have indicated that factor analysis has been used for various purposes, with enormously different views on the scientific status of factors over the years. Data from the pilot study underwent the Exploratory Factor Analysis (EFA) via SmartPLS 4 software and PLS-SEM analysis.

3.5.3.2 Confirmatory Factor Analysis (CFA)

Confirmatory Factor Analysis (CFA) is a statistical technique used to test whether a set of observed variables represents a number of underlying latent constructs. It is a subset of Structural Equation Modeling (SEM) and is widely used across various fields such as behavioural sciences, social sciences, kinesiology, and more. CFA is particularly useful for validating the structure of a theoretical model by confirming the expected relationships between observed variables and their underlying latent factors. This process involves specifying a model based on theoretical expectations and then using empirical data to test the model's fit (Said et al., 2011).

While CFA is a powerful tool for validating theoretical models, it requires careful consideration of model specification, data quality, and fit assessment. Researchers must ensure that their models are theoretically grounded and empirically supported to draw valid conclusions. Additionally, advancements in CFA methodologies, such as SCFA, offer promising solutions to some of the traditional challenges associated with high-dimensional data and model complexity (Yang et al., 2024). Data from the pilot study underwent the Confirmatory Factor Analysis (CFA) via SmartPLS 4 software and PLS-SEM analysis.

3.5.3.3 Structural Equation Modelling (PLS-SEM) analysis

Inferential statistical analysis, as a quantitative approach, was used to analyse data from the questionnaire survey (empirical survey) using the Partial Least Squares Structural Equation Model approach (PLS-SEM). The PLS-SEM was used to test seven primary hypotheses in this study through the Statistical Package for the Social Sciences (IBM SPSS Statistics) and SmartPLS Statistics software applications. The PLS-SEM was used because this research was non-parametric and this approach offered more accurate estimations by roughly estimating the relationships and rallied the theory validation(S. Hassan, Buang, Wahab, Shamsudin, & Hasim, 2020).

The reliability and validity of the measurement model have been assessed using the partial least squares structural equation modelling (PLS-SEM) analysis in the SmartPLS software application. The reliability of the model was evaluated to ensure that the measurement instrument was free of random errors, while its validity was assessed based on the capacity of the dimensions to distinguish real differences related to the characteristics being measured (Hashim et al., 2023).The PLS-SEM analysis was also performed to assess two main aspects: to test the measurement model, with the aim of validating the instruments used in the study; and to examine the structural model, with the aim of testing the hypotheses formulated in this research.

Figure 3.12 shows the two stages of PLS-SEM analysis and assessments.

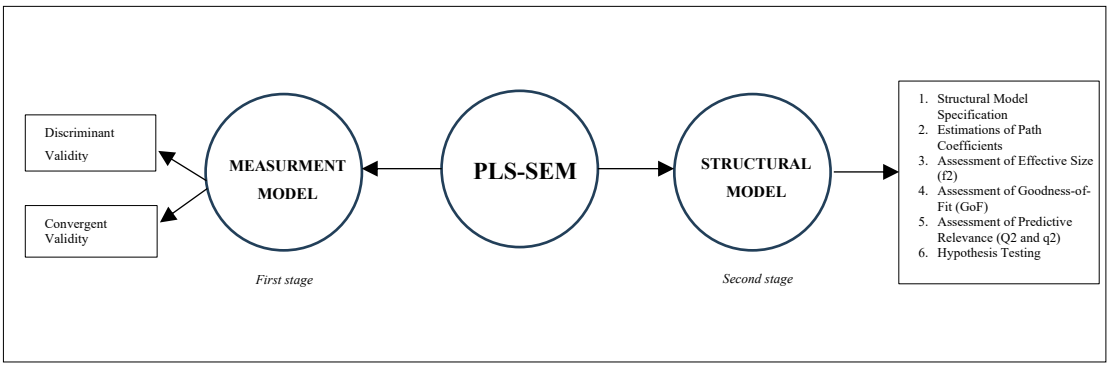

Figure 3.12 The Two Stages of PLS-SEM Analysis and Assessments (Adopted from Hashim et al. (2023)

To evaluate the PLS-SEM models, this study has examined their reliability to ensure that the measurement instruments were free of random errors and validity to

ensure that the dimensions could accurately reflect real differences in the object related to the characteristic being measured (Abu et al., 2021). The PLS-SEM analysis was also conducted to test both the measurement model (to validate the instruments) and the structural model (to test the hypothesis). Table 3.29 shows a summary of the measurement and structural model cut-off values in this study.

Table 3.29
The Measurement and Structural Model Cut-off Values

No.	Testing	Description	References
Reflective Measurement Model			
Convergent Validity (CV)			
1.	Reflective indicator loading	Values for loadings are set at > 0.5.	Jayasingam et al. (2018); Rezaei et al. (2016)
2.	Composite Reliability (CR)	Recommended CR values within 0.70 – 0.90 are satisfactory.	Hair et al. (2019); Rezaei et al. (2016)
3.	Average Variance Extracted (AVE)	AVE for each construct should be > 0.5.	Hair et al. (2019); Jayasingam et al. (2018); Kashif et al. (2018); Rezaei et al. (2016); Samuel & Ramayah (2016)
Discriminant Validity (DV)			
4.	Heterotrait-monotrait ratio of correlations (HTMT)	a. For conceptually similar constructs: HTMT < 0.90. b. For conceptually different constructs: HTMT < 0.85.	Hair et al. (2019)
Formative Measurement Model			
5.	Variation Inflation Factor (VIF)	a. Probable (i.e., critical) collinearity issues when VIF > 5. b. Possible collinearity issues when VIF > 3-5. c. Ideally show that VIF < 3.	Hair et al. (2019)
6.	Statistical Significance of Weights	*p*-value < 0.05 or the 95% confidence interval (based on the percentile method or in case of a skewed bootstrap distribution, the BCa method) does not include zero.	Hair et al. (2019)
Structural Model			
7.	Coefficients of Determination (R^2)	R^2 result is equal to 1 for repeated indicator approach	Becker et al. (2012)

No.	Testing	Description	References
8.	Q^2 Value	a. Blindfolding-based cross validated redundancy measure (Q^2). b. Values higher than zero denote meaningful. c. Values larger than 0, 0.25 and 0.50 indicate small, medium and large predictive accuracy of the PLS path model.	Hair et al. (2019); Samuel & Ramayah (2016)
9.	PLS Predict	Q^2 predict values > 0 indicate that the model outperforms the most naïve benchmark (i.e., the indicator means from the analysis sample).	Hair et al. (2019); Shmueli et al. (2019)
10.	Size and Significance of Path Coefficients		Hair et al., 2014; Gholami et al., 2016.

Adapted from Abu et al. (2021)

3.6 Ethics in Data Collection

Sekaran & Bougie (2016) divided ethics into two categories: ethics of the researchers and ethics of the respondents. Respondent participation in this study was completely voluntary, and they have a right to withdraw at any time as stated in the cover letter of the questionnaire. Ethical approval to conduct this study obtained from UiTM Research Ethics Committee (600-TNCPI (5/1/6) with reference number: REC/12/2021 (MR/936) dated 14th December 2021 (Refer Appendix 12).

3.7 Summary

This chapter has discussed the research methodology used to conduct this study. It has highlighted the research model comprising three dependent variables and seven independent variables based on the developed hypotheses. The research design consisted of a mixed method approach the using exploratory sequential design, whereby the qualitative method was followed by the quantitative method. This chapter focus on the processes conducted in this study, including research design, instruments, population, sample size, qualitative survey via the Delphi method, a pilot test, questionnaire distribution, data collection and data analysis. Table 3.30 shows the overall research methodology of this study.

Table 3.30
Research Matrix for the Development of Maintenance Planning Framework for *Masjid kariah*

RESEARCH AIM	This research aims to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.				
RESEARCH PROBLEM	**RESEARCH QUESTIONS**	**RESEARCH OBJECTIVE**	**RESEARCH METHODOLOGY**		**RESEARCH OUTPUT**
			DATA COLLECTION	**DATA ANALYSIS**	
1. Existing studies on mosque maintenance in Malaysia are fragmented and largely descriptive, with no systematic synthesis of the issues and challenges affecting *Masjid kariah*; as a result, decision-makers lack a clear baseline of problems and performance gaps to guide strategic, performance-based maintenance planning.	**Review of Literature**				
	RQ1: What are the main issues and challenges associated with mosque maintenance in Malaysia?	RO1: To address the issues and challenges related to mosque maintenance as a foundational aspect	Secondary data: Journal, books, theses, proceedings, government documents and newspapers Qualitative Approach: 1. Conduct a comprehensive review to develop the body of knowledge on maintenance strategy criteria and maintenance performance measurements. 2. Compile and synthesis relevant secondary data related to maintenance strategy criteria and performance measurements for mosque maintenance	Document review/Literature Review: 1. Systematically analyse secondary sources to identify recurring themes, key maintenance challenges, and gaps in mosque maintenance practices. 2. Extract and classify issues and challenges affecting *Masjid kariah* maintenance practices at national and local levels.	Identification of relevant maintenance strategy criteria for mosque maintenance planning. Identification of maintenance performance measurements applicable to *Masjid kariah* maintenance planning. Synthesized thematic findings on issues and challenges in mosque maintenance as foundational input for subsequent phases (RO2–RO4).

RESEARCH AIM	This research aims to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.				
RESEARCH PROBLEM	**RESEARCH QUESTIONS**	**RESEARCH OBJECTIVE**	**RESEARCH METHODOLOGY**		**RESEARCH OUTPUT**
			DATA COLLECTION	**DATA ANALYSIS**	
	Main Study				
1. There is no agreed set of context-specific performance indicators for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective; current practice relies on generic building maintenance indicators, leading to inconsistent assessment and difficulty in prioritizing appropriate maintenance strategies.	RQ2: What are the key performance indicators for current maintenance planning of *Masjid kariah* from Malaysia's perspective?	RO2: To investigate performance indicators relevant for evaluating maintenance planning of *Masjid kariah* from Malaysia's perspective	Primary Data: Semi-structured interviews Qualitative Approach: 1. 10 expert panels consisting of academicians, maintenance practitioners, Jabatan Kerja Raya (JKR), and Unit Penyelenggaraan Masjid Daerah (UPMD). 2. Collect expert insights to validate and refine maintenance strategy criteria and maintenance performance measurements suitable for *Masjid kariah*.	Two round Delphi Method: 1. Round 1: Identify, validate, and refine potential maintenance performance indicators. 2. Round 2: Achieve expert consensus on the relevance, clarity, and applicability of the indicators for *Masjid kariah*.	Assessment and confirmation of relevant maintenance strategy criteria for *Masjid kariah*. Identification of additional or specific attributes required to strengthen maintenance performance measurements. Development of a validated list of performance indicators suitable for evaluating *Masjid kariah* maintenance planning.
1. Although potential maintenance performance indicators have been identified, their clarity, relevance and applicability to *Masjid*	RQ3: How effective are the identified performance indicators in evaluating the current maintenance planning of *Masjid kariah*	RO3: To evaluate the performance indicators on maintenance planning of *Masjid*	**Content Validity Stage (Expert Review)** Primary Data: 1. Face-to-face interviews 2. Content Validity Index	**Content Validation (Expert CVI)** 1. Prepare CV form 2. Select expert review panel 3. Conduct content	Validated questionnaire items with acceptable content validity indices (I-CVI and S-CVI/Ave). Removal or refinement

RESEARCH AIM	This research aims to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.				
RESEARCH PROBLEM	**RESEARCH QUESTIONS**	**RESEARCH OBJECTIVE**	**RESEARCH METHODOLOGY**		**RESEARCH OUTPUT**
			DATA COLLECTION	**DATA ANALYSIS**	
kariah in Kelantan have not been empirically validated, creating a risk of weak construct validity and unreliable measurements if a structured questionnaire is used without prior testing. 2. The strength and direction of relationships between maintenance performance indicators and the maintenance planning of *Masjid kariah* are not yet empirically established; without robust quantitative evidence, mosque authorities cannot determine which factors most strongly influence maintenance strategy decisions and overall planning effectiveness.	in Kelantan State?	*kariah* in Kelantan State	(CVI) assessment by 6 expert panels Purpose: Validate clarity, relevance, and applicability of items before pilot testing.	validation 4. Review item relevance & clarity 5. Provide score & calculate CVI (I-CVI & S-CVI/Ave)	of unclear, irrelevant, or low-relevance items to improve conceptual clarity. Production of a conceptually strong and expert-verified instrument ready for pilot testing.
			Pilot Study (Preliminary Survey): Primary Data: 1. Preliminary questionnaire survey 2. 30 committee members from 6 *Masjid kariah* in Kota Bharu Purpose: 1. Reliability testing 2. Factor identification for item refinement	**Pilot Study Analysis** Inferential Statistical Analysis: 1. Cronbach's Alpha (Reliability) 2. Exploratory Factor Analysis (EFA) 3. Confirmatory Factor Analysis (CFA) Purpose: 1. Ensure internal consistency 2. Identify underlying factor structure 3. Confirm	Establishment of reliable constructs through Cronbach's Alpha tests with acceptable reliability levels. Identification of underlying factor structures using EFA, ensuring construct validity. Confirmation of measurement model fit using CFA prior to full empirical testing. Refinement and

RESEARCH AIM	This research aims to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.				
RESEARCH PROBLEM	**RESEARCH QUESTIONS**	**RESEARCH OBJECTIVE**	**RESEARCH METHODOLOGY**		**RESEARCH OUTPUT**
			DATA COLLECTION	**DATA ANALYSIS**	
				measurement model fit	finalization of questionnaire items for use in the main survey.
			Main Questionnaire Survey Primary Data: 1. Empirical questionnaire survey 2. 384 committee members targeted across 59 *Masjid kariah* in 10 districts of Kelantan 3. Actual responses obtained: 354 Purpose: 1. Evaluate effectiveness of performance indicators 2. Conduct statistical analyses for RO3	**Main Study Analysis** Descriptive Analysis (SPSS 21): 1. Frequency distribution 2. Percentage analysis Inferential Analysis (SmartPLS 4): 1. Structural equation modelling 2. Analysis of significant indicators 3. Evaluation of relationships among 10 indicators (3 strategy criteria; 7 performance measurements)	Descriptive findings on respondent characteristics and perceptions using frequency and percentage analyses. Identification of significant indicators influencing maintenance strategy criteria and maintenance performance measurements through SmartPLS 4 analysis. Verification of relationships among 10 indicators (3 strategy criteria + 7 performance measurements). Evaluation of the effectiveness of performance indicators

RESEARCH AIM	This research aims to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.				
RESEARCH PROBLEM	**RESEARCH QUESTIONS**	**RESEARCH OBJECTIVE**	**RESEARCH METHODOLOGY**		**RESEARCH OUTPUT**
			DATA COLLECTION	**DATA ANALYSIS**	
					for assessing maintenance planning of *Masjid kariah* in Kelantan State.
1. At present there is no integrated, empirically grounded and expert-validated maintenance planning framework for *Masjid kariah* in Kelantan; existing guidelines do not translate research evidence and performance measurements into a practical model that links maintenance strategy criteria with measurable outcomes for community mosques**.**	**Frameworks' Development**				
	RQ4: How can maintenance planning framework could be enhanced to address the issues and improve outcomes for *Masjid kariah* in Kelantan State?	RO4: To develop a framework for *Masjid kariah*'s maintenance planning in Kelantan State, Malaysia	Primary Data: Expert Validation Survey Qualitative Approach: 1. Five experts panel consisting of maintenance practitioner. 2. Experts evaluate and validate the proposed components of the maintenance planning framework.	Descriptive Statistical Analysis (IBM SPSS 21): 1. Frequency distribution 2. Mean score 3. Rank score Content Analysis: 1. Thematic categorization of expert feedback 2. Identification of essential strategy criteria and performance elements 3. Refinement of framework components based on expert consensus	Consolidation of expert-reviewed criteria and indicators for framework development. Identification of the most relevant and high-ranked maintenance strategy criteria and performance measurement indicators. Refinement of framework components through descriptive statistics and content analysis. Validation of essential elements required to enhance maintenance planning for *Masjid kariah*.

RESEARCH AIM	This research aims to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia.				
RESEARCH PROBLEM	**RESEARCH QUESTIONS**	**RESEARCH OBJECTIVE**	**RESEARCH METHODOLOGY**		**RESEARCH OUTPUT**
			DATA COLLECTION	**DATA ANALYSIS**	
					Development of an integrated, expert-validated maintenance planning framework based on performance measurement and strategic maintenance criteria.

CHAPTER 4
FRAMEWORK DEVELOPMENT FOR MASJID KARIAH MAINTENANCE PLANNING

4.1 Introduction

Chapter 4 presents the qualitative foundation for developing the maintenance planning framework for *Masjid kariah* in Kelantan State. This chapter reports the outcomes generated from Phase 1 of the study, which used the Delphi Method through semi-structured interviews and expert validation sessions to identify and refine the maintenance strategy criteria and maintenance performance measurement indicators relevant to mosque maintenance in Malaysia.

Aligned with Research Objective Two (RO2), this chapter consolidates and synthesises the expert panels' perspectives to establish a comprehensive set of indicators and dimensions that represent the essential components required for evaluating maintenance planning of *Masjid kariah*. The findings from the expert discussions are integrated with the literature reviewed in Chapter 2 to strengthen the theoretical grounding of the indicators identified.

Furthermore, this chapter contributes to Research Objective Four (RO4) by providing the initial synthesis needed to support the development of the performance-based maintenance planning framework. The expert-validated constructs established here form the conceptual basis for the quantitative evaluation presented in Chapter 5 and the final framework development in Chapter 6.

4.2 Framework for the Masjid Kariah Maintenance Planning

The development of the *Masjid kariah* maintenance planning framework is grounded in the principles of British Standard 3811 (1993) and MS ISO 41001:2018, which emphasise systematic, evidence-based, and performance-driven maintenance practices. Drawing from the issues and challenges identified under Research Objective One (RO1), and the expert insights obtained through the Delphi Method in Phase 1 (RO2), two key domains were established: maintenance performance measurements and maintenance strategy criteria. These domains form the conceptual foundation for

strengthening the overall maintenance planning system for community mosques in Kelantan.

The first domain, Maintenance Performance Measurements (MPM), comprises the core indicators used to evaluate the effectiveness and efficiency of mosque maintenance activities. Based on expert validation, these include organisation management, planning and scheduling, financial provision, service quality, assessment, resources allocation, and safety and health. These indicators function as the independent variables that influence how maintenance planning is formulated and implemented. The second domain, Maintenance Strategy Criteria (MSC), represents the strategic approaches necessary for structured maintenance planning, namely planned preventive maintenance, planned corrective maintenance, and corrective maintenance. These criteria act as the dependent variables shaped by the performance indicators. Figure 4.1 shows the framework development.

The interaction between these two domains is illustrated in Figure 4.1, where the maintenance performance measurements inform, support, and strengthen the development of maintenance strategy criteria, converging at the central construct of Maintenance Planning. This integrated structure forms the initial conceptual framework of the study and provides the qualitative basis for subsequent quantitative evaluation in Chapter 5 and the final framework refinement in Chapter 6. By synthesising literature-based insights with expert consensus, this framework offers a holistic and contextually relevant approach to improving maintenance planning for *Masjid kariah* in Kelantan.

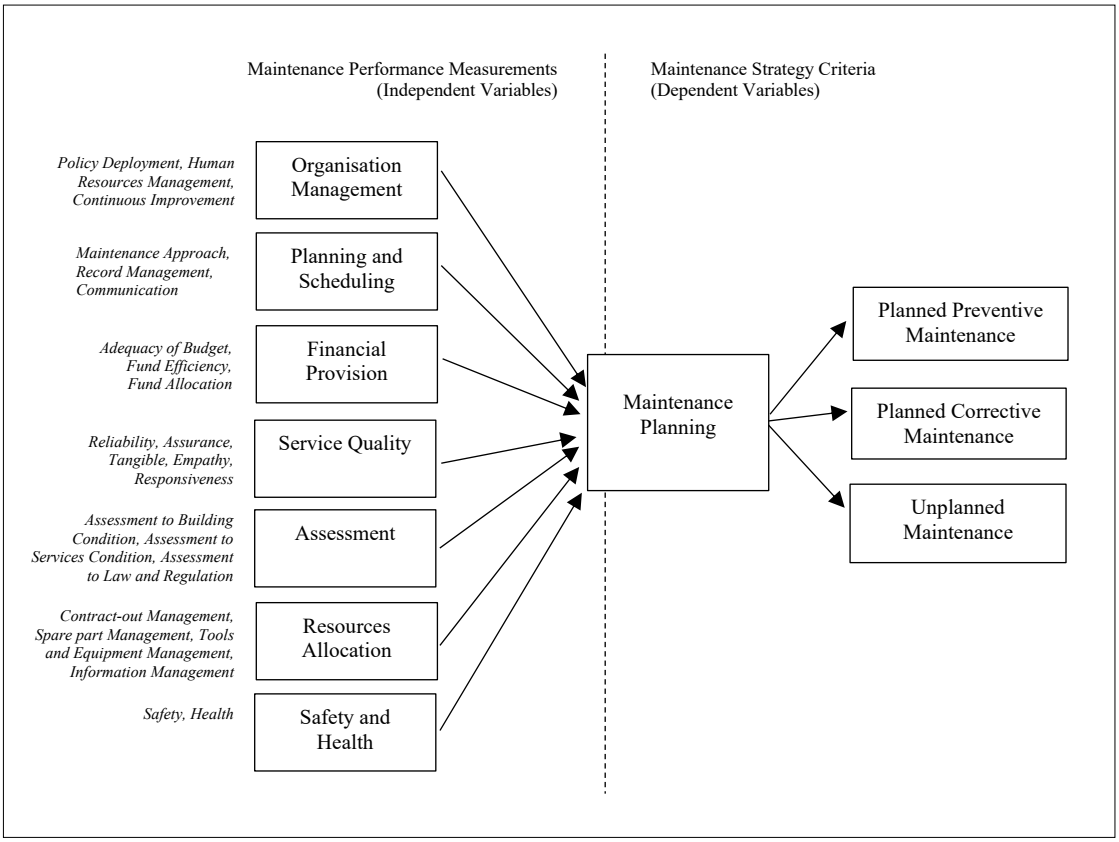

Figure 4.1 Framework's Development

4.3 Delphi Method's Results for the Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM) Indicators

The Delphi Method was employed in Phase 1 of this study to obtain expert consensus on the Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM) indicators relevant to *Masjid kariah* in Kelantan. This method involved a structured, iterative consultation process with experienced mosque practitioners, facility management professionals, and academicians to ensure that the identified indicators are theoretically sound, contextually appropriate, and practically applicable. Across two rounds of engagement beginning with semi-structured interviews and followed by a validation and confirmation stage – the experts refined, clarified, and strengthened the constructs generated earlier in the literature review. The results presented in this section therefore reflect both the convergence of expert judgement and the systematic refinement of the maintenance indicators, contributing directly to the fulfilment of Research Objective Two (RO2) and forming the qualitative foundation for the subsequent quantitative evaluation in Chapter 5.

4.3.1 1st Round: Semi-Structured Interview with Expert Panels' Results

1st round: there are two types of variables that have been assessed in this study which are Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM).

4.3.1.1 Maintenance Strategy Criteria (MSC)

Table 4.1 refers to the list of Maintenance Strategy Criteria (MSC) acceptance during the 1st round of Delphi interview. All three initial Maintenance Strategy Criteria (MSC) were accepted by expert panels as independent variables in this study. However, A3 which was initially Unplanned Maintenance (Emergency) was proposed to rename into Unplanned Maintenance by omitting (Emergency).

Table 4.1
List of Maintenance Strategy Criterias (MSC): 1st Round Result

No.	Initial Set	Renamed/ Addition (+)/omitted	1st round Maintenance Strategy Criteria
1.	A1: Planned Preventive maintenance	-	Planned Preventive maintenance
2.	A2: Planned Corrective Maintenance	-	Planned Corrective Maintenance
3.	A3: Unplanned Maintenance (Emergency)	Unplanned Maintenance	Unplanned Maintenance

4.3.1.2 Maintenance Performance Measurement (MPM) Constructs

Table 4.2 refers to the Maintenance Performance Measurement (MPM) constructs during the first round of Delphi interview. There were seven constructs during the initial proposal. All were acceptable with two constructs were proposed to be renamed.

Table 4.2
List of Maintenance Performance Measurements (MPM) Construct: 1st Round Result

No.	Initial Set	Renamed/ Addition (+)/omitted	1st round MPM
1.	B1: Organisation Management	-	B1: Organisation Management
2.	B2: Planning and Scheduling	-	B2: Planning and Scheduling
3.	B3: Financial Management	Financial Provision	B3: Financial Provision
4.	B4: Service Quality	-	B4: Service Quality
5.	B5: Assessment	Maintenance Assessment	B5: Maintenance Assessment
6.	B6: Resource Allocation	-	B6: Resource Allocation
7.	B7: Environment	-	B7: Environment

4.3.1.3 Maintenance Performance Measurement (MPM) Dimensions

Table 4.3 refers to the Maintenance Performance Measurement (MPM) dimension during the first round of Delphi interview. There were 23 dimensions during the initial proposal. Two dimensions were proposed to be omitted and three dimensions were proposed to be added. Among the 21 acceptable dimensions, only one dimension proposed to be renamed. Thus, the final dimensions are 24. However, all are accepted. There were overall twenty-two dimensions that were approved by the expert panel.

Table 4.3
List of Maintenance Performance Measurement (MPM) Dimension: 1st Round Result

No.	Initial Set	Renamed/ Addition (+)/omitted	1st round MPM Dimension
1.	C1: Policy Deployment	-	C1: Policy Deployment
2.	C2: Human Resources	-	C2: Human Resources
3.	C3: Continuous Improvement	-	C3: Continuous Improvement
4.		+Fund Management	C4: Fund Management
5.	C5: Maintenance Approach	-	C5: Maintenance Approach
6.	C6: Record Management	-	C6: Record Management
7.	C7: Communication	-	C7: Communication
8.		+Resources	C8: Resources
9.	C9: Adequacy of Budget	-	C9: Adequacy of Budget
10.	C10: Fund Efficiency	-	C10: Fund Efficiency
11.	C11: Fund Allocation	-	C11: Fund Allocation
12.		+Fund Management	C12: Fund Management
13.	C13: Reliability	-	C13: Reliability
14.	C14: Assurance	-	C14: Assurance
15.	C15: Tangible	-	C15: Tangible
16.	C16: Empathy	-	C16: Empathy
17.	C17: Responsiveness	-	C17: Responsiveness

No.	Initial Set	Renamed/ Addition (+)/omitted	1st round MPM Dimension
18.	C18: Assessment to Building Condition		C18: Assessment to Building Condition
19.	C19 Assessment to Service Condition		C19: Assessment to Service Condition
20.	C20: Assessment to law and regulation	Statutory Obligation	C20: Statutory Obligation
21.	C21: Contract Out Management	-	C21: Contract Out Management
22.	C22: Spare part Management	Omitted	-
23.	C23: Tools and Equipment	Omitted	-
24.	C24: Information Management	-	C22: Information Management
25.	C25Safety	-	C23: Safety
26.	C26: Health	-	C24: Health

4.3.2 2nd Round: Validation and Confirmation Results

In 2nd round: validation and confirmation results with expert panels' results. three Maintenance Strategy Criteria (MSC), seven Maintenance Performance Measurement (MPM) construct and 24 maintenance performance measurement dimensions.

4.3.2.1 Maintenance Strategy Criteria (MSC)

Table 4.4 refers to the 2nd round Delphi method ranks. Based on the second round of interview, the Maintenance Strategy Criteria (MSC) were maintained.

Table 4.4
Delphy Method 2nd Round: Maintenance Strategy Criterias (MSC)

No.	1st Round MSC Result	Renamed/ Addition (+)/omitted	2nd round MSC
1.	A1: Planned Preventive maintenance	-	Planned Preventive maintenance
2.	A2: Planned Corrective Maintenance	-	Planned Corrective Maintenance
3.	A3 Unplanned Maintenance	-	Unplanned Maintenance

4.3.2.2 Maintenance Performance Measurement (MPM) Indicators

Table 4.5 refers to the result of 2nd round Delphi method for the Maintenance Performance Measurement (MPM) construct approved.

Table 4.5
Delphy Method 2nd Round: Maintenance Performance Measurement (MPM) Contruct

No.	1st round MPM Result	Renamed/ Addition (+)/omitted	2nd round MPM
1.	B1: Organisation Management	-	Organisation Management
2.	B2: Planning and Scheduling	-	Planning and Scheduling
3.	B3: Financial Provision	-	Financial Provision
4.	B4: Service Quality	-	Service Quality
5.	B5: Maintenance Assessment	-	Maintenance Assessment
6.	B6: Resource Allocation	-	Resource Allocation
7.	B7: Environmental safety	Safety and Health	Safety and Health

4.3.2.3 Maintenance Performance Measurement Dimensions

Table 4.6 refers to the 2nd round Delphi method for Maintenance Performance Measurement (MPM) dimension. There were twenty-two dimensions used for the initial stage.

Table 4.6
Delphy Method 2nd Round: Maintenance Performance Measurement (MPM) Contruct

No.	1st round MPM Result	Renamed/ Addition (+)/omitted	2nd round MPM Dimension result
1.	C1: Policy Deployment	-	C1: Policy Deployment
2.	C2: Human Resources	-	C2: Human Resources
3.	C3: Continuous Improvement		C3: Continuous Improvement
4.	C4: Fund Management	Omitted	-
5.	C5: Maintenance Approach	-	C4: Maintenance Approach
6.	C6: Record Management	-	C5: Record Management
7.	C7: Communication	-	C6: Communication
8.	C8: Resources	Omitted	-
9.	C9: Adequacy of Budget	-	C7: Adequacy of Budget
10.	C10: Fund Efficiency	-	C8: Fund Efficiency
11.	C11: Fund Allocation	-	C9: Fund Allocation
12.	C12: Fund Management	Omitted	-
13.	C13: Reliability	-	C10: Reliability
14.	C14: Assurance	-	C11: Assurance
15.	C15: Tangible	-	C12: Tangible
16.	C16: Empathy	-	C13: Empathy
17.	C17: Responsiveness	-	C14: Responsiveness
18.	C18: Assessment to Building	-	C15: Assessment to

No.	1st round MPM Result	Renamed/ Addition (+)/omitted	2nd round MPM Dimension result
	Condition		Building Condition
19.	C19: Assessment to Service Condition	-	C16: Assessment to Service Condition
20.	C20: Statutory Obligation	Assessment to law and regulation	C17: Assessment to law and regulation
21.	C21: Contract-Out Management	-	C18: Contract-Out Management
22.	-	Addition	C19: Spare part Management
23.	-	Addition	C20: Tools and Equipment
24.	C22: Information Management	-	C21: Information Management
25.	C23: Safety	-	C22: Safety
26.	C24: Health	-	C23: Health

4.3.3 Final Interview Results (Final Indicators and Dimension)

Thus, based on semi-structured interview within 10 expert panels by using Delhi method processes, the results have been confirmed that there are seven Maintenance Performance Measurement (MPM) construct, and 23 dimensions have been used in this study. Table 4.7 refers to the result of Maintenance Performance Measurement (MPM) construct and their dimension.

Table 4.7
Overall Final Maintenance Performance Measurement (MPM) List

MPM Construct		Final Dimension
B1	Organisation Management	C1: Policy deployment
		C2: Human resources
		C3: Continuous improvement
B2	Planning and Scheduling	C4: Maintenance approach
		C5: Record management
		C6: Communication
B3	Financial Provision	C7: Adequacy of budget
		C8: Fund efficiency
		C9: Fund allocation
B4	Service Quality	C10: Reliability
		C11: Assurance
		C12: Tangible
		C13: Empathy
		C14: Responsiveness
B5	Maintenance Assessment	C15: Assessment to building
		C16: Assessment to services
		C17: Assessment to law and regulation
B6	Resource Allocation	C18: Contract-out management
		C19: Spare part management

MPM Construct		Final Dimension
		C20: Tools and equipment
		C21: Information management
B7	Safety and Health	C22: Safety
		C23: Health

4.4 Synthesis of Indicators and Dimensions for Framework Development (RO2)

The results for two round Delphi methods in previous section indicated that in both rounds of interview, all expert panels have reached a consensus and validated the establishment of all key elements in maintenance planning involving maintenance strategy criteria and maintenance performance measurements, specifically for *Masjid kariah* from a Malaysian perspective. Hence, the following three objectives could also be achieved (1) to investigate the interest, experience and willingness of the experts to be part of Delphi method process, (2) to familiarize the experts on the framework derived from literature review and (3) to explain each maintenance strategy criteria and maintenance performance measurement. The second round of semi-structured interview survey (Delphi method) was executed to enhance the consistency and accuracy of measurements with the following two main objectives: (1) to seek for honest feedback from experts regarding the reliability of the attributes provided for the next stage of research, and (2) to validate improvement on the framework based on the feedback gathered from the first survey interview. Table 4.8 shows the summary of expert panels feedback from two rounds of semi-structured interview.

Table 4.8
Summary of Expert from Semi-structured Interview

No.	Item	Objective	Summarized Results derived from the Synthesis of Feedback provided by Expert Panels
1.	First round experts' interview	To investigate the interest, experience and willingness of the experts to be part of Delphi survey process.	The experts do agree with the involvement during Delphi survey process but do not promise to deliver the feedback on specific times.
		To familiarize the experts on the framework derived from literature review.	The experts closely reviewed the document presented to them and understood the roles that were expected from them to give views and opinions regarding the framework.
		To explain each maintenance strategy criteria and maintenance performance measurement.	Experts were given explanation regarding each of the maintenance strategy criteria and the maintenance performance measurements contained in the framework

No.	Item	Objective	Summarized Results derived from the Synthesis of Feedback provided by Expert Panels
			and understood the purpose to create the framework of maintenance strategy criteria and maintenance performance measurements.
2.	Second round experts' interview	The researcher asks for honest feedback from experts regarding the reliability of the attributes provided for the next stage of research.	The maintenance strategy criteria and maintenance performance measurements provided by the researcher can be understood by the experts.
			All maintenance strategy criteria were agreed by all experts and most element of maintenance performance measurements attributes were also agreed by most experts.
		Feedback gathered from the first interview will have the primary usage to improve the framework and used in the second round of interview.	All experts believe that the frameworks that were formulated from the literature review were good enough to be used in the next stage of the research.

The synthesis presented in this section integrates the validated indicators from the Delphi study with the theoretical models, international standards, and empirical insights reviewed in Chapter 2. Rather than reporting new findings, this synthesis consolidates the Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM) dimensions into a coherent conceptual structure, demonstrating how both sets of constructs collectively contribute to the formulation of a maintenance planning framework for *Masjid kariah* in Kelantan. This critical integration responds to the examiner's emphasis on establishing a clear linkage between empirical validation and the broader body of knowledge.

From the strategic perspective, the three Maintenance Strategy Criteria (MSC) – planned preventive maintenance, planned corrective maintenance, and unplanned maintenance directly reflect the maintenance territories defined in BS 3811 (1993). The Delphi panel's confirmation of these three categories reinforces their continued relevance within mosque operations, despite the evolving nature of facility management practices. The alignment between expert consensus and BS 3811 indicates that mosque maintenance, even within community-managed settings, requires structured categorisation anchored in internationally recognised maintenance principles. This recognition helps reposition mosque maintenance from an ad hoc, reactive practice to

one grounded in systematic planning and prioritisation. The synthesis therefore supports the argument that strategic clarity, based on BS 3811, is essential for ensuring consistency and predictability in the maintenance activities of *Masjid kariah*.

The seven dimensions of Maintenance Performance Measurement (MPM) — organisation management, planning and scheduling, financial provision, service quality, assessment, resource allocation, and safety and health – further complement the strategic categories by providing the operational, managerial, and evaluative components of maintenance planning. These dimensions align strongly with the requirements of MS ISO 41001:2018 Facility Management – Management Systems, which emphasises performance evaluation, operational planning and control, resource efficiency, risk and safety compliance, and stakeholder-centred service delivery. The incorporation of ISO 41001 into the synthesis illustrates how mosque committees, despite their volunteer-based structures, must adopt formal performance-driven management approaches to ensure accountability, transparency, and continual improvement. Thus, the validated MPM indicators bridge the gap between international facility management practices and the contextual realities of mosque operations in Kelantan.

Beyond ISO 41001, the MPM indicators further resonate with the General Maintenance Management Model (Tsang et al., 1999) and the Performance Measurement Model by Cholasuke et al. (2004). Tsang's model highlights the need for integrated planning, resource allocation, performance monitoring, and feedback loops – elements strongly reflected in organisation management, planning and scheduling, and assessment dimensions. Meanwhile, Cholasuke's model associate's performance with financial capability, regulatory compliance, human resource readiness, and service quality, all of which correspond to financial provision, safety and health, resources allocation, and service quality dimensions validated in this study. The triangulation of ISO 41001, Tsang, and Cholasuke frameworks with the empirical indicators strengthens the theoretical legitimacy of the MPM dimensions and demonstrates that the constructs are not only grounded in literature but also empirically coherent within the *Masjid Kariah* environment.

The synthesis also demonstrates the interdependent relationship between MSC and MPM. Literature establishes that strategy and performance cannot be treated separately: effective maintenance strategies (BS 3811) are only meaningful when supported by robust performance indicators (ISO 41001; Tsang; Cholasuke). The

Delphi findings affirm this relationship, showing that preventive, corrective, and reactive strategies require organisational capability, financial stability, workforce competence, documentation quality, and safety compliance to function effectively. This relationship echoes Swanson's (2001) empirical evidence that proactive and aggressive maintenance strategies correlate positively with strong performance measurements. The same pattern appears in the *Masjid kariah* context, where expert consensus supports the integration of both domains into a single, unified framework.

Collectively, this synthesis confirms that the findings of the study fully achieve Research Objective Two (RO2), which aims to investigate performance indicators relevant to evaluating maintenance planning for *Masjid kariah*. More importantly, the consolidation of MSC as dependent variables and MPM as independent variables establishes a sound conceptual foundation for the framework developed in Chapter 6. The indicators and dimensions validated through expert consensus are theoretically embedded, empirically supported, and contextually relevant, forming a coherent performance-based approach to mosque maintenance planning. This integrated perspective ensures that the framework is both academically rigorous and practically applicable, addressing organisational, operational, financial, and safety aspects essential for the sustainable management of *Masjid kariah* facilities in Kelantan.

4.5 Summary

This chapter critically examined and synthesised the Maintenance Strategy Criteria (MSC) and Maintenance Performance Measurement (MPM) indicators validated through the Delphi method, establishing the empirical foundation necessary for evaluating the effectiveness of maintenance planning within *Masjid kariah* in Kelantan (RO3). The expert consensus not only confirmed the relevance of the identified constructs but also revealed significant gaps in current mosque maintenance practices, including inconsistent planning routines, inadequate organisational structures, and insufficient performance monitoring mechanisms. These shortcomings highlight the pressing need for a structured, evidence-based planning approach grounded in both strategic clarity and measurable performance parameters.

A key contribution of this chapter lies in demonstrating how the three Maintenance Strategy Criteria (MSC) and seven Maintenance Performance Measurement (MPM) dimensions interact to form a coherent and interdependent

system. The strategic categories derived from BS 3811 which provide the overarching direction for mosque maintenance, while the performance dimensions – aligned with MS ISO 41001 and established maintenance management models – supply the operational and managerial capacities required to execute those strategies effectively. This alignment confirms that effective maintenance planning for *Masjid kariah* cannot be achieved through isolated or ad hoc efforts; instead, it requires a systematic integration of strategy and performance, supported by organisational capability, resource sufficiency, safety compliance, and continuous assessment.

By synthesising theoretical models with expert-validated constructs, this chapter advances the study toward the development of a comprehensive maintenance planning framework (RO4). The empirical insights presented here demonstrate that the validated indicators form a robust and contextually appropriate measurement structure capable of capturing the complexities of mosque maintenance performance. More importantly, they enable the transition from conceptual understanding to empirical testing, which will be addressed in Chapter 5 through statistical validation and model analysis. Collectively, the synthesis in this chapter provides the intellectual scaffolding and empirical justification for the performance-based framework presented in Chapter 6—ensuring that the final model is theoretically grounded, empirically supported, and practically relevant to *Masjid kariah* in Kelantan.

CHAPTER 5
KEY FACTORS INFLUENCING THE FRAMEWORK OF MASJID KARIAH'S MAINTENANCE PLANNING IN KELANTAN, MALAYSIA

5.1 Introduction

Chapter Five presents the quantitative findings derived from the pilot study, Content Validity Index (CVI) assessment, and the full-scale empirical analysis using SPSS and SmartPLS. This chapter forms the core of the quantitative phase that addresses Research Objective Three (RO3) – to evaluate the performance indicators of maintenance planning for *Masjid kariah* in Kelantan – and establishes the empirical foundation that supports Research Objective Four (RO4) in developing the maintenance planning framework.

This chapter begins by outlining the preliminary validation process, including item screening, expert-based CVI assessment, and the reliability confirmation obtained through the pilot study. These processes ensured that all indicators and constructs were psychometrically sound prior to full-scale data collection. Subsequently, the chapter presents descriptive and inferential statistical analyses involving 354 respondents from 59 *Masjid kariah*, covering demographic profiles, central tendencies for each construct, factor loadings, validity tests, and structural model results.

Overall, this chapter integrates expert validation (Delphi and CVI) with empirical evidence (Pilot & PLS-SEM) to demonstrate which performance indicators significantly influence maintenance planning and how these validated constructs contribute to the development of a performance-based framework for *Masjid kariah* in Kelantan.

5.2 Content Validity Index (CVI) Result and Pilot Study Result

This section presents two essential components of the instrument validation process: the Content Validity Index (CVI) and the pilot study results, both of which ensured the construct validity, clarity, and reliability of the questionnaire used in the full-scale survey. The CVI represents the expert-based validation process conducted

during the qualitative-to-quantitative transition stage, where 10 experts evaluated the relevance, accuracy, and linguistic appropriateness of each item based on the seven Maintenance Performance Measurement (MPM) constructs and three Maintenance Strategy Criteria (MSC) constructs. This expert-driven validation ensured that all items aligned with BS 3811:1993, MS ISO 41001:2018, and the theoretical foundations discussed in Chapter 2.

Following the CVI process, a pilot study involving 30 respondents from five *Masjid kariah* in Kelantan was conducted to test the reliability and internal consistency of the survey instrument. Statistical outputs demonstrated strong psychometric performance across all constructs, with Cronbach's Alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) exceeding the minimum acceptable thresholds. Feedback from respondents also supported the instrument's clarity and usability, requiring only minor wording adjustments.

Together, the CVI and pilot study results confirm that the questionnaire is both valid and reliable, forming a robust basis for large-scale data collection in this study. These preliminary validation stages are critically important in ensuring that the subsequent PLS-SEM analysis accurately reflects the relationships between maintenance performance indicators and maintenance strategy criteria within the *Masjid kariah* context.

5.2.1 Content Validity Index (CVI) Result

According to Polit et al. (2007) and Yusoff (2019), when six experts are involved in the validation process, an I-CVI score of 0.83 or higher is considered acceptable. This threshold reflects the minimum agreement required to ensure that the item is not rated as relevant purely by chance. Furthermore, the Scale-Level Content Validity Index (S-CVI) was computed using the average method (S-CVI/Ave), which represents the mean of all I-CVI scores across each construct. The results demonstrated that all items achieved I-CVI values exceeding the recommended threshold of 0.83, indicating a strong consensus among the experts on the relevance of the items. The S-CVI/Ave scores for each construct also exceeded 0.90, signifying excellent overall content validity across the instrument.

In addition to the quantitative ratings, qualitative comments from the experts were also reviewed. These insights were used to refine item wording and ensure

contextual suitability to the operational and administrative realities of *Masjid kariah* in Kelantan. The validated items were subsequently used in the pilot survey and served as the foundation for further statistical validation, including reliability testing and factor analysis. The CVI results therefore confirmed that the measurement instrument possessed strong content validity, and that the selected items were appropriate for assessing the constructs in the proposed performance-based maintenance planning framework.

Furthermore, the verified items were carried forward into the pilot study and full-scale quantitative analysis. These formed the measurement model tested through PLS-SEM in this chapter, where the relationships among the validated constructs were statistically examined to identify key influencing factors. The culmination of these processes is presented in Chapter 6, where the final performance-based maintenance planning framework is proposed and validated. Thus, the CVI findings not only serve as preliminary empirical evidence of content relevance but also directly contribute to answering Research Question Three (RQ3) and achieving Research Objective Three (RO3). They establish the initial set of validated constructs and indicators that inform the broader framework development and model testing phases in the subsequent chapters.

5.2.2 Pilot Study Result

The pilot study was conducted with 30 committee members from five selected *Masjid kariah* in Kelantan. This phase served as an essential pre-test to evaluate the reliability and validity of the proposed measurement constructs prior to large-scale data collection. The analysis was performed using SmartPLS 4, focusing on seven key constructs. This early empirical testing provided initial evidence for the psychometric strength of the instrument in the context of mosque maintenance planning.

At this initial stage, the PLS-SEM analysis confirmed that all constructs achieved Cronbach's Alpha coefficients exceeding the minimum threshold of 0.70, indicating acceptable to good reliability. As outlined by Sekaran & Bougie (2016), values below 0.60 are considered poor, those in the 0.70 range are acceptable, and values above 0.80 reflect strong internal consistency. This reliability assessment was crucial for validating the measurement items and ensuring that the instrument was statistically sound for use in developing the intended framework.

To further reinforce the measurement model, Exploratory Factor Analysis (EFA) was employed to identify the underlying factor structure and to group items into theoretically coherent constructs. This was followed by Confirmatory Factor Analysis (CFA), which verified the factor structure and confirmed that the constructs met the criteria for convergent and discriminant validity. Collectively, the results from Cronbach's Alpha, EFA, and CFA provided strong evidence of the instrument's reliability and validity, supporting its use in the subsequent full-scale empirical study. Table 5.1 shows the summary of reliability and validity results from Pilot Survey (PLS-SEM).

Table 5.1
Summary of Reliability and Validity Results from Pilot Survey (PLS-SEM)

No.	Construct	Cronbach's Alpha	EFA (Factor Loading > 0.5)	CFA (AVE > 0.5, CR > 0.7)
1.	Organisational Management	0.823	Achieved	AVE = 0.621, CR = 0.859
2.	Planning and Scheduling	0.816	Achieved	AVE = 0.603, CR = 0.845
3.	Financial Provision	0.842	Achieved	AVE = 0.649, CR = 0.873
4.	Service Quality	0.869	Achieved	AVE = 0.688, CR = 0.889
5.	Assessment	0.790	Achieved	AVE = 0.573, CR = 0.824
6.	Resource Allocation	0.803	Achieved	AVE = 0.592, CR = 0.837
7.	Safety and Health	0.811	Achieved	AVE = 0.609, CR = 0.847

To assess internal consistency, Cronbach's Alpha was used. All seven constructs recorded alpha values above the minimum threshold of 0.70, with scores ranging from 0.790 to 0.869. The highest reliability was observed for Service Quality ($\alpha = 0.869$), while the lowest acceptable value was recorded for Assessment ($\alpha = 0.790$). These results confirm that the items within each construct reliably measure the same underlying dimension, demonstrating consistency across the scale.

The construct validity was further supported through Exploratory Factor Analysis (EFA), which indicated that all items achieved factor loadings greater than 0.60. This confirms the structural coherence of the measurement model and the theoretical grouping of the indicators under their respective constructs. Following this, a preliminary Confirmatory Factor Analysis (CFA) was also carried out. All constructs met the recommended thresholds for Average Variance Extracted ($AVE \geq 0.50$) and Composite Reliability ($CR \geq 0.70$). For example, Organisational Management recorded AVE = 0.621 and CR = 0.859, while Service Quality recorded AVE = 0.688 and CR = 0.889, indicating strong convergent validity and construct reliability.

In response to feedback from the pilot participants, several items were revised to improve linguistic clarity, contextual relevance, and respondent comprehension. No item was excluded from the final instrument, as all indicators satisfied the empirical criteria. The combination of reliability and validity results provided strong justification to retain the full set of constructs and items for further analysis in the main study.

5.3 Demographic Profile of Respondents

The background information of the *Masjid kariah* and respondents are presented in Table 5.2. Total number of respondents are 354 that comprised of nazir (16.7%), deputy nazir (16.7%), secretary (16.7%), deputy secretary (16.7%), treasurer (16.7%) and bureau of development committee members (16.7%) of *Masjid kariah*'s organizational committee. All respondents are male, contract workers and majority of them (58.2%) belonged to the 51 years old and above age group, followed by the 41 to 50's (41.0%) and 31-40's (0.8%). One third of them (33.3%) possess has highest qualification of degree certificate while the rest had diploma and Malaysian Certificate of Education (SPM). In terms of general information of the *Masjid kariah*; all the *Masjid kariah* in the study area is under government ownership and have been registered under the Department of Agama Islam dan Adat Istiadat Melayu Kelantan (JAHEAIK). Most of the *Masjid kariah* was over than 15 years (93.2%). All *Masjid kariah* has a written building maintenance policy for the implementation of maintenance strategy. Two third of *Masjid kariah* has planned corrective maintenance (66.1%) while the rest has unplanned maintenance (33.9%). All the *Masjid kariah* management has been responsible for carrying out its duties properly, either every month (42.4%), every six months (39.0%) and every three months (18.6%).

Table 5.2
The Background of *Masjid kariah* in the Kelantan State and Respondents' Profile

No.	Variable	Description	Frequency	Percentage (%)
Section A: General Information of Masjid kariah in the Kelantan State				
1.	District	Kota Bharu	78	22.0
		Pasir Puteh	42	11.9
		Jeli	12	3.4
		Machang	24	6.8
		Gua Musang	24	6.8
		Tanah Merah	24	6.8
		Pasir Mas	54	15.3
		Tumpat	30	8.5

No.	Variable	Description	Frequency	Percentage (%)
		Kuala Krai	30	8.5
		Bachok	36	10.2
2.	Type of ownership	Government	354	100.0
		Private	0	0.0
		Waqf	0	0.0
		Others	0	0.0
3.	The age of the *Masjid kariah*	1-5 years	0	0.0
		6-10 years	18	5.1
		11-15 years	6	1.7
		>15 years	330	93.2
4.	Registered under the Department Agama Islam & Adat Istiadat Melayu Kelantan (JAHEAIK)	Yes	354	100.0
		No	0	0.0
Section B: General Information Committee members of Masjid kariah				
5.	Position	Chairman/Nazir	59	16.7
		Deputy chairman/Vice Nazir	59	16.7
		Bureau of Development and Maintenance	59	16.7
		Secretary	59	16.7
		Deputy Secretary	59	16.7
		Treasurer	59	16.7
6.	Gender	Male	354	100.0
		Female	0	0.0
7.	Academic qualifications	None	0	0.0
		Lower Secondary Assessment (PMR)	0	0.0
		Malaysian Certificate of Education (SPM)	118	33.3
		Diploma	118	33.3
		Degree	118	33.3
		Masters	0	0.0
		Doctor of Philosophy (PhD)	0	0.0
		Others	0	0.0
8.	Average Age	21-30 years old	0	0.0
		31-40 years old	3	0.8
		41-50 years old	145	41.0
		Over 51 years old	206	58.2
9.	Serving as	Fixed	0	0.0
		Contract	354	100.0
		Voluntary	0	0.0
		Others	0	0.0
Section C: Implementation of Maintenance Strategy in Masjid kariah				
10.	Does this *Masjid kariah* have a written building	Yes	354	100.0
		No	0	0.0

No.	Variable	Description	Frequency	Percentage (%)
	maintenance policy?			
11.	Which maintenance strategy is used by this *Masjid kariah*?	Planned Preventive Maintenance (PPM)	0	0.0
		Planned Corrective Maintenance (PCM)	234	66.1
		Unplanned Maintenance (UM)	120	33.9
		None	0	0.0
12.	The maintenance of this *Masjid kariah* is done by?	The Mosque Management	354	100.0
		Outside Contractor	0	0.0
		External Contractor & Mosque Management jointly	0	0.0
13.	How often is maintenance at this *Masjid kariah*?	None	0	0.0
		When needed	0	0.0
		Every week	0	0.0
		Every month	150	42.4
		Every Three Months	66	18.6
		Every Six Months	138	39.0
		Once a year	0	0.0
Note: Empirical questionnaire survey responses were 354 out of 384 sample size				

5.4 Key Factors influencing the Maintenance Planning of Masjid Kariah in Kelantan through PLS-SEM Model Assessment

In assessing the relationship between Maintenance Strategy Criteria and Maintenance Performance Measurements and what factors will contribute positive influence on Maintenance Planning of *Masjid kariah* in the study area, the PLS-SEM model assessment has been used to verify the seven hypotheses of this study:

H1: Organization Management (OM) has significantly positive influence on *Masjid kariah* Maintenance Planning (MKMP)

H2: Planning and Scheduling (PS) has significantly positive influence on *Masjid kariah* Maintenance Planning (MKMP)

H3: Financial Provision (FP) has significantly positive influence on *Masjid kariah* Maintenance Planning (MKMP)

H4: Service Quality (SQ) has significantly positive influence on *Masjid kariah* Maintenance Planning (MKMP)

H5: Assessment (AS) has significantly positive influence on *Masjid kariah*

Maintenance Planning (MKMP)

H6: Resource Allocation (RA) has significantly positive influence on *Masjid kariah* Maintenance Planning (MKMP)

H7: Safety and Health (SH) has significantly positive influence on *Masjid kariah* Maintenance Planning (MKMP)

This study composes one dependent variable (Maintenance Strategy Criteria) within three main indicators i.e. Planned Preventive Maintenance, Planned Corrective Maintenance and Unplanned Maintenance (Emergency Maintenance) and one independent variable (Maintenance Performance Measurements) within seven constructs i.e. Organisation Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation and Safety and Health) that have been measured in this study. The seven indicators of Maintenance Performance Measurements are predicted as important in Maintenance Planning of *Masjid kariah* in Kelantan and it will lead to a positive influence to a frameworks' development of Maintenance Planning of *Masjid kariah* in Kelantan. Table 5.3 shows the item loadings and conceptual model with items of every latent construct and Figure 3.10 shows the conceptual model with items of every latent constructs.

Table 5.3
The Item Loadings

No.	Model Construct	No.	Measurement Item	Item Represent
1.	*Masjid kariah* Maintenance Planning (MKMP)	1.	D_PPT	Planned Preventive Maintenance
		2.	D_PBT	Planned Corrective Maintenance
		3.	D_PTT	Unplanned Maintenance
2.	Organization Management (OM)	*a. Policy Usage*		
		1.	C1_PD_01_PPT	Use of a clear Policy: Planned Preventive Maintenance
		2.	C1_PD_01_PBT	Use of a clear policy: Planned Corrective Maintenance
		3.	C1_PD_01_PTT	Use of a clear policy: Unplanned Maintenance
		4.	C1_PD_02_PPT	Effective policy application: Planned Preventive Maintenance
		5.	C1_PD_02_PBT	Effective policy application: Planned Corrective Maintenance
		6.	C1_PD_02_PTT	Effective policy application: Unplanned Maintenance
		b. Management of Human Resources		
		7.	C1_HRM_01_PPT	Adequate workforce: Planned Preventive Maintenance
		8.	C1_HRM_01_PBT	Adequate workforce: Planned Corrective

No.	Model Construct	No.	Measurement Item	Item Represent
				Maintenance
		9.	C1_HRM_01_PTT	Adequate workforce: Unplanned Maintenance
		10.	C1_HRM_02_PPT	Facilities are well maintained: Planned Preventive Maintenance
		11.	C1_HRM_02_PBT	Facilities are well maintained: Planned Corrective Maintenance
		12.	C1_HRM_02_PTT	Facilities are well maintained: Unplanned Maintenance
		c. Continual Improvement		
		13.	C1_C1_01_PPT	Adequate training and education: Planned Preventive Maintenance
		14.	C1_C1_01_PBT	Adequate training and education: Planned Corrective Maintenance
		15.	C1_C1_01_PTT	Adequate training and education: Unplanned Maintenance
		16.	C1_C1_02_PPT	Basic knowledge exposure: Planned Preventive Maintenance
		17.	C1_C1_02_PBT	Basic knowledge exposure: Planned Corrective Maintenance
		18.	C1_C1_02_PTT	Basic knowledge exposure: Unplanned Maintenance
3.	Planning and Scheduling (PS)	*a. Maintenance Approach*		
		1.	C2_MA_01_PPT	Appropriate work sequence and duration: Planned Preventive Maintenance
		2.	C2_MA_01_PBT	Appropriate work sequence and duration: Planned Corrective Maintenance
		3.	C2_MA_01_PTT	Appropriate work sequence and duration: Unplanned Maintenance
		4.	C2_MA_02_PPT	Work periods that do not interrupt prayer times and programs: Planned Preventive Maintenance
		5.	C2_MA_02_PBT	Work periods that do not interrupt prayer times and programs: Planned Corrective Maintenance
		6.	C2_MA_02_PTT	Work periods that do not interrupt prayer times and programs: Unplanned Maintenance
		b. Records Management		
		7.	C2_RM_01_PPT	Recorded for future inspection: Planned Preventive Maintenance
		8.	C2_RM_01_PBT	Recorded for future inspection: Planned Corrective Maintenance
		9.	C2_RM_01_PTT	Recorded for future inspection: Unplanned Maintenance
		10.	C2_RM_02_PPT	Effectiveness of file handling: Planned Preventive Maintenance
		11.	C2_RM_02_PBT	Effectiveness of file handling: Planned Corrective Maintenance
		12.	C2_RM_02_PTT	Effectiveness of file handling: Unplanned

No.	Model Construct	No.	Measurement Item	Item Represent
				Maintenance
		c. Communication		
		13.	C2_Com_01_PPT	Facilitate communication: Planned Preventive Maintenance
		14.	C2_Com_01_PBT	Facilitate communication: Planned Corrective Maintenance
		15.	C2_Com_01_PTT	Facilitate communication: Unplanned Maintenance
		16.	C2_Com_02_PPT	The mosque committee members can communicate clearly: Planned Preventive Maintenance
		17.	C2_Com_02_PBT	The mosque committee members can communicate clearly: Planned Corrective Maintenance
		18.	C2_Com_02_PTT	The mosque committee members can communicate clearly: Unplanned Maintenance
4.	Financial Provision (FP)	*a. Adequacy of the Budget*		
		1.	C3_AB_01_PPT	Adequacy of maintenance plan provisions: Planned Preventive Maintenance
		2.	C3_AB_01_PBT	Adequacy of maintenance plan provisions: Planned Corrective Maintenance
		3.	C3_AB_01_PTT	Adequacy of maintenance plan provisions: Unplanned Maintenance
		4.	C3_AB_02_PPT	Receive adequate payment: Planned Preventive Maintenance
		5.	C3_AB_02_PBT	Receive adequate payment: Planned Corrective Maintenance
		6.	C3_AB_02_PTT	Receive adequate payment: Unplanned Maintenance
		b. Fund Efficiency		
		7.	C3_FE_01_PPT	Efficient tracking of fund savings: Planned Preventive Maintenance
		8.	C3_FE_01_PBT	Efficient tracking of fund savings: Planned Corrective Maintenance
		9.	C3_FE_01_PTT	Efficient tracking of fund savings: Unplanned Maintenance
		10.	C3_FE_02_PPT	Efficient fund allocation: Planned Preventive Maintenance
		11.	C3_FE_02_PBT	Efficient fund allocation: Planned Corrective Maintenance
		12.	C3_FE_02_PTT	Efficient fund allocation: Unplanned Maintenance
		c. Fund Allocation		
		13.	C3_FA_01_PPT	Adequate fund allocation in mosques: Planned Preventive Maintenance
		14.	C3_FA_01_PBT	Adequate fund allocation in mosques: Planned Corrective Maintenance
		15.	C3_FA_01_PTT	Adequate fund allocation in mosques: Unplanned Maintenance

No.	Model Construct	No.	Measurement Item	Item Represent
		16.	C3_FA_02_PPT	Adequate allocation of funds with annual work: Planned Preventive Maintenance
		17.	C3_FA_02_PBT	Adequate allocation of funds with annual work: Planned Corrective Maintenance
		18.	C3_FA_02_PTT	Adequate allocation of funds with annual work: Unplanned Maintenance
5.	Service Quality (SQ)	*a. Reliability*		
		1.	C4_Ass_01_PPT	Able to perform scheduled services: Planned Preventive Maintenance
		2.	C4_Ass_01_PBT	Able to perform scheduled services: Planned Corrective Maintenance
		3.	C4_Ass_01_PTT	Able to perform scheduled services: Unplanned Maintenance
		b. Empathy		
		4.	C4_Emp_01_PPT	Maintenance staff may pay special attention to complaints: Planned Preventive Maintenance
		5.	C4_Emp_01_PBT	Maintenance staff may pay special attention to complaints: Planned Corrective Maintenance
		6.	C4_Emp_01_PTT	Maintenance staff may pay special attention to complaints: Unplanned Maintenance
		c. Assurance		
		7.	C4_Rel_01_PPT	Ensuring an efficient maintenance service: Planned Preventive Maintenance
		8.	C4_Rel_01_PBT	Ensuring an efficient maintenance service: Planned Corrective Maintenance
		9.	C4_Rel_01_PTT	Ensuring an efficient maintenance service: Unplanned Maintenance
		d. Responsive		
		10.	C4_Res_01_PPT	Maintenance staff can help provide maintenance services: Planned Preventive Maintenance
		11.	C4_Res_01_PBT	Maintenance staff can help provide maintenance services: Planned Corrective Maintenance
		12.	C4_Res_01_PTT	Maintenance staff can help provide maintenance services: Unplanned Maintenance
		e. Tangible		
		13.	C4_Tan_01_PPT	The maintenance staff can provide good maintenance services: Planned Preventive Maintenance
		14.	C4_Tan_01_PBT	The maintenance staff can provide good maintenance services: Planned Corrective Maintenance
		15.	C4_Tan_01_PTT	The maintenance staff can provide good maintenance services: Unplanned Maintenance

No.	Model Construct	No.	Measurement Item	Item Represent
6.	Assessment (AS)	*a. Building condition assessment*		
		1.	C5_ALR_01_PPT	Being able to maintain the physical elements of mosque buildings: Planned Preventive Maintenance
		2.	C5_ALR_01_PBT	Being able to maintain the physical elements of mosque buildings: Planned Corrective Maintenance
		3.	C5_ALR_01_PTT	Being able to maintain the physical elements of mosque buildings: Unplanned Maintenance
		b. Assessment of equipment system conditions		
		4.	C5_ALR_02_PPT	Evaluating the state of equipment systems in the mosque properly: Planned Preventive Maintenance
		5.	C5_ALR_02_PBT	Evaluating the state of equipment systems in the mosque properly: Planned Corrective Maintenance
		6.	C5_ALR_02_PTT	Evaluating the state of equipment systems in the mosque properly: Unplanned Maintenance
		c. Legal obligations		
		7.	C5_ASC_01_PPT	Fulfilling building law requirements in assessing the physical condition of mosques: Planned Preventive Maintenance
		8.	C5_ASC_01_PBT	Fulfilling building law requirements in assessing the physical condition of mosques: Planned Corrective Maintenance
		9.	C5_ASC_01_PTT	Fulfilling building law requirements in assessing the physical condition of mosques: Unplanned Maintenance
		10.	C5_ABC_01_PPT	Fulfilling building law requirements in assessing mosque equipment systems: Planned Preventive Maintenance
		11.	C5_ABC_01_PBT	Fulfilling building law requirements in assessing mosque equipment systems: Planned Corrective Maintenance
		12.	C5_ABC_01_PTT	Fulfilling building law requirements in assessing mosque equipment systems: Unplanned Maintenance
7.	Resource Allocation (RA)	*a. Contract Management*		
		1.	C6_CM_01_PPT	Giving contractors adequate contracts: Planned Preventive Maintenance
		2.	C6_CM_01_PBT	Giving contractors adequate contracts: Planned Corrective Maintenance
		3.	C6_CM_01_PTT	Giving contractors adequate contracts: Unplanned Maintenance
		b. Spare Parts Management		
		4.	C6_SP_01_PPT	A regular and adequate spare parts schedule for recurring maintenance: Planned Preventive Maintenance

No.	Model Construct	No.	Measurement Item	Item Represent
		5.	C6_SP_01_PBT	A regular and adequate spare parts schedule for recurring maintenance: Planned Corrective Maintenance
		6.	C6_SP_01_PTT	A regular and adequate spare parts schedule for recurring maintenance: Unplanned Maintenance
		c. Tools and Equipment		
		7.	C6_TE_01_PPT	Designation of specific and available tools: Planned Preventive Maintenance
		8.	C6_TE_01_PBT	Designation of specific and available tools: Planned Corrective Maintenance
		9.	C6_TE_01_PTT	Designation of specific and available tools: Unplanned Maintenance
		d. Information management		
		10.	C6_IM_01_PPT	Compatible with integrated maintenance management system (CMMS): Planned Preventive Maintenance
		11.	C6_IM_01_PBT	Compatible with integrated maintenance management system (CMMS): Planned Corrective Maintenance
		12.	C6_IM_01_PTT	Compatible with integrated maintenance management system (CMMS): Unplanned Maintenance
8.	Safety and Health (SH)	*a. Safety*		
		1.	C7_Safety_01_PPT	This strategy ensures that the mosque is free from sick building syndrome: Planned Preventive Maintenance
		2.	C7_Safety_01_PBT	This strategy ensures that the mosque is free from sick building syndrome: Planned Corrective Maintenance
		3.	C7_Safety_01_PTT	This strategy ensures that the mosque is free from sick building syndrome: Unplanned Maintenance
		4.	C7_Safety_02_PPT	This strategy ensures cleanliness in maintained areas: Planned Preventive Maintenance
		5.	C7_Safety_02_PBT	This strategy ensures cleanliness in maintained areas: Planned Corrective Maintenance
		6.	C7_Safety_02_PTT	This strategy ensures cleanliness in maintained areas: Unplanned Maintenance
		b. Health		
		7.	C7_Health_01_PPT	Provide safety against accidents due to falls and trips: Planned Preventive Maintenance
		8.	C7_Health_01_PBT	Provide safety against accidents due to falls and trips: Planned Corrective Maintenance
		9.	C7_Health_01_PTT	Provide safety against accidents due to falls and trips: Unplanned Maintenance
		10.	C7_Health_02_PPT	The frequency of checking the mosque's

No.	Model Construct	No.	Measurement Item	Item Represent
				equipment system to ensure user safety: Planned Preventive Maintenance
		11.	C7_Health_02_PBT	The frequency of checking the mosque's equipment system to ensure user safety: Planned Corrective Maintenance
		12.	C7_Health_02_PTT	The frequency of checking the mosque's equipment system to ensure user safety: Unplanned Maintenance
Note: There are eight model constructs and 108 measurement items				

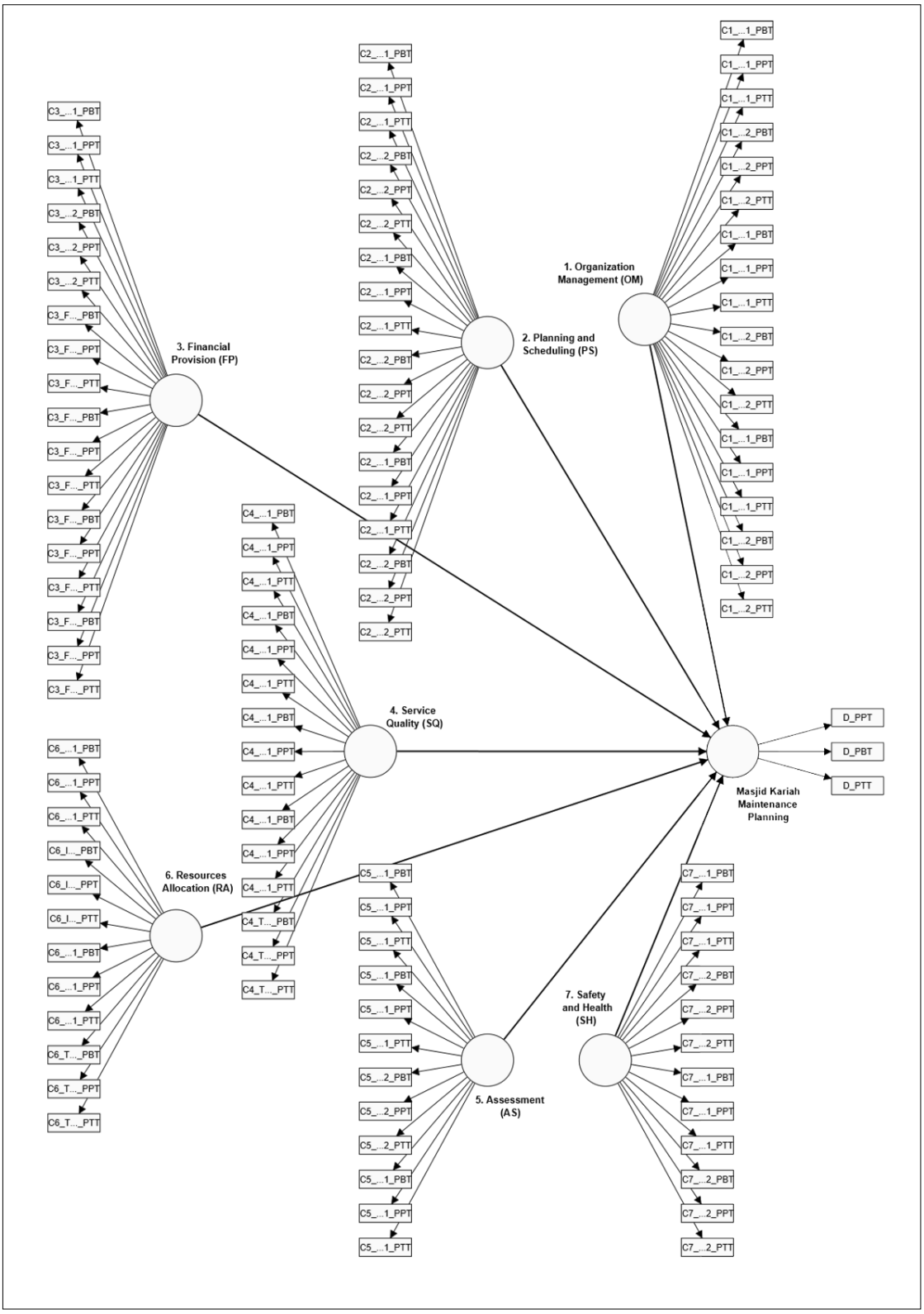

Figure 5.1 The Conceptual Model with Items of every Latent Constructs

5.4.1 Assessment of the Measurement Model

Following the recommendation of Hashim et al. (2023), Abu et al. (2021), Jayasingam et al. (2018) and Kashif et al. (2018), the convergent validity (CV) was assessed using factor loadings, average variance extracted (AVE) and composite reliability (CR) – the recommended values for loadings were set at >0.5, AVE at >0.5 and CR at > 0.7. From Table 5.4, the results showed that the measurement models' results surpassed the proposed values hence suggesting adequate convergent validity and all reflectively measured constructs were above the threshold of 0.5. However, 84 lower loading items were dropped to obtained better reliability and discriminant validity as the CR varied between 0 and 1 but CR values of above 0.7 were still considered satisfactory (Abu et al., 2021; Hair, Risher, et al., 2019). Besides, all the AVE assessed were higher than the critical value of 0.5 which indicated that the main construct captured more construct-related variance than error variance.

Table 5.4
Convergent Validity

No.	Model Construct	Measurement Item	Loadings	AVE	CR
1.	*Masjid kariah* Maintenance Planning (MKMP)	D_PPT	0.776	0.674	0.861
		D_PBT	0.847		
		D_PTT	0.838		
2.	Organization Management (OM)	C1_PD_01_PPT	0.872	0.579	0.803
		C1_PD_01_PTT	0.649		
		C1_PD_02_PPT	0.745		
3.	Planning and Scheduling (PS)	C2_RM_02_PTT	0.715	0.526	0.768
		C2_Com_02_PPT	0.647		
		C2_Com_02_PTT	0.805		
4.	Financial Provision (FP)	C3_AB_01_PTT	0.857	0.696	0.873
		C3_FE_01_PTT	0.768		
		C3_FA_01_PTT	0.874		
5.	Service Quality (SQ)	C4_Ass_01_PPT	0.650	0.503	0.752
		C4_Rel_01_PBT	0.733		
		C4_Tan_01_PTT	0.742		
6.	Assessment (AS)	C5_ALR_01_PTT	0.719	0.501	0.750
		C5_ASC_01_PBT	0.687		
		C5_ABC_01_PPT	0.716		
7.	Resource Allocation (RA)	C6_CM_01_PPT	0.836	0.643	0.844
		C6_SP_01_PPT	0.788		
		C6_TE_01_PPT	0.780		
8.	Safety and Health (SH)	C7_Health_01_PTT	0.609	0.529	0.769
		C7_Health_02_PTT	0.735		
		C7_Health_02_PBT	0.822		

Finally, after confirming the convergent validity (CV), the discriminant validity (DV) was assessed using HTMT method. The DV assessment shows that all the HTMT values were significantly lower than 0.9 and according to Samuel & Ramayah (2016), the constructs were distinct from each other because they were below the suggested cut-off of 0.9. All the HTMT values were significantly lower than the threshold value and different from 0.9. Thus, this result indicates as valid and significant to measures the structural model analysis in the next sub-topic. Table 5.5 shows the obtained values for the discriminant validity (HTMT).

Table 5.5
Discriminant Validity (HTMT)

	MKMP	**OM**	**PS**	**FP**	**SQ**	**AS**	**RA**	**SH**
Masjid kariah Maintenance Planning (MKMP)								
Organization Management (OM)	0.425							
Planning and Scheduling (PS)	0.087	0.757						
Financial Provision (FP)	0.311	0.347	0.468					
Service Quality (SQ)	0.307	0.128	0.274	0.781				
Assessment (AS)	0.203	0.603	0.186	0.342	0.017			
Resource Allocation (RA)	0.497	0.010	0.601	0.141	0.379	0.720		
Safety and Health (SH)	0.293	0.870	0.322	0.521	0.433	0.300	0.363	

The determination of model fitness is achieved through PLS-predict analysis which involves examining measures of goodness-of-fit, including R^2 (evaluate the extents to which the model explains variance) and Q^2 (assesses the model's ability to predict outcomes accurately). A Q^2 value greater than 0 indicates adequate predictive relevance for the model (Abu et al., 2021; Samuel & Ramayah, 2016). In this study, the Q^2 for *Masjid kariah* Maintenance Planning (MKMP) was 1.000 which means, the model's ability to predict outcomes were accurate. Besides, the measurement of model-fit and predictive relevance was confirmed by collinearity statistic (VIF). The predictor constructs' VIF values were assessed to ensure that there were no collinearity issues between the construct's indicators. As all VIF values were below 3, the results presented

were ideal (VIF < 3), indicating no multi-collinearity problems (Hashim et al., 2023). Thus, this study indicates that all the VIF values constructs were less than 3 (OM : 1.124; PS : 1.213; FS : 1.038; SQ : 1.176; AS : 1.199; RA : 1.066; SH : 1.034) and the model's ability to predict outcomes (Q2) were accurate.

5.4.2 Assessment of the Structural Model Analysis

According to Hair et al. (2019), by utilizing a 5,000-sample re-sample, bootstrapping procedures were subsequently used to assess the structural model's path coefficients, standard errors, t-values and p-values. This method, recommended for its robustness, involves generating numerous bootstrap samples from the original dataset to estimate the sampling distribution of statistics. Moreover, in response to the critique raised by Hahn & Ang (2017) regarding the limited reliability of p-values as the sole criterion for hypothesis testing a variety of criteria were integrated in their analysis – these included not only p-values but also confidence intervals. By incorporating multiple criteria, the researchers aimed to provide a more comprehensive evaluation of the hypotheses, thereby enhancing the validity and reliability of their findings. Therefore, these criteria were incorporated into the analysis and have been examined. Table 5.6 shows the hypotheses testing results of this study and Figure 5.2 visually illustrates several significant relationships in the research framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators (Constructs: AVE, Outer model: P values, Inner model: Path coefficients and P values).

Table 5.6
Hypotheses Testing

Hypotheses	**Path Co-Efficient (β)**	**Standard Deviation**	***t*-Value**	***p*-Value**	**Bias Confidence Interval (BCI)**		**Results**
					5.0%	**95.0%**	
H1: OM → MKMP	-0.058	0.169	0.344	0.365	-0.595	0.031	Not Supported
H2: PS → MKMP	0.254	0.184	1.385	0.000	0.103	0.588	Supported
H3: FP → MKMP	-0.203	0.053	3.814	0.000	-0.292	-0.116	Not supported
H4: SQ → MKMP	0.070	0.076	0.929	0.000	0.066	0.179	Supported
H5: AS → MKMP	0.037	0.073	0.511	0.000	0.111	0.129	Supported
H6: RA → MKMP	0.100	0.057	1.754	0.040	0.056	0.169	Supported
H7: SH → MKMP	-0.059	0.049	1.210	0.113	-0.100	0.140	Not Supported

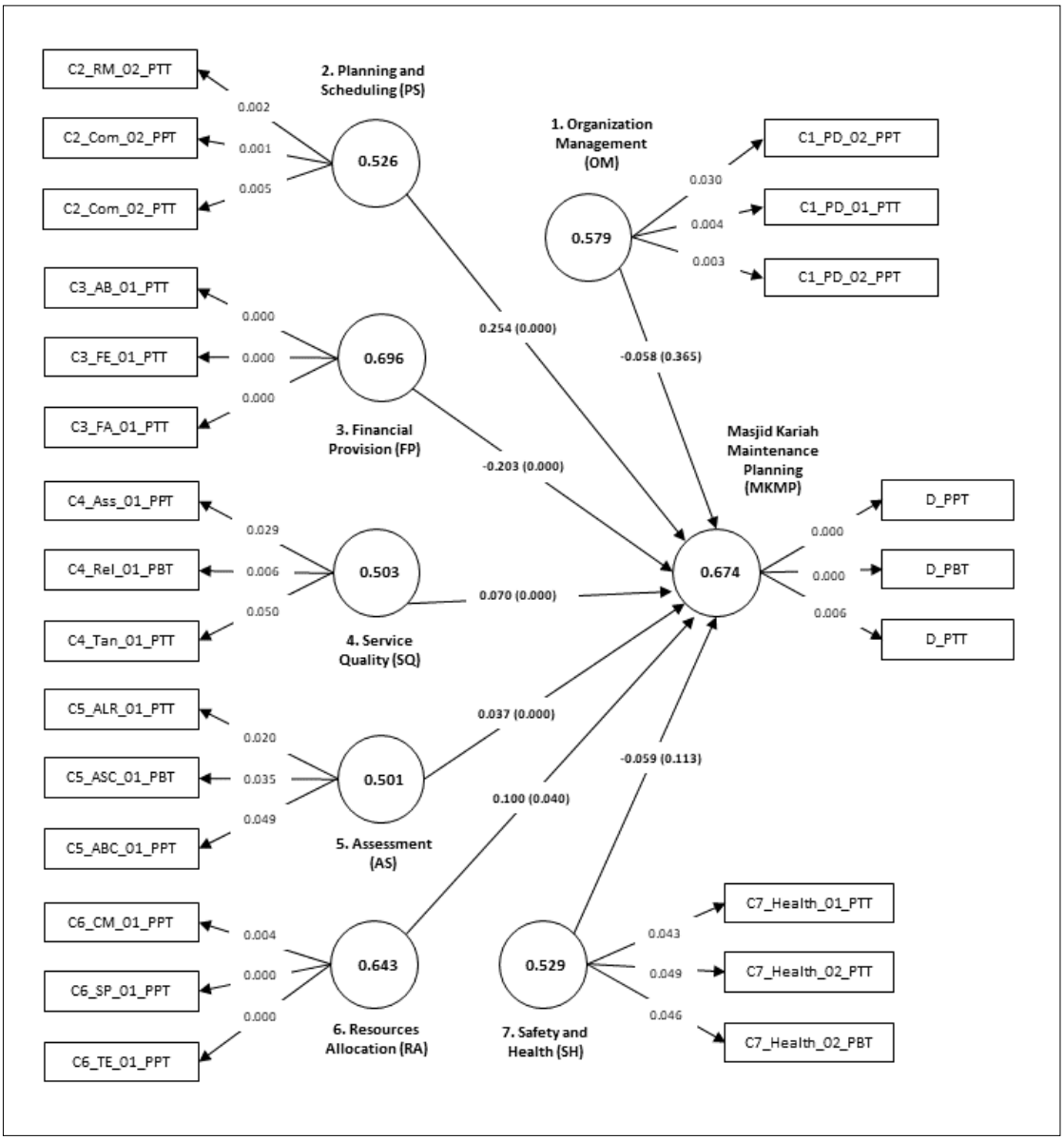

Figure 5.2 The Research Framework of Relationship between Maintenance Strategy Criteria's Indicators and Maintenance Planning via Maintenance Performance Measurement's Indicators

The results presented in Table 5.6 and Figure 5.2 revealed that three out of the seven hypotheses did not demonstrate a statistically significant positive relationship i.e. (1) Organization Management (OM) did not significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=-0.058, p<0.365), (2) Financial Provision (FP) did not significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=-0.203, p<0.000), and (3) Safety and Health (SH) did not have significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=-0.059, p<0.113). In contrast, the remaining four out of seven hypotheses exhibited a statistically significant positive relationship i.e. (1) Planning and Scheduling (PS) has significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=0.254, p<0.000), (2) Service Quality (SQ) has significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=0.070, p<0.000), (3) Assessment (AS) has significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=0.037, p<0.000) and (4) Resource Allocation (RA) has significantly positive influence with *Masjid kariah* Maintenance Planning (MKMP) (β=0.100, p<0.040). Thus, the findings supported the hypothesis for H1, H2, H3, H4, H5, H6 and H7.

5.5 Synthesis of Key Factors Influencing Masjid Kariah Maintenance Planning (RO3)

This section synthesises the results of the PLS-SEM analysis with the theoretical and empirical literature reviewed in Chapter 2 to critically evaluate the key factors influencing maintenance planning for *Masjid kariah* in Kelantan, thereby fulfilling Research Objective Three (RO3). The synthesis begins with the presentation of significant and non-significant indicators derived from the measurement and structural model assessment. These empirical outcomes form the basis for a deeper theoretical interpretation that explains why certain indicators significantly shape maintenance planning while others do not, considering both international maintenance theories and local mosque-specific operational realities. Table 5.7 shows the summary of significant findings.

Table 5.7
Summary of Significant Findings

No.	Model Construct	No.	Sub-Model Construct (Sub-indicators)	Total Measurement Item	Item Represent
1.	*Masjid kariah* Maintenance Planning (MKMP)	1.	Planned Preventive Maintenance	1/1	Planned Preventive Maintenance (D_PPT)
		2.	Planned Corrective Maintenance	1/1	Planned Corrective Maintenance (D_PBT)
		3.	Unplanned Maintenance	1/1	Unplanned Maintenance (D_PTT)
2.	Organization Management (OM)	1.	Policy Usage	3/6	Use of a clear policy: Planned Preventive Maintenance (C1_PD_01_PPT)
					Use of a clear policy: Unplanned Maintenance (C1_PD_01_PTT)
					Effective policy application: Planned Preventive Maintenance (C1_PD_02_PPT)
		2.	Management of Human Resources	0/6	N/A
		3.	Continual Improvement	0/6	N/A
3.	Planning and Scheduling (PS)	1.	Maintenance Approach	0/6	N/A
		2.	Records Management	1/6	Effectiveness of file handling: Unplanned Maintenance (C2_RM_02_PTT)
		3.	Communication	2/6	The mosque committee members can communicate clearly: Planned Preventive Maintenance (C2_Com_02_PPT)
					The mosque committee members can communicate clearly: Unplanned Maintenance (C2_Com_02_PTT)
4.	Financial Provision (FP)	1.	Adequacy of the Budget	1/6	Adequacy of maintenance plan provisions: Unplanned Maintenance (C3_AB_01_PTT)
		2.	Fund Efficiency	1/6	Efficient tracking of fund savings: Unplanned Maintenance (C3_FE_01_PTT)
		3.	Fund Allocation	1/6	Adequate fund allocation in mosques: Unplanned

No.	Model Construct	No.	Sub-Model Construct (Sub-indicators)	Total Measurement Item	Item Represent
					Maintenance (C3_FA_01_PTT)
5.	Service Quality (SQ)	1.	Trustworthiness	1/3	Able to perform scheduled services: Planned Preventive Maintenance (C4_Ass_01_PPT)
		2.	Empathy	0/3	N/A
		3.	Guarantee	1/3	Ensuring an efficient maintenance service: Planned Corrective Maintenance (C4_Rel_01_PBT)
		4.	Responsive	0/3	N/A
		5.	Tangible	1/3	The maintenance staff can provide good maintenance services: Unplanned Maintenance (C4_Tan_01_PTT)
6.	Assessment (AS)	1.	Building condition assessment	1/3	Being able to maintain the physical elements of mosque buildings: Unplanned Maintenance (C5_ALR_01_PTT)
		2.	Assessment of equipment system conditions	0/3	N/A
		3.	Legal obligations	2/6	Fulfilling building law requirements in assessing the physical condition of mosques: Planned Corrective Maintenance (C5_ASC_01_PBT)
					Fulfilling building law requirements in assessing mosque equipment systems: Planned Preventive Maintenance (C5_ABC_01_PPT)
7.	Resources Allocation (RA)	1.	Contract Management	1/3	Giving contractors adequate contracts: Planned Preventive Maintenance (C6_CM_01_PPT)
		2.	Spare Parts Management	1/3	A regular and adequate spare parts schedule for recurring maintenance: Planned Preventive Maintenance (C6_SP_01_PPT)
		3.	Tools and Equipment	1/3	Designation of specific and available tools: Planned Preventive Maintenance

No.	Model Construct	No.	Sub-Model Construct (Sub-indicators)	Total Measurement Item	Item Represent
					(C6_TE_01_PPT)
		4.	Information management	0/3	N/A
8.	Safety and Health (SH)	1.	Safety	0/6	N/A
		2.	Health	3/6	Provide safety against accidents due to falls and trips: Unplanned Maintenance (C7_Health_01_PTT)
					The frequency of checking the mosque's equipment system to ensure user safety: Unplanned Maintenance (C7_Health_02_PTT)
					The frequency of checking the mosque's equipment system to ensure user safety: Planned Corrective Maintenance (C7_Health_02_PBT)

Note: N/A: Not Applicable;

As shown in Table 5.7, the indicators exhibit varying levels of influence across the Maintenance Strategy Criteria (MSC) and the eight constructs of Maintenance Performance Measurement (MPM). These variations highlight the asymmetric behaviour of maintenance constructs within community-based religious facilities such as *Masjid kariah*. The following synthesis integrates these empirical findings with relevant literature to provide a comprehensive understanding of the factors shaping maintenance planning.

The strong support for all three Maintenance Strategy Criteria (MSC) – Planned Preventive Maintenance, Planned Corrective Maintenance, and Unplanned Maintenance indicate clear alignment with the maintenance territories defined in BS 3811. Prior studies, such as Swanson (2001), emphasise that classifying maintenance into proactive and reactive categories enhances planning precision, resource allocation, and maintenance effectiveness. The significant support for these indicators suggests that mosque committees, even without formal facility management structures, intuitively adopt similar strategic distinctions. This reinforces the applicability of BS 3811 in community-managed mosques when supported by routine scheduling and prioritisation mechanisms.

Organisation Management (OM) demonstrates partial significance, with policy usage emerging as the strongest contributor. This finding aligns with Sapril et al. (2016) and Ku & Kim (2019), who assert that formalised policies improve consistency and accountability in maintenance operations. However, human resource–related indicators were not significant, consistent with Wijaya & Muhammad (2016), who observed that mosques typically rely on volunteers rather than trained facility management staff. This divergence indicates that HR-based performance models commonly used in institutional or commercial settings may not translate directly into volunteer-driven mosque environments.

Communication within the Planning and Scheduling (PS) construct showed significant influence, consistent with Cholasuke et al. (2004), who highlight coordination as a key determinant of maintenance performance. In contrast, records management indicators were non-significant, supporting findings from Sapril et al. (2016) that mosques often rely on informal documentation practices. This reliance on verbal communication and manual record-keeping reduces the impact of documentation-intensive planning systems typically found in industrial or government facility management contexts.

Financial Provision (FP) exhibited partial significance, with budget adequacy and fund allocation positively contributing to maintenance planning. This supports Parida & Kumar (2009), who argue that financial readiness directly influences maintenance capability and strategic decision-making. However, because mosques rely heavily on community donations, their financial stability is inherently inconsistent. This is consistent with Brown et al. (1994), who found that organisations with irregular funding cycles experience uneven maintenance performance – a trend reflected in the partial significance of financial indicators in this study.

Service Quality (SQ) indicators revealed mixed results. Reliability and tangibility – representing the technical and physical dimensions of service were significant, supporting Brown et al. (1994) and Campbell & Jardine (2001), who highlight the influence of technical service quality on maintenance outcomes. However, empathy and responsiveness were non-significant, consistent with Wijaya & Muhammad (2016), who observed that mosque users prioritise functional adequacy and physical condition over interpersonal service attributes. This suggests that maintenance planning in mosques is shaped more by technical performance than by service interaction quality.

Assessment (AS) and Resource Allocation (RA) constructs further highlight the operational focus of mosque maintenance. Building condition assessment was significant, aligning with Coetzee (1998), who emphasises that condition evaluation is fundamental to maintenance planning. Indicators related to contractor management, spare parts availability, and tools and equipment were also significant, consistent with Campbell & Jardine's (2001) assertion that operational readiness underpins maintenance performance. Non-significant indicators such as equipment assessment and information management underscore the limited use of inspection tools and digital systems within mosque committees.

A broader pattern emerges across the constructs: operational and technical indicators exert a stronger influence on maintenance planning than administrative or strategic indicators. This mirrors Swanson's (2001) conclusion that proactive strategies require strong operational support to achieve meaningful impact. The weak influence of HR, documentation, and assessment systems reflects the governance limitations typical of community-managed religious facilities. These limitations highlight the need for capacity-building initiatives that address skills development, documentation culture, and basic digital adoption within mosque committees.

Overall, the synthesis of significant and non-significant indicators confirms that maintenance planning in *Masjid kariah* is predominantly shaped by operational readiness, resource availability, financial support, and clear maintenance strategies. At the same time, the weak influence of governance-related indicators points to structural gaps that hinder long-term planning maturity. These contextual insights confirm that Research Objective Three (RO3) has been met, and they provide a robust empirical and theoretical foundation for developing the performance-based maintenance planning framework presented in Chapter 6.

5.6 Summary

This chapter critically evaluated the key factors influencing the maintenance planning of *Masjid kariah* in Kelantan by analysing the structural relationships tested through the PLS-SEM model. Overall, the findings revealed a multi-dimensional structure in which maintenance planning effectiveness is shaped by seven performance-based constructs (MPM) i.e. Organisation Management, Planning and Scheduling, Financial Provision, Service Quality, Maintenance Assessment, Resource Allocation,

and Safety & Health together with three Maintenance Strategy Criteria (MSC) derived from British Standard 3811 (1993), namely Planned Preventive Maintenance, Planned Corrective Maintenance, and Unplanned Maintenance. Through this analysis, the chapter successfully fulfilled Research Objective Three (RO3) by identifying which indicators and dimensions significantly influence the formulation of a structured and performance-driven maintenance planning framework for *Masjid kariah*.

A critical assessment of the structural model showed that several hypothesised relationships were supported, reflecting strong empirical grounding, while other relationships were statistically insignificant. Supported hypotheses indicate that dimensions such as policy usage, communication, fund efficiency, legal compliance, tool and equipment availability, and aspects of health and building condition play substantive roles in strengthening mosque maintenance performance. These results demonstrate that effective maintenance planning for *Masjid kariah* cannot rely solely on reactive practices but must adopt a systematic approach that integrates organisational governance, resource optimisation, and compliance with regulatory and safety requirements. The supported findings underscore the need for a more holistic and standardised planning mechanism aligned with MS ISO 41001:2018 and facility management best practices.

Equally important are the unsupported hypotheses, which provide meaningful insights into contextual realities of *Masjid kariah*. The insignificance of several constructs i.e. management of human resources, continual improvement, spare parts management, empathy, and certain safety indicators – suggests internal limitations unique to community mosques. These may be attributed to the voluntary structure of mosque committees, absence of skilled maintenance personnel, lack of technical training, and reliance on community donations rather than professionally managed asset systems. The contrasting patterns between supported and unsupported results reflect the heterogeneous operational environment of *Masjid kariah* and demonstrate that policy transfer from commercial buildings cannot be applied directly without cultural and institutional adaptation. This reinforces the argument that maintenance strategies for *Masjid kariah* must be tailored to their socio-religious context rather than adopting generic facility management models.

The chapter further synthesised all significant indicators and dimensions into a consolidated representation, as shown in Table 5.6 (Summary of Significant Findings). This table provides a refined and empirically validated set of factors that serve as the

foundational components for the development of the performance-based maintenance strategy framework. Table 5.6 strengthens the critical contribution of this chapter by distinguishing between dimensions that are operationally influential and those that require structural enhancement or policy intervention. As such, the findings directly shape the refinement of the proposed framework by clarifying which aspects must be prioritised during framework formulation and which require further institutional improvement.

In conclusion, this chapter established the empirical backbone of the study by identifying the most influential performance indicators that improve maintenance planning for *Masjid kariah*, while also exposing structural weaknesses that hinder effective maintenance execution. These insights fulfil Research Objective Three (RO3) and serve as the bridge to Research Objective Four (RO4), which focuses on integrating these validated indicators into a comprehensive, performance-based maintenance strategy framework. The subsequent chapter (Chapter 6) builds upon these findings by developing and validating the final Maintenance Strategies Performance-Based Framework, ensuring that the framework is both theoretically robust and operationally practical within the institutional realities of *Masjid kariah* in Kelantan.

CHAPTER 6
FRAMEWORK OF MAINTENANCE STRATEGY FOR THE MASJID KARIAH IN KELANTAN STATE, MALAYSIA

6.1 Introduction

This chapter presents the final step in developing the maintenance planning framework for *Masjid kariah* in Kelantan, in line with the overall research aim "to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia" and Research Objective Four (RO4), which is to evaluate and refine the proposed framework through expert review. The framework was initially constructed from the theoretical and conceptual foundations in Chapter 2, further elaborated through the qualitative Delphi study on Maintenance Performance Measurement (MPM) dimensions in Chapter 4, and empirically tested using Partial Least Squares Structural Equation Modelling (PLS-SEM) in Chapter 5. While the PLS-SEM results provided statistical support for several key relationships in the model, a final practice-oriented review was necessary to ensure that the framework is also realistic, usable and meaningful for stakeholders responsible for *Masjid kariah* maintenance planning.

To fulfil RO4, a targeted expert review was conducted with five experienced panellists, from industry practician and academician sectors, who served as independent reviewers of the PLS-SEM–based framework. These experts were purposefully selected as key informant to provide deep and complementary perspectives – conceptual and practical on the suitability of the framework for *Masjid kariah*. Experts' demographic and professional profiles, extracted from the Expert Review Form, are summarised in Table 6.1.

A structured Expert Validation Form (Appendix 15) was used to guide the process. The form presents the main PLS-SEM results and the proposed framework and invites the expert to record his level of agreement, identify the most critical variables for *Masjid kariah* and provide written comments and suggestions. During the semi-structured interviews, the researcher guided the expert through the form, clarified any questions and encouraged to elaborate on his responses. The completed forms and

interview notes were then analysed thematically to confirm, qualify and refine the framework derived from the quantitative analysis.

The remainder of this chapter is organised as follows. Section 6.2 revisits the performance-based maintenance framework produced from the PLS-SEM analysis. Section 6.3 explains the expert-review procedure in detail and presents the main themes that emerged from the experts' feedback. Section 6.4 integrates the quantitative findings and expert insights to present the refined maintenance planning framework for *Masjid kariah* and to discuss its implications for practice. Finally, Section 6.5 concludes the chapter by summarising how this final step completes the development of the maintenance planning framework in accordance with the research aim.

6.2 Framework of Maintenance Strategies for the Masjid Kariah in Kelantan State, Malaysia based on PLS-SEM Results

The performance-based framework for *Masjid kariah* maintenance planning was first established and tested using Partial Least Squares Structural Equation Modelling (PLS-SEM) in Chapter 5. As shown in Figure 6.1, the structural model specifies one dependent construct – *Masjid kariah* Maintenance Planning (MKMP), which represents the three Maintenance Strategy Criteria (MSC) of Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) – and seven independent constructs representing the Maintenance Performance Measurement (MPM) dimensions: Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Service Quality (SQ), Assessment (AS), Resource Allocation (RA), and Safety and Health (SH). These constructs were derived from the theoretical framework in Chapter 2 and the Delphi-based indicator development in Chapter 4.

The PLS-SEM results indicated that all seven MPM dimensions exert positive effects on MKMP, but with varying strengths and levels of statistical support. Operational dimensions such as Planning and Scheduling (PS), Resource Allocation (RA), Assessment (AS) and aspects of Service Quality (SQ) showed stronger and more consistent relationships with MKMP, reflecting their central role in driving the adoption of planned preventive and planned corrective maintenance strategies in *Masjid kariah*. In contrast, Organisation Management (OM), Financial Provision (FP) and Safety and Health (SH) exhibited more mixed or partial support at the indicator level: some

measures were significant, while others were weaker or non-significant. These findings suggest that, although OM, FP and SH are conceptually important and frequently highlighted in the literature, their direct influence on MKMP in the current empirical data is less straightforward than anticipated.

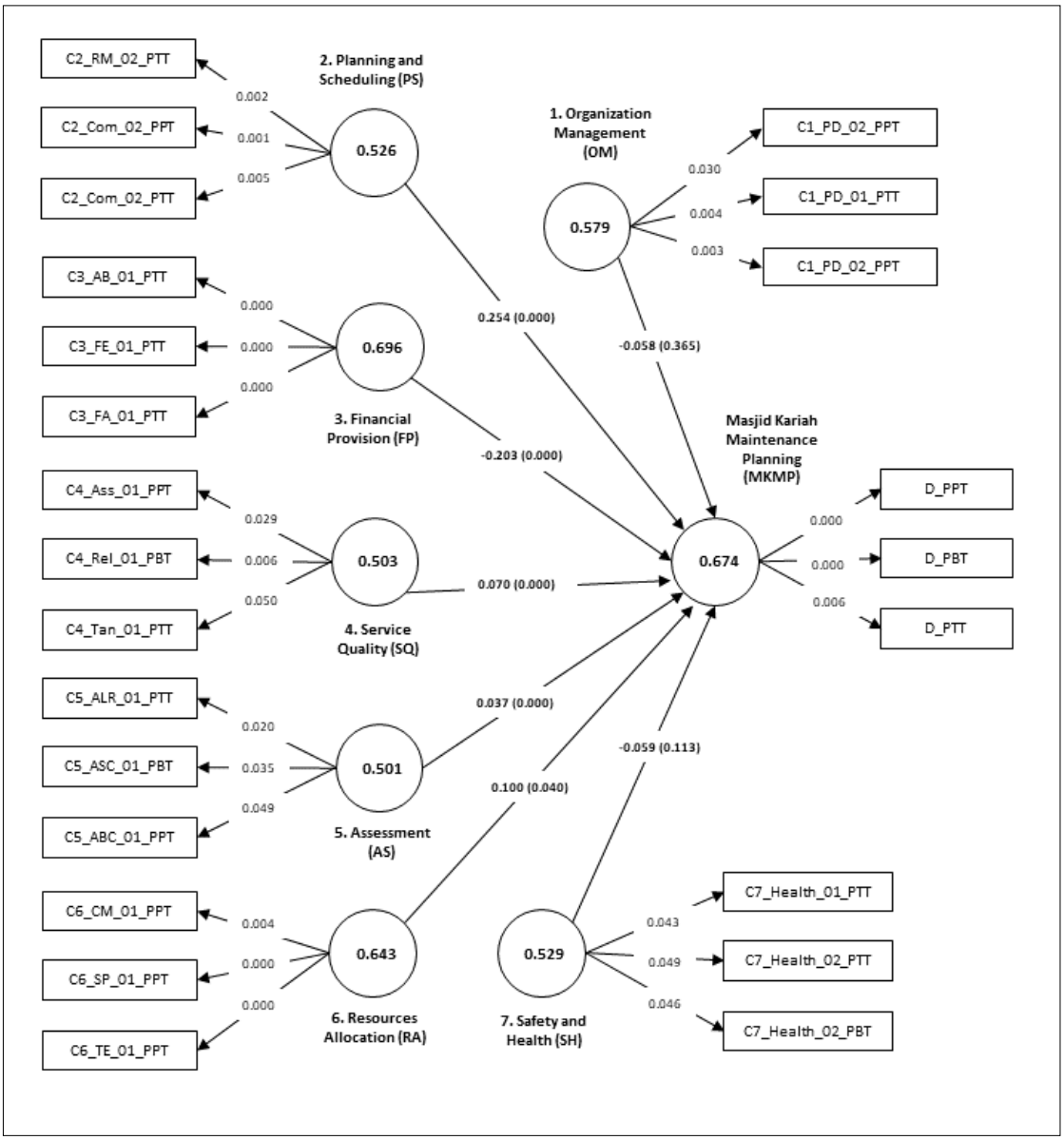

Figure 6.1 The Research Framework (based on PLS-SEM Results)

Overall, the PLS-SEM analysis presented in Chapter 5 fulfilled Research Objective Three (RO3) by identifying the key factors that statistically influence *Masjid kariah* maintenance planning and by confirming the general structure of the proposed framework. However, the mixed results for several dimensions - particularly Financial Provision (FP), which the literature and practitioners often regard as critical - raised

important questions about how the framework should be interpreted and applied in practice. These issues provided the main motivation for the expert review reported in the following sections, where the PLS-SEM–based framework is evaluated and refined to ensure its practicality and relevance for *Masjid kariah* stakeholders.

6.3 Expert Validation on the Framework

Following the PLS-SEM analysis reported in Chapter 5, five expert's review were undertaken to evaluate and refine the proposed maintenance planning framework for *Masjid kariah*. This section explains how the experts were selected, how the review was conducted using the Expert Validation Form, and how his feedback was used to confirm and adjust the framework so that it is both conceptually sound and practically applicable.

6.3.1 Selection and Demographic Profile of Expert Panels

Five experts were purposefully selected as independent reviewers of the PLS-SEM–based framework to evaluate the clarity, relevance, and practical implement ability of the proposed maintenance planning framework for *Masjid kariah*. The panel design intentionally combined industry and academic viewpoints to ensure that the validated framework is not only conceptually defensible but also operationally feasible at committee level. In purposive selection, the emphasis was placed on domain-specific expertise, decision-making exposure, and the ability to provide critical, improvement-oriented feedback that could refine the framework into a realistic implementation package for mosque facilities.

The industry expert panel (EA) comprised three private-sector practitioners with distinct but complementary professional vantage points spanning facility governance, project delivery, and building services systems. EA-1 is a facilities management and building maintenance practitioner from the consultancy sector, serving as a Director with approximately 10 years of experience in facility management and building maintenance practice. This expert profile was selected to contribute a governance-and-implementation lens, focusing on how mosque committees can operationalise maintenance planning through clear procedures, condition-based prioritisation, and practical controls that support transparency and accountability. EA-2 is a senior industry

practitioner from the construction/project delivery domain, serving as a Group Managing Director (contractor leadership) with industry experience exceeding nine years in construction management and project execution. This profile was selected to stress-test the framework from an execution feasibility perspective, including the realism of budgeting discipline, cost control mechanisms, procurement routing (minor, medium or major works), and payment governance in community-based settings. EA-3 is a building services specialist (M&E) from the consultancy domain, serving as a Managing Director with more than 18 years of experience in M&E building services such as ACMV, fire protection, and plumbing systems, as well as tender/contract management and site supervision. This expert profile was selected to ensure that the framework adequately addresses service-system reliability, recurring servicing requirements, and the budgeting and supervision intensity needed to sustain critical building services performance in mosque facilities.

Collectively, these three industry experts strengthened the validation through triangulation across (i) facility governance and maintenance administration (EA-1), (ii) delivery-oriented financial and procurement controls (EA-2), and (iii) technical-operational reliability of building services systems (EA-3). This composition enhances the credibility of the validation outcomes by ensuring that the refined framework can be translated into practical actions – covering planning, prioritisation, funding discipline, procurement execution, and quality assurance within the operational realities of *Masjid kariah* committees.

The academician expert panel (EB) was included to provide theoretical scrutiny and an institutional governance perspective on the framework's coherence, applicability, and contextual fit for Masjid kariah. EB-1 is a university-based practitioner-academic with professional property management expertise, including registration as a Registered Property Manager under LPPEH or BOVAEP (Registration No.: PM2357). This profile was selected to strengthen feedback on governance readiness, documentation discipline, accountability mechanisms, and the practicality of translating the framework into committee-level procedures. EB-2 is a Senior Lecturer with prior exposure to local authority practice (former MBSJ officer) and private-sector experience, with long professional experience in planning-related work and public-sector coordination. This profile was selected to provide an implementation-oriented perspective on institutional interfaces (committee–authority coordination), continuity of governance, and operational realism in community facility management.

Collectively, the academician panel complemented the industry experts by strengthening the framework's conceptual defensibility, policy or governance alignment, and feasibility of adoption within the organisational realities of *Masjid kariah* committees.

The selection criteria were: (1) substantial experience in building and mosque maintenance; (2) direct involvement in planning, managing, supervising, or evaluating maintenance activities; (3) familiarity with operational and governance issues faced by Masjid Kariah; and (4) willingness to provide detailed, constructive feedback on the proposed framework. The experts' demographic and professional profiles were captured using the Expert Validation Form (Appendix 15) and are summarised in Table 6.1, which reports their sector, organisation, position, years of experience, and main area of expertise. Although the number of panellists is small, the experts were purposefully selected as key informants with deep, practice-relevant knowledge and complementary viewpoints, which is appropriate for refining and validating the framework.

Table 6.1
The List of Experts and Profiles

No.	Expert Code	Sector/ Organisation	Designation	Year of Experience	Justification of Selection	Field
1.	EA-1	Consultant (Amas FM Consultant Sdn Bhd)	Director	10	Private Sector — extensive FM/building maintenance exposure; suitable to review practicality of implementation for community facilities	Facility Management & Building Maintenance (practice pengurusan bangunan; pengalaman FM & building maintenance)
2.	EA-2	Consultant (Vertex Central Industries Sdn. Bhd.)	Group Managing Director	9	Private Sector — senior industry practitioner (construction leadership) to validate feasibility of governance/financial-procurement controls and	Construction management / contractor (civil & structural) + construction project management

No.	Expert Code	Sector/ Organisation	Designation	Year of Experience	Justification of Selection	Field
					implementation realism	
3.	EA-3	Consultant (Perunding Ilham IZ (M) Sdn Bhd)	Managing Director	18	Private Sector — M&E building services specialist with mosque-related tender/site supervision exposure; strengthens technical-operational validation of services scope, budgeting, and contractor accountability	M&E building services (ACMV, fire protection, plumbing) + tender/contract management & site supervision (mosque facilities)
4.	EB-1	Universiti Kebangsaan Malaysia (UKM)	Registered Property Manager (RPM) registered with the Board of Valuers, Appraisers, Estate Agents and Property Managers (LPPEH/BOVAEP), Malaysia (Registration No.: PM2357)	12	Public Sector — academician/ practitioner background with registered property management credential; suitable to review governance feasibility, documentation discipline, and practical implementation of maintenance planning for community facilities.	Property Management / Facility & Building Maintenance (registered property manager; experience in property management + academia)
5.	EB-2	Universiti Teknologi MARA (UiTM)	Senior Lecturer (currently); former	27	Public Sector — academician with planning	Town and Regional Planning; Physical

No.	Expert Code	Sector/ Organisation	Designation	Year of Experience	Justification of Selection	Field
			MBSJ officer with private-sector experience		and local-authority exposure; strengthens theoretical and implementation scrutiny, especially governance continuity, stakeholder coordination, and operational realism for Masjid Kariah committees.	Planning; Urban Environment; Low Carbon Cities; Sustainable Development
Note: EA – Industry Practician expert EB – Academician expert						

6.3.2 Validation Procedure and Protocol

The expert review used a structured Expert Validation Form developed specifically for this study (Appendix 15). The form contains three components: (1) an expert information section, (2) Section A on research recommendations, and (3) Section B on overall feedback and suggestions. In the Expert Information section, the panellists recorded basic details such as name, field of expertise, organisation, contact information and signature. This information was used to verify that the expert met the selection criteria and to prepare the demographic summary in Table 6.1 above.

In Section A: Research Recommendations – A Framework of Maintenance Strategies for the Masjid Kariah, the experts were presented with a summary table of the PLS-SEM hypothesis-testing results (H1–H7), including path coefficients, t-values and significance levels, together with the research framework diagram derived from Chapter 5. He was asked to indicate whether they agreed that these results provide an adequate basis for a framework of maintenance strategies for *Masjid kariah* and to give written comments on the adequacy of the constructs, the clarity of the relationships and any aspects that required refinement.

In Section B: Overall Feedback and Suggestions for Future Improvement, the experts were shown the theoretical framework diagram that distinguishes the three

Maintenance Strategy Criteria – Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM) – as dependent variables and the seven Maintenance Performance Measurement (MPM) dimensions as independent variables. They were requested to (1) identify which variable(s) they considered most significant for *Masjid kariah* at present, (2) explain the reasons for their choice, and (3) provide any additional comments or recommendations that could strengthen the framework or its implementation.

The Expert Review Form and a short briefing note were emailed to the panellist several days before the interview so that they could study the results and framework in advance. Subsequently, individual semi-structured interview was conducted with expert. At the start of session, the researcher briefly revisited the research aim, the development of the framework in previous chapters and the main PLS-SEM findings, before guiding the expert through Sections A and B of the form. Clarifications were provided where necessary and the expert was encouraged to elaborate on his written answers and to give concrete examples drawn from his experience.

The interview lasted approximately 15–30 minutes and was audio-recorded with the experts' consent. The completed forms and interview transcripts were then analysed thematically. Initial codes were generated around (1) overall agreement or disagreement with the framework, (2) perceived importance of each MPM dimension and MSC component, and (3) specific suggestions for refining the framework or its application in *Masjid kariah*. These codes were grouped into broader themes, which are presented in the next subsection.

6.3.3 Key Validation Findings and Implications for the Framework

6.3.3.1 Expert Panel One (EA-1)

The Expert Panel One (EA-1) expressed overall agreement with the structure of the framework and confirmed that the seven MPM dimensions and three Maintenance Strategy Criteria appropriately represent the main elements of maintenance planning for Masjid Kariah. An EA-1 considered the separation between performance dimensions (OM, PS, FP, SQ, AS, RA, SH) and strategy outcomes (PPM, PCM, UM) to be conceptually sound and consistent with an EA-1's experience in building and mosque

maintenance. No additional constructs were proposed, indicating that the framework is broadly comprehensive from the EA-1's perspectives.

At the same time, the EA-1 offered several important nuances that refine the interpretation of the PLS-SEM results:

i. **Central role of Financial Provision (FP)**:

The EA-1 highlighted FP as a critical practical dimension, even though its direct path to MKMP was weaker in the statistical analysis. He argued that adequate and well-managed financial resources are a prerequisite for implementing planned preventive and planned corrective maintenance programmes, and that FP influences maintenance planning indirectly by enabling or constraining Planning and Scheduling, Resource Allocation, and Service Quality.

In particular, EA-1 emphasised that a dedicated and ring-fenced maintenance budget is necessary to break the current reactive (complaint-based) and deferred maintenance culture. He recommended that *Masjid kariah* allocate a minimum of 10% of annual income/collections into a Dedicated Maintenance Fund (maintained as a separate account/record). This allocation can be increased (e.g., 15%–20%) for older mosques or those with higher critical defects, guided by periodic Building Condition Assessment (BCA) findings.

To strengthen cost-efficiency and "value for money", EA-1 further proposed that the maintenance fund should be operationally integrated with (i) periodic BCA outputs (priority list and budgeting), (ii) a transparent procurement SOP, and (iii) an updated Schedule of Rates for common works – thus, that recurring defects can be reduced and budgeting decisions become more evidence-based.

ii. **Importance of Planning and Scheduling (PS), Resource Allocation (RA) and Assessment (AS)**:

The EA-1 supported the finding that PS, RA and AS are among the most influential dimensions in driving the adoption of PPM and PCM. They

emphasised that without systematic inspection schedules, clear work programmes, sufficient manpower and tools, and regular assessment of building condition, *Masjid kariah* will continue to rely on complaint-based and unplanned maintenance. These dimensions were therefore identified as priority areas for improvement in mosque maintenance practice.

iii. **Organisation Management (OM) and Safety and Health (SH) as governance requirements**:

The EA-1 viewed OM and SH as governance- and compliance-oriented dimensions that should always be present in any framework for mosque maintenance, even if their statistical effects are modest. OM captures leadership, role clarity and communication among mosque committees and related authorities, while SH reflects statutory obligations and the religious responsibility to protect worshippers. EA-1 suggested that OM and SH be framed as baseline requirements that shape how the other dimensions operate.

iv. **Operationalisation through simple and workable implementation tools**

The EA-1 agreed with the proposed framework and described it as supportive of a more systematic, transparent, and consistent maintenance approach. However, he stressed that implementation at *Masjid kariah* level should be strengthened with a simple but workable guideline, particularly covering: (1) establishing a Dedicated Maintenance Fund, (2) conducting periodic BCA (1–2 times per year) to generate a priority list and support budget planning, (3) applying a clear procurement process/SOP based on work categories, and (4) developing a Maintenance Schedule of Rates (unit price list) for common works to improve cost control and decision-making.

EA-1 also recommended that mosque maintenance activities be consistently classified into Planned Maintenance and Unplanned Maintenance. Planned maintenance refers to scheduled

preventive/cyclical works based on time and/or condition assessment (e.g., air-conditioning servicing, roof/dome inspection, PA system testing, painting cycle, carpet deep cleaning/replacement, water tank and gutter cleaning, pest control). Unplanned maintenance refers to reactive corrective or emergency repairs due to failures/incidents (e.g., faulty lamps, roof leaks, plumbing bursts, electrical faults/short circuits, urgent defects). This classification supports budgeting, procurement routing, and the development/use of a Schedule of Rates.

Where procurement is required, EA-1 proposed a tiered SOP aligned to work magnitude: minor works (direct purchase/simple quotation), medium works (minimum three quotations with technical-cost comparison), and major works (tender/registered contractor with clear scope, timeline, warranty, and payment terms).

In parallel, EA-1 recommended a Maintenance Schedule of Rates (unit rates) for common works (e.g., HVAC servicing, electrical, plumbing, painting, toilets, roofing, water tank cleaning, landscaping), reviewed at least annually based on market rates and past quotations.

v. **Clarity and usability of the framework**:

The EA-1 agreed that the framework is understandable and can be used as a practical guide for discussions between mosque committees, state religious authorities and technical agencies. He suggested minor refinements to labelling and wording for instance, consistently using the terms “Maintenance Strategy Criteria (MSC)” and “Maintenance Performance Measurement (MPM) dimensions” to enhance clarity when the framework is communicated to non-technical stakeholders.

Overall, EA-1’s feedback implies that while the framework is conceptually sound and comprehensive, its practical effectiveness at *Masjid kariah* level depends on strengthening financial governance and translating the model into a simple, workable implementation package for committees. The recommended ring-fenced maintenance budget (with indicative allocation targets), periodic Building Condition Assessment

(BCA) to generate prioritised work lists, a transparent tiered procurement SOP, and an updated Maintenance Schedule of Rates (unit-rate list) strengthen cost control, transparency, and evidence-based decision-making. In parallel, reinforcing Planning and Scheduling (PS), Resource Allocation (RA), and Assessment (AS) as core operational drivers while framing Organisation Management (OM) and Safety and Health (SH) as baseline governance requirements – improves consistency, accountability, and increases the likelihood that planned maintenance (PPM/PCM) can be sustained and reliance on unplanned, complaint-based works can be reduced.

6.3.3.2 Expert Panel Two (EA-2)

The Expert Panel Two (EA-2) expressed overall agreement with the proposed framework and supported its relevance as a structured guide for *Masjid kariah* committees to move from ad-hoc, complaint-based maintenance towards more planned and accountable decision-making. EA-2 did not propose additional constructs, indicating that the seven MPM dimensions and three MSC outcomes are generally comprehensive for capturing mosque maintenance planning requirements.

At the same time, EA-2 offered several important nuances that refine how the PLS-SEM results should be interpreted and operationalised in practice:

i. **Central role of Financial Provision (FP)**:

EA-2 reinforced FP as a practical "enabling factor" that determines whether other dimensions can be executed consistently. In particular, EA-2 argued that maintenance failures in community facilities often persist not because defects are unknown, but because funding is not planned, not ring-fenced, and not controlled through consistent procurement and approval procedures. To strengthen FP, EA-2 recommended a Dedicated Maintenance Fund, cost-control mechanisms (quotation comparison using unit-rate checks and approval thresholds), and payment governance based on completion verification and basic documentation.

ii. **Operationalisation through an implementation pack (guideline) and end-to-end linkage**:

Consistent with the implementation emphasis in EA-1, EA-2 stressed that the framework should be supported by a short guideline (implementation pack) with simple templates (defect register, priority scoring sheet, annual maintenance budget sheet, quotation comparison sheet, work order, completion verification form, and payment checklist). This is intended to help non-technical committee members implement the framework consistently and maintain a clear audit trail. EA-2 also recommended making the implementation pathway explicit, linking periodic condition checking/BCA → defect register and priority list → annual budget allocation → procurement packages, so that prioritisation is translated into planned spending rather than reactive expenditure.

iii. **Committee capacity-building, training, and knowledge-sharing (OM)**:

EA-2 also highlighted the importance of strengthening Organisation Management (OM) through a simple committee capacity-building, training, and knowledge-sharing mechanism. EA-2 suggested that short briefing and basic training sessions be conducted for committee members (e.g., once every six months) to standardise maintenance knowledge and decision-making practices among AJKs. These sessions function as an induction and refresher to improve role clarity, ensure consistent interpretation of defects and priorities, strengthen documentation discipline, and support more consistent governance in maintenance implementation. Where relevant, the training can include practical walkthroughs on using the implementation templates (defect register, priority scoring, quotation comparison, work order, completion verification, and payment checklist) so committees can apply the framework consistently even when membership changes.

iv. **Procurement SOP, work packaging, and contractor accountability**:

EA-2 further proposed strengthening procurement governance through a tiered SOP aligned to work magnitude: minor works (simplified

quotation with capped value and basic work order), medium works (minimum three quotations with technical–cost evaluation and unit-rate check), and major works (tender or registered contractor with clear scope, timeline, supervision plan, warranty or defect liability, and staged payments). EA-2 emphasised that incorporating defect liability or rectification responsibility can reduce repeated repairs and improve workmanship quality. In addition, EA-2 recommended "work packaging" (bundling similar works) to reduce mobilisation costs, improve monitoring, and strengthen contractor accountability.

v. **Cost control and payment governance**:

To improve value-for-money, EA-2 recommended introducing a Schedule of Rates or unit cost benchmark for recurring mosque works (e.g., plumbing, electrical, roofing, toilets, painting, AC servicing) to support quotation comparison and reduce cost variability. Finally, EA-2 stressed that completion verification (site inspection/photo evidence and sign-off) should be a minimum requirement before payment release, including for staged payments where deliverables and acceptance criteria should be defined to minimise rework risk.

Overall, EA-2's feedback implies that while the framework is conceptually adequate, its practical effectiveness depends on strengthening implementation discipline at *Masjid kariah* level through simple but consistent governance controls. EA-2 emphasised ring-fenced funding via a Dedicated Maintenance Fund, basic cost-control (quotation comparison supported by unit-rate checks and approval thresholds), and verification-based payment release as minimum conditions for accountable delivery. In addition, EA-2 highlighted the need for an implementation pack with standard templates and periodic committee briefings or training (e.g., every six months) to standardise role clarity, defect interpretation, prioritisation, and documentation practices, including practical walkthroughs of the key forms used in the workflow. Collectively, the tiered procurement SOP, work packaging, contractor accountability (including defect liability), and documentation requirements strengthen transparency and auditability and increase the likelihood that planned maintenance can be sustained at *Masjid kariah* level.

6.3.3.3 Expert Panel Three (EA-3)

The Expert Panel Three (EA-3) expressed overall agreement with the framework and confirmed that it supports a more systematic and transparent approach to mosque maintenance planning. EA-3 did not suggest adding new constructs, but emphasised that the framework can be strengthened by foregrounding the operational realities of building services (M&E) systems because service failures directly affect comfort, safety, hygiene, and continuity of mosque operations.

At the same time, EA-3 offered several important nuances that refine the interpretation of the PLS-SEM results:

i. **Central role of Financial Provision (FP) for building services reliability**:

EA-3 highlighted FP as practically significant because building services maintenance typically requires consistent recurring expenditure for servicing, inspection, consumables, and competent contractors. EA-3 noted that service systems degrade quickly when budgets are not planned or ring-fenced, resulting in higher repair costs, frequent downtime, and safety/hygiene risks (e.g., electrical faults, plumbing leaks, pump failure, or non-functional fire protection items). To strengthen FP specifically for services, EA-3 recommended: (1) a ring-fenced maintenance fund with sub-allocation for recurring ACMV/electrical/plumbing/fire protection servicing, (2) service-based budget planning using an annual service schedule (routine vs corrective vs emergency), and (3) cost and payment governance using unit-rate benchmarking, quotation comparison, and verification-based payment release.

ii. **Operationalisation through a Building Services (M&E) Maintenance Module**:

EA-3 proposed that implementation should include a simple M&E asset register and a minimum preventive maintenance schedule covering ACMV, electrical, plumbing or sanitary, and fire protection systems. This recommendation strengthens the “actionability” of the framework

by ensuring that service systems are planned and serviced systematically rather than being addressed only when breakdowns occur.

iii. **Service-based scheduling, response time, and competency-based procurement**:
EA-3 further recommended defining routine servicing frequency (monthly, quarterly or annual) and minimum response time for critical breakdowns to protect safety and continuity of operations. In procurement terms, EA-3 emphasised that M&E works require clearer scoping (materials, testing or commissioning where relevant), supervision or acceptance criteria, and the appointment of competent contractors to reduce hidden defects and repeat failures.

iv. **Completion verification and payment governance for M&E quality control**:
EA-3 stressed that verification before payment release should be treated as a basic quality-control mechanism, especially for building services works where defects may not be immediately visible and repeat failures are common.

Overall, EA-3's feedback implies that the refined framework should incorporate a "building services reliability layer" that translates the model into practical tools (asset register, preventive schedule, response-time expectations) and governance controls (competency-based scoping, verification-based payment release, and ring-fenced service budgets). These refinements strengthen the operational feasibility of the framework for mosque committees and align maintenance planning with the recurring lifecycle needs of critical service systems.

6.3.3.4 Expert Panel Four (EB-1)

The Expert Panel Four (EB-1) expressed overall agreement with the proposed framework and confirmed that it provides a structured and evidence-based guide for *Masjid kariah* maintenance implementation, particularly for committee-level decision-making where resources and technical capacity may be limited. Based on the hypotheses

testing, EB-1 agreed that four (4) significant elements should be retained as the core operational pathway in the framework i.e. Planning and Scheduling (PS), Service Quality (SQ), Assessment (AS), and Resource Allocation (RA), because these components reflect the practical route from identifying maintenance needs to delivering measurable service outcomes. EB-1 further noted that although these elements are significant, their operational priority may differ depending on defect criticality, urgency, service disruption, and resource constraints; therefore, flexibility in sequencing and prioritisation is necessary to ensure timely action for critical defects while routine maintenance remains systematic. In addition, EB-1 highlighted that Organisational Management (OM), Financial Provision (FP), and Safety and Health (SH) should remain explicitly emphasised as implementation enablers because they influence governance clarity, budget feasibility, and safety-based decision-making – often determining whether planned maintenance activities can be executed consistently and transparently.

At the same time, EB-1 offered several important nuances that refine the interpretation of the PLS-SEM results and strengthen the framework's implementation readiness:

i. **Central role of Planning and Scheduling (PS) as the execution "control centre"**:

EB-1 identified PS as the most significant variable at this stage because it functions as the "control centre" that coordinates maintenance delivery and determines whether other elements can produce real outcomes. EB-1 emphasised that even when Assessment (AS) identifies the correct problems and Service Quality (SQ) targets are clearly defined, maintenance performance will still deteriorate without a structured plan specifying what must be done first, who is responsible, how tasks are sequenced, and when works are expected to be completed. In practical terms, PS prevents maintenance from becoming reactive, fragmented, and dependent on ad-hoc committee decisions—especially under limited budgets and competing needs.

ii. **Priority classification for risk control and timely response (urgent–moderately urgent–non-urgent)**:

EB-1 stressed that PS is critical because it enables a structured route for prioritisation and risk control. EB-1 recommended that committees adopt a simple priority system (urgent, moderately urgent /or non-urgent) because defects carry different levels of safety risk and service disruption. Urgent items typically involve safety hazards, essential system breakdowns, or disruptions affecting large numbers of users; moderately urgent items reduce comfort or may escalate if ignored; non-urgent items can be scheduled as routine works within the maintenance cycle. This classification supports strategic use of limited resources and ensures critical risks are addressed first.

iii. **Strengthening the PS mechanism through practical scheduling and control tools**:

To strengthen Planning and Scheduling at *Masjid kariah* level, EB-1 recommended actionable mechanisms such as: (1) a defect register with priority scoring to standardise decision-making across committee members, (2) a planned maintenance structure with three scheduling tracks (routine–corrective–emergency) and response targets, (3) work packaging and sequencing (bundling similar works within the same mobilisation window) to reduce mobilisation cost and improve monitoring continuity, (4) responsibility and timeline clarity (approval–monitoring–verification) with simple milestones, and (5) integration with Resource Allocation (RA) by linking tasks to budget availability, labour capacity, and procurement lead time to reduce postponements and repeated delays.

iv. **Translating Assessment (AS) into an actionable work plan and improving feasibility realism**:

EB-1 emphasised that the framework's effectiveness depends on strengthening the "assessment-to-action" translation, so assessment outputs directly generate a prioritised work plan. EB-1 recommended that assessment records include recommended action type (routine,

corrective or emergency), estimated resources, and a suggested schedule window to support realistic execution. In parallel, EB-1 stressed that Resource Allocation should explicitly reflect typical *Masjid kariah* constraints (budget cycle, donation-based funding, limited technical staff, and contractor availability), and suggested practical approaches such as phased works, bundling similar tasks, and basic procurement planning to minimise delays.

v. **Governance enablers, verification, and continuous improvement loop**:

EB-1 reiterated that OM, FP, and SH should remain visible as governance enablers to strengthen accountability, transparency, and safety-based prioritisation, even if some statistical paths appear weaker. EB-1 recommended minimum documentation for governance (defect register, priority list, quarterly or annual schedule template, work order form, approval record, completion evidence, and post-maintenance verification checklist) to improve auditability and continuity when committee membership changes. EB-1 also recommended embedding Service Quality verification (completion checks, photo evidence, and short user feedback) as a feedback loop so outcomes can be confirmed and used to improve future planning – supporting sustained planned maintenance performance.

Overall, EB-1's feedback implies that while the framework is conceptually adequate and supported for implementation, its practical effectiveness at *Masjid kariah* level depends on positioning Planning and Scheduling (PS) as the main execution "control centre" and embedding a flexible priority logic that responds to defect criticality, urgency, service disruption, and resource constraints. The recommended implementation emphasis – retaining PS, SQ, AS, and RA as the core operational pathway – should be strengthened through committee-ready tools and minimum documentation to improve transparency, auditability, and continuity across committee terms. In parallel, maintaining OM, FP, and SH as explicit governance enablers, supported by verification-based checks and a simple feedback loop, strengthens

accountability and increases the likelihood that planned maintenance outcomes can be sustained in practice at *Masjid kariah* level.

6.3.3.5 Expert Panel Five (EB-2)

The Expert Panel Five (EB-2) expressed overall agreement with the proposed *Masjid kariah* Maintenance Planning framework and supported retaining all seven indicators within a single integrated model. Although Organisational Management (OM), Financial Provision (FP), and Safety and Health (SH) were reported as non-significant in the hypotheses testing, EB-2 emphasised that these constructs remain critical interdependent implementation enablers. In practice, EB-2 highlighted that maintenance planning at mosque level requires the indicators to operate as an integrated system because weaknesses in governance, funding reliability, or safety oversight can undermine the delivery of planning and scheduling, assessment routines, service quality verification, and resource allocation.

At the same time, EB-2 offered several important nuances that refine the interpretation of the PLS-SEM results and strengthen implementation readiness:

i. **Interdependence of non-significant constructs as practical enablers (OM, FP, SH)**:
   EB-2 stressed that OM, FP, and SH should not be interpreted as "unimportant" simply because their direct statistical paths are weaker. EB-2 positioned OM as the governance backbone (role clarity, coordination, continuity), FP as the feasibility driver (ability to execute planned work without delay), and SH as a constant risk lens that protects worshippers and anchors prioritisation to safety-critical needs. EB-2 emphasised that deficiencies in any of these enablers can disrupt otherwise strong operational dimensions.

ii. **Digital enablement to strengthen transparency, communication, and funding mobilisation**:
   EB-2 recommended strengthening the framework through digital enablement at *Masjid kariah* level by developing an official website or mobile application. EB-2 suggested that the digital platform should

function as an operational support tool and a transparency mechanism with minimum features such as: (1) updated mosque information and announcements (real-time communication), (2) a committee contact directory for quick coordination and reporting, (3) a donation and dedicated maintenance fund channel (e.g., QR code/bank details with a clear fund purpose), and (4) basic financial transparency cues to strengthen trust and encourage recurring contributions. EB-2 further argued that a structured digital donation mechanism can reduce persistent funding constraints by widening community participation and enabling faster mobilisation of resources for urgent and planned maintenance works.

iii. **Maintenance as the core outcome, with Planning and Scheduling (PS) as the coordinating "driver"**:

EB-2 highlighted that maintenance should remain the central priority because usability, safety, and comfort are directly determined by building condition and system functionality. EB-2 reinforced that Planning and Scheduling (PS) should be positioned as the main coordinating element that translates maintenance needs into an operational workflow (Assessment → Prioritisation → Plan & Schedule → Resource Allocation → Verification). This strengthens consistency, reduces ad-hoc decision-making, and improves governance at *Masjid kariah* level.

iv. **Reinforcing periodic Assessment and preventive action for safety-critical systems**:

EB-2 emphasised scheduled assessment and preventive maintenance as essential, particularly for high-risk building systems (especially electrical services) to minimise hazards such as fire and unsafe occupancy. EB-2 recommended that assessment records be strengthened so they directly support prioritisation, planned actions, and verification – ensuring the mosque remains safe, comfortable, and suitable for public use.

v. **Integrating compliance readiness into governance and prioritisation (eligibility, approvals, CF)**:

EB-2 introduced a governance-and-liability perspective by highlighting that *Masjid kariah* facilities should be evaluated in terms of operational legitimacy and compliance readiness (e.g., planning permission and Certificate of Fitness/occupancy documentation). EB-2 noted that unclear compliance standing can complicate responsibility pathways and risk coverage (including insurance feasibility) during incidents. Therefore, EB-2 recommended integrating basic compliance or eligibility checks into decision-making and encouraging collaborative support with relevant local authorities (PBT) to regularise requirements where needed.

vi. **Strengthening responsiveness through structured communication and contact visibility**:

EB-2 recommended using the proposed digital platform to improve responsiveness by providing updated information and a clearly displayed committee contact directory. This supports faster reporting, coordination, and response – improving service responsiveness, stakeholder access, and community confidence in mosque management and maintenance performance.

vii. **Introducing a simple priority classification with safety escalation rules**:

EB-2 recommended adding urgent, moderate or routine categories with indicative response targets (immediate, within days or within weeks). EB-2 emphasised that safety-related defects (electrical, structural, fire risks) should trigger fast-track approval and escalation to competent parties, strengthening risk-based decision-making and ensuring timely intervention.

viii. **Standardising minimum documentation and verification requirements for transparency**:

EB-2 recommended standardising minimum evidence and record-keeping such as defect logs, assessment records, photo evidence (before or after), work approval notes, completion verification, and basic cost records. EB-2 highlighted that these records strengthen auditability, accountability, and trust – particularly when donation-based funding is used.

ix. **Clarifying governance roles and ownership boundaries (committee vs authority)**:

EB-2 recommended a short governance map clarifying who manages daily operations (committee), who provides technical oversight or approval (relevant agencies or competent persons), and who holds authority for compliance actions. This reduces confusion on responsibility pathways when incidents occur and strengthens operational accountability.

x. **Promoting preventive maintenance culture to reduce "reactive-only" practice**:

EB-2 encouraged strengthening preventive maintenance scheduling, especially for M&E systems to reduce repeated breakdowns, lower long-term costs, and sustain service quality. EB-2 framed this as necessary to shift practice away from reactive-only maintenance and to support continuous improvement.

Overall, EB-2's feedback implies that while the framework is conceptually adequate, its practical effectiveness depends on treating the model as an integrated implementation system supported by digital enablement and governance controls. The recommended digital platform (website or app) with a dedicated maintenance fund channel, transparent communication, and basic financial cues strengthens trust, broadens community donations, and improves resource mobilisation for urgent and planned works. In parallel, positioning maintenance as the core outcome with Planning and Scheduling (PS) as the coordinating driver – reinforced by periodic Assessment for

safety-critical systems, a simple priority classification with escalation rules, minimum documentation and verification, and a clear governance-role map – strengthens accountability, reduces ad-hoc decision-making, and increases the likelihood that planned maintenance can be sustained at *Masjid kariah* level.

These themes are summarised in Table 6.2, which maps both industry (EA) and academician (EB) experts' key comments to the corresponding framework components and clarifies how each comment is translated into actionable refinements in the refined framework (Section 6.4). The mapping is presented as implementation-oriented themes rather than new constructs, consistent with the panels' emphasis on strengthening operationalisation, governance discipline, and continuity at committee level.

Table 6.2
Summary of Expert Feedback and Implications for the Framework

No.	Theme	Key Expert Comments	Implication for Framework
1.	Operational pathway clarity and minimum tools	EA-1 and EA-2 stressed the need for a clear end-to-end workflow supported by an implementation pack and simple templates; EB-1 reinforced that the operational delivery chain (PS–AS–RA–SQ) must remain prominent and practical for committee execution	Add an implementation pack (guideline) with minimum templates (defect register, priority scoring, schedule/budget sheet, quotation comparison, work order, completion verification, payment checklist) and explicitly present the operational pathway in Section 6.4, highlighting PS–AS–RA–SQ as the delivery chain.
2.	Financial governance, transparency, and funding feasibility (FP)	EA-2 emphasised ring-fenced funding and basic cost-control (Dedicated Maintenance Fund, unit-rate checks, approval thresholds, verification-based payment release); EB-2 supported strengthening FP through simple transparency and accessible communication mechanisms to sustain community participation and trust.	Strengthen FP as an enabling governance layer: dedicated fund, unit-rate benchmark or Schedule of Rates, approval thresholds, minimum documentation + completion verification prior to payment release; include basic transparency or communication guidance to support sustained funding feasibility.
3.	Procurement SOP, accountability, and quality verification	EA-2 and EA-3 emphasised tiered procurement SOP by work magnitude, scope clarity and acceptance criteria, supervision discipline, defect liability or rectification responsibility, work packaging, and verification checkpoints; EB-1 reinforced	Introduce a tiered procurement SOP (minor, medium or major works), embed scope clarity + acceptance criteria, defect liability clauses, work packaging guidance, and verification checkpoints; include a simple decision rule to fast-track safety-

No.	Theme	Key Expert Comments	Implication for Framework
		flexibility for defect-driven prioritisation while maintaining traceable records and accountability.	critical defects while retaining traceability and accountability.
4.	Governance continuity via OM, including sharing session/awareness for AJKs	EA-2 recommended periodic sharing sessions or awareness briefings and basic training for AJK (e.g., every six months) to standardise role clarity, defect interpretation, prioritisation, and documentation practices; EB-1 framed OM, FP or SH as enabling conditions for consistent implementation; EB-2 reinforced an integrated-system interpretation and the need for practical adoption mechanisms that support continuity when committee membership changes.	Add an OM "governance continuity" mechanism: 6-monthly sharing session or awareness briefing and basic training with walkthrough of key templates; explicitly frame OM, FP or SH as implementation enablers; strengthen continuity measures to reduce variability when committee members change.
5.	Safety-critical prioritisation and preventive maintenance routines (SH)	EA-3 highlighted safety-critical systems and the importance of preventive routines, particularly for services such as electrical, fire-related systems, plumbing, and HVAC; EB-1 and EB-2 reinforced safety as a decision lens that should guide prioritisation and escalation even when statistical direct paths are weaker.	Introduce safety-based escalation rules and planned inspection or servicing routines for critical systems (e.g., electrical and fire safety), supported by minimum records, evidence-based verification, and corrective follow-up to reduce hazard risk and reactive-only practices.
6.	Service quality confirmation and post-work feedback loop (SQ)	EA-1 stressed that completion verification should be linked to service quality confirmation; panels consistently supported minimum evidence (inspection, photo evidence or sign-off) to confirm work completion and performance outcomes.	Include a simple post-work verification and feedback step (inspection + photo evidence + sign-off) to confirm service quality outcomes, support audit trail, and inform subsequent scheduling and budgeting decisions.

Note:
Planning and Scheduling (PS), Resource Allocation (RA), Assessment (AS), Service Quality (SQ), Organisation Management (OM), Organisation Management (OM), Financial Provision (FP), Safety and Health (SH)

Overall, the expert review confirmed the conceptual robustness and practical relevance of the framework, with both industry (EA) and academician (EB) panels converging on the need to strengthen implementation realism at *Masjid kariah* level. Across the panels, Planning and Scheduling (PS), Assessment (AS), Resource Allocation (RA), and Service Quality (SQ) were consistently emphasised as the

operational delivery chain that should be made explicit through a clear workflow and minimum implementation tools, while allowing flexibility to fast-track safety-critical defects without losing traceability. Financial Provision (FP) was reinforced as a critical enabling condition that requires ring-fenced funding, cost-control mechanisms (including unit-rate benchmarking), verification-based payment governance, and basic transparency practices to sustain community participation and trust. Importantly, Organisation Management (OM) was strengthened through the recommendation of periodic sharing sessions or awareness briefings and basic training for AJK (e.g., every six months) to standardise role clarity and documentation practices and to ensure consistent use of the implementation templates, particularly when committee membership changes. Finally, Safety and Health (SH) and Service Quality (SQ) were reinforced through safety-based prioritisation, preventive routines for critical systems, and post-work verification practices that confirm performance outcomes and reduce repeated defects. These combined insights are incorporated into the refined maintenance planning framework presented in Section 6.4.

6.4 Refined Maintenance Planning Framework and Research Findings

This section integrates the quantitative findings from Chapter 5 with the expert validation insights presented in Section 6.3 and summarised in Table 6.2 to produce the refined maintenance planning framework for *Masjid kariah* and to synthesise the key research findings related to Research Objective Four (RO4). Based on the theoretical foundations in Chapter 2, the Delphi results in Chapter 4, and the PLS-SEM model in Chapter 5, *Masjid kariah* Maintenance Planning (MKMP) is conceptualised through Maintenance Strategy Criteria (MSC) comprising Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM), influenced by seven Maintenance Performance Measurement (MPM) dimensions. The expert review confirmed the relevance of these constructs and clarified how they should be interpreted and operationalised in practice. Drawing on this integrated evidence, a refined maintenance planning framework is proposed and illustrated in Figure 6.2.

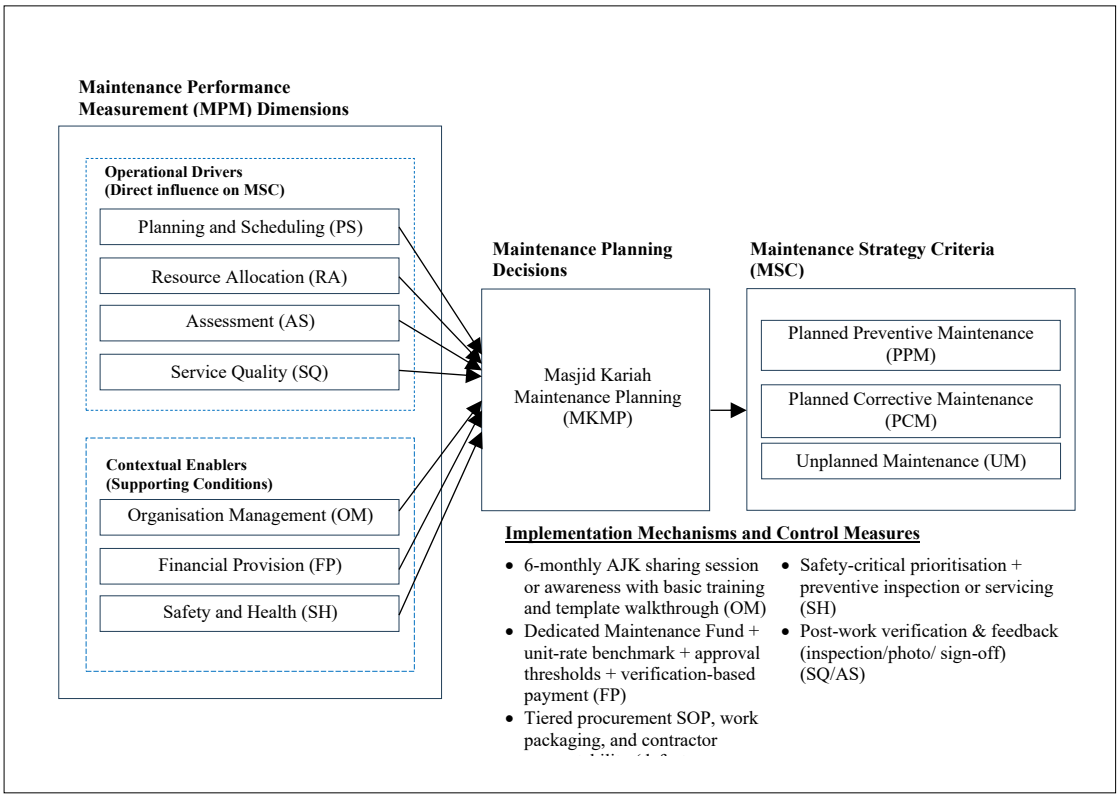

Figure 6.2 Refined Maintenance Planning Framework for *Masjid kariah*

Figure 6.2 retains the same seven MPM dimensions and three MSC outcomes; therefore, the refinement does not introduce new constructs. Instead, it strengthens adoption realism by clarifying the operational delivery chain that drives MKMP decisions and by explicitly positioning key supporting conditions and implementation mechanisms recommended by the expert panels. In the refined framework, the MPM dimensions are presented in two functional layers: (1) Operational Drivers that directly influence MKMP decisions and (2) Contextual Enablers that provide supporting conditions for feasibility, accountability, and continuity of implementation at *Masjid kariah* level.

6.4.1 Research Findings: Operational Drivers shaping MKMP (PS, RA, AS, SQ)

The PLS-SEM results indicate that four dimensions – Planning and Scheduling (PS), Resource Allocation (RA), Assessment (AS) and Service Quality (SQ) – function as the primary operational drivers that shape MKMP and, consequently, the maintenance strategy mix (PPM, PCM and UM). Interpreted as an operational workflow, the findings suggest that MKMP improves when committees institutionalise

a repeatable chain of actions: periodic condition checking or assessment, defect recording and prioritisation, planning and scheduling, resource allocation and execution, and service quality verification. This delivery chain strengthens planned preventive and planned corrective works and reduces reliance on unplanned, complaint-driven responses.

Expert validation reinforced how these operational drivers should be interpreted in practice. EA-1 emphasised PS as the coordinating execution driver, recommending clearer translation of assessment outputs into prioritised schedules with responsibility and timeline clarity, supported by simple priority classification and response targets. EA-3 reinforced technical-operational discipline for services and safety-critical systems, highlighting clearer scoping, supervision, preventive routines, and verification practices to reduce rework and repeated defects. EB-1 and EB-2 supported presenting PS–AS–RA–SQ as the prominent delivery chain while allowing flexibility for defect-driven prioritisation, particularly for safety-related issues, without losing traceability and accountability.

6.4.2 Research Findings: Contextual Enablers Supporting Feasibility (OM, FP, SH)

The integrated findings indicate that Organisation Management (OM), Financial Provision (FP) and Safety and Health (SH) remain essential contextual enablers of maintenance planning. Although these dimensions may show weaker direct effects in the structural model, expert validation confirmed that they provide the governance, financial, and safety conditions that determine feasibility and continuity of implementation at *Masjid kariah* level. EB-1 and EB-2 in particular reinforced an integrated-system interpretation in which enabling conditions shape the reliability and consistency of execution and should not be treated as "unimportant" simply because direct statistical paths are weaker.

EA-2 provided detailed operational guidance that strengthens these enabling conditions through practical governance controls. EA-2 emphasised that planned maintenance can fail not because defects are unknown, but because funding is not ring-fenced and decisions are not supported by consistent approval, procurement, and documentation discipline. Accordingly, OM, FP and SH are retained explicitly as contextual enablers within the refined framework and are strengthened through

implementation mechanisms and control measures rather than being positioned as optional add-ons.

6.4.3 Implementation Mechanisms and Control Measures Derived from Expert Validation

To translate the expert feedback into actionable adoption guidance, Figure 6.2 incorporates an operationalisation layer labelled Implementation Mechanisms and Control Measures, consistent with the themes mapped in Table 6.2. The mechanisms incorporated are: (1) 6-monthly AJK sharing sessions or awareness briefings with basic training and template walkthrough (OM) to standardise role clarity, defect interpretation, prioritisation, and documentation practices, including continuity when committee membership changes; (2) Dedicated Maintenance Fund, unit-rate benchmark or Schedule of Rates, approval thresholds, and verification-based payment release (FP) to strengthen cost control, transparency, and accountability; (3) tiered procurement SOP, work packaging, and contractor accountability including defect liability or rectification responsibility (PS/RA) to reduce repeated defects and improve value-for-money; (4) safety-critical prioritisation with preventive inspection or servicing (SH) to strengthen risk governance and reduce hazard-driven failures; and (5) post-work verification and feedback (SQ/AS) through minimum evidence such as inspection, photographic proof, and sign-off to confirm performance outcomes and maintain an audit trail.

6.4.4 Summary of Refined Framework Implications (RO4)

Overall, the refined maintenance planning framework in Figure 6.2 combines operational drivers and contextual enablers within a single performance-based model that is empirically grounded and practically implementable for *Masjid kariah* stakeholders. The key findings for RO4 can be summarised as follows: first, the seven MPM dimensions and three MSC outcomes remain conceptually robust and practically relevant for representing *Masjid kariah* maintenance planning; second, PS, RA, AS and SQ form the operational delivery chain that most strongly drives MKMP and should be institutionalised as a repeatable workflow for committees; third, OM, FP and SH should be interpreted as enabling conditions that determine feasibility and continuity and

should be strengthened through practical governance routines and controls; and finally, the implementation mechanisms and control measures derived from expert validation increase the likelihood that prioritised works are translated into planned spending, executed with accountability, and sustained over time at *Masjid kariah* level. Accordingly, Section 6.5 concludes the chapter by consolidating the RO4 findings and highlighting the overall implications of the refined framework for *Masjid kariah* implementation.

6.5 Conclusion

This chapter presented the development and finalisation of a maintenance planning framework for *Masjid kariah* in Kelantan by integrating empirical evidence from the PLS-SEM assessment with an independent expert validation stage. The chapter first established the proposed framework structure based on the structural model results, clarifying how the seven Maintenance Performance Measurement (MPM) dimensions relate to *Masjid kariah* Maintenance Planning (MKMP) and the three Maintenance Strategy Criteria (MSC) outcomes (PPM, PCM and UM). The quantitative findings provide an evidence-based explanation of which dimensions most strongly drive planning decisions and how planned maintenance can be strengthened while reducing reliance on unplanned responses.

Subsequently, the expert validation process confirmed that the proposed constructs are relevant and sufficiently comprehensive for the *Masjid kariah* context, while offering practical refinements that strengthen implementability at committee level. Rather than introducing new constructs, the experts emphasised operationalisation improvements and governance discipline—particularly the need to translate assessment outputs into prioritised schedules, strengthen documentation and verification routines, and embed basic financial and procurement controls to improve accountability and transparency. The mapping of expert feedback into themes provides a clear rationale for how each comment was incorporated into the final refined framework.

Based on this integrated evidence, the chapter produced the refined maintenance planning framework, which retains the same seven MPM dimensions and three MSC outcomes but reorganises the model into operational drivers (PS, RA, AS, SQ) and contextual enablers (OM, FP, SH). The refined framework highlights the operational

delivery chain that committees can institutionalise as a repeatable workflow (assessment/condition checking → prioritisation → planning and scheduling → resource allocation/execution → service quality verification). At the same time, the framework explicitly recognises that governance continuity, funding readiness, and safety-based prioritisation shape feasibility and consistency of execution in community-managed mosque settings.

In summary, Chapter 6 fulfils Research Objective Four (RO4) by delivering a validated and practice-oriented maintenance planning framework for *Masjid kariah* in Kelantan. The refined framework bridges statistical evidence and real-world implementation requirements by retaining empirically supported constructs while incorporating committee-ready mechanisms such as (1) periodic AJK sharing sessions or awareness and basic training to strengthen continuity and documentation discipline, (2) ring-fenced funding and cost-control measures, (3) tiered procurement and contractor accountability practices, (4) safety-critical prioritisation and preventive routines, and (5) post-work verification and feedback records. The next chapter consolidates the overall conclusions of the study, highlights the research contributions, and outlines limitations and recommendations for future research and practice.

CHAPTER 7
CONCLUSION AND RECOMMENDATION

7.1 Introduction

This chapter concludes the study on maintenance planning for *Masjid kariah* in Kelantan State, Malaysia. The overarching aim of the research was to develop a maintenance planning framework for the *Masjid kariah* in Kelantan State, Malaysia, supported by four specific research objectives (RO1–RO4). These objectives were addressed through a sequence of research phases: a detailed review of literature and relevant standards (BS 3811 and MS ISO 41001), a Delphi study to develop and refine maintenance performance measurement dimensions, a questionnaire survey analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM), and an expert review of the proposed framework.

This chapter synthesises the findings from all previous chapters and demonstrates how each research objective has been achieved. Section 7.2 presents the conclusion of the study, organised explicitly according to RO1–RO4, by linking the objectives, methods employed and the corresponding key findings. Section 7.3 outlines the research contributions, distinguishing between contributions to the body of knowledge and contributions to practice and policy in the management of *Masjid kariah*.

Section 7.4 discusses the limitations of the study, particularly in relation to scope, data and methods, while Section 7.5 offers recommendations for future research that could extend or refine the present work. Finally, Section 7.6 provides a brief finale, reflecting on the overall significance of the maintenance planning framework developed in this thesis for *Masjid kariah* and similar community-based religious facilities.

7.2 Conclusion

This section concludes the study by demonstrating how each research objective (RO1–RO4) has been achieved through the sequence of research phases described in the thesis. For each objective, the discussion links the methods employed – including the in-depth literature review, Delphi study, questionnaire survey with PLS-SEM

analysis, and expert validation – to the key empirical and conceptual findings. Together, these outcomes confirm that the study has successfully developed a maintenance planning framework for *Masjid kariah* in Kelantan State, Malaysia.

7.2.1 Research Objective One (RO1): To address the issues and challenges related to mosque maintenance as a foundational aspect

RO1 was achieved primarily through the problem analysis in Chapter 1 and the in-depth literature review in Chapter 2. Drawing on academic studies, policy documents, and standards such as BS 3811 and MS ISO 41001, the study identified a series of persistent issues in mosque maintenance. These include fragmented responsibilities between religious authorities, local governments and mosque committees; limited and unpredictable financial resources; reliance on reactive, ad hoc maintenance; lack of formal planning, documentation and performance monitoring; and shortages of technically competent personnel at *Masjid kariah* level. The review of Malaysian and international mosque studies further highlighted problems related to accessibility, safety and health, ageing building services, and under-utilisation of mosques as community facilities due to poor maintenance conditions.

By synthesising these strands of evidence, the study established that the core challenge is not only technical deterioration of mosque facilities but also the absence of a structured, performance-based maintenance planning system that is aligned with facility management standards and local governance realities. This diagnosis provided the conceptual foundation for subsequent objectives by clarifying why *Masjid kariah* requires a systematic framework that integrates organisational, financial, safety and service-quality considerations into day-to-day and long-term maintenance decisions. Accordingly, RO1 has been fulfilled.

7.2.2 Research Objective Two (RO2): To investigate performance indicators relevant for evaluating maintenance planning of Masjid Kariah from Malaysia's perspective

RO2 was addressed through the framework development work in Chapter 2 and Chapter 4. Building on the issues identified under RO1, a comprehensive pool of potential maintenance performance indicators was first extracted from the literature on

building maintenance, facility management, mosque studies and Malaysian regulatory requirements. These indicators were then refined and contextualised through a two-round Delphi study involving experts from public agencies (JKR, JAHEAIK, UPMD) and academia. The Delphi process enabled the panel to review, rate and consolidate the indicators until consensus was reached.

As a result, the study identified seven Maintenance Performance Measurement (MPM) dimensions – Organisation Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Service Quality (SQ), Assessment (AS), Resource Allocation (RA), and Safety and Health (SH) – together with three Maintenance Strategy Criteria (MSC) – Planned Preventive Maintenance (PPM), Planned Corrective Maintenance (PCM) and Unplanned Maintenance (UM). Each dimension was operationalised through specific items that reflect Malaysian policy, BS 3811 definitions and MS ISO 41001 clauses, while also capturing the realities of *Masjid kariah* governance and funding mechanisms. These validated indicators formed the measurement instruments for the subsequent survey and provided a Malaysian-centred basis for evaluating mosque maintenance planning. Hence, RO2 has been successfully achieved.

7.2.3 Research Objective Three (RO3): To evaluate the performance indicators on maintenance planning of Masjid Kariah in Kelantan State

RO3 was fulfilled through the quantitative analysis presented in Chapter 5. Using the indicators established under RO2, a structured questionnaire was administered to 354 committee members from 59 *Masjid kariah* across 10 districts in Kelantan. The data were analysed using reliability analysis, Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Partial Least Squares Structural Equation Modelling (PLS-SEM) to evaluate both the measurement and structural models.

The findings confirmed that the seven MPM dimensions and the MSC construct are statistically reliable and valid for assessing *Masjid kariah* maintenance planning. Structural model results showed that Planning and Scheduling (PS), Service Quality (SQ), Assessment (AS) and Resource Allocation (RA) exert significant positive effects on maintenance strategy criteria, indicating that these dimensions act as core operational drivers in shaping the balance between preventive, corrective and unplanned maintenance. In contrast, Organisation Management (OM), Financial Provision (FP)

and Safety and Health (SH) did not exhibit statistically significant direct effects on MSC, but the analysis and qualitative interpretation suggested that they remain important as enabling conditions that support effective implementation of the more operational dimensions. Overall, the PLS-SEM results provide an empirically grounded understanding of which indicators most strongly influence maintenance planning outcomes, thereby fulfilling RO3.

7.2.4 Research Objective Four (RO4): To develop a framework for Masjid kariah's maintenance planning in Kelantan State, Malaysia

RO4 was achieved in Chapter 6 by integrating the theoretical foundations (BS 3811 and MS ISO 41001), the Delphi-refined constructs, and the PLS-SEM results into a refined maintenance planning framework for *Masjid kariah*, followed by expert validation. The refined framework retains the same seven Maintenance Performance Measurement (MPM) dimensions and the three Maintenance Strategy Criteria (MSC) outcomes (PPM, PCM and UM), but strengthens its practical adoption by distinguishing between core operational drivers (Planning and Scheduling, Resource Allocation, Assessment and Service Quality) that directly shape MKMP decisions and contextual enablers (Organisation Management, Financial Provision and Safety and Health) that govern feasibility, continuity, accountability and safety assurance at committee level. The final refined framework is presented in Figure 6.2.

To ensure implementability in the *Masjid kariah* context, the proposed framework was independently reviewed by a separate panel of five experts representing both industry and academic perspectives using the structured Expert Validation Form. The expert feedback confirmed that the framework reflects the key challenges identified under RO1, incorporates relevant and measurable indicators established under RO2 and RO3, and is sufficiently practical for committee-level adoption. Importantly, the expert review strengthened the framework at the operationalisation layer by incorporating implementation mechanisms and control measures, including (1) periodic AJK sharing sessions or awareness briefings with basic training and template walkthrough (e.g., every six months), (2) a Dedicated Maintenance Fund supported by unit-rate benchmarking, approval thresholds and verification-based payment release, (3) a tiered procurement SOP with work packaging and contractor accountability (including defect liability or rectification responsibility), (4) safety-critical prioritisation with preventive

inspection or servicing routines, and (5) post-work verification and feedback records (inspection, photo or sign-off). Minor refinements were made to terminology and presentation, resulting in the final refined framework that directly fulfils RO4 and the overall research aim.

7.3 Research Contributions

This study makes several contributions to both the body of knowledge and to practice, particularly in the context of mosque maintenance management at *Masjid kariah* level. The contributions derive from the integration of maintenance management theory, facility management standards (BS 3811 and MS ISO 41001), Delphi expert consensus, empirical evidence from *Masjid kariah* in Kelantan and expert review of the final framework. The following subsections distinguish between the theoretical contributions and the contributions to practice and policy.

7.3.1 Contribution to the Body of Knowledge (Theoretical)

From a theoretical standpoint, the study addresses several gaps in the existing literature on building maintenance and mosque facilities.

First, the study extends the application of maintenance and facility management theory to the specific context of *Masjid kariah*. Previous works on mosque maintenance in Malaysia and abroad have largely described physical conditions, user satisfaction, or general management issues, with limited attempts to situate mosque maintenance within a structured theoretical framework. By synthesising BS 3811 concepts of maintenance types and strategies with the management-system perspective of MS ISO 41001, and by integrating these with established maintenance models such as Tsang's general maintenance management model and Cholasuke et al.'s maintenance performance model, this study positions *Masjid kariah* maintenance planning within a broader facility management paradigm. This conceptual integration clarifies how mosque maintenance can be treated as a performance-based management system rather than merely a set of technical repair activities.

Second, the study develops and validates a comprehensive set of Maintenance Performance Measurement (MPM) dimensions and indicators that are specific to mosque institutions. While numerous maintenance performance indicators have been

proposed for commercial and industrial facilities, very few studies have systematically derived indicators tailored to *Masjid kariah*, taking into account their governance structure, funding mechanisms, and religious roles. Through literature review and Delphi consensus, the study establishes seven MPM dimensions – Organisation Management, Planning and Scheduling, Financial Provision, Service Quality, Assessment, Resource Allocation, and Safety and Health – together with empirically tested measurement items. These constructs provide a theoretically grounded and empirically supported operationalisation of mosque maintenance performance that future researchers can adopt or adapt.

Third, the study contributes empirical evidence on the relationships between MPM dimensions and maintenance strategy criteria in the mosque context. Using PLS-SEM, the research demonstrates that Planning and Scheduling, Resource Allocation, Assessment, and Service Quality have significant direct effects on the maintenance strategy criteria (PPM, PCM, and UM). At the same time, the findings support a theoretically important interpretation in which Organisation Management, Financial Provision, and Safety and Health should be conceptualised as contextual enablers that shape feasibility, continuity, and implementation discipline, rather than being treated as "unimportant" due to weaker direct statistical effects. This driver–enabler distinction refines maintenance management theory by clarifying which dimensions act as the core operational delivery chain and which operate primarily as enabling conditions in community-based religious facilities.

Finally, the study proposes and validates a maintenance planning framework for *Masjid kariah* that consolidates the above theoretical elements into a single integrated model (Figure 6.2). The framework clarifies the position of mosque maintenance within the body of knowledge by demonstrating how BS 3811 and MS ISO 41001 principles, maintenance performance models, and empirically tested relationships can be combined to guide maintenance planning at community mosques. Importantly, the validated refinement strengthens theoretical clarity by distinguishing between operational drivers and contextual enablers within one coherent framework while incorporating an operationalisation layer (implementation mechanisms and control measures) derived from expert validation to improve adoption realism without introducing new constructs. As such, the study not only fills a theoretical gap in mosque maintenance research but also offers a reference model for subsequent comparative or longitudinal studies across different regions and community-managed facility types.

7.3.2 Contribution to Practice and Policy

In practical terms, the study offers several contributions to practitioners, policymakers and stakeholders involved in the maintenance of *Masjid kariah* in Kelantan and, by extension, other states in Malaysia.

First, the refined maintenance planning framework provides a structured and committee-ready tool for mosque committees and religious authorities (such as MAIK and district religious offices) to organise maintenance planning activities in a consistent and accountable manner. By distinguishing between core operational drivers (Planning and Scheduling, Resource Allocation, Assessment and Service Quality) and contextual enablers (Organisation Management, Financial Provision and Safety and Health), the framework clarifies where improvements should be prioritised and how responsibilities can be distributed. Importantly, the framework is operationalised through practical implementation mechanisms, enabling committees to translate assessment findings into scheduled work programmes, allocate resources, verify completion, and document decisions in a traceable workflow rather than relying on ad-hoc responses.

Second, the MPM indicators and survey instrument developed in this study can be applied as a diagnostic, benchmarking, and monitoring tool for continuous improvement. Religious departments, local authorities, and technical agencies (e.g., JKR and UPMD) can use the indicators to assess mosque maintenance performance, identify specific weaknesses (e.g., limited assessment routines, weak documentation, inconsistent service quality verification, or constrained financial provision), and track progress over time. This supports evidence-based decision-making and prioritisation, complementing routine inspections and enabling more systematic targeting of assistance, training, or budget support.

Third, the study provides actionable policy guidance on strengthening governance continuity, financial discipline, and procurement accountability in mosque maintenance. Expert validation highlighted that planned maintenance is often constrained by non-ringfenced funding and inconsistent approval or procurement practices. Accordingly, the study proposes practical controls that can be adopted as state or district guidelines, such as establishing a Dedicated Maintenance Fund, applying unit-rate benchmarking (Schedule of Rates) for quotation comparison, setting approval thresholds, and enforcing verification-based payment release with minimum documentation. In addition, the study supports the introduction of a tiered procurement

SOP aligned with work magnitude, work packaging to reduce mobilisation costs, and contractor accountability measures (including defect liability or rectification responsibility). For committee capability and continuity, the study also recommends periodic AJK sharing sessions or awareness briefings with basic training (e.g., every six months) and template walkthrough to standardise role clarity, prioritisation practices, and documentation discipline, particularly when committee membership changes.

Fourth, by demonstrating that stronger planning and scheduling, resource allocation, assessment and service quality are associated with higher adoption of planned preventive and planned corrective maintenance and reduced reliance on unplanned maintenance, the study highlights the practical benefits of shifting towards a planned and performance-based maintenance culture. These benefits include improved safety and risk control (especially for safety-critical systems), better comfort and usability for mosque users, stronger transparency and trust in maintenance spending, and more efficient use of limited public and community resources. The inclusion of post-work verification and feedback records (inspection, photo or sign-off) further strengthens accountability and provides an auditable basis for future planning and budgeting.

Overall, the practical contributions of this study lie in providing a validated framework, measurement tools, and implementation-oriented guidance that can be applied by mosque committees, religious authorities, and technical agencies to strengthen maintenance planning, governance discipline, and decision-making at community level.

7.4 Limitations of this Study

Like all empirical research, this study is subject to several limitations that should be acknowledged when interpreting the findings and applying the proposed framework. These limitations do not weaken the overall value of the research but rather define the boundaries within which the conclusions are valid and point to areas for future improvement.

First, the scope of the study is geographically and institutionally bounded. The empirical survey focused on *Masjid kariah* located in Kelantan State and on the specific governance structure under the Majlis Agama Islam dan Adat Istiadat Melayu Kelantan

(MAIK). Although the state provides a useful and rich context, the findings may not be fully generalisable to other states or countries where mosque governance, funding arrangements and maintenance policies differ. The proposed maintenance planning framework should therefore be applied cautiously outside Kelantan and, if adopted elsewhere, may require contextual adaptation.

Second, the sampling strategy and respondents also introduce limitations. The questionnaire survey targeted committee members of *Masjid kariah* as the primary decision-making units and did not include other stakeholders such as mosque users, contractors, technical officers from JKR or local authorities. The perspectives captured thus reflect mainly the views of management committees rather than the broader community of users and service providers. In addition, the cross-sectional design captures perceptions at a single point in time and cannot fully account for temporal changes in policies, funding or mosque conditions.

Third, there are methodological constraints related to measurement and analysis. The maintenance performance dimensions and indicators were operationalised as self-reported items in a structured Likert-scale questionnaire. Such measures are susceptible to social desirability bias, recall bias and differing interpretations of the response categories among respondents. Furthermore, PLS-SEM provides evidence of associations between constructs but does not by itself establish causal relationships. The Delphi and expert review phases, while valuable in securing professional judgement, involved a relatively small number of experts whose views may not represent all possible professional perspectives on mosque maintenance.

Finally, the conceptual focus of the study is necessarily selective. The framework emphasises maintenance strategy criteria and maintenance performance measurements from the perspective of facility management standards and *Masjid kariah* governance. Other potentially relevant aspects i.e. detailed life-cycle costing, environmental sustainability indicators, digital asset management systems or comparative analysis with other types of religious facilities – were beyond the scope of this research. As a result, the proposed framework should be viewed as a comprehensive but not exhaustive representation of factors influencing mosque maintenance planning.

Recognising these limitations is important for understanding the context within which the findings and framework are most applicable and for guiding future research that can extend, deepen or test the model under different conditions.

7.5 Recommendations for Future Research

Based on the findings and conclusions presented in this study, the following recommendations have been proposed for future research:

i. **Expansion of Geographic Scope**: Future research could expand beyond the state of Kelantan to include other states in Malaysia, or even other countries with similar religious and cultural contexts. This would allow for a comparative analysis of maintenance strategies and performance measurements in different regions.

ii. **Longitudinal Studies**: Longitudinal studies could be conducted to track the implementation and impact of maintenance strategies over time, which would provide further insights into their long-term effectiveness and sustainability. This knowledge would also help in understanding how these strategies evolve and adapt to changing conditions.

iii. **Integration of Technology**: Exploring the integration of advanced technologies, such as the Building Information Modelling (BIM), the Internet of Things (IoT), and artificial intelligence in maintenance planning for *Masjid kariah* could provide innovative solutions to enhance efficiency and effectiveness.

iv. **Stakeholder Engagement**: Future research could focus on the roles of different stakeholders, including community members, religious authorities, and government agencies in the maintenance planning process. Understanding their perspectives and involvement could help in developing more inclusive and collaborative maintenance strategies.

v. **Financial Models and Budgeting**: Different financial models and budgeting practices could be investigated for maintenance planning to provide insights into optimising resource allocation and ensuring financial sustainability. This could include exploring public-private

partnerships, community fundraising, and government funding mechanisms.

vi. **Safety and Health Protocols**: Given the importance of safety and health in maintenance planning, future studies could delve deeper into developing and implementing specific safety and health protocols tailored to the unique requirements of *Masjid kariah*.

vii. **Case Studies and Best Practices**: Detailed case studies of successful maintenance planning and implementation in other religious or heritage buildings could provide valuable lessons and best practices that could be adapted for *Masjid kariah*.

These recommendations were aimed at building on the existing research and providing a comprehensive approach for enhancing maintenance planning and management for *Masjid kariah*, thus, ensuring their longevity and optimal functions.

7.6 Finale

This study set out to address a practical and long-standing issue in the management of *Masjid kariah* in Kelantan, namely the absence of a structured, context-sensitive, and performance-based approach to maintenance planning. Through the integration of literature synthesis, Delphi consensus, survey analysis, PLS-SEM modelling, and expert validation, the study has demonstrated that maintenance planning in community-managed mosques should not be treated as a reactive or purely technical function, but as a systematic organisational process shaped by operational drivers, enabling conditions, and governance discipline. In doing so, the study contributes both a clearer understanding of how maintenance planning can be conceptualised in the mosque context and a refined framework that is more aligned with the realities of committee-based implementation.

More importantly, the study shows that improving mosque maintenance is not only about repairing defects, but about strengthening how decisions are made, how priorities are set, how resources are allocated, and how accountability is maintained over time. The refined maintenance planning framework developed in this thesis

provides a practical pathway for *Masjid kariah* committees and relevant authorities to move from ad-hoc, complaint-driven actions towards more planned, transparent, and sustainable maintenance practices. It is hoped that the findings and framework presented in this thesis will serve not only as an academic reference, but also as a useful guide for future policy improvement, institutional strengthening, and continued research on mosque facilities and other community-based religious assets in Malaysia.

REFERENCES

Abdul-Lateef, O. A. (2010). Quantitative analysis of criteria in university building maintenance in Malaysia. *Australasian Journal of Construction Economics and Building, The, 10*(3), 51.

Abdul-Matin, I. (2010). *Green deen: What Islam teaches about protecting the planet*: Berrett-Koehler Publishers.

Abdul Lateef Olanrewaju, A. (2012). Quantitative analysis of defects in university buildings: user perspective. *Built Environment Project and Asset Management, 2*(2), 167-181. doi:10.1108/20441241211280909

Abdullah, M. A. A., Ariff, N. R. M., Ismail, N., & Kaliwon, J. (2017). Facade Maintainability For Mosques: A Review For Maintenance Consideration. *International Journal of Real Estate Studies, 11*(2), 10.

Abu, F., Gholami, H., Saman, M. Z. M., Zakuan, N., Streimikiene, D., & Kyriakopoulos, G. L. (2021). An SEM approach for the barrier analysis in lean implementation in manufacturing industries. *Sustainability, 13*(4), 1978.

Adam, F., & Latief, Y. (2018). *Evaluating Maintenance Policy and Implementation Strategies to improve Building Functional Performance in Government Building: A Case Study in Jakarta, Indonesia.* Paper presented at the Proceedings of the International Conference on Industrial Engineering and Operations Management.

Adenuga, O. A. (2010). Labour Composition For Maintenance Works In Public Hospital Built Environment In South-West, Nigeria. *Journal of Building Performance, 1*, 16.

Adenuga, O. O., MB Raheem, AA. (2010). Effective maintenance policy as a tool for sustaining housing stock in downturn economy. *Journal of Building Performance, 1*(1).

Adewunmi, Y., Omirin, M., & Koleoso, H. (2012). Developing a sustainable approach to corporate FM in Nigeria. *Facilities, 30*(9/10), 350-373. doi:10.1108/02632771211235206

Adil, M. A. M., Mohd-Sanusi, Z., Jaafar, N. A., Khalid, M. M., & Aziz, A. A. (2013). Financial management practices of mosques in Malaysia. *GJAT, 3*(1), 23-29.

Aditya, P., & Kumar, U. (2009). Maintenance Performance Measurement Methods, Tools and Applications. *Research, Technology, Development And*

Training, 1, 4.

Adler, M., & Ziglio, E. (1996). *Gazing into the oracle: The Delphi method and its application to social policy and public health*: Jessica Kingsley Publishers.

Adnan, A. A. (2015). *Pengurusan derma awam dalam menjana ekonomi masjid: perbandingan Masjid Negara dan Masjid Al-Ghufran Pinggiran Taman Tun Dr Ismail Kuala Lumpur/Amru Alhaz bin Adnan.* University of Malaya,

Ahmad, J., Ahmad, D. S., Majid, M. A., & Wahid, H. (2018). Dana Dan Harta Masjid Di Malysia: Ke Arah Pengurusan Strategik.

Ahmad, R., Arsad, S., Said, R., Hassan, A., & Shahabuddin, S. (2020). Development Of Framework For Good Governance Index For Mosques In Kedah. *Development, 7*(19), 2020.

Ahmad, R., & Ahmad, R. (2020). *Development of framework for good Governance Index for Mosques in Kedah*. Retrieved from https://www.researchgate.net/profile/Rahayati-Ahmad/publication/344590740_development_of_framework_for_good_governance_index_for_mosques_in_kedah/links/5f82812f92851c14bcbe76ba/development-of-framework-for-good-governance-index-for-mosques-in-kedah.pdf

Aju kumar, V. N., Gupta, P., & Gandhi, O. P. (2018). Maintenance performance evaluation using an integrated approach of graph theory, ISM and matrix method. *International Journal of System Assurance Engineering and Management, 10*(1), 57-82. doi:10.1007/s13198-018-0753-6

Akasah, Z. A., Shamsuddin, S. H., Rahman, I. A., & Alias, M. (2009). *School Building Maintenance Strategy: a new management approach.* Paper presented at the Malaysian Technical Universities Conference on Engineering and Technology (MUCEET 2009), Universiti Malaysia Pahang, Pahang.

Al-bakri, Z. M. (2019). Pengimarahan Masjid: Tugas Kita. *Bayan Linnas Siri Ke-206*, 25. Retrieved from www.muftiwp.gov.my website

Al-Bukhari, S. (Book 23, 1337). *Funerals (Al-Janaa'iz)* (Vol. 2): hadith 93.

Al-Homoud, M., Abdou, A., & Budaiwi, I. (2005). Mosque energy performance, part II: monitoring of energy end use in a hot-humid climate. *Engineering Sciences, 16*(1).

Al-Krenawi, A. (2016). The role of the mosque and its relevance to social work. *International Social Work, 59*(3), 359-367. doi:10.1177/0020872815626997

Al-Najjar, B. (1997). *Condition-based maintenance: Selection and improvement of a*

cost-effective vibration-based policy in rolling element bearings. KFS AB

Al-Najjar, B., & Alsyouf, I. (2003). Selecting the most efficient maintenance approach using fuzzy multiple criteria decision making. *International Journal of Production Economics, 84*(1), 85-100.

Al-Turki, U. (2011). A framework for strategic planning in maintenance. *Journal of Quality in Maintenance Engineering, 17*(2), 150-162. doi:10.1108/13552511111134583

Alexander, K. (1994). A Strategy for Facilities Management. *Facilities, 12*(11), 6-10. doi:10.1108/02632779410070200

Ali, A., Keong, K., Zakaria, N., Zolkafli, U., & Akashah, F. (2013). The effect of design on maintenance for school buildings in Penang, Malaysia. *Structural Survey*.

Ali, A. S. (2013). *Teknologi dan pengurusan penyelenggaraan bangunan*: Penerbit Universiti Malaya.

Ali, A. S., Chua, S. J. L., & Ali, D. B. (2016). Issues and challenges faced by government office buildings in performing maintenance W\work. *Jurnal Teknologi, 78*(11).

Ali, A. S., Chua, S. J. L., & Ali, D. B. A. (2016). Issues and challenges faced by government office buildings in performing maintenance work. *Jurnal Teknologi, 78*(11).

Ali, A. S., Chua, S. J. L., & Alia, D. B. A. (2016). Issues And Challenges Faced By Government Office Buildings In Performing Maintenance Work. *Teknologi*, 13.

Allen, D. (1993). What Is Building Maintenance? *Facilities, 11*(3), 7-12. doi:10.1108/eum0000000002230

Almanasreh, E., Moles, R., & Chen, T. F. (2019). Evaluation of methods used for estimating content validity. *Res Social Adm Pharm, 15*(2), 214-221. doi:10.1016/j.sapharm.2018.03.066

Alner, G., & Fellows, R. (1990). *Maintenance of local authority school building in UK: a case study.* Paper presented at the Proceedings of the International Symposium on Property Maintenance Management and Modernisation. Singapore.

Alsyouf, I. (2006). Measuring maintenance performance using a balanced scorecard approach. *Journal of Quality in Maintenance Engineering*.

Alsyouf, I. (2009). Maintenance practices in Swedish industries: Survey results. *International Journal of Production Economics, 121*(1), 212-223. doi:10.1016/j.ijpe.2009.05.005

Álvarez Velázquez, E., Vargas Hernández, A. N., & Martínez Sánchez, C. E. (2023). Escala de medición de la satisfacción laboral. *HUMAN Review, 12*, 2–11. https://doi.org/10.37467/revhuman.v12.4730.

Amaratunga, D., & Baldry, D. (2002a). Moving from performance measurement to performance management. *Facilities, 20*(5/6), 217-223.

Amaratunga, D., & Baldry, D. (2002b). Performance measurement in facililities management and its relationships with management theory and motivation. *Facilities, 20*(10), 327-336.

Amaratunga, D., & Baldry, D. (2003). A conceptual framework to measure facilities management performance. *Property Management, 21*(2), 171-189.

Amaratunga, R. G. (2001). *Theory building in facilities management performance measurement: application of some core performance measurement and management principles.* University of Salford,

Amin, R. A. (2016). *Condition-based maintenance: innovation in building maintenance management.* UCL (University College London).

Amos, D., Musa, Z. N., & Au-Yong, C. P. (2019). A review of facilities management performance measurement. *Property Management, 37*(4), 490–511. https://doi.org/10.1108/PM-08-2018-0051.

Anderson, K., & McAdam, R. (2004). A critique of benchmarking and performance measurement. *Benchmarking: An International Journal*.

Ang, G., Groosman, M., & PM Scholten, N. (2005). Dutch performance-based approach to building regulations and public procurement. *Building Research & Information, 33*(2), 107-119.

Anwar, J., & Hasnu, S. A. F. (2017). Strategy-performance relationships. *Journal of Advances in Management Research, 14*(4), 446-465. doi:10.1108/jamr-07-2016-0056

Arslankaya, S., & Atay, H. (2015). Maintenance Management and Lean Manufacturing Practices in a Firm Which Produces Dairy Products. *Procedia - Social and Behavioral Sciences, 207*, 214-224. doi:10.1016/j.sbspro.2015.10.090

Arumsari, P., & Rarasati, A. D. (2017). Maintenance strategy for public-rented residential building: a case study in Jakarta, Indonesia. *Built Environment Project and Asset Management, 7*(1), 99-110. doi:10.1108/bepam-11-2015-0067

Asharaf, M., Abdullaah, J., Norman, H., Asmaddy, H., & Mohammad Aizuddin, A.

(2012). Pengurusan Kewangan Masjid: Model Imarah Masjid. *Wisdom Publication, Nilai, Negeri Sembilan*.

Ashworth, A. (2015). *Cost studies of buildings (5th ed.)*
Italy, Taylor and Francis.

Asiah Abdul Rahim, Mohamad Ridzuan Yahya, Shahrul Nizar Shaari, Mohd Ramzi Mohd Hussain, Izawati Tukiman, & Ismail, Z. (2019). *The Effectiveness Of Maintenance Management Through Implementation Of Building Maintenance Policy In Commercial High Rise Building*. Paper presented at the 15th NAPREC Conference, Inspen, Bangi.

Atkinson, H., & Brown, J. (2001). Rethinking performance measures: assessing progress in UK hotels. *International Journal of Contemporary Hospitality Management, 13*(3), 128-135.

Atmaca, A. B., & Gedik, G. Z. (2019). Evaluation of mosques in terms of thermal comfort and energy consumption in a temperate-humid climate. *Energy and Buildings, 195*, 195-204. doi:10.1016/j.enbuild.2019.04.044

Au-Yong, C. P., Ali, A. S., & Ahmad, F. (2013). Significant characteristics of scheduled and condition-based maintenance in office buildings. *Journal of Performance of Constructed Facilities, 28*(2), 257-263.

Au-Yong, C. P., Ali, A. S., & Ahmad, F. (2014a). Participative mechanisms to improve office maintenance performance and customer satisfaction. *Journal of Performance of Constructed Facilities, 29*(4), 04014103.

Au-Yong, C. P., Ali, A. S., & Ahmad, F. (2014b). Preventive maintenance characteristics towards optimal maintenance performance: a case study of office buildings. *World Journal of Engineering and Technology, 2*.

Awang, Z., Afthanorhan, A., & Mamat, M. (2016). The Likert scale analysis using parametric based Structural Equation Modeling (SEM). *Computational Methods in Social Sciences, 4*(1), 13.

Awuzie, B., & Emuze, F. (2017). Promoting sustainable development implementation in higher education: Universities in South Africa. *International Journal of Sustainability in Higher Education, 18*(7), 1176-1190.

Aziz, T. A. T. D. S. U. Z. B. T. A. (2022). *T. D. S. U. Z. T. (2022). Ucapan Bajet 2023: Memperkukuh momentum pemulihan, membina daya tahan ekonomi dan memacu pembaharuan komprehensif* [Teks ucapan]. Kementerian Kewangan Malaysia. Retrived from

https://belanjawan.mof.gov.my/pdf/2023/ucapan/buku-ucapan-bajet-2023.pdf

Azlan, S. A. (2009). Cost decision making in building maintenance practice in Malaysia. *Journal of Facilities Management, 7*(4).

Baharum, Z. A., Saat, A. H. N., Nawawi, A. H., & Saat, Z. M. (2007). *PROPERTYQUAL: a service quality instrument in property management of purpose built office buildings in Malaysia*.

Bahrom, H. (2008). Menjana Sumber Kewangan Masjid Pemangkin Pembangunan Ekonomi Ummah. *Book Chapter of Pengurusan Berkualiti Memacu Kecemerlangan Pengurusan Masjid. Universiti Teknologi Malaysia*.

Barberá, L., Crespo, A., Viveros, P., & Stegmaier, R. (2012). Advanced model for maintenance management in a continuous improvement cycle: integration into the business strategy. *International Journal of System Assurance Engineering and Management, 3*(1), 47-63.

Barsallo, G., & Achig, M. C. (2020). Preventive conservation plan for the Chapel of Susudel, Ecuador. *The International Archives of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, XLIV-M-1-2020, 811-818. https://doi.org/10.5194/ISPRS-ARCHIVES-XLIV-M-1-2020-811-2020

Bashiri, M., Badri, H., & Hejazi, T. H. (2011). Selecting optimum maintenance strategy by fuzzy interactive linear assignment method. *Applied Mathematical Modelling, 35*(1), 152-164.

Basiran, M. N. (2002). *Kajian Sistem Pengurusan Penyenggaraan Bangunan Hospital dari Aspek Perancangan dan Perlaksanaan Kerja.* Projek Sarjana Muda. Universiti Teknologi Malaysia.

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine, 25*(24), 3186-3191.

Becker, J.-M., Klein, K., & Wetzels, M. (2012). Hierarchical latent variable models in PLS-SEM: guidelines for using reflective-formative type models. *Long Range Planning, 45*(5-6), 359-394.

Bell, E., Bryman, A., & Harley, B. (2018). *Business research methods*: Oxford university press.

Ben-Daya, M., Ait-Kadi, D., Duffuaa, S. O., Knezevic, J., & Raouf, A. (2009). *Handbook of maintenance management and engineering* (Vol. 7): Springer.

Beşiktepe, D., Ozbek, M. E., & Atadero, R. A. (2020). Identification of the criteria for

building maintenance decisions in facility management: First step to developing a multi-criteria decision-making approach. *Buildings, 10*(9), 166. https://doi.org/10.3390/buildings10090166.

Bevilacqua, M., & Braglia, M. (2000). The analytic hierarchy process applied to maintenance strategy selection. *Reliability Engineering & System Safety, 70*(1), 71-83.

Blessing, O., Richard, J., & Emmanuel, A. (2015). Assessment of building maintenance management practices of higher education institutions in Niger State – Nigeria. *Journal of Design and Built Environment, 15*(2), 1-14. doi:10.22452/jdbe.vol15no2.4

Bocasso, F., Cardinali, M., De Lucia, G., & Tamborrino, R. (2024). The urban heritage of religious interest: From a redundant system to a planned resource. *Territorio*, 108, 45-56. https://doi.org/10.13138/2039-2362/3310

Brown, D. W. (1996). *Facility maintenance: The manager's practical guide and handbook*: American Management Association.

Brown, M. G., Hitchcock, D. E., & Willard, M. L. (1994). *Why TQM Fails and What to Do About It. Burr Ridge, IL*: Irwin Professional Publishers. Castro, E.(1999). PERL and CGI for the World ….

Glossary of terms used in terotechnology, BS 3811:1984 C.F.R. (1964).

Glossary of terms used in terotechnology, BS 3811:1984 C.F.R. (1974).

Glossary of terms used in terotechnology, BS 3811:1984 C.F.R. (1984).

Glossary of terms used in terotechnology, BS 3811:1993 C.F.R. (1993).

British Standards Institution. (1993). *BS 3811:1993 – Glossary of terms used in terotechnology.* British Standards Institution.

Budaiwi, I. M. (2011). Envelope thermal design for energy savings in mosques in hot-humid climate. *Journal of Building Performance Simulation, 4*(1), 49-61. doi:10.1080/19401491003746639

Budi, B. S., & Wibowo, A. S. (2018). A Typological Study of Historical Mosques in West Sumatra, Indonesia. *Journal of Asian Architecture and Building Engineering, 17*(1), 1-8. doi:10.3130/jaabe.17.1

Bujang, M. A., & Baharum, N. (2017). Guidelines of the minimum sample size requirements for Kappa agreement test. *Epidemiology, Biostatistics and Public Health, 14*(2).

Burden, E. E. (2004). *Illustrated dictionary of architectural preservation: restoration,*

renovation, rehabilitation, resuse.

Campbell, J. D., & Jardine, A. K. (2001). *Maintenance excellence: optimizing equipment life-cycle decisions*: CRC Press.

Campbell, J. D., & Reyes-Picknell, J. V. (2015). *Uptime: Strategies for excellence in maintenance management*: CRC Press.

Carpio, M., Ortega, J., & Prieto, A. J. (2021). Expert panel on in-situ visual inspections for masonry churches maintenance stage. *Journal of Civil Engineering and Management*, *27*(8), 579-593. https://doi.org/10.3846/JCEM.2021.15256

Cato, W. W., & Mobley, R. K. (2002). Chapter 2 - Definition of a CMMS. In W. W. Cato & R. K. Mobley (Eds.), *Computer-Managed Maintenance Systems (Second Edition)* (pp. 13-55). Woburn: Butterworth-Heinemann.

CEN, E. (2007). 15251, Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics. *European Committee for Standardization, Brussels, Belgium*.

Chanter, B., & Swallow, P. (2008). *Building maintenance management*: John Wiley & Sons.

Chemweno, P., Pintelon, L., Horenbeek, A. V., & Muchiri, P. N. (2015). Asset maintenance maturity model: structured guide to maintenance process maturity. *International Journal of Strategic Engineering Asset Management, 2*(2), 119-135.

Chianchana, C. (2022). Development of an Educational Sustainability Assessment Model: Application of the Delphi Technique and Pilot Study. *Journal of Education and e-Learning Research, 9*(2), 119-128.

Cholasuke, C., Bhardwa, R., & Antony, J. (2004). The status of maintenance management in UK manufacturing organisations: results from a pilot survey. *Journal of Quality in Maintenance Engineering, 10*(1), 5-15.

Chua, S. J. L., Zubbir, N. B., Ali, A. S., & Au-Yong, C. P. (2018). Maintenance of high-rise residential buildings. *International Journal of Building Pathology and Adaptation, 36*(2), 137-151. doi:10.1108/ijbpa-09-2017-0038

CICA. (1989). *Accounting and Reporting for Physical Assets by Governments*: Canadian Institute of Chartered Accountants.

CIOB. (1990). *Maintenance Management: A Guide to Good Practice. Ascot: The Chartered Institute of Building.*

Coetzee, J. L. (1998). *A structured approach to Maintenance Auditing.* Paper presented at the International Conference of Maintenance Societies, Adelaide, Australia.

Collis, J., & Hussey, R. (2013). *Business research: A practical guide for undergraduate and postgraduate students*: Macmillan International Higher Education.

Crespo Márquez, A., Uday, K., Moreu de León, P., Gómez Fernández, J. F., Parra Márquez, C., & López Campos, M. (2009). The maintenance management framework. *Journal of Quality in Maintenance Engineering, 15*(2), 167-178. doi:10.1108/13552510910961110

Cresswell, J. W. (2014). Research Design: Qualitative, Quantitative, and Mixed Methods Approaches-John W. Creswell. In: Google Books. New Jersey: Pearson Education. https://doi. org/10.1007/s13398

Creswell, J. W., & Clark, V. L. P. (2017). *Designing and conducting mixed methods research*: Sage publications.

Creswell, J. W., & Creswell, J. D. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4 ed.): Sage publications.

Cruzan, R. (2009). *Manager's Guide to Preventive Building Maintenance*: The Fairmont Press, Inc.

Da, C. J., Ning, L. Z., Yin, W. W., Radeef, R. A., & Naeini, S. M. (2021). Maintainability of Modern Mosque: A Review on Maintenance Strategies.

David, F. R. (1986). *Fundamentals of strategic management* (Vol. 1): Macmillan Pub Co.

Davis, L. L. (1992). Instrument review: Getting the most from a panel of experts. *Applied nursing research, 5*(4), 194-197.

De Groote, P. (1995). Maintenance performance analysis: a practical approach. *Journal of Quality in Maintenance Engineering*.

De Silva, N., Ranasinghe, M., & De Silva, C. (2012). Risk factors affecting building maintenance under tropical conditions. *Journal of Financial Management of Property and Construction*.

DeCotiis, T. A., & Summers, T. P. (1987). A path analysis of a model of the antecedents and consequences of organizational commitment. *Human relations, 40*(7), 445-470.

Department of Standards Malaysia. (2021). *MS ISO 41001:2018 – Facility management – Management systems – Requirements with guidance for use (ISO 41001:2018, IDT).* Department of Standards Malaysia.

Department of Standards Malaysia. (2024). *MS ISO 41001:2018/Amd 1:2024 – Facility management – Management systems – Requirements with guidance for use – Amendment 1: Climate action changes***.** Department of Standards Malaysia.

Dhillon, B. S. (2002). *Engineering maintenance: a modern approach*: cRc press.

Dhillon, B. S. (2006). *Maintainability, maintenance, and reliability for engineers*: CRC press.

Ding, S.-H., & Kamaruddin, S. (2014). Maintenance policy optimization—literature review and directions. *The International Journal of Advanced Manufacturing Technology, 76*(5-8), 1263-1283. doi:10.1007/s00170-014-6341-2

Ding, S.-H., & Kamaruddin, S. (2015). Assessment of distance-based multi-attribute group decision-making methods from a maintenance strategy perspective. *Journal of Industrial Engineering International, 11*(1), 73-85.

Dixon, J. R., Alfred J. Nanni, J., & Vollmann., T. E. (1990). *The new performance challenge: measuring operations for world-class competition*. Homewood, Ill. :: Dow Jones-Irwin.

Dotchin, J. A., & Oakland, J. S. (1994). Total Quality Management in Services. *International Journal of Quality & Reliability Management, 11*(4), 6-28. doi:10.1108/02656719410057926

Douglas, J. (1996). Building performance and its relevance to facilities management. *Facilities*.

Dragostinov, Y., Harðardóttir, D., McKenna, P. E., Robb, D. A., Nesset, B., Ahmad, M. I., Jang, Y. (2022). Preliminary psychometric scale development using the mixed methods Delphi technique. *Methods in Psychology, 7*, 100103.

Duffuaa, S. O., Ben-Daya, M., Al-Sultan, K. S., & Andijani, A. A. (2001). A generic conceptual simulation model for maintenance systems. *Journal of Quality in Maintenance Engineering, 7*(3), 207-219. doi:10.1108/13552510110404512

Dzulkifli, N. a., Sarbini, N. N., Ibrahim, I. S., Abidin, N. I., Yahaya, F. M., & Nik Azizan, N. Z. (2021). Review on maintenance issues toward building maintenance management best practices. *Journal of Building Engineering, 44*, 102985. doi:https://doi.org/10.1016/j.jobe.2021.102985

Ebekozien, A., Samsurijan, M. S., Aigbavboa, C., & Awo-Osagie, A. I. (2022). Developing a framework for building maintenance: A case study of Malaysia's low-cost housing via soft system methodology. *International Journal of Building Pathology and Adaptation, 42*(5), 1041–1057.

https://doi.org/10.1108/IJBPA-04-2022-0055

Elmualim, A., Shockley, D., Valle, R., Ludlow, G., & Shah, S. (2010). Barriers and commitment of facilities management profession to the sustainability agenda. *Building and Environment, 45*(1), 58-64.

Elyna Myeda, N., Nizam Kamaruzzaman, S., & Pitt, M. (2011). Measuring the performance of office buildings maintenance management in Malaysia. *Journal of Facilities Management, 9*(3), 181-199. doi:10.1108/14725961111148090

ENAKMEN. (1994). *Enakmen Majlis Agama Islam Dan Adat Istiadat Melayu Kelantan 1994*.

Farhana Omar, M., Aswad Ibrahim, F., & Mohd Sabki Wan Omar, W. (2017). Key Performance Indicators for Maintenance Management Effectiveness of Public Hospital Building. *MATEC Web Conf., 97*, 01056.

Frank Taillandier, Gerard Sauce, & Bonetto, R. (2011). Method and tools for building maintenance plan arbitration. *Engineering, Construction and Architectural Management, 18*(4), 343-362.

Furr, M., & Bacharach, V. (2007). Validity. *Psychometrics: An Introduction*, 191-235.

Fotovatfard, A., & Heravi, G. (2021). Identifying key performance indicators for healthcare facilities maintenance. *Journal of Building Engineering*, *44*, 102838. https://doi.org/10.1016/j.jobe.2021.102838

Gackowiec, P. (2019). General overview of maintenance strategies – Concepts and approaches. *Multidisciplinary Aspects of Production Engineering, 2*(1), 126–139. https://doi.org/10.2478/mape-2019-0013

Gallimore, F. K., & Penlesky, J. R. (1988). Framework For Developing Maintenance Strategies. *29*, 16-22.

Gala Mong, S., Fikri Mohamed, S., & Mohd. Saidin Misnan, M. (2018). Maintenance Management Model: an Identification of Key Elements for Value-Based Maintenance Management by Local Authority. *International Journal of Engineering & Technology, 7*(3.25), 35. doi:10.14419/ijet.v7i3.25.17467

Gan, X., Zuo, J., Wu, P., Wang, J., Chang, R., & Wen, T. (2017). How affordable housing becomes more sustainable? A stakeholder study. *Journal of Cleaner Production, 162*, 427-437. doi:10.1016/j.jclepro.2017.06.048

Gandhare, B. S., Akarte, M. M., & Patil, P. P. (2018). Maintenance performance measurement – a case of the sugar industry. *Journal of Quality in Maintenance Engineering, 24*(1), 79-100. doi:10.1108/jqme-07-2016-0031

Garg, A., & Deshmukh, S. G. (2006). Maintenance management: literature review and directions. *Journal of Quality in Maintenance Engineering, 12*(3), 205-238. doi:10.1108/13552510610685075

Goldberg, L. R., & Velicer, W. F. (2006). Principles of exploratory factor analysis. *Differentiating normal and abnormal personality, 2*, 209-337.

Gopikrishnan, S., & Topkar, V. M. (2019). Attributes and descriptors for building performance evaluation. *HBRC Journal, 13*(3), 291-296. doi:10.1016/j.hbrcj.2015.08.004

Gordon, T. J. (1994). The delphi method. *Futures research methodology, 2*(3), 1-30.

Graubner, C.-A., Pelzeter, A., & Pohl, S. (2016). A new approach to measure sustainability in German facility management. *Facilities*.

Guillén, A. J., Crespo, A., Gómez, J. F., & Sanz, M. D. (2016). A framework for effective management of condition based maintenance programs in the context of industrial development of E-Maintenance strategies. *Computers in Industry, 82*, 170-185. doi:10.1016/j.compind.2016.07.003

Gulati, R., Kahn, J., & Baldwin, R. (2010). *The professional's guide to maintenance and reliability terminology*: Reliabilityweb. com Incorporated.

Hafizi, Z., Kadir, A., Shaharuddin, A., Kadaruddin, A., & Zahedi, F. (2010). Pengurusan Fasiliti Dalam Penyelenggaraan Bangunan:Amalan Kualiti, Keselamatan dan Kesihatan. *Journal of Techno Social, 2*(1).

Hahn, E. D., & Ang, S. H. (2017). From the editors: New directions in the reporting of statistical results in the Journal of World Business. In (Vol. 52, pp. 125-126): Elsevier.

Hair, J. F., LDS Gabriel, M., Silva, D. d., & Braga, S. (2019). Development and validation of attitudes measurement scales: fundamental and practical aspects. *RAUSP Management Journal, 54*, 490-507.

Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European business review, 31*(1), 2-24.

Hair Jr, J., Black, W., Babin, B., Anderson, R., & Tatham, R. (2010). SEM: An introduction. *Multivariate data analysis: A global perspective*, 629-686.

Haidari, S. M., & Uzun, N. B. (2019). Content validity and confirmatory factor analysis of Cooperative Learning Attitude Scale (CLAS) for the EFL students. *International Journal of Social Sciences and Education Research, 5*(4), 418–433. https://doi.org/10.24289/IJSSER.632336.

Hamdan, W. S. Z. W., Hashim, M. H. M., Mohd, N. A., Radzuan, M. A. H., & Ismail, R. A. (2023). The Importance Maintenance Budgeting For The Mosques Management In Malaysia: A Systematic. *Management, 8*(34), 78-92.

Harun, M. T., Salamudin, N., & Hushin, H. F. (2013). Appraisal of the sport facilities maintenance management practices of Malaysian Stadium Corporations. *Asian Social Science, 9*(12), 93.

Hashim, A. R. (2006). *Maintenance Management and Services: Case Study: PERKESO Building's in Peninsular of Malaysia.* Universiti Teknologi Malaysia,

Hashim, S. F., Othman, R. N. R., Abdullah, Y. A., & Salleh, M. Z. M. (2023). Key Factors Influencing The Family-Friendly Neighbourhood Through Pls-Sem Model Assessment. Case Study: Ss4, Petaling Jaya, Selangor, Malaysia. *Planning Malaysia, 21*.

Hassan, S., Buang, R. R., Wahab, M. I., Shamsudin, M. F., & Hasim, M. A. (2020). Exploring mediating role of corporate image between service quality and student loyalty using PLS-SEM. *Int. J. Eng. Innov. Explor. Eng, 9*, 2726-2730.

Hasan, R., Hassan, M. K., & Rashid, M. (2019). Cash waqf investment and poverty alleviation: Case of tabung masjids in Malaysia. *Journal of Islamic Monetary Economics and Finance, 4*(2). https://doi.org/10.21098/JIMF.V4I2.1006.

Hassan, S. N. S., Seh, H., Mohamad, K., & Tawil, S. F. M. (2021). Managing Website Development for Darul Hana Mosque in Sarawak by Implementing ADDIE Approach. *UMRAN-International Journal of Islamic and Civilizational Studies, 8*(1).

Hassin, M. A., Rahman, A., & colleagues. (2025). Barriers and challenges of building maintenance in public universities. *Built Environment Journal, 22*(2).

Hatta, Z. A., & Saad, Z. M. (2021). Malezya'daki müslüman "sosyal hizmet" faaliyetleri. *Apjir, 5*(1). https://doi.org/10.52115/APJIR.857556.

Hauashdh, A., Jailani, J., & Rahman, I. A. (2022). Strategic approaches towards achieving sustainable and effective building maintenance practices in maintenance-managed buildings: A combination of expert interviews and a literature review. *Journal of Building Engineering, 45*, 103490.

Hauashdh, A. J., Junaidah Abdul Rahman, Ismail Al-fadhali, Najib. (2020). Building maintenance practices in Malaysia: a systematic review of issues, effects and the way forward. *International Journal of Building Pathology and Adaptation, 38*(5), 653-672. doi:10.1108/ijbpa-10-2019-0093

Heizer, J., & Render, B. (2012). *Operations management*: Prentice Hall.

Hellingsworth, B., Best, R., & De Valence, G. (2002). *Design and Construction: Building in Value (Building Value)*: Verlag: Butterworth Heinemann.

Hidayatullah, L., Wijaya, A., & Aji, A. I. (2022). Implementation of Preventive Maintenance Management in Mosque Buildings: Indonesia. *International Conference of Industrial Engineering and Operation Management Istanbul, Turkey*.

Hise, R. T., & McGinnis, M. A. (1976). Evaluating the effects of anonymous respondents on mail survey results. *Journal of the Academy of Marketing Science, 4*(3), 592-598. doi:10.1007/bf02729772

Hitam, M., & Talib, A. (2005). The Malaysian mosque: evolution, elements & meaning.

Hoang, C.-T. T., Nhat, P. V., & Thi, H.-T. D. (2024). Using the Delphi methodology to develop technology criteria to assess e-learning readiness in Higher education Institutions. *Journal of Science and Technology, 7*(1).

Holmberg, K., Adgar, A., Arnaiz, A., Jantunen, E., Mascolo, J., & Mekid, S. (2010). *E-maintenance*: Springer Science & Business Media.

Horner, R. M. W., El-Haram, M. A., & Munns, A. K. (1997). Building maintenance strategy: a new management approach. *Journal of Quality in Maintenance Engineering, 3*(4), 273-280. doi:10.1108/13552519710176881

Hsu, C.-C., & Sandford, B. A. (2007). The Delphi technique: making sense of consensus. *Practical Assessment, Research, and Evaluation, 12*(1), 10.

Hui, E. Y., & Tsang, A. H. (2004). Sourcing strategies of facilities management. *Journal of Quality in Maintenance Engineering, 10*(2), 85-92.

Husaini, A. A., & Tabassi, A. (2014). *Performance assessment of maintenance practices in government office buildings: case study of parcel e, Putrajaya.* Paper presented at the MATEC Web of Conferences.

Huzaifah Sulong, H. W. & Mohd Ali Mohd Noor. (2017). *Hubungan Antara Latarbelakang Pentadbir Masjid, Pengurusan Kewangan dan Keaktifan Aktiviti Masjid : Kajian di Hulu Terengganu, Terengganu.* Paper presented at the Kelestarian pembangunan Ekonomi: Kearah transformasi dasar yang holistik, inklusif dan futuristik, Hotel Bangi-Putrajaya, Bangi.

HY Lee, Hackman, & Scott, D. (2008). Development of a Conceptual Framework for the Study of Building Maintenance Operation Processes in the Context of Facility Management. *Surveying and Built Environment, 19*(1), 21.

Ibem, E. O., & Aduwo, E. B. (2013). Assessment of residential satisfaction in public housing in Ogun State, Nigeria. *Habitat International, 40*, 163-175.

Ibrahim, N. A. M., & Deraman, R. (2024). Maintenance management at Sultan Abdul Samad Jamek Mosque, Kuala Lumpur: A case study. *Journal of Sustainable Management and Built Environment*, *4*(1), 56-68. https://doi.org/10.30880/jsmbe.2024.04.01.006

Ibrahim, M. N., Rasid, A. A. A., & Yahya, M. R. (2009). *Maintenance management of kariah masjid: A preliminary study on the technical background of masjid's maintenance staff in Federal Territory Kuala Lumpur.* Paper presented at the Proceedings of Seminar Kebangsaan Pengurusan Masjid Kali Ke.

Idrus, A., Khamidi, M. F., & Olanrewaju, A. L. (2009). Value-based maintenance management model for university buildings in Malaysia-a critical review. *Journal of Sustainable Development, 2*(3), 127-133.

Imam, S. (2000). Mosque Architecture: Formulation of design criteria and Standards in the context of Bangladesh. *Bangladesh University of Engineering and Technology*.

Imamuddin, A. H., Hassan, S. A., & Sarkar, D. (1985). Community Mosque-Symbol of Society.

Ing, W. T. (2008). *Jenis-jenis kerja penyelenggaraan di bangunan pejabat.* Universiti Teknologi Malaysia,

International Organization for Standardization. (2018). *ISO 41001:2018 – Facility management – Management systems – Requirements with guidance for use*. ISO

International Organization for Standardization (2017). *ISO 41011:2017 Facility Management—Vocabulary*. ISO. Retrieved from https://www.iso.org/obp/ui/#iso:std:iso:41011:ed-1:v1:en

International Facility Management Association (2026). *What is facility management?* Retrieved from https://www.ifma.org/about/what-is-fm/

Ismaeil, E. M. H. (2024). Asset information model management-based GIS/BIM integration in facility management contract. *Sustainability, 16*(6), 2495. https://doi.org/10.3390/su16062495

Ismail, Z., Hashim, R., Aminudin, Z. M., Ghani, F. A., & Hamid, N. A. (2024). Innovative mosque management activities for income generation and community inclusion. *Environment-Behaviour Proceedings Journal, 9*(SI19). https://doi.org/10.21834/e-bpj.v9isi19.5754.

Ismail, M. (2003). *Peranan Masjid Kuala Lumpur: DarulNu'man*: Utusan Publications and Distributors Sdn. Bhd.

Ismail, Z.-A. (2014). Improving maintenance management practices for building facility. *KICEM Journal of Construction Engineering and Project Management, 4*(3), 21-32.

Islamiyah, N. (2019). The financial management practice of mosque: Study case in Malaysia. *Jurnal Akuntansi dan Keuangan Islam, 7*(1). https://doi.org/10.21002/JAKI.2019.06.

Izobo-Martins, O. (2014). *Maintenance Strategies and Condition of Public Secondary School Buildings in Ado-Odo/Ota Local Government Area Ogun State, Nigeria.* Covenant University, Ota,

Jaafar, A., Habidin, N. F., Hussin, M. Y. M., Zakaria, Z., & Hamid, A. A. (2013). A Proposed Model For Strategic Management (Sm) And Mosque Performance (Mp) In Mosque Management. *International Journal of Management, Information Technology and Engineering (BEST: IJMITE), 1*(3), 8.

JAIS. (2019). Senarai Masjid yang didaftarkan. Retrieved from http://e-masjid.jais.gov.my/index.php/profail

Jakim. (2021). Statistik Bilangan Masjid dan Surau di Malaysia. Retrieved from http://masjid.islam.gov.my/index.php?data=c3RhdGlzdGlrLnBocA

Jayasingam, S., Fujiwara, Y., & Thurasamy, R. (2018). 'I am competent so I can be choosy': choosiness and its implication on graduate employability. *Studies in Higher Education, 43*(7), 1119-1134.

Johannesson, P., & Perjons, E. (2014). *Design Science*: Springer.

Johar, S., Ahmad, A. G., Che-Ani, A. I., Tawil, N. M., & Abdullah, N. A. G. (2011). Analisa Kajian Lapangan ke atas Kecacatan Pada Bangunan Masjid Lama di Malaysia. *Journal Design + Built*.

Johnson, T. M., & Crossing, P. F. (2020). The World by Religion. *Journal of Religion and Demography, 7*(1), 4-91. doi:10.1163/2589742x-12347101

Johor, E. (2003). *Administration of The Religion of Islam (State of Johor) Enactment 2003*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Ori_lib.nsf/100ae747c72508e748256faa00188094/99f9b0f3e850fee2482576c00018b353?OpenDocument.

Jonsson, P. (1997). The status of maintenance management in Swedish manufacturing

firms. *Journal of Quality in Maintenance Engineering, 3*(4), 233-258.

Jabatan Perancangan Bandar dan Desa Semenanjung Malaysia. (2011). *Garis panduan perancangan masjid dan surau (GP008-A)* [Draf]. Retrived from https://rehdaselangor.com/wp-content/uploads/2q.-GP008-A_Masjid-Surau_2011.pdf

Kalaian, S., & Shah, H. (2006). *Overview of parametric and non-parametric statistical methods for analyzing Delphi data.* Paper presented at the Annual Meeting of the Mid-Western Educational Research Association. Columbus, Ohio.

Kalumbu, R., Mutingi, M., & Mbohwa, C. (2016, 4-7 Dec. 2016). *Critical success factors for developing building maintenance strategies: A case of Namibia.* Paper presented at the 2016 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM).

Kamaruzzaman, S. N. B., Kim Wing, A. C., bin Mohammed, A. H., bin Abdullah, M. N., Ali, A. S. B., Azmi, N. F. B., & Chua, S. J. L. (2016). A literature review on maintenance priority - conceptual framework and directions. *MATEC Web of Conferences, 66*, 00004. doi:10.1051/matecconf/20166600004

Kamaruzzaman, S. N. B., Zawawi, Z. A., Khalid, M. K. A., Ahmad, N. A., Zahari, N. F., Agus Salim, N. A., . . . Chua, S. J. L. (2016). Operation And Maintenance In Facilities Management Practices: A Gap Analysis In Malaysia. *MATEC Web of Conferences, 66*, 00116. doi:10.1051/matecconf/20166600116

Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard: measures that drive performance.

Karim, N. R. (2016). *Faktor yang mempengaruhi kecenderungan masyarakat dalam mengimarahkan masjid*.

Kashif, M., Zarkada, A., & Ramayah, T. (2018). The impact of attitude, subjective norms, and perceived behavioural control on managers' intentions to behave ethically. *Total Quality Management & Business Excellence, 29*(5-6), 481-501.

Kedah, A. (2008). *Administration Of Islamic Law (Kedah Darul Aman) Enactment 2008.* Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Ori_lib.nsf/100ae747c72508e748256faa00188094/cd28b7c12426c1a24825769500066fa4?OpenDocument.

Kelantan, E. (1994). *Council Of The Religion Of Islam And Malay Custom, Kelantan Enactment 1994*. Retrieved from

http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Ori_lib.nsf/100ae747c72508e748256faa00188094/f0fe1e5568555bb4482576510031e7a4?OpenDocument.

Kelly, A. (1997). *Maintenance organization &systems-Business-centred maintenance*: Butterworth-Heinemann.

Kelly, A. (2006). *Strategic Maintenance Planning*.

Kelly, J., Hunter, K., Shen, G., & Yu, A. (2005). Briefing from a facilities management perspective. *Facilities, 23*(7/8), 356-367.

Kennerley, M., & Neely, A. (2003). Measuring performance in a changing business environment. *International Journal of Operations & Production Management*.

Khalit, N. A. (2011). *Revitalizing roles and functions of mosques in Kuala Lumpur.* Universiti Teknologi MARA,

Khanal, B., & Chhetri, D. B. (2024). A Pilot Study Approach to Assessing the Reliability and Validity of Relevancy and Efficacy Survey Scale. *Janabhawana Research Journal, 3*(1), 35-49. doi:10.3126/jrj.v3i1.68384

Kim, M. J., Sung, E., Choi, E. Y., Ju, Y.-S., Park, E.-W., Cheong, Y.-S., . . . Kim, S. (2017). Delphi survey for designing a intervention research study on childhood obesity prevention. *Korean Journal of Family Medicine, 38*(5), 284.

Kim, S.-S., Yang, I.-H., Yeo, M.-S., & Kim, K.-W. (2005). Development of a housing performance evaluation model for multi-family residential buildings in Korea. *Building and Environment, 40*(8), 1103-1116.

Kline, P. (2014). *An easy guide to factor analysis*: Routledge.

Kobbacy, K. A. H., & Murthy, D. P. (2008). *Complex system maintenance handbook*: Springer Science & Business Media.

Komonen, K., Kortelainen, H., & Räikkönen, M. (2011). Corporate asset management for industrial companies: an integrated business-driven approach. In *Asset management: The state of the art in Europe from a life cycle perspective* (pp. 47-63): Springer.

Kondos, N. A., Barrett, J., McDonall, J., & Bucknall, T. (2023). A Delphi study to obtain consensus on medical emergency team (MET) stand-down decision making. *Journal of Clinical Nursing, 32*(21-22), 7873-7882.

Krejcie, R. V., & Morgan, D. W. (2016). Determining Sample Size for Research Activities. *Educational and Psychological Measurement, 30*(3), 607-610. doi:10.1177/001316447003000308

Kreps, D. M. (1990). Corporate culture and economic theory. In *Perspectives on positive political economy* (Vol. 90, pp. 8).

Ku, S., & Kim, C. (2019). Development of a model for maintenance performance measurement. *Journal of Quality in Maintenance Engineering, 26*(1), 69-86. doi:10.1108/jqme-07-2018-0060

Kumar, U., Kumar, U., Galar, D., Parida, A., Stenström, C., & Berges, L. (2013). Maintenance performance metrics: a state-of-the-art review. *Journal of Quality in Maintenance Engineering, 19*(3), 233-277. doi:10.1108/jqme-05-2013-0029

Kunc, M. H., & Morecroft, J. D. (2010). Managerial decision making and firm performance under a resource-based paradigm. *Strategic management journal, 31*(11), 1164-1182.

Kutucuoglu, K. Y., Hamali, J., Irani, Z., & Sharp, J. M. (2001). A framework for managing maintenance using performance measurement systems. *International Journal of Operations & Production Management, 21*(1/2), 173-195. doi:10.1108/01443570110358521

Lam, E. W., Chan, A. P., & Chan, D. W. (2010). Benchmarking success of building maintenance projects. *Facilities, 28*(5/6), 290-305.

Lateef Olanrewaju, A., Idrus, A., & Faris Khamidi, M. (2011). Investigating building maintenance practices in Malaysia: a case study. *Structural Survey, 29*(5), 397-410. doi:10.1108/02630801111182420

Latief, H., Robani, A., Kamarudin, M. F., & Rozikan, R. (2021). Becoming the State-Funded Madrasah or Retaining Autonomy: The Case of Two Madrasahs in Kelantan. *QIJIS (Qudus International Journal of Islamic Studies), 9*(1), 1-36.

Lau Yen Yen, E., Hashim, H., & Md Yunus, M. (2023). Development and validation of an instrument to evaluate technology-enhanced learning and teaching sustainability in teaching spelling. *Sustainability, 15*(5), 4256. https://doi.org/10.3390/su15054256.

Lavy, S., A. Garcia, J., & K. Dixit, M. (2014a). KPIs for facility's performance assessment, Part I: identification and categorization of core indicators. *Facilities, 32*(5/6), 256-274. doi:10.1108/f-09-2012-0066

Lavy, S., A. Garcia, J., & K. Dixit, M. (2014b). KPIs for facility's performance assessment, Part II: identification of variables and deriving expressions for core indicators. *Facilities, 32*(5/6), 275-294.

Lavy, S., & Bilbo, D. L. (2009). Facilities maintenance management practices in large

public schools, Texas. *Facilities, 27*(1/2), 5-20. doi:10.1108/02632770910923054

Lavy, S., Garcia, J. A., & Dixit, M. K. (2010). Establishment of KPIs for facility performance measurement: review of literature. *Facilities, 28*(9/10), 440-464.

Lavy, S., Garcia, J. A., Scinto, P., & Dixit, M. K. (2014). Key performance indicators for facility performance assessment: simulation of core indicators. *Construction Management and Economics, 32*(12), 1183-1204. doi:10.1080/01446193.2014.970208

Le, A. T. H., Domingo, N., Rasheed, E., & Park, K. S. (2018). *Building Maintenance Cost Planning and Estimating: A Literature Review".* Paper presented at the Proceedings of 34th Annual ARCOM Conference, Gorse, C., Neilson, CJ, Belfast, UK, Association of Researchers in Construction Management.

Leahy, K., Gallagher, C. V., Bruton, K., O'Donovan, P., & O'Sullivan, D. T. (2017). *Automatically identifying and predicting unplanned wind turbine stoppages using scada and alarms system data: Case study and results.* Paper presented at the Journal of Physics: Conference Series.

Lee, J. Y., Irisboev, I. O., & Ryu, Y. S. (2021). Literature review on digitalization in facilities management and facilities management performance measurement: Contribution of Industry 4.0 in the global era. *Sustainability, 13*(23), 13432. https://doi.org/10.3390/su132313432.

Lee, H. H. Y., & Scott, D. (2009). Overview of maintenance strategy, acceptable maintenance standard and resources from a building maintenance operation perspective. *Journal of Building Appraisal, 4*(4), 269-278. doi:10.1057/jba.2008.46

Lee, W. W., & Zainordin, N. (2019). An identification of building maintenance criteria toward green building residential project. *Malaysian Construction Research Journal (MCRJ)*, 95.

Leong, K. (2004). The Essence Of Good Facility Management–A Guide For Maximization Of Facility Assets' Economic Life And Asset Optimisation For Reliable Services And User Satisfaction. *Buletin Ingenieur, 24*, 7-19.

Lewis, A. (2012). Benchmarking Best Practice in Maintenance Management. *Benchmarking: An International Journal*.

Lewis, A., Riley, D., & Elmualim, A. (2010). Defining high performance buildings for operations and maintenance. *International Journal of Facility Management,*

1(2).

Lewis, B. (2000). *Facility Manager's Portable Handbook New York*: USA, McGraw-Hill.

Li, Q. (2012). A novel Likert scale based on fuzzy sets theory. *Expert Systems With Applications*.

Li, Q., Ji, C., Yuan, J., & Han, R. (2017). Developing dimensions and key indicators for the safety climate within China's construction teams: A questionnaire survey on construction sites in Nanjing. *Safety Science, 93*, 266-276.

Liehr, P., & Smith, M. J. (1999). Middle range theory: spinning research and practice to create knowledge for the new millennium. *ANS Adv Nurs Sci, 21*(4), 81-91. doi:10.1097/00012272-199906000-00011

Likert, R. (1932). A technique for the measurement of attitudes. *Archives of psychology*.

Lin, C., Tsai, H.-L., & Wu, J.-C. (2014). Collaboration strategy decision-making using the Miles and Snow typology. *Journal of Business Research, 67*(9), 1979-1990. doi:10.1016/j.jbusres.2013.10.013

Lind, H., & Muyingo, H. (2012). Building maintenance strategies: Planning under uncertainty. *Property Management, 30*(1), 14-28. doi:10.1108/02637471211198152

Liu, Y.-D. (2009). Implementing and evaluating performance measurement initiative in public leisure facilities: an action research project. *Systemic Practice and Action Research, 22*(1), 15-30.

Liyanage, J. P., & Kumar, U. (2003). Towards a value-based view on operations and maintenance performance management. *Journal of Quality in Maintenance Engineering, 9*(4), 333-350.

Löfsten, H. (2000). Measuring maintenance performance–in search for a maintenance productivity index. *International Journal of Production Economics, 63*(1), 47-58.

Loosemore, M., & Hsin, Y. (2001). Customer-focused benchmarking for facilities management. *Facilities, 19*(13/14), 464-476.

Low, Z. (2021). Maintainability of Modern Mosque : A Review on Maintenance Strategies.

Ludwig, B. (1997). Predicting the future: Have you considered using the Delphi methodology. *Journal of extension, 35*(5), 1-4.

Lussier, D. n. (2019). Mosques, Churches, and Civic Skill Opportunities in Indonesia.

JOURNAL FOR THE SCIENTIFIC STUDY OF RELIGION.

Lynn, M. R. (1986). Determination and quantification of content validity. *Nursing research, 35*(6), 382-386.

Madlock, P., & Booth-Butterfield, M. (2008). The Effects of Coworker Relational Maintenance Strategies on Employee Outcomes. In: TBA: Montreal, Quebec, Canada.

Mahfoud, H., Abdellah, E. B., & El Biyaali, A. (2018). Dependability-based maintenance optimization in healthcare domain. *Journal of Quality in Maintenance Engineering, 24*(2), 200-223. doi:10.1108/jqme-07-2016-0029

MAIK. (2014). *Masjid-Masjid Di Kelantan, Malaysia*. Shah Alam: Ultimate Print Sdn Bhd (62208-H).

Maisham, M., Adnan, H., Ismail, N. A. A., & Mahat, N. A. A. (2019). Developing a research methodology for life cycle costing framework for application in green projects. *IOP Conference Series: Earth and Environmental Science, 385*(1), 012066. https://doi.org/10.1088/1755-1315/385/1/012066.

Malaysia. (1957). *Federal Constitution*. Retrieved from http://www.refworld.org/docid/3ae6b5e40.html.

Malaysia, Jabatan Kerja Raya. Bahagian Perundingan Pengurusan Aset. (2021). *Garis Panduan Pengurusan Operasi dan Penyenggaraan* (GPOP) (Edisi 2021). (ISBN 978-967-19782-0-7).

Malaysia, Jabatan Kerja Raya. Bahagian Perundingan Pengurusan Aset. (2021*). Garis Panduan Pengurusan Ruang* (GPPR). (ISBN 978-967-19782-3-8).

Malaysia, L. O. (1993). *Administration Of Islamic Law (Federal Territories) Act 1993*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_act_lib.nsf/f0a1dd6010da414b48256815001bd4fc/ab0758fbb137d564c82568a200176e93?OpenDocument.

Márquez, A. C. (2007). *The maintenance management framework: models and methods for complex systems maintenance*: Springer Science & Business Media.

Marquez, A. C., & Gupta, J. N. (2006). Contemporary maintenance management: process, framework and supporting pillars. *Omega, 34*(3), 313-326.

Martínez-Corral, A., & Carnero, M. C. (2024). Fuzzy multicriteria evaluation and trends of asset management performance: A case study of Spanish buildings. *Case Studies in Construction Materials, 20*, e02788.

https://doi.org/10.1016/j.cscm.2023.e02788.

Matrone, F., Colucci, E., Iacono, E., Lingua, A., & Spanò, A. (2023). The HBIM-GIS Maintanance platform to enhance the maintenance and conservation of historical built heritage. *Sensors*, 23(19), 8112. https://doi.org/10.3390/s23198112

Marsh, C. (2003). *Building services procurement*: Routledge.

Mathew, S. (2008). An inspection maintenance strategy using the inspection factor. *International Journal of Quality & Reliability Management, 25*(5), 532-540. doi:10.1108/02656710810873916

Matos, R., Rodrigues, F., Rodrigues, H., & Costa, A. (2021). Building condition assessment supported by Building Information Modelling. *Journal of Building Engineering, 38*, 102186. doi:https://doi.org/10.1016/j.jobe.2021.102186

Maxwell, J. A. (2013). Applied social research methods series: Vol. 41. *Qualitative research design: An interactive approach, 3*.

Mazlan, E., Che-Ani, A., & Mohd Sarman, A. (2018). Management Of Building Mosque In Malaysia. *World Journal of Engineering Research and Technology, 4*, 48-56.

McKone, K. E., & Weiss, E. N. (1998). TPM: planned and autonomous maintenance: bridging the gap between practice and research. *Production and operations management, 7*(4), 335-351.

McNamara, C. (1999). General guidelines for conducting interviews, Minnesota. *Missouri Institute of science*.

McQueen, R. A., & Knussen, C. (2002). *Research methods for social science: A practical introduction*: Pearson Education.

Melaka, E. (2002). *Administration Of The Religion Of Islam (State Of Malacca) Enactment 2002*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Ori_lib.nsf/f831ccddd195843f48256fc600141e84/cdd425f6f28ed4b348256fc60012a4a7?OpenDocument.

Mhonsiwa, A. (2024). *Maintenance Planning and Asset Optimisation Processes in Relation to Production Performance in South African Mining Operations.* University of the Witwatersrand, Johannesburg (South Africa),

Miles, D., & Syagga, P. (1987). Building maintenance. *Wheaton & Co., Ltd., London*.

Mills, E. D. (1980). *Building maintenance and preservation: a guide for design and*

management: Butterworth-Heinemann.

Millán-Millán, P. M., & Cabeza-Lainez, J. M. (2022). HBIM methodology for habitability analysis in protected heritage contexts: Monastery of Santa Clara, Spain. *International Journal of Architectural Heritage*, *16*(4), 567-585

Mintzberg, H. (1994). Rethinking strategic planning part II: new roles for planners. *Long Range Planning, 27*(3), 22-30.

Mintzberg, H., & Lampel, J. (1999). Reflecting on the strategy process. *Sloan management review, 40*, 21-30.

Mohamad, A. H. (2019a). konsep rahmah dalam pengurusan masjid. In J. K. I. Malaysia (Ed.), (9 ed., pp. 26): Firdaus Press Sdn. Bhd.

Mohamad, A. H. (2019b). Peranan Jawatankuasa Dalam Menjayakan Masjid Berkonsep Rahmah. *Rahmah Dalam Pengurusan Masjid*(9), 26.

Mohammad, S. (2017). *Kajian Terhadap Pengurusan Penyelenggaraan Masjid Sultan Ibrahim, Universiti Tun Hussein Onn Malaysia (Uthm)*. Universiti Tun Hussein Onn Malaysia

Mohammed, A. H., & Wan Mat, W. M. (1991). *Teknologi penyenggaraan bangunan*: Dewan Bahasa dan Pustaka.

Mohamed, I. S., Mustafa, N. A., Yusuf, S. N. S., & Daud, Z. (2023). Issues in financial governance practices in Malaysia's mosques. *Journal of Nusantara Studies, 8*(3), 134–146. https://doi.org/10.24200/jonus.vol8iss3pp134-146.

Mohd Norazam, Y., Rosli Mohamad, Z., Abd Halid, A., Muhammad Shafiq, M., & Muhammad Fikri, H. (2017). The most common problem facing by the maintenance department: A case Study between Universiti Tun Hussein Onn Malaysia (UTHM) and Universiti Teknologi Malaysia (UTM). *IOP Conference Series: Materials Science and Engineering, 271*(1), 012047.

Mohd Taib, M. Z., Ismail, Z., Ahmad, S., & Rasdi, T. (2016). Mosque Development in Malaysia: Is it the product of evolution and social behaviour? *Environment-Behaviour Proceedings Journal, 1*(1), 36. doi:10.21834/e-bpj.v1i1.192

Mohit, M. A., & Azim, M. (2012). Assessment of residential satisfaction with public housing in Hulhumale', Maldives. *Procedia-Social and Behavioral Sciences, 50*, 756-770.

Mong, S. G., Mohamed, S. F., & Misnan, M. S. (2018). Key strategies to overcome cost overruns issues in building maintenance management. *Int. J. Eng. Technol, 7*, 269-273.

Morris, A., & Dennison, P. (1995). Sick building syndrome: survey findings of libraries in Great Britain. *Library management*.

Mosque. (2018). Oxford dictionaries. Retrieved from https://en.oxforddictionaries.com/definition/mosque

Mostafa, S., Dumrak, J., & Soltan, H. (2015). Lean maintenance roadmap. *Procedia Manufacturing, 2*, 434-444.

Motawa, I., & Almarshad, A. (2013). A knowledge-based BIM system for building maintenance. *Automation in Construction, 29*, 173-182.

Moullin, M. (2007). Performance measurement definitions: linking performance measurement and organisational excellence. *Int J Health Care Qual Assur, 20*(2-3), 181-183. doi:10.1108/09526860710743327

Muchiri, P., Pintelon, L., Gelders, L., & Martin, H. (2011). Development of maintenance function performance measurement framework and indicators. *International Journal of Production Economics, 131*(1), 295-302. doi:10.1016/j.ijpe.2010.04.039

Muhey, S. (2012). *Facility Management Model for Maintenance and Repair for Office Buildings.* (PhD Facility Management), Concordia University,

Muin, Z., Sapri, M., Sipan, I., & Adjei-Twum, A. (2016). Key Drivers of Sustainable Facilities Management (Fm) Practice for Mosques in Malaysia. *International Journal of Real Estate Studies*.

Muin, Z. B. H. A. (2017). *Facilities Management Model For State Mosque In Peninsular Malaysia.* (Doctor of Philosophy (Facilities Management)), Universiti Teknologi Malaysia

Muñoz Moreno, M. F., Prieto, A. J., Ortiz, R., & Macías-Bernal, J. M. (2022). Preventive conservation and restoration monitoring of heritage buildings based on fuzzy logic. *International Journal of Architectural Heritage*, *16*(3), 440-457. https://doi.org/10.1080/15583058.2021.2018520

Mustafa, N. K. F., Johar, S., Ahmad, A. G., Zulkarnain, S. H., Rahman, M. Y. A., & Ani, A. I. C. (2011). Conservation and Repair Works for Traditional Timber Mosque in Malaysia: A Review on Techniques. *World Academy of Science, Engineering and Technology International Journal of Humanities and Social Sciences, 5*(5), 6.

Mustari, M., & Jasmi, K. A. (2008). *Pengurusan Berkualiti Memacu Kecemerlangan Pengurusan Masjid*: Skudai, Johor Bahru, Johor: Universiti Teknologi Malaysia

Press.

Mutalib, M. A., & Razali, W. M. F. A. W. (2013). *Model Pengimarahan Dan Prestasi Masjid Di Malaysia: Satu Pengenalan Awal Kajian.* Paper presented at the Seminar Kebangsaan Pengajian Akidah dan Agama, Universiti Sains Islam Malaysia.

Nawi, M. M., Lee, A., & Nor, K. (2011). Barriers to implementation of the industrialised building system (IBS) in Malaysia. *The Built & Human Environment Review, 4*(2), 34-37.

Ncamiso, M., Nokulunga, M., Clinton, A., & Didibhuku, T. (2022). *A Theoretical Assessment of Causes for Deferred Maintenance of Public Buildings in developing countries-The Kingdom of Eswatini.* Paper presented at the Construction in the 21st Century 12th International Conference (CITC 12).

Neely, A., Gregory, M., & Platts, K. (1995). Performance measurement system design: a literature review and research agenda. *International Journal of Operations & Production Management, 15*(4), 80-116.

Negeri, D. U. (2003). *Warta Kerajaan*.

Newman, P. (2006). The environmental impact of cities. *Environment and Urbanization, 18*(2), 275-295.

Ng, R., Lai, J. H. K., Leung, O. C. H., & Edwards, D. (2023). Assessing lift maintenance performance of high-rise residential buildings. *Journal of Building Engineering*, *68*, 106202. https://doi.org/10.1016/j.jobe.2023.106202

Nieto Julián, J. E., Bruno, S., & Moyano, J. (2024). An efficient process for the management of the deterioration and conservation of architectural heritage: The HBIM project of the Duomo of Molfetta (Italy). *Remote Sensing*, *16*(23), 4542. https://doi.org/10.3390/rs16234542

Nik-Mat, N. E. M., Kamaruzzaman, S. N., & Pitt, M. (2011). Assessing The Maintenance Aspect of Facilities Management through a Performance Measurement System: A Malaysian Case Study. *Procedia Engineering, 20*, 329-338. doi:10.1016/j.proeng.2011.11.174

Nilsson, J., & Bertling, L. (2007). Maintenance management of wind power systems using condition monitoring systems—life cycle cost analysis for two case studies. *IEEE Transactions on energy conversion, 22*(1), 223-229.

Nizarudin, N. D. (2017). *Factors influencing use of urban mosque open spaces in Kuala Lumpur, Malaysia.* (Doctor of Phylosophy), The University of Edinburgh,

Nor 'Adha Abd Hamid, Normazaini Saleh, Nazifah Mustaffha, Norziah Ohman, Wawarah Saidpudin, & Awang, A. H. (2015). The Governance Practices of Mosques: A Study of Public Perception in Selangor. *Australian Journal of Basic and Applied Sciences, 9*(31), 10.

Nordin, Z. S. (2023). Kelestarian dana masjid di negeri Sarawak [Sustainability of mosque funds in the state of Sarawak]. *e-Bangi, 20*(2). https://doi.org/10.17576/ebangi.2023.2002.21.

Ogunbayo, B. F., Ohis Aigbavboa, C., Thwala, W. D., & Akinradewo, O. I. (2022). Assessing maintenance budget elements for building maintenance management in Nigerian built environment: a Delphi study. *Built Environment Project and Asset Management, 12*(4), 649-666. doi:10.1108/BEPAM-06-2021-0080

Olajide, F. J., & Afolarin, A. O. (2012). Evaluation Of Maintenance Management Practice In Banking Industry In Lagos State, Nigeria. *International Journal of Sustainable Construction Engineering & Technology, 3*(1), 9.

Olanrewaju, Lateef, A., Khamidi, Faris, M., & Idrus, A. (2010). Building Maintenance Management in a Malaysian University Campuses: A Case Study. *Australasian Journal of Construction Economics and Building, 10*(1/2), 14.

Olanrewaju, A. L., & Abdul-Aziz, A.-R. (2015). Building Maintenance Processes, Principles, Procedures, Practices and Strategies. In *Building Maintenance Processes and Practices* (pp. 79-129). Singapore: Springer Singapore.

Omar, A. R. C., Hussin, M. Y. M., & Muhammad, F. (2017). *Strategic Orientation and Mosques Economic Activities.* Paper presented at the INTERNATIONAL BUSINESS MANAGEMENT CONFERENCE (IBMC 2017).

Omar, M. F., Ibrahim, F. A., & Wan Omar, W. M. S. (2016). An Assessment of the Maintenance Management Effectiveness of Public Hospital Building Through Key Performance Indicators. *SAINS HUMANIKA, 8*(4-2). doi:10.11113/sh.v8n4-2.1059

Othman, C., Busari, A. H., & Sulong, M. (2024). Content Validity Of Instruments Measuring Instructional Leadership, Organizational Commitment And Followership In Malaysian Primary Schools. *International Journal of Humanities Technology and Civilization*, 153-166.

Pahang, E. (1991). *Administration Of Islamic Law Enactment 1991*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Upd.nsf/f831ccddd195843f48256fc600141e84/b8d7119915228e134825

76cf002bd7bf?OpenDocument.

Pallant, J. (2013). *SPSS survival manual*: McGraw-Hill Education (UK).

Parasuraman, A., Z. V., & Berry, L. L. (1990). *Delivery Quality Service* 1230 Avenue of Americas, New York, NY 10020: THE FREE PRESS.

Parasuraman, A., Berry, L. L., & Zeithaml, V. A. (1993). More on improving service quality measurement. *Journal of Retailing, 69*(1), 140-147.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perception of Service Quality. *Journal of Retailing, 64*(1), 12-40.

Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1994). Reassessment of Expectations as a Comparison Standard in Measuring Service Quality: Implications for Further Research. *Journal of Marketing, 58*(1), 111-124.

Parida, A. (2007). Study and analysis of maintenance performance indicators (MPIs) for LKAB. *Journal of Quality in Maintenance Engineering, 13*(4), 325-337. doi:10.1108/13552510710829434

Parida, A., & Chattopadhyay, G. (2007). Development of a multi-criteria hierarchical framework for maintenance performance measurement (MPM). *Journal of Quality in Maintenance Engineering, 13*(3), 241-258. doi:10.1108/13552510710780276

Parida, A., Chattopadhyay, G., & Kumar, U. (2005). *Multi criteria maintenance performance measurement: a conceptual model.* Paper presented at the Proceedings of the 18th International Congress of COMADEM.

Parida, A., & Kumar, U. (2006). Maintenance performance measurement (MPM): issues and challenges. *Journal of Quality in Maintenance Engineering, 12*(3), 239-251. doi:10.1108/13552510610685084

Parida, A., & Kumar, U. (2009). Maintenance productivity and performance measurement. In *Handbook of maintenance management and engineering* (pp. 17-41): Springer.

Parida, A., Kumar, U., Galar, D., & Stenström, C. (2015). Performance measurement and management for maintenance: a literature review. *Journal of Quality in Maintenance Engineering, 21*(1), 2-33.

Park, R. E., Goethert, W. B., & Florac, W. A. (1996). *Goal-Driven Software Measurement. A Guidebook*. Retrieved from

Patidar, L., Soni, V. K., & Soni, P. K. (2017). Maintenance Strategies and their Combine

Impact on Manufacturing Performance. *International Journal of Mechanical and Production Engineering Research and Development, 7*(1), 13-22.

Paulo, P. V., Branco, F., & de Brito, J. (2013). BuildingsLife: a building management system. *Structure and Infrastructure Engineering, 10*(3), 388-397. doi:10.1080/15732479.2012.756919

Pawar, B. S. (2009). *Theory building for hypothesis specification in organizational studies*: SAGE Publications India.

Penang, E. (2004). *Administration Of The Religion Of Islam*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Upd.nsf/100ae747c72508e748256faa00188094/956416665139d431482576c0000454cf?OpenDocument.

Perak, E. (2004). *Administration Of The Religion Of Islam (Perak) Enactment 2004*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Ori_lib.nsf/100ae747c72508e748256faa00188094/f7230f6926d8a6134825704c00140690?OpenDocument.

Perlis, E. (1963). *Administration Of Muslim Law Enactment, 1963*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen/Eng_enactment_lib.nsf/100ae747c72508e748256faa00188094/c7dba23b3f728742482573950297034?OpenDocument.

Phogat, S., & Gupta, A. K. (2017). Identification of problems in maintenance operations and comparison with manufacturing operations. *Journal of Quality in Maintenance Engineering, 23*(2), 226-238. doi:10.1108/jqme-06-2016-0027

Piaw, C. Y. (2012). *Mastering research methods*. Malaysia: McGraw-Hill.

Pintelon, L. (2008). Liliane Pintelon and Alejandro Parodi-Herz. *Complex System Maintenance Handbook*, 21.

Pintelon, L., Raouf, A., Pinjala, S. K., & Vereecke, A. (2006). Evaluating the effectiveness of maintenance strategies. *Journal of Quality in Maintenance Engineering, 12*(1), 7-20. doi:10.1108/13552510610654501

Pitt, M., Cannavina, D., Sulaiman, R., Mahyuddin, N., & Wu, C. (2016). Hotel maintenance management in Sanya, China. *Journal of Facilities Management, 14*(4), 304-314. doi:10.1108/jfm-12-2015-0034

Pitt, T. J. (1997). Data requirements for the prioritization of predictive building maintenance. *Facilities, 15*(3/4), 97-104.

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Research in nursing & health, 30*(4), 459-467.

Pun, K. P., Tsang, Y. P., Choy, K. L., Tang, V., & Lam, H. Y. (2017, 9-13 July 2017). *A fuzzy-AHP-based decision support system for maintenance strategy selection in facility management.* Paper presented at the 2017 Portland International Conference on Management of Engineering and Technology (PICMET).

Quinn, J. B. (1980). *Strategies for change: Logical incrementalism*: Irwin Professional Publishing.

Radwan, A. H. (2021). The Mosque as a public space in the Islamic City-An Analytical study of Architectural & Urban design of contemporary examples. *Journal of Architecture, Arts and Humanistic Science, 6*(30), 18.

Radzuan, N. A. M., Hamdan, W. S. Z., Hamid, M. Y., & Abdullah-Halim, A. H. (2011). The Importance of Building Condition Survey Report for New House Buyers. *Procedia Engineering, 20*, 147-153.

Rahman, R. A., & Salim, M. R. (2010). *Corporate governance in Malaysia: Theory, law, and context*: Sweet & Maxwell Asia.

Ramly, A. (2002). *Prinsip dan praktis pengurusan penyenggaraan bangunan*: Pustaka Ilmi.

Ramly, A. (2003). *prinsip dan praktis pengurusan penyelenggaraan bangunan*: Pustaka Ilmi.

Rani, N. A. A., Baharum, M. R., Akbar, A. R. N., & Nawawi, A. H. (2015). Perception of Maintenance Management Strategy on Healthcare Facilities. *Procedia - Social and Behavioral Sciences, 170*, 272-281. doi:10.1016/j.sbspro.2015.01.037

Rasdi. (2014). *Rethinking the Mosque in the Modern Muslim Society.*: Institut Terjemahan & Buku Malaysia Berhad.

Rasdi, M. T. M., & Utaberta, N. (2012). The Design of Mosques as Community Development Centers from the Perspective of the Sunna and Wright's Organic Architecture. *Journal of Islamic Architecture, 1*(1).

Razak, A. A., Hussin, M. Y. M., Muhammad, F., & Nurhanie, M. (2014). Economic Significance of Mosque Institution in Perak State, Malaysia (Special Feature: Socio-Economic Role of Islamic Finance and its Potential in the Post-Capitalist Era). *イスラーム世界研究, 7*, 98-109.

Remly, M. R., Kadir, M. N. A., Othman, F. M., & Ismail, D. (2019). Cabaran pengurusan aktiviti pengimarahan institusi masjid: Kajian kes di masjid cemerlang di Malaysia [Challenges in management of mosque institution activity: A case study in excellence mosque in Malaysia]. *Journal of Islamic, Social, Economics and Development, 4*(21), 92–104.

Rezaei, S., Shahijan, M. K., Amin, M., & Ismail, W. K. W. (2016). Determinants of app stores continuance behavior: a PLS path modelling approach. *Journal of Internet Commerce, 15*(4), 408-440.

Richard, F. N., & Golkarian, Sh. (2023). Architectural conservation of the rock-hewn churches of Lalibela, Ethiopia: A study on preservation and socio-economic conservation. *Revista Amazonia Investiga*, *12*(67), 134-145. https://doi.org/10.34069/ai/2023.67.07.12

Rozita, B. (2006). Maintenance Factors in Building Designs. *Unpublished Master's Thesis, University Technology Malaysia*.

Ruparathna, R., Hewage, K., & Sadiq, R. (2018). Multi-period maintenance planning for public buildings: A risk based approach for climate conscious operation. *Journal of Cleaner Production, 170*, 1338-1353. doi:10.1016/j.jclepro.2017.09.178

S.H. Ibrahim, A. B., Nawi, M.N.M. Junaidi E. (2014). Assessment of thermal comfort in the mosque in Sarawak, Malaysia. *International Journal Of Energy And Environment, 5*(3), 8.

Sabah, E. (2004). *Majlis Ugama Islam Negeri Sabah Enactment 2004*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Ori_lib.nsf/100ae747c72508e748256faa00188094/2923c4f98bd365384825761f00135127?OpenDocument.

Sabri, R., & Olagoke, O. A. (2020). Safeguarding the colonial era's ecclesiastical heritage: Towards a sustainable protection-use model. *Journal of Cultural Heritage Management and Sustainable Development*, *10*(3), 345-360. https://doi.org/10.1108/JCHMSD-01-2020-0017

Said, H., Badru, B. B., & Shahid, M. (2011). Confirmatory factor analysis (CFA) for testing validity and reliability instrument in the study of education. *Australian Journal of Basic and Applied Sciences, 5*(12), 1098-1103.

Salonen, A., & Bengtsson, M. (2011). The potential in strategic maintenance development. *Journal of Quality in Maintenance Engineering, 17*(4), 337-350.

Samuel, R., & Ramayah, T. (2016). Employability, mobility and work-life balance: How do they relate for MBA holders in Malaysia. *Pertanika Journal of Social Sciences & Humanities, 24*(1), 359-374.

Sandelowski, M. (1998). The call to experts in qualitative research. *Research in nursing & health, 21*(5), 467-471.

Santos, A. d. (1999). *Application of flow principles in the production management of construction sites.* University of Salford.

Sapri, M., Ab Muin, Z., Sipan, I., Adjei-Twum, A., Yusof, F. M., Mahamud, R., & Omar, M. (2014). *Potential of facilities management in uplifting mosque management functions.* Paper presented at the International Conference on Masjid, Zakat and Waqaf (i-MAF).

Sapril, M., Muin, Z. A., & Sipan, I. (2016). Key Drivers of an Effective Facilities Management Practice for Malaysia State Mosque *MATEC Web of Conferences, 66*, 9. doi:10.1051/matecconf/20166

Sarawak, E. (2001). *Majlis Islam Sarawak Ordinance, 2001*.

Satish, U., Mendell, M. J., Shekhar, K., Hotchi, T., Sullivan, D., Streufert, S., & Fisk, W. J. (2012). Is CO2 an indoor pollutant? Direct effects of low-to-moderate CO2 concentrations on human decision-making performance. *Environmental health perspectives, 120*(12), 1671-1677.

Saunders, M., Lewis, P., & Thornhill, A. (2009). *Research methods for business students*: Pearson education.

Saunders, M., Lewis, P., & Thornhill, A. (2016). *Research Methods for Business Students*: Pearson Education Limited.

Schraven, D., Hartmann, A., & Dewulf, G. (2011). Effectiveness of infrastructure asset management: challenges for public agencies. *Built Environment Project and Asset Management, 1*(1), 61-74.

Seecharan, T., Labib, A., & Jardine, A. (2018). Maintenance strategies: Decision Making Grid vs Jack-Knife Diagram. *Journal of Quality in Maintenance Engineering, 24*(1), 61-78. doi:10.1108/jqme-06-2016-0023

Seeley, I. H. (1987). *Building maintenance*: Macmillan International Higher Education.

Sekaran, U., & Bougie, R. (2016). *Research methods for business: A skill building approach* (seven ed.). Chichester, West Sussex, United Kingdom: John Wiley & Sons.

Selangor, E. (2003). *Administration Of The Religion Of Islam (State Of Selangor) Enactment 2003*. Selangor Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Upd.nsf/100ae747c72508e748256faa00188094/d9a9b41ebbb56cfe48256f35002716ee?OpenDocument.

Sembilan, E. N. (2003). *Administration Of The Religion Of Islam (Negeri Sembilan) Enactment 2003*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Upd.nsf/b3ac9c218c8efdc4482568310022d8b3/56d0fdc6b5e96a1d48256ede000628dc?OpenDocument.

Serageldin, I. (1990). Contemporary expressions of Islam in buildings: the religious and the secular. *Expressions of Islam in buildings, Indonesia*.

Seshadhri, G., & Paul, V. K. (2017). User requirement related performance attributes for government residential buildings. *Journal of Facilities Management, 15*(4), 409-422. doi:10.1108/jfm-11-2016-0047

Seshadhri, G., & Paul, V. K. (2018). Measuring satisfaction with user requirement related building performance attributes: A questionnaire. *2018, 9*(1).

Shafiee, M. (2015). Maintenance strategy selection problem: an MCDM overview. *Journal of Quality in Maintenance Engineering, 21*(4), 378-402. doi:10.1108/jqme-09-2013-0063

Shahin, A., Shirouyehzad, H., & Pourjavad, E. (2012). Optimum maintenance strategy: a case study in the mining industry. *International Journal of Services and Operations Management, 12*(3).

Shandiz, M. (2015). Service Quality Expectations: Exploring the Importance of SERVQUAL Dimensions from Different Nonprofit Constituent Groups. *Journal of Nonprofit & Public Sector Marketing, 27*(1), 48-69.

Sharif-Alhoseini, M., Saadat, S., Rahimi-Movaghar, A., Motevalian, A., Amin-Esmaeili, M., Hefazi, M., & Rahimi-Movaghar, V. (2012). Reliability of a patient survey assessing “Short Form Injury Questionnaire 7” in Iran. *Chinese Medical Journal, 15*(3), 145-147.

Sherwin, D. (2000). A review of overall models for maintenance management. *Journal of Quality in Maintenance Engineering, 6*(3), 138-164. doi:10.1108/13552510010341171

Shin, J.-H., & Jun, H.-B. (2015). On condition based maintenance policy. *Journal of*

Computational Design and Engineering, 2(2), 119-127.

Shmueli, G., Sarstedt, M., Hair, J. F., Cheah, J.-H., Ting, H., Vaithilingam, S., & Ringle, C. M. (2019). Predictive model assessment in PLS-SEM: guidelines for using PLSpredict. *European Journal of Marketing, 53*(11), 2322-2347.

Shoemaker, S. J. (2021). 15 On the Holy Places Adomnán/Arculf. In *A Prophet Has Appeared* (pp. 164-170): University of California Press.

Shohet, I. M. (2003). Building evaluation methodology for setting maintenance priorities in hospital buildings. *Construction Management and Economics, 21*(7), 681-692. doi:10.1080/0144619032000115562

Shohet, I. M. (2003). Key performance indicators for maintenance of health-care facilities. *Facilities, 21*(1/2), 5-12.

Shohet, I. M., Lavy-Leibovich, S., & Bar-On, D. (2002). *Integrated maintenance management of hospital buildings in Israel.* Paper presented at the Proceedings of the 17th International Symposium of the international Federation of Hospital Engineering.

Shohet, I. M., & Nobili, L. (2016). Performance-Based Maintenance of Public Facilities: Principles and Implementation in Courthouses. *Journal of Performance of Constructed Facilities, 30*(4), 04015086. doi:10.1061/(asce)cf.1943-5509.0000835

Shohet, I. M., & Nobili, L. (2017). Application of key performance indicators for maintenance management of clinics facilities. *International Journal of Strategic Property Management, 21*(1), 58-71.

Sileyew, K. J. (2019). *Research design and methodology* (Vol. 7): Cyberspace London.

Sinclair, D. (1996). Assessing the effectiveness of performance measurement systems: A case study. *Total Quality Management, 7*(4), 367-378. doi:10.1080/09544129650034729

Skulmoski, G. J. H., Francis T Krahn, Jennifer. (2007). The Delphi method for graduate research. *Journal of Information Technology Education: Research, 6*(1), 1-21.

Smith, R. (2002). *How to develop and implement a successful maintenance skills training program.* Paper presented at the Engineering Technology Conference on Energy.

Söderholm, P., Holmgren, M., & Klefsjö, B. (2007). A process view of maintenance and its stakeholders. *Journal of Quality in Maintenance Engineering*.

Sofii, I., & Pertiwi, I. (2021). The Role of The Mosque in Economic Empowerment and

Community Welfare Through MSMEs in The South Jakarta Region. *JES (Jurnal Ekonomi Syariah), 6*(1), 36-52.

Soh, K. Y., Chua, S. J. L., Ali, A. S., Au-Yong, C. P., & Alias, A. (2019). Relationship between building maintenance sourcing strategy selection factors and performance. *Journal of Facilities Management, 17*(2), 157-174. doi:10.1108/jfm-04-2018-0026

Statistics, D. o. (2021). Population Distribution and Basic Demographic Characteristic Report 2010. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/ctheme&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09&bul_id=MDMxdHZjWTk1SjFzTzNkRXYzcVZjdz09

Statistics, D. o. (2024). Population Distribution and Basic Demographic Characteristic Report 2010. Retrieved from https://www.dosm.gov.my/v1/index.php?r=column/ctheme&menu_id=L0pheU43NWJwRWVSZklWdzQ4TlhUUT09&bul_id=MDMxdHZjWTk1SjFzTzNkRXYzcVZjdz09

Sulaiman, A., & Kamarudin, A. R. (2025). Eksplorasi pengurusan dana Masjid Al-Muktafi Billah Shah, Terengganu [Exploration of fund management at Masjid Al-Muktafi Billah Shah, Terengganu]. *e-Bangi, 22*(1). https://doi.org/10.17576/ebangi.2025.2201.10.

Sullivan, J. (2018). Worship and Learning. In J. Sullivan (Ed.), *The Christian Academic in Higher Education* (pp. 143-166). Cham: Springer International Publishing.

Swanson, L. (2001). Linking maintenance strategies to performance. *International Journal of Production Economics, 70*(3), 237-244. doi:10.1016/s0925-5273(00)00067-0

Swincer, D. A. (2019). *Prayer: Premised on Worship*: Integrity Publications.

Tabachnick, B., & Fidell, L. (2001). Using multivariate statistics. 4th edn.: 139–179. *New York: HarperCollins*.

Taherdoost, H. (2016). Validity and reliability of the research instrument; how to test the validation of a questionnaire/survey in a research. *How to test the validation of a questionnaire/survey in a research (August 10, 2016)*.

Teddlie, C., & Tashakkori, A. (2009). *Foundations of mixed methods research: Integrating quantitative and qualitative approaches in the social and behavioral sciences*: Sage.

Teixeira, F., & Junior, J. L. (2016). Methodology for assessing the probabilistic condition of an asset based in concepts of structural reliability "PCBM-Probabilistic Condition Based Maintenance". *Procedia Structural Integrity, 1*, 181-188.

Terengganu, E. (2001). *Administration Of Islamic Religious Affairs (Terengganu) Enactment 1422h/2001m*. Retrieved from http://www2.esyariah.gov.my/esyariah/mal/portalv1/enakmen2011/Eng_enactment_Upd.nsf/f831ccddd195843f48256fc600141e84/4baf6fccf0f0e22e48257aa600128f85.

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L. P., . . . Goldsmith, C. H. (2010). A tutorial on pilot studies: the what, why and how. *BMC medical research methodology, 10*(1), 1-10.

Tommasi, C., Achille, C., Fanzini, D., Fassi, F., & Gianinetto, M. (2020). Advanced digital technologies for the conservation and valorisation of the UNESCO Sacri Monti. In *Digital Heritage and Archaeology in Practice* (383-407). Springer. https://doi.org/10.1007/978-3-030-33570-0_34

Triwijayanty, F., & Sakti, W. (2020). *Maintenance Building Strategies in a private University in Jakarta.* Paper presented at the IOP Conference Series: Materials Science and Engineering.

Tsang, A. H. C. (1998). A strategic approach to managing maintenance performance. *Journal of Quality in Maintenance Engineering, 4*(2), 87-94. doi:10.1108/13552519810213581

Tsang, A. H. C. (2002). Strategic dimensions of maintenance management. *Journal of Quality in Maintenance Engineering, 8*(1), 7-39. doi:10.1108/13552510210420577

Tsang, A. H. C., Jardine, A. K. S., & Kolodny, H. (1999). Measuring maintenance performance: a holistic approach. *International Journal of Operations & Production Management, 19*(7), 691-715. doi:10.1108/01443579910271674

Ugwu, O., Okafor, C., & Nwoji, C. (2018). Assessment of building maintenance in Nigerian university system: a case study of University of Nigeria, Nsukka. *Nigerian Journal of Technology, 37*(1), 44-52.

Upshall, P. (1991). Results of The Coopers & Lybrand and Works Management UK Maintenance Survey. *Coopers & Lybrand, London*.

Utama, D., Triana, Y., Iqbal, M., Iksal, M., Fikri, I., & Dharmawan, T. (2018). *Decision*

support model for mosque renovation and rehabilitation (Case study: Ten mosques in Jakarta Barat, Indonesia). Paper presented at the Journal of Physics: Conference Series.

Vaughn, M., Parsons, S. A., Kologi, S., & Saul, M. (2014). Action research as a reflective tool: A multiple case study of eight rural educators' understandings of instructional practice. *Reflective Practice, 15*(5), 634-650.

Velmurugan, R. S., & Dhingra, T. (2015). Maintenance strategy selection and its impact in maintenance function. *International Journal of Operations & Production Management, 35*(12), 1622-1661. doi:10.1108/ijopm-01-2014-0028

Voordt, T. J. v. d., & Jensen, P. A. (2018). Measurement and benchmarking of workplace performance: Key issues in value adding management. *Journal of Corporate Real Estate, 20*(3), 177-195.

Waeyenbergh, G., & Pintelon, L. (2002). A framework for maintenance concept development. *International Journal of Production Economics, 77*(3), 299-313. doi:10.1016/s0925-5273(01)00156-6

Wahab, N. A. A., Hamid, N. A., & Man, N. C. (2017). Pemerkasaan peranan masjid di Malaysia era kontemporari. *e-Academia Journal, 5*(2).

Wahab, Y. A., & Basari, A. S. H. (2015). Hostel Facility Maintenance Preliminary Finding of Higher Education Institution in Malaysia. *International Journal of Scientific and Research Publications, 5*(5), 6.

Wang, L., Chu, J., & Wu, J. (2007). Selection of optimum maintenance strategies based on a fuzzy analytic hierarchy process. *International Journal of Production Economics, 107*(1), 151-163. doi:10.1016/j.ijpe.2006.08.005

Wang, Y., Han, Q., de Vries, B., & Zuo, J. (2016). How the public reacts to social impacts in construction projects? A structural equation modeling study. *International Journal of Project Management, 34*(8), 1433-1448. doi:10.1016/j.ijproman.2016.07.008

Warraich, S., & Feroze, K. (2007). A Management Guide for Mosques &Islamic Centres. Manchester: OAK Community Development. In.

Watson, P. (1998). *Performance specified maintenance contracts–why it is better for a client to specify desired results rather than how to achieve them.* Paper presented at the Proc. Of the 3rd Intl. Conf. of Maintenance Societies, Adelaide, Australia.

Weidner, T. J. (2023). Planned maintenance vs unplanned maintenance and facility costs. *IOP Conference Series: Earth and Environmental Science, 1176*(1),

012037. https://doi.org/10.1088/1755-1315/1176/1/012037.

Wetzer, M., Garrow, G. R., West, I. D. P., Weir, P. E., Ashby, G., & Newton III, C. P. (2008). Identification, categorization, and integration of unplanned maintenance, repair and overhaul work on mechanical equipment.

Wijaya, M. F., & Muhamad, M. D. (2016). *Pengurusan Fasiliti Masjid: Sorotan Sejarah dan Pengurusan Masakini.* Paper presented at the International Conference on Masjid, Zakat and Waqf, Shah Alam, Selangor.

Wijesinghe, D., & Mallawarachchi, H. (2019). A systematic approach for maintenance performance measurement. *Journal of Quality in Maintenance Engineering*.

Wireman, T. (2004). *Benchmarking best practices in maintenance management*: Industrial Press Inc.

Wireman, T. (2005). *Developing performance indicators for managing maintenance*: Industrial Press Inc.

Wireman, T. (2012). Benchmarking Best Practice in Maintenance Management. In *Benchmarking: An International Journal* (Vol. 19, pp. 126-127).

Wireman, T. (2013). *Maintenance Work Management Processes - Maintenance Strategy Series*.

Wordsworth, P., & Lee, R. (2001). *Lee's building maintenance management*: Blackwell Science London.

Yadugiri, M. (1986). Some pragmatic implications of the use of yes and no in response to yes-no questions. *Journal of Pragmatics, 10*(2), 199-210.

Yahaya, M. F., Isa, N. M., Abdullah, A., Azmi, A., Fuad, N., & Ashar, M. (2023). *The Delphi Approach for Benchmarking Student Learning Behaviour in Ubiquitous Learning Context.* Paper presented at the 2023 8th International Conference on Business and Industrial Research (ICBIR).

Yahya, M., Yusof, A., & Abidin, N. Z. (2017). Masjid's Maintenance Management Implementation Case Study: Masjids In Klang Valley, Malaysia. In M. R. Osman, G. Din, & N. Lateh (Eds.), *Contemporary Issue on ZAKAT, WAQF AND ISLAMIC PHILANTHROPY*. Academy Contemporary Islamic Study, UiTM: UiTM.

Yan, L., Zhang, L., Liang, W., Li, W., & Du, M. (2017). Key factors identification and dynamic fuzzy assessment of health, safety and environment performance in petroleum enterprises. *Safety Science, 94*, 77-84.

Yang, Y., Ma, T., Bi, C., & Chen, S. (2024). Semi-Confirmatory Factor Analysis for

High-Dimensional Data with Interconnected Community Structures. *arXiv preprint arXiv:2401.00624*.

Yasoa, M. R., Ghazali, M. S., Alwi, M. A. M., & Rani, M. A. M. (2019). Fund management: An exploratory case study of several mosques in Kelantan. *Research in World Economy, 10*(2), 53–60. https://doi.org/10.5430/RWE.V10N2P53.

Yatim, N., Mat Yatin, S. F., Ahmad Kamal, J., & Khairunnisa, S. (2011). Key Performance Indicator (KPI) of Mosque Management in the State of Selangor: Records Management Perspective. *Proceedings of the 6th World Congress of Muslim Librarians and Information Scientists 2011 (WCOMLIS 2011)*.

Yoon, J., & Cha, H. (2016). *An empirical study of facility management performance on commercial office building in South Korea.* Paper presented at the Proc., 5th Int. Conf. on Civil Engineering and Urban Planning (CEUP). Singapore: World Scientific.

Yuniarti, Y., Makaginsar, C., Nia Irasanti, S., & Awalia Yulianto, F. (2022). Validity and Reliability of a Questionnaire About Dental and Oral Health. *KnE Life Sciences, 7*(5), 29–35. doi:10.18502/kls.v7i5.12505

Yusof, A., Yahya, M., & Ismail, F. (2020). Maintenance Strategy Implementation in Kariah Mosque- A Preliminary Study in State of Selangor Darul Ehsan.

Yusof, A., Yahya, M. R., & Misnan, M. S. (2025). Determining the key elements in maintenance planning of the Masjid Kariah in Malaysian perspective. *Built Environment Journal, 22*(1), 56-70.

Yusoff, M. S. B. (2019). ABC of content validation and content validity index calculation. *Resource, 11*(2), 49-54.

Zairi, M. (2012). *Measuring performance for business results*: Springer Science & Business Media.

Zain, S. R. M., Samad, R. N. A., Samsudin, M. M., & Jusoh, M. A. (2020). The dynamics of accounting practices and accountability in the selected mosques in Federal Territory. *International Journal of Islamic and Middle Eastern Finance and Management, 13*(3), 419–435.

Zawawi, E. M. A. (2009). Personnel Characteristics of Maintenance Practice: A Case of High-Rise Office Buildings in Malaysia. *Sustainable Development, 2*(1), 6.

Zawawi, E. M. A., Kamaruzzaman, S. N., Ali, A. S., & Sulaiman, R. (2010). Assessment of building maintenance management in Malaysia: Resolving using

a solution diagram. *Journal of Retail & Leisure Property, 9*(4), 349-356. doi:10.1057/rlp.2010.16

Zawawi, E. M. A., Kamaruzzaman, S. N., Ithnin, Z., & Zulkarnain, S. H. (2011). A Conceptual Framework for Describing CSF of Building Maintenance Management. *Procedia Engineering, 20*, 110-117. doi:10.1016/j.proeng.2011.11.145

Zolkepli, S. N. R., & Latiffi, A. A. (2021). Kerja-Kerja Penyelenggaraan Bangunan Masjid Lama. *Research in Management of Technology and Business, 2*(2), 656-669.

Zulkifli Mohd Al-bakri. (2018, 11/2/2018) *Categories of Mosque/Interviewer: A. B. Yusof*. Imarah Masjid, Majid Arrahman, University Malaya.

APPENDICES

APPENDIX 1

CERTIFICATE OF APPRECIATION FOR TRANSLATION

UNIVERSITI TEKNOLOGI MARA
Certificate of Appreciation
THIS CERTIFICATE IS AWARDED TO
Puan Hasnah binti Jaafar
in recognition of your invaluable contribution as a translator for this thesis title: Developing Maintenance Planning Framework on Strategy Performance-Based for Masjid Kariah in Kelantan State, Malaysia. Your expertise and dedication have been instrumental in ensuring the accuracy and quality of the translation, thereby significantly contributing to the success of the thesis. Your exceptional linguistic skills and attention to detail have not only facilitated effective communication but also enhanced the overall impact of our work. We extend our deepest gratitude for your efforts and look forward to future collaborations.
Ts Sr Dr Mohamad Ridzuan Yahya, PJM
Centre of Studies for Building Surveying
College of Built Environment
UiTM Shah Alam
Ts Sr Dr Mohamad Ridzuan Yahya
Supervisor
Ts Sr Azhar bin Yusof
Doctor of Philosophy (Built Environment)
CBE Student: 2017272712

UNIVERSITI TEKNOLOGI MARA
Certificate of Appreciation
THIS CERTIFICATE IS AWARDED TO
Puan Ayunie Hazrina binti Che Razali
in recognition of your invaluable contribution as a translator for this thesis title: Developing Maintenance Planning Framework on Strategy Performance-Based for Masjid Kariah in Kelantan State, Malaysia. Your expertise and dedication have been instrumental in ensuring the accuracy and quality of the translation, thereby significantly contributing to the success of the thesis. Your exceptional linguistic skills and attention to detail have not only facilitated effective communication but also enhanced the overall impact of our work. We extend our deepest gratitude for your efforts and look forward to future collaborations.
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Doctor of Philosophy (Built Environment)
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APPENDIX 2

SAMPLE COVER LETTER FOR DELPHI ANALYSIS QUESTIONNAIRE SURVEY

UNIVERSITI TEKNOLOGI MARA
Fakulti Senibina, Perancangan dan Ukur

Rujukan Kami : 100-FSPU (HEA/PPS.36/4/3) (A)
Tarikh : 15/11/2022

Tuan

MEMOHON KEBENARAN MENDAPATKAN MAKLUMAT SECARA SOAL SELIDIK
NAMA : AZHAR BIN YUSOF
K/P UiTM : 2017272712
NO K/ PENGENALAN :
NO TELEFON :

Dengan segala hormatnya perkara di atas dirujuk.

Merujuk perkara di atas, dimaklumkan bahawa pemegang surat ini adalah pelajar program AP991-Doktor Falsafah Alam Bina Fakulti, Senibina Perancangan dan Ukur, Universiti Teknologi MARA. Pelajar dikehendaki menjalankan satu kajian akademik bagi memenuhi keperluan tesis bertajuk: **"Developing Maintenance Planning Framework on Strategy Performance-Based for Masjid Kariah in Kelantan State, Malaysia"** secara kaedah ***Delphi***. Untuk makluman pelajar adalah dibawah seliaan Ts Sr Dr Mohamad Ridzuan Yahya.

2. Sehubungan itu, berikutan penularan wabak COVID-19, pengumpulan maklumat yang dilakukan secara fizikal hendaklah mematuhi Prosedur Operasi Standard (SOP) yang ditetapkan oleh Majlis Keselamatan Negara (MKN).

3. Sehubungan dengan itu, pihak jabatan berharap pihak tuan tidak keberatan untuk memberi kerjasama serta bantuan kepada pelajar tersebut untuk melaksanakan tugasan akademik yang diperlukan. Kerjasama daripada pihak tuan dalam perkara ini sangatlah dihargai dan disanjung tinggi demi kemajuan akademik pelajar.

Sekian, terima kasih.

"WAWASAN KEMAKMURAN BERSAMA 2030"
"BERKHIDMAT UNTUK NEGARA"

Yang benar,

PROF MADYA Sr Ts DR ZULHABRI ISMAIL
Ketua Pusat Pengajian Siswazah

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Puan Aznen Anizam Binti Ab Aziz
Jurutera Awam
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Ustaz Haji Habil Bin Mohammad
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Bandar Jeli, 17600 Jeli, Kelantan

UNIVERSITI TEKNOLOGI MARA
Institut Pengajian Siswazah

Our Reference : **500-IPSis (8/6/9)**
Date : **21/10/2022**

To Whom It May Concern

Dear Sir/Madam,

CONFIRMATION OF STUDENT'S STATUS AT UNIVERSITI TEKNOLOGI MARA (UiTM)

Name	:	**Azhar bin Yusof**
Student No	:	**2017272712**
IC/Passport No	:	
Name & Programme Code	:	**DOCTOR OF PHILOSOPHY (BUILT ENVIRONMENT) (AP991)**
Mode of Learning	:	**Research**
Study Mode	:	**Full Time**
Faculty	:	**Faculty Of Architecture, Planning And Surveying**
Duration of study (Estimated)	:	**Min (3 years / 6 semesters), Max (5 years / 10 semesters)**

2. This letter is to certify that **Azhar bin Yusof** is enrolled as a postgraduate student in UiTM, for academic session beginning **September 2017**. The method of study for this program is by **research** and the student is expected to complete his study in **October 2022** academic session.

3. The Institute of Graduate Studies UiTM verifies that **Azhar bin Yusof** is in **Semester 10**. His current academic status is **'Active'** for academic session of **October 2022 - February 2023**. The validity of this letter is for the above mentioned semester only. For your information, the medium of instruction for postgraduate programmes in UiTM is **English**.

4. For further information about this student, please contact the Head of Programme at **03 - 5521 1563** or the Institute of Graduate Studies office at **03-55448322/ 55438491/ 55438559/ 55438480**.

Thank you.

"WAWASAN KEMAKMURAN BERSAMA 2030"
"BERKHIDMAT UNTUK NEGARA"

Yours faithfully,

ASMIZA SUPAR
Senior Assistant Registrar (Academic)

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APPENDIX 3

SAMPLE COVER LETTER FOR PILOT QUESTIONNAIRE SURVEY

UNIVERSITI TEKNOLOGI MARA
Fakulti Senibina, Perancangan dan Ukur

Rujukan Kami : 100-FSPU (HEA/PPS.36/4/3) (A)
Tarikh : 15/11/2022

Tuan

MEMOHON KEBENARAN MENDAPATKAN MAKLUMAT SECARA SOAL SELIDIK
NAMA : AZHAR BIN YUSOF
K/P UiTM : 2017272712
NO K/ PENGENALAN :
NO TELEFON :

Dengan segala hormatnya perkara di atas dirujuk.

Merujuk perkara di atas, dimaklumkan bahawa pemegang surat ini adalah pelajar program AP991-Doktor Falsafah Alam Bina Fakulti, Senibina Perancangan dan Ukur, Universiti Teknologi MARA. Pelajar dikehendaki menjalankan satu kajian akademik bagi memenuhi keperluan tesis bertajuk: **"Developing Maintenance Planning Framework on Strategy Performance-Based for Masjid Kariah in Kelantan State, Malaysia"** secara kaedah ***Pilot***. Untuk makluman pelajar adalah dibawah seliaan Ts Sr Dr Mohamad Ridzuan *Y*ahya.

2. Sehubungan itu, berikutan penularan wabak COVID-19, pengumpulan maklumat yang dilakukan secara fizikal hendaklah mematuhi Prosedur Operasi Standard (SOP) yang ditetapkan oleh Majlis Keselamatan Negara (MKN).

3. Sehubungan dengan itu, pihak jabatan berharap pihak tuan tidak keberatan untuk memberi kerjasama serta bantuan kepada pelajar tersebut untuk melaksanakan tugasan akademik yang diperlukan. Kerjasama daripada pihak tuan dalam perkara ini sangatlah dihargai dan disanjung tinggi demi kemajuan akademik pelajar.

Sekian, terima kasih.

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"BERKHIDMAT UNTUK NEGARA"

Yang benar,

PROF MADYA Sr Ts DR ZULHABRI ISMAIL
Ketua Pusat Pengajian Siswazah

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UNIVERSITI TEKNOLOGI MARA
Institut Pengajian Siswazah

Our Reference : **500-IPSis (8/6/9)**
Date : **21/10/2022**

To Whom It May Concern

Dear Sir/Madam,

CONFIRMATION OF STUDENT'S STATUS AT UNIVERSITI TEKNOLOGI MARA (UiTM)

Name	:	**Azhar bin Yusof**
Student No	:	**2017272712**
IC/Passport No	:	
Name & Programme Code	:	**DOCTOR OF PHILOSOPHY (BUILT ENVIRONMENT) (AP991)**
Mode of Learning	:	**Research**
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4. For further information about this student, please contact the Head of Programme at **03 - 5521 1563** or the Institute of Graduate Studies office at **03-55448322/ 55438491/ 55438559/ 55438480**.

Thank you.

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APPENDIX 4

SAMPLE COVER LETTER FOR QUESTIONNAIRE SURVEY

UNIVERSITI TEKNOLOGI MARA
Fakulti Senibina, Perancangan dan Ukur

Rujukan Kami : 100-FSPU (HEA/PPS.36/4/3) (A)
Tarikh : 15/11/2022

Tuan

MEMOHON KEBENARAN MENDAPATKAN MAKLUMAT SECARA SOAL SELIDIK
NAMA : AZHAR BIN YUSOF
K/P UiTM : 2017272712
NO K/ PENGENALAN : (
NO TELEFON : (

Dengan segala hormatnya perkara di atas dirujuk.

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2. Sehubungan itu, berikutan penularan wabak COVID-19, pengumpulan maklumat yang dilakukan secara fizikal hendaklah mematuhi Prosedur Operasi Standard (SOP) yang ditetapkan oleh Majlis Keselamatan Negara (MKN).

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Sekian, terima kasih.

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UiTM di hatiku

UNIVERSITI TEKNOLOGI MARA
Institut Pengajian Siswazah

Our Reference : **500-IPSis (8/6/9)**
Date : **21/10/2022**

To Whom It May Concern

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CONFIRMATION OF STUDENT'S STATUS AT UNIVERSITI TEKNOLOGI MARA (UiTM)

Name	:	**Azhar bin Yusof**
Student No	:	**2017272712**
IC/Passport No	:	[illegible]
Name & Programme Code	:	**DOCTOR OF PHILOSOPHY (BUILT ENVIRONMENT) (AP991)**
Mode of Learning	:	**Research**
Study Mode	:	**Full Time**
Faculty	:	**Faculty Of Architecture, Planning And Surveying**
Duration of study (Estimated)	:	**Min (3 years / 6 semesters), Max (5 years / 10 semesters)**

2. This letter is to certify that **Azhar bin Yusof** is enrolled as a postgraduate student in UiTM, for academic session beginning **September 2017**. The method of study for this program is by **research** and the student is expected to complete his study in **October 2022** academic session.

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Senior Assistant Registrar (Academic)

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40000 Shah Alam, Selangor, MALAYSIA
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ISO 9001:2015 No. Sijil: 10120156
UiTM di hatiku

APPENDIX 5

DELPHI TECHNIQUE QUESTION

UNIVERSITI TEKNOLOGI MARA

RESEARCH TITLE: DEVELOPING MAINTENANCE PLANNING FRAMEWORK ON STRATEGY PERFORMANCE BASED FOR *MASJID KARIAH* IN KELANTAN STATE, MALAYSIA

1st ROUND DELPHI METHOD FOR EXPERT PANELS FILTERATION AND VALIDATION

EXPERT PANEL INFORMATION SHEET

1	Name of investigator	:	Azhar bin Yusof (2017272712)
2	Name of Department	:	Department of Built Environment
3	Name of Faculty	:	Built Environment College (KAAB), UiTM Shah Alam, Selangor Darul Ehsan, Malaysia
4	Name of Supervisors	:	Ts. Sr Dr. Mohamad Ridzuan bin Yahya (Main Supervisor)
		:	Associate Professor Sr Dr. Faridah binti Ismail (Co Supervisor)
5	Name of sponsor	:	Self-Funding

INTRODUCTION OF RESEARCH

The maintenance planning of *masjid kariah* is crucial specifically in maintenance strategy criteria. A comprehensive maintenance performance measurement is needed to develop a proper maintenance planning framework. Therefore, the solution proposed must be based on the performance of masjid maintenance, which is capable in measuring the maintenance strategy before the maintenance planning frameworks can be developed.

This study, therefore, aims to develop a maintenance planning framework for *Masjid kariah* based on maintenance strategy criteria towards the maintenance performance measurements. It proposes a maintenance planning framework to ensure suitable maintenance strategy were based on maintenance performance measurement before it can be implemented to all *masjid kariah* in Kelantan Darul Naim. These efforts should assist the maintenance management team in evaluating a maintenance strategy and provide an assessment in achieving the professional goals.

PURPOSE OF RESEARCH

The purpose of this research is to develop a maintenance planning framework by measuring the maintenance strategy base on the maintenance performance specifically to *masjid kariah*.

RESEARCH PROCEDURE

You are invited to participate in this research because you are among the expert panels that have been selected for this research according to your expert field. I would request the sincere cooperation of you as expert panels in providing the required information. The expert panels are needed to reassess, comment and suggested any new attribute to improve the maintenance performance measurement in maintenance planning for *masjid kariah*.

PARTICIPATION IN RESEARCH

Your participation in this research is entirely voluntary. You may refuse to take part in the study, or you may withdraw yourself from participation in the research at any time without penalty.

BENEFIT OF RESEARCH

There may or may not be any benefits to you. However, the information obtained from this study will help in developing maintenance planning frameworks on maintenance strategy performance-based details that applicable for the maintenance management and stakeholders of *masjid kariah* in Malaysia. Information obtained from this research will benefit to the individuals, researchers, *masjid kariah* stakeholders, institution, and community for the advancement of knowledge and future practice with related to *masjid kariah* facilities.

RESEARCH RISK

There is no risk involves in this study.

CONFIDENTIALITY

Your information will be kept confidential by the investigator and will not be made public unless disclosure is required by law.

By clicking I AGREE below, you will authorize the review of records, analysis and use of the data arising from this research. If you have any question about this research or your rights, please contact Azhar bin Yusof at 013 330 3100.

RESEARCH PURPOSE

The purpose of this semi structured questionnaire is to determine the relationship between maintenance strategy criteria and maintenance performance measurement in maintenance planning of the *Masjid kariah*. Therefore, in order to assist us in better decision making, we have decided to conduct this survey to allow us to gather more accurate information and feedback on the factors that could give any additional or omission of the attribute proposed.

Thus, we would request the sincere cooperation of you as expert panels in providing the required information. The expert panels are needed to reassess, comment and suggested any new attributed to improve maintenance strategy criteria and maintenance performance measurement that will be used particularly to the *Masjid kariah*

The information provided in **THIS QUESTIONS WILL BE KEPT CONFIDENTIAL.** It will only be used for the academic purpose only. Thank you.

INSTRUCTIONS

1 Please respond to all questions.

2 Each respondent is only eligible to send one feedback. Please discuss the answer with your other colleagues, if necessary.

3 To reduce potential mistake in our analysis, please use only one method (e.g., ticking) to respond and please respond only once.

OVERALL THEORETICAL FRAMEWORKS FOR THIS STUDY

1st ROUND DELPHI ANAYSIS

DEFINITION OF *MASJID KARIAH* FOR THIS STUDY

One typology of religious building with a Social Obligation to the Muslim community located at the small town or villages.

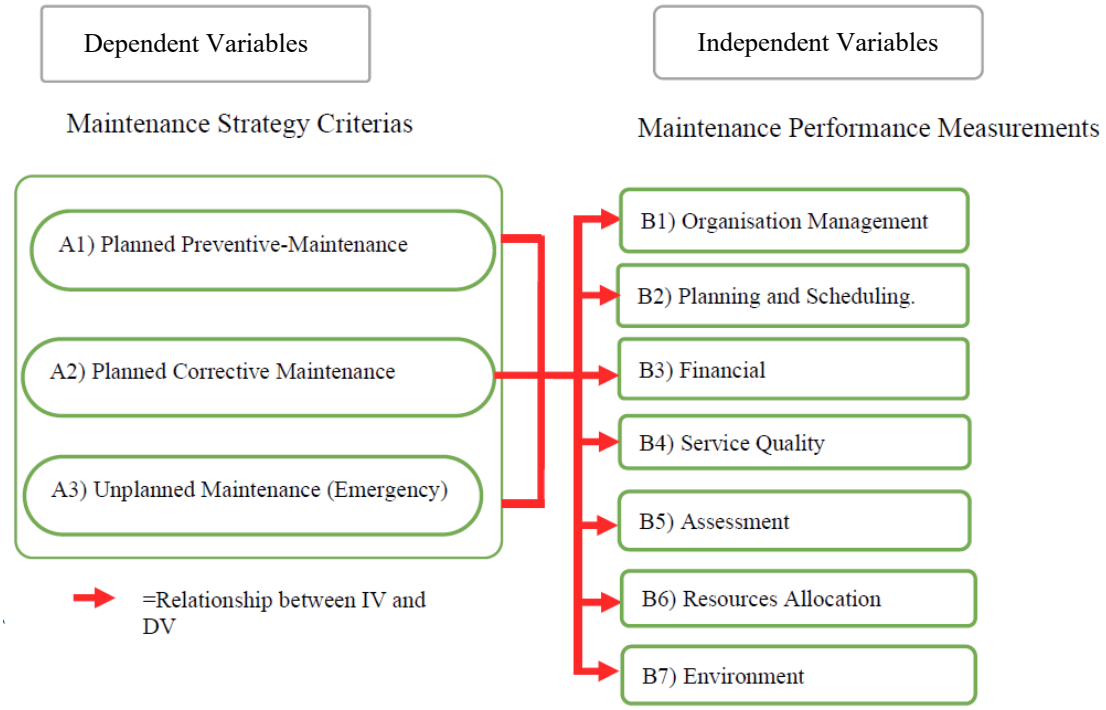
DEFINITION OF MAINTENANCE STRATEGY CRITERIAS FOR THIS STUDY

Refer to British Standard 3811 maintenance strategy criteria comprise of three attributes (1) Planned Preventive Maintenance, (2) Planned Corrective Maintenance, and (3) Unplanned Corrective Maintenance.

DEFINITION OF MAINTENANCE PERFORMANCE MEASUREMENTS FOR THIS STUDY

Maintenance performance construct that can measure the effectiveness of the existing maintenance strategy criteria.

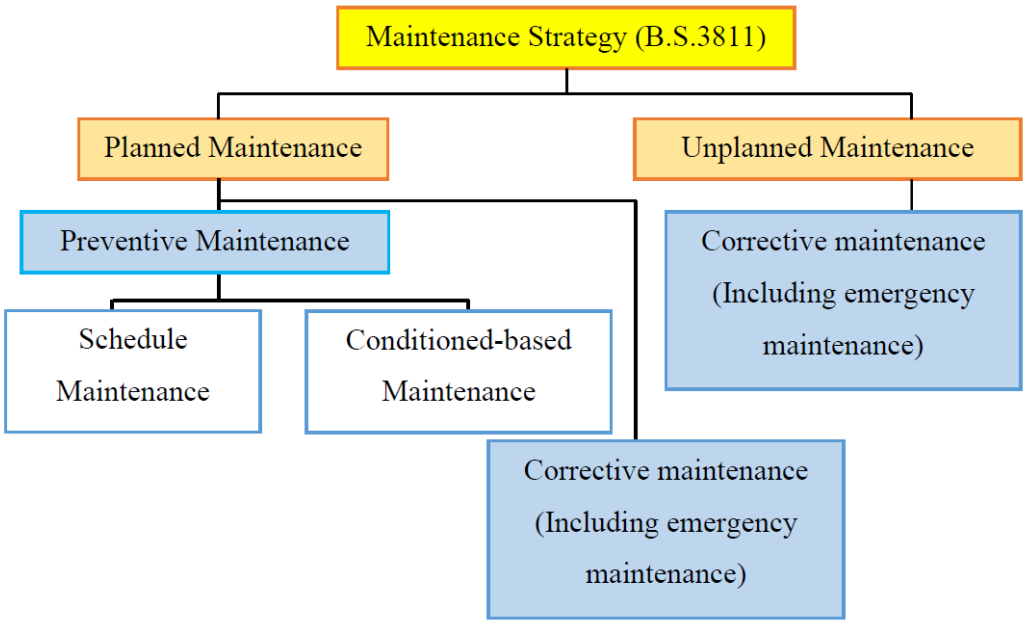
Proposed Theoretical Frameworks for *Masjid kariah*: Based on the initial theoretical framework given below, please give your opinion and advice for maintenance strategy criteria as Dependent Variable (DV) and Maintenance performance measurement as Independent Variables (IV).



Theoretical frameworks above are the initial proposal for this research before filtering and validate by all expert panels. the questionnaire will be solely based on 7 Independent Variable (IV) and 3 Dependent Variables (DV). This Independent Variable (IV) and Dependent Variables (DV) are expected to be implemented to the *Masjid kariah*.

SECTION B: MAINTENANCE STRATEGY CRITERIAS (INDEPENDENT VARIABLES)

Based on the maintenance Strategy Criteria on the picture below, please tick "YES" if you think was relevant or "NO" if you think was NOT RELEVAN with three maintenance strategy Criteria below:



		Yes	No
`1	Maintenance Strategy		
A	Planned Preventive Maintenance (PPM)	☐	☐
B	Planned Corrective Maintenance (PCM)	☐	☐
C	Unplanned Corrective Maintenance (UCM)	☐	☐
2	Do you think this maintenance strategy criteria are relevant for maintenance of *masjid kariah*?	☐	☐
3	Is there any other construct can be added from three maintenance strategy criteria given in the picture above?	☐	☐

SECTION C: MAINTENANCE PERFORMANCE MEASUREMENTS (DEPENDENT VARIABLES)

The instrument questionnaire in Section C is comprise of seven (7) constructs proposed for this study. Each of construct given have their own dimension. Please answer either "YES" if you think is RELEVENT or "NO" if not you think NOT RELEVENT for that statement. All Seven (7) construct is expected to use for *Masjid kariah* in this study. Please comment if the any new information for the improvement that suitable to use for *Masjid kariah*.

C1	**ORGANISATION MANAGEMENT**	**YES**	**NO**
A	Policy Deployment	☐	☐
B	Human Resources	☐	☐
C	Continuous Improvement	☐	☐

Based on the propose (C1) Organisation Management construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C2	PLANNING AND SCHEDULING	YES	NO
A	Maintenance Approach		
B	Record Management		
C	Communication		

Based on the propose (C2) Planning and Scheduling construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

`C3	FINANCIAL PROVISION	YES	NO
A	Adequacy of Budget		
B	Fund Efficiency		
C	Fund Allocation		

Based on the propose (C3) Financial Provision construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C4	SERVICE QUALITY	YES	NO
A	Reliability		
B	Assurance		
C	Tangible		
D	Empathy		
E	Responsiveness		

Based on the propose (C4) Service Quality construct and five dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C5	ASSESSMENT	YES	NO
A	Assessment to Building Condition		
B	Assessment to Service Condition		
C	Assessment to law and regulation		

Based on the propose (C5) Assessment construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

`C6	RESOURCES ALLOCATION	YES	NO
A	Contract-out Management		
B	Spare part Management		
C	Tools and equipment		
D	Information Management (CMMS)		

Based on the proposed (C6) Resources Allocation construct and four dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C7	SAFETY AND HEALTH	YES	NO
A	Safety		
B	Health		

Based on the proposed (C7) Safety and Health construct and two dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

APPENDIX 6

DELPHI TECHNIQUE QUESTIONNAIRE
2nd ROUND

UNIVERSITI TEKNOLOGI MARA

RESEARCH TITLE: DEVELOPING MAINTENANCE PLANNING FRAMEWORK ON STRATEGY PERFORMANCE BASED FOR *MASJID KARIAH* IN KELANTAN STATE, MALAYSIA

2nd vs FINAL ROUND DELPHI METHOD FOR EXPERT PANELS FILTERATION AND VALIDATION

EXPERT PANEL INFORMATION SHEET

1	Name of investigator	:	Azhar bin Yusof (2017272712)
2	Name of Department	:	Department of Built Environment
3	Name of Faculty	:	College of Built Environment (CBE), UiTM Shah Alam, Selangor Darul Ehsan, Malaysia
4	Name of Supervisors	:	Ts. Sr Dr. Mohamad Ridzuan bin Yahya (Main Supervisor)
		:	Associate Professor Sr Dr. Faridah binti Ismail (Co Supervisor)
5	Name of sponsor	:	Self-Funding

INTRODUCTION OF RESEARCH

The maintenance planning of *Masjid kariah* is crucial specifically in maintenance strategy criteria. A comprehensive maintenance performance measurement is needed to develop a proper maintenance planning framework. Therefore, the solution proposed must be based on the performance of masjid maintenance, which is capable in measuring the maintenance strategy before the maintenance planning frameworks can be developed.

This study, therefore, aims to develop a maintenance planning framework for *Masjid kariah* based on maintenance strategy criteria towards the maintenance performance measurements. It proposes a maintenance planning framework to ensure suitable maintenance strategy were based on maintenance performance measurement before it can be implemented to all *Masjid kariah* in Kelantan Darul Naim. These efforts should assist the maintenance management team in evaluating a maintenance strategy and provide an assessment in achieving the professional goals.

PURPOSE OF RESEARCH

The purpose of this research is to develop a maintenance planning framework by measuring the maintenance strategy base on the maintenance performance specifically to *Masjid kariah*.

RESEARCH PROCEDURE

You are invited for a 2nd round (final) to participate in this research because you are among the expert panels that have been selected for this research according to your expert field. I would request the sincere cooperation of you as expert panels in providing the required information. The expert panels are needed to reassess, comment and suggested any new attribute to improve the maintenance performance measurement in maintenance planning for *Masjid kariah*.

PARTICIPATION IN RESEARCH

Your participation for a 2nd round (final) in this research is entirely voluntary. You may refuse to take part in the study, or you may withdraw yourself from participation in the research at any time without penalty.

BENEFIT OF RESEARCH

There may or may not be any benefits to you. However, the information obtained from this study will help in developing maintenance planning frameworks on maintenance strategy performance-based details that applicable for the maintenance management and stakeholders of *Masjid kariah* in Malaysia. Information obtained from this research will benefit to the individuals, researchers, *Masjid kariah* stakeholders, institution, and community for the advancement of knowledge and future practice with related to *Masjid kariah* facilities.

RESEARCH RISK

There is no risk involves in this study.

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RESEARCH PURPOSE

The purpose of this semi structured questionnaire is to determine the relationship between maintenance strategy criteria and maintenance performance measurement in maintenance planning of the *Masjid kariah*. Therefore, in order to assist us in better decision making, we have decided to conduct this survey to allow us to gather more accurate information and feedback on the factors that could give any additional or omission of the attribute proposed.

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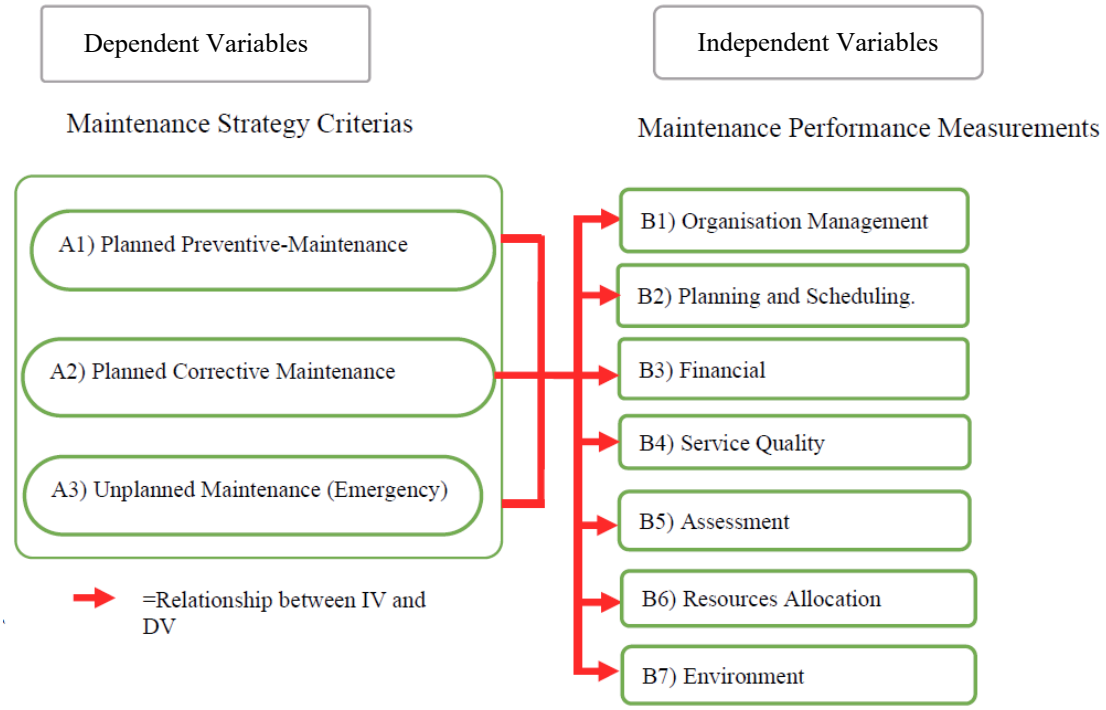

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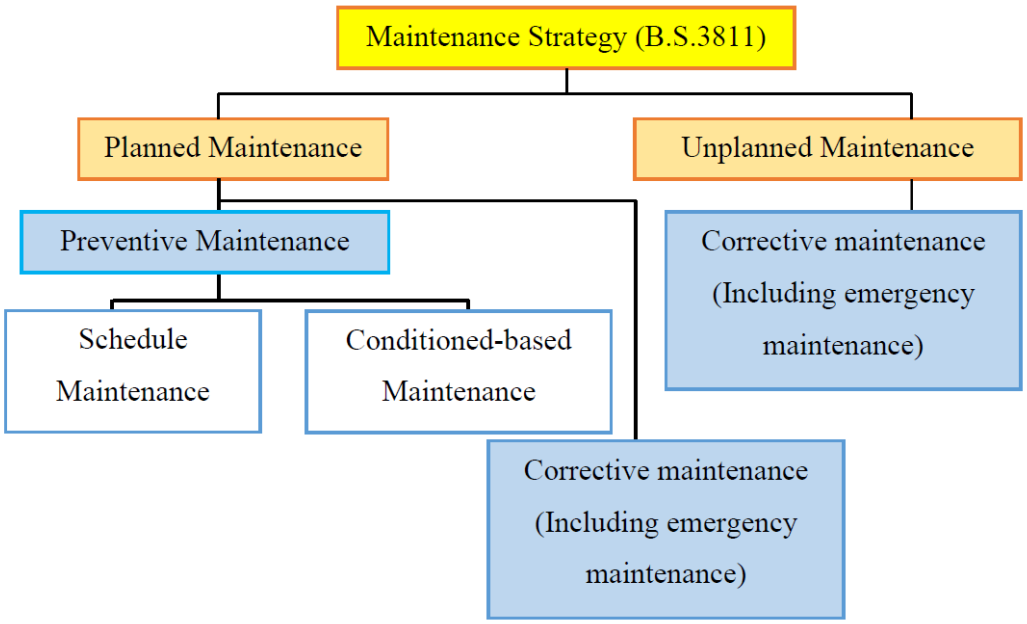
SECTION B: MAINTENANCE STRATEGY CRITERIAS (INDEPENDENT VARIABLES)

Based on the maintenance Strategy Criteria on the picture below, please tick "YES" if you think was relevant or "NO" if you think was NOT RELEVAN with three maintenance strategy Criteria below:



		Yes	No
`1	Maintenance Strategy		
A	Planned Preventive Maintenance (PPM)	☐	☐
B	Planned Corrective Maintenance (PCM)	☐	☐
C	Unplanned Corrective Maintenance (UCM)	☐	☐
2	Do you think this maintenance strategy criteria are relevant for maintenance of *Masjid kariah*?	☐	☐
3	Is there any other construct can be added from three maintenance strategy criteria given in the picture above?	☐	☐

SECTION C: MAINTENANCE PERFORMANCE MEASUREMENTS (DEPENDENT VARIABLES)

The instrument questionnaire in Section C is comprise of seven (7) constructs proposed for this study. Each of construct given have their own dimension. Please answer either "YES" if you think is RELEVENT or "NO" if not you think NOT RELEVENT for that statement. All Seven (7) construct is expected to use for *Masjid kariah* in this study. Please comment if the any new information for the improvement that suitable to use for *Masjid kariah*.

C1	**ORGANISATION MANAGEMENT**	**YES**	**NO**
A	Policy Deployment	☐	☐
B	Human Resources	☐	☐
C	Continuous Improvement	☐	☐

Based on the propose (C1) Organisation Management construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C2	PLANNING AND SCHEDULING	YES	NO
A	Maintenance Approach		
B	Record Management		
C	Communication		

Based on the propose (C2) Planning and Scheduling construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

`C3	FINANCIAL PROVISION	YES	NO
A	Adequacy of Budget		
B	Fund Efficiency		
C	Fund Allocation		

Based on the propose (C3) Financial Provision construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C4	SERVICE QUALITY	YES	NO
A	Reliability		
B	Assurance		
C	Tangible		
D	Empathy		
E	Responsiveness		

Based on the propose (C4) Service Quality construct and five dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C5	ASSESSMENT	YES	NO
A	Assessment to Building Condition		
B	Assessment to Service Condition		
C	Assessment to law and regulation		

Based on the propose (C5) Assessment construct and three dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

`C6	RESOURCES ALLOCATION	YES	NO
A	Contract-out Management		
B	Spare part Management		
C	Tools and equipment		
D	Information Management (CMMS)		

Based on the proposed (C6) Resources Allocation construct and four dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

C7	SAFETY AND HEALTH	YES	NO
A	Safety		
B	Health		

Based on the proposed (C7) Safety and Health construct and two dimensions above, please advise if any dimension need to add or omit for *Masjid kariah*.

APPENDIX 7

SUMMARIES RESULT FROM DELPHI TECHNIQUE ANALYSIS

Variables	Maintenance Strategy Criteria (MSC)			Comment and Suggestion
1st Round	PPM	PCM	UM	
Expert 1	/√	/√	√	Agree
Expert 2	√	√	√	
Expert 3	√	√	√	
Expert 4	√	√	**C/X**	Suggest using only two variables for MSC because there is uncertainty for Unplanned maintenance.
Expert 5	√	√	√	
Expert 6	**C**/√	**C**/√	**C**/√	Suggested use 1) Proactive Maintenance (Planned Maintenance) 2) Reactive Maintenance (Corrective/Emergency /ad hoc)
Expert 7	√	√	√	
Expert 8	√	√	√	
Expert 9	√	√	√	
Expert 10	√	√	√	
Expert 11	√	√	√	
Total	11/0	11/0	10/1	
2nd Round				Comment and Suggestion
Expert 1	√	√	√	
Expert 2	√	√	√	
Expert 3	√	√	√	
Expert 4	√	√	√	Agree to insert again UM for the purpose of the variables
Expert 5	√	√	√	
Expert 6	√	√	√	Agree to use three attributes as listed particularly for *Masjid kariah* only
Expert 7	√	√	√	
Expert 8	√	√	√	
Expert 9	√	√	√	
Expert 10	√	√	√	
Expert 11	√	√	√	
Total	11/0	11/0	11/0	
PPM= Planned Preventive Maintenance			PCM=Planned Corrective maintenance	UM = Unplanned Maintenance

Variables	Maintenance Performance Measurements (MPM))																						Total	Comment and Suggestion
1st Round	(C1) OM			(C2) P&S			(C3) FP			(C4) SQ					(C5) A			(C6) RA				(C7) SH			
	PD	**HR**	**CI**	**MA**	**RM**	**Com**	**AB**	**FE**	**FA**	**R**	**A**	**T**	**E**	**R**	**AB**	**AS**	**ALR**	**CM**	**SPM**	**TE**	**IM**	**S**	**H**		
Expert 1	**C/√**	**C/√**	**C/√**	√	√	√	**C/√**	**C/√**	**C/√**	√	√	√	√	√	√	√	√	√	√	√	√	√	√	25/23	OM: Add financial management FP: Add Fund Management
Expert 2	√	√	√	√	√	√	√	√	**C/√**	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	Fine but serious consideration be given to financial component because it is highly variable and uncertain
Expert 3	√	√	√	**C/√**	**C/√**	**C/√**	√	√	√	√	√	√	√	√	√	√	√	√	**C/X**	**C/X**	√	√	√	21/23	Suggestion P&S: propose add Resources RA: Omit SPM and TE
Expert 4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	21/23	No Comment
Expert 5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	OM: Add Budgetary maintenance P&S: Add Priorities maintenance All the Attribute is suggested to be recorded.
Expert 6	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	No Comment
Expert 7	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**C/√**	√	√	√	√	√	√	23/23	Suggest Change Assessment to law and regulation to Statutory Obligation Be more specific for Assessment, to change term into Maintenance assessment
Expert 8	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	No Comment
Expert 9	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	Suggest adding if there any attribute for maintenance measurement that can measure the masjid who built on river/sea. Because it will affect the building itself.
Expert 10	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	No Comment
Expert 11	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	23/23	No Comment
Total	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	10/1	10/1	11/0	11/0	11/0		

2nd Round	(C1) OM				(C2) P&S				(C3) FP				(C4) SQ					(C5) MA			(C6) RA		(C7) S&H		Total	Comment and Suggestion
	PD	**HR**	**CI**	**FM**	**MA**	**RM**	**Com**	**Res**	**AB**	**FE**	**FA**	**FM**	**R**	**A**	**T**	**E**	**R**	**AB**	**AS**	**SO**	**CM**	**IM**	**S**	**H**		
Expert 1	√	√	√	**C/X**	√	√	√	**C/X**	√	√	**C/√**	**C/X**	√	√	√	√	√	√	√	√	**C/√**	**C/√**	√	√	**23/24**	Agree to add fund management as fund allocation at FP Fund management =with fund allocation, need to omit FM at FP Resources redundant with RA Add again SPM Add again tools and equipment
Expert 2	√	√	√	**C/X**	√	√	√	**C/X**	√	√	√	**C/X**	√	√	√	√	√	√	√	**C/X**	√	√	√	√	**21/24**	Fund management =with fund allocation, need to omit FM. Because related with fund from public donation Financial Management change to financial provision Suggest use term Maintenance assessment instead of assessment for A Suggest using Assessment to law and regulation instead of Statutory Obligation

Variables	Maintenance Performance Measurements (MPM))																							Total	Comment and Suggestion
																									Suggest change to assessment to law and gelation instead of statutory obligation Resources at P&S are not applicable term
Expert 3	√	√	√	**C/X**	√	√	√	√	√	√	√	**C/X**	√	√	√	√	√	√	√	√	√	√	√	**22/24**	Fund management =with fund allocation, need to omit FM
Expert 4	√	√	√	**C/X**	√	√	√	√	√	√	√	**C/X**	√	√	√	√	√	√	√	√	√	√	√	**23/24**	Fund management =with fund allocation
Expert 5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**C/X**	√	√	√	**23/24**	No Comment
Expert 6	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/24**	No Comment
Expert 7	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/24**	No Comment
Expert 8	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/24**	No Comment
Expert 9	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/24**	No Comment
Expert 10	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/24**	No Comment
Expert 11	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/24**	No Comment
Total	11/0	11/0	11/0	7/4	11/0	11/0	11/0	3/8					11/0	11/0	11/0	11/0	11/0								
Expert Panels being explained the details for 2nd round on every construct for maintenance performance measurements to get consensus																									
Final Result	(C1) OM			(C2) P&S			(C3) FP			(C4) SQ					(C5) MA			(C6) RA				(C7) S&H			
	PD	**HR**	**CI**	**MA**	**RM**	**Com**	**AB**	**FE**	**FA**	**R**	**A**	**T**	**E**	**R**	**AB**	**AS**	**ALR**	**CM**	**SPM**	**TE**	**IM**	**S**	**H**		Agreed
Expert 1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	**23/23**	Agreed
Expert 2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 3	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 5	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 6	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 7	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 8	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 9	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 10	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Expert 11	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	**23/23**	Agreed
Total	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0	11/0		
Panel 6agree to used three main attributes for *Masjid kariah*																									
Expert Panel 1: Sr Dr Mohamad Ridzuan Bin Yahya, Expert, Expert Panel 2: Associate Professor Dr Naseem Ameer Ali, Expert Panel 3: Sr Dr Mohd Saidin Bin Misnan, Expert Panel 4: Professor Dr Najib Bin Ibrahim, Expert Panel 5: Ir. Dr Nabilah Binti Sarbini, Expert Panel 6: Sr Anuar Bin Haron, Expert Panel 7: Encik Nik Hud bin Nik Yunoh, Expert Panel 8: Mardiyah Binti Zahidi, Expert Panel 9: Aznen Anizam Binti Ab. Aziz, Expert Panel 10: Ustaz Haji Abdullah Bin Muhammad Expert Panel 11: Ustaz Habil Mohammad																									
OM= Organisation Management PD= Policy Deployment HR=Human Resources CI=Continuous Improvement FM=Fund Management																									
P&S=Planning and Scheduling MA=Maintenance Approach RM=Record Management Com=Communication Res= Resources																									
FP=Financial Management/Financial Provision AB=Adequacy of Budget FE=Fund Efficiency FA=Fund Allocation																									
SQ=Service Quality R=Reliability A=Assurance T=Tangible E=Empathy R=Responsiveness																									
A=Assessment/MA=Maintenance Assessment AB=Assessment to Building Condition AS=Assessment to Service Condition ALR/SO= Assessment to law and regulation (Statutory Obligation)																									
RA=Resources Allocation CM= Contract out Management SPM=Spare parts Management TE=Tools and Equipment IM-Information Management																									
Env=Environment S=Safety H=Health																									

APPENDIX 8

VALIDATION FORM SURVEY

VALIDATION FORM ON RELATIONSHIP BETWEEN MAINTENANCE STRATEGY CRITERIA AND MAINTENANCE PERFORMANCE MEASUREMENTS IN MAINTENANCE PLANNING FRAMEWORKS OF *MASJID KARIAH*, KELANTAN STATE, MALAYSIA

Dear Expert,

This validation form contains twenty-three (23) domain and Sixty-Three (63) items related to the maintenance strategy criteria and maintenance performance measurement in maintenance planning of *Masjid kariah*.

For the purpose of this study, we need your expert judgement on the degree of relevancy of each item to be measured. Your review should be based on the definition and relevant terminologist that provided to you. Please be as objective and constructive as possible in your review and use the following rating scale:

Relevancy

1 = The item is not relevant to the measured domain.

2 = The item is somewhat relevant to the measured domain.

3 = The item is quite relevant to the measured domain.

4 = The item is highly relevant to the measured domain.

Clarity

1 = The item is clear.

2 = The item needs some reason.

3 = The item clear but need minor reason.

4 = The item very clear.

ORGANISATION MANAGEMENT

Domain 1: Policy Deployment

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards the policy deployment

TESTED ITEMS	RELEVANCE			
1. Has clear written objectives, goals, and targets to the organisation of this *Masjid kariah*	1	2	3	4
2. Uses an effective maintenance policy to be used in the management of maintenance.	1	2	3	4
3. Implemented with the needs and wants in the organisation	1	2	3	4

Domain 2: Human Resources Management

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards human resources management

TESTED ITEMS	RELEVANCE			
1. Provide sufficient manpower to conduct the task	1	2	3	4
2. Ensure that any facility in the *Masjid kariah* is well maintained	1	2	3	4
3. Ensure that any facility in the *Masjid kariah* is easily accessible	1	2	3	4

Domain 3: Continuous Improvement

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards continuous improvement

TESTED ITEMS	RELEVANCE			
1. Provide adequate training and education for employees on each maintenance strategy	1	2	3	4
2. Exposed to basic knowledge through short course related to maintenance of *Masjid kariah*	1	2	3	4
3. Have knowledge in this maintenance strategy	1	2	3	4

PLANNING AND SCHEDULING

Domain 4: Maintenance Approach

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards maintenance approach

	TESTED ITEMS	RELEVANCE			
1.	Approach used have a sequence of work.	1	2	3	4
2.	Made periodically and on time as needed.	1	2	3	4
3.	Has a scheduled maintenance in maintaining the *Masjid kariah*?	1	2	3	4
4	The duration of maintenance works does not interfere with prayer times and programs conducted at *Masjid kariah*.	1	2	3	4

Domain 5: Record Management

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards record management

	TESTED ITEMS	RELEVANCE			
1.	Recorded management for future inspection in the event of problems with each the maintenance	1	2	3	4
2.	Has effective file handling	1	2	3	4
3.	Can maintain records in controlling the inventory of materials and equipment	1	2	3	4

Domain 6: Communication

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards communication

	TESTED ITEMS	RELEVANCE			
1.	Facilitate the means of communication to all parties involved.	1	2	3	4
2.	Committee members communicate with maintenance workers clearly.	1	2	3	4
3.	Maintenance worker regularly communicate with committee members.	1	2	3	4

FINANCIAL PROVISION

Domain 7: Adequacy of Budget

Definition: Committee members level of adequacy regarding three (3) maintenance strategy criteria towards adequacy of budget

	TESTED ITEMS	RELEVANCE			
1.	Allocate a budget in accordance with the maintenance plan.	1	2	3	4
2.	Identify payment to the maintenance needs on *Masjid kariah*.	1	2	3	4

Domain 8: Fund Efficiency

Definition: Committee members level of efficiency regarding three (3) maintenance strategy criteria towards fund efficiency

	TESTED ITEMS	RELEVANCE			
1.	Has opportunity for fund savings	1	2	3	4
2.	Efficient in allocating budget	1	2	3	4
3.	Offer real cost of maintenance work	1	2	3	4

Domain 9: Fund Allocation

Definition: Committee members level of adequacy regarding three (3) maintenance strategy criteria towards fund allocation

	TESTED ITEMS	RELEVANCE			
1.	Allocate maintenance fund been set	1	2	3	4
2.	Ensure the allocation of available fund is commensurate with set manual works	1	2	3	4

SERVICE QUALITY					
Domain10: Reliability					
Definition: Committee members satisfaction level regarding three (3) maintenance strategy criteria towards reliability.					
	TESTED ITEMS	RELEVANCE			
1.	Perform maintenance services accurately	1	2	3	4
2.	Provide maintenance service at time promise	1	2	3	4
3.	Able to follow up the maintenance report regarding any maintenance problem	1	2	3	4
Domain11: Assurance					
Definition: Committee members satisfaction level regarding three (3) maintenance strategy criteria towards assurance.					
	TESTED ITEMS	RELEVANCE			
1.	Ensure maintenance services are perform efficiently	1	2	3	4
2.	Do maintenance works at right area	1	2	3	4
3.	Feel Safe	1	2	3	4
Domain12: Tangible					
Definition: Committee members satisfaction level regarding three (3) maintenance strategy criteria towards tangible.					
	TESTED ITEMS	RELEVANCE			
1.	Provide well maintenance service	1	2	3	4
2.	Waste is cleared after rectification works	1	2	3	4
3.	Maintenance worker appearance	1	2	3	4
Domain13: Empathy					
Definition: Committee members satisfaction level regarding three (3) maintenance strategy criteria towards empathy.					
	TESTED ITEMS	RELEVANCE			
1.	Pay special attention to complaints received	1	2	3	4
2.	Understand specific area to do maintenance works	1	2	3	4
3.	Give attention to the *Masjid kariah* users during maintenance process	1	2	3	4
Domain14: Responsiveness					
Definition: Committee members opinion regarding three (3) maintenance strategy criteria towards responsiveness.					
	TESTED ITEMS	RELEVANCE			
1.	Maintenance worker help give maintenance service to committee members	1	2	3	4
2.	Deal maintenance works effectively	1	2	3	4

MAINTENANCE ASSESSEMENT

Domain15: Assessment to Building Condition

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards assessment to building condition

TESTED ITEMS	RELEVANCE			
1. Preserve physical element in this *Masjid kariah*	1	2	3	4
2. Prevent corrosion and others form of deterioration of *Masjid kariah*	1	2	3	4

Domain16: Assessment to Services Condition

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards assessment to services condition

TESTED ITEMS	RELEVANCE			
1. Well assess the condition of existing electrical equipment and fitting in *Masjid kariah*	1	2	3	4
2. Well assess the condition of existing air conditioning equipment in *Masjid kariah*	1	2	3	4
3. Well assess the condition of existing plumbing system and sanitary in *Masjid kariah*	1	2	3	4

Domain17: Assessment to Law and Regulation

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards assessment to law and regulation.

TESTED ITEMS	RELEVANCE			
1. Meet requirement of law and regulation in assessing physical condition of masjid.	1	2	3	4
2. Meet requirement of law and regulation in assessing services condition of masjid.	1	2	3	4

RESOURCES ALLOCATION

Domain18: Contract out Management

Definition: Committee members adequacy level regarding three (3) maintenance strategy criteria towards contract out management.

	TESTED ITEMS	RELEVANCE			
1.	Has adequate documentation, part list, manuals, and drawing to use	1	2	3	4
2.	Contract out to external parties	1	2	3	4

Domain19: Spare part Management

Definition: Committee members adequacy level regarding three (3) maintenance strategy criteria towards spare part management

	TESTED ITEMS	RELEVANCE			
1.	Periodic spare part schedule for repetitive maintenance	1	2	3	4
2.	Sufficient spare parts	1	2	3	4

Domain 20: Tools and Equipment

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards tools and equipment

	TESTED ITEMS	RELEVANCE			
1.	Can provide the tools and equipment needed when to be used.	1	2	3	4
2.	Set out related tools and equipment and it is available	1	2	3	4

Domain 21: Information Management

Definition: Committee members level of agreement regarding three (3) maintenance strategy criteria towards information management

	TESTED ITEMS	RELEVANCE			
1.	Suitable for using an integrated maintenance management system (CMMS)	1	2	3	4
2.	Can implement integrated maintenance management system (CMMS)	1	2	3	4

SAFETY AND HEALTH

Domain 22: Safety

Definition: Committee members safety level regarding three (3) maintenance strategy criteria towards safety

TESTED ITEMS	RELEVANCE			
1. Ensure provide safety from accident due to fall and tripping	1	2	3	4
2. Provide protection to *Masjid kariah* users from security threats during maintenance work.	1	2	3	4
3. Allow frequent inspection of the of *Masjid kariah* structure to ensure safety to the users	1	2	3	4
4. Allow frequent inspection of the of *Masjid kariah* services to avoid danger	1	2	3	4

Domain 23: Health

Definition: Committee members health level regarding three (3) maintenance strategy criteria towards health

TESTED ITEMS	RELEVANCE			
1. Ensure the *Masjid kariah* is free from sick building syndrome	1	2	3	4
2. Ensure that the environment inside *Masjid kariah* is healthy	1	2	3	4
3. Ensure that the environment outside *Masjid kariah* is healthy	1	2	3	4
4. Ensure maintenance location are healthy during maintenance work	1	2	3	4

APPENDIX 9

SUMMARIES RESULT FROM VALIDATION FORM SURVEY FOR CONTENT VALIDITY INDEX (CVI)

Table A9.1 below presents the relevance ratings on the item scale by six experts. All 35 items achieved an Item-Level Content Validity Index (I-CVI) of at least 0.83, indicating acceptable content validity. A total of 30 items achieved full agreement (UA=1), while 5 items received agreement from five out of six experts (UA=0). The overall Scale-Level CVI Average (S-CVI/Ave) and Universal Agreement (S-CVI/UA) exceeded 0.80, demonstrating strong content validity for the instrument.

Item	E1	E2	E3	E4	E5	E6	Agreement	I-CVI	UA
Q1	1	1	1	1	1	1	6	1	1
Q2	1	1	1	1	1	1	6	1	1
Q3	1	1	1	1	1	1	6	1	1
Q4	1	1	1	1	1	1	6	1	1
Q5	1	1	1	1	1	1	6	1	1
Q6	1	1	1	1	1	1	6	1	1
Q7	1	1	1	1	1	1	6	1	1
Q8	1	1	1	1	1	1	6	1	1
Q9	1	1	1	1	1	1	6	1	1
Q10	1	1	1	1	1	1	6	1	1
Q11	1	1	1	1	1	1	6	1	1
Q12	1	1	1	1	1	1	6	1	1
Q13	1	1	1	1	1	1	6	1	1
Q14	1	1	1	1	1	1	6	1	1
Q15	1	1	1	1	1	1	6	1	1
Q16	1	1	1	1	1	1	6	1	1
Q17	1	1	1	1	1	1	6	1	1
Q18	1	1	1	1	1	1	6	1	1
Q19	1	1	1	1	1	1	6	1	1
Q20	1	1	1	1	1	1	6	1	1
Q21	1	1	1	1	1	1	6	1	1
Q22	1	1	1	1	1	1	6	1	1
Q23	1	1	1	1	1	1	6	1	1
Q24	1	1	1	1	1	1	6	1	1
Q25	1	1	1	1	1	1	6	1	1
Q26	1	1	1	1	1	1	6	1	1
Q27	1	1	1	1	1	1	6	1	1

Q28	1	1	1	1	1	1	6	1	1
Q29	1	1	1	1	1	1	6	1	1
Q30	1	1	1	1	1	1	6	1	1
Q31	0	1	1	1	1	1	5	0.83	0
Q32	1	1	0	1	1	1	5	0.83	0
Q33	1	1	0	1	1	1	5	0.83	0
Q34	1	1	1	1	0	1	5	0.83	0
Q35	1	1	0	1	1	1	5	0.83	0
Proportion relevance	**0.97**	**1**	**0.91**	**1**	**0.97**	**1**			
						Average proportion relevance		**0.98**	**0.86**

APPENDIX 10

PILOT QUESTIONNAIRE

BORANG KAJISELIDIK BERSTRUKTUR
PENETAPAN KRITERIA UTAMA PENGUKURAN PENCAPAIAN PRESTASI PENYENGGARAAN TERHADAP *MASJID KARIAH*

APPENDIX 11

PILOT SURVEY
(TINJAUAN RINTIS)

Kepada Ahli Jawatankuasa *Masjid kariah*, Saya merupakan pelajar Sarjana Doktor Falsafah daripada Jabatan Alam Bina, di bawah Fakulti Senibina Perancangan dan Ukur, UiTM Shah Alam, Selangor Darul Ehsan. Objektif kajian ini adalah untuk mengenalpasti strategi penyelenggaraan yang manakah yang berkesan untuk digunakan sebagai rangka kerja perancangan penyelenggaraan di *Masjid kariah*. Strategi penyelenggaraan ini diukur berdasarkan kepada tahap prestasi penyelenggaraan dalam pengurusan penyelenggaraan di *Masjid kariah* secara keseluruhan.

Ahli Jawatankuasa masjid yang dihormati, borang kaji selidik ini mengandungi soalan-soalan yang berkaitan dengan kajian penyelenggaraan yang dijalankan di *Masjid kariah* yang terpilih. Sila jawab soalan-soalan tersebut berdasarkan penilaian sebenar pihak tuan/puan. Penilaian tuan/puan akan mempengaruhi ketepatan hasil kajian ini. Kajian ini adalah untuk tujuan akademik semata-mata. Di harap tuan/puan dapat memberikan masa dan kerjasama bagi membolehkan kaji selidik ini dilengkapkan. Kaji selidik ini bertujuan mengukur hubungan antara kriteria strategi penyelenggaraan dan prestasi penyelenggaraan semasa operasi aktiviti penyelenggaraan di *Masjid kariah*. Responden hendaklah seorang ahli jawatankuasa *Masjid kariah* yang bertanggungjawab terhadap pengurusan penyelenggaraan. Maklumat dan fakta yang paling tepat dan jujur adalah amat dihargai bagi menjayakan kaji selidik ini.

Soal selidik ini dibahagikan kepada Tiga (3) Bahagian iaitu:
(A) MAKLUMAT AM
(B) PERLAKSANAAN STRATEGI PENYELENGGARAAN
(C) PENGUKURAN HUBUNGAN ANTARA STRATEGI PENYENGGARAAN DAN PRESTASI PENYELENGGARAN

NOTA: Segala maklumat responden akan dirahsiakan dan tiada sebarang obligasi undang-undang atas segala pandangan yang diberikan. Ia adalah bertujuan untuk melengkapkan kajian semata-mata.

KEBENARAN UNTUK MENJAWAB KAJI SELIDIK

☐ Saya bersetuju mengambil bahagian dalam kaji selidik ini.

☐ Saya juga faham bahawa penyertaan saya adalah sukarela dan saya bebas menarik diri pada bila-bila masa tanpa memberi alasan.

BAHAGIAN A: MAKLUMAT AM *MASJID KARIAH* DAN DEMOGRAFI RESPONDEN.

BAHAGIAN I: MAKLUMAT AM *MASJID KARIAH* DI NEGERI KELANTAN DARUL NAIM.

Pernyataan berikut adalah tentang *Masjid kariah* pihak tuan/puan. Sila tandakan (√) pada petak yang sesuai atau mengisi ruang yang disediakan

1. NAMA *MASJID KARIAH* INI:

_____

_____

2. DAERAH

☐	Kota Bharu	☐	Tanah Merah
☐	Pasir Puteh	☐	Pasir Mas
☐	Jeli	☐	Tumpat
☐	Machang	☐	Kuala Krai
☐	Gua Musang	☐	Bachok

3. JENIS PEMILIKAN

☐	Kerajaan	☐	Wakaf
☐	Persendirian	☐	Lain-lain

4. PURATA USIA *MASJID KARIAH* INI

☐	1-5 Tahun	☐	11-15 Tahun
☐	6-10 Tahun	☐	>15 Tahun

5. BERDAFTAR DIBAWAH JABATAN AGAMA ISLAM & ADAT ISTIADAT MELAYU KELANTAN (JAHEAIK)

☐	Ya	☐	Tidak

BAHAGIAN II: MAKLUMAT AM AHLI JAWATANKUASA *MASJID KARIAH*.

Pernyataan berikut adalah tentang diri anda. Sila tandakan (√) pada petak yang sesuai atau mengisi ruang yang disediakan:

1. Jawatan Yang Disandang Di *Masjid kariah* Ini

☐	Pengerusi /Nazir	☐	Setiausaha
☐	Timbalan Pengerusi/Timbalan Nazir	☐	Timbalan Setiausaha
☐	Biro Pembangunan dan Penyelenggaraan	☐	Bendahari

2. Bangsa:

☐	Melayu	☐	India
☐	Cina	☐	Lain-lain

3. Jantina:

☐	Lelaki	☐	Perempuan

4. Kelayakan Akademik Tertinggi:

☐	Tiada	☐	Penilaian Menengah Rendah (PMR)
☐	Sijil Pelajaran Malaysia (SPM)	☐	Diploma
☐	Ijazah Sarjana Muda	☐	Ijazah Sarjana
☐	Doktor Falsafah (PhD)	☐	Lain-lain

5. Umur

☐	21-30 Tahun	☐	31-40 Tahun
☐	41-50 Tahun	☐	51 Tahun ke atas

6. Berkhidmat secara:

☐	Tetap	☐	Kontrak
☐	Sukarela	☐	Lain-lain

BAHAGIAN B: PERLAKSANAAN STRATEGI PENYELENGGARAAN DI *MASJID KARIAH*.

DEFINISI KRITERIA STRATEGI PENYELENGGARAAN

Penyelenggaraan Pencegahan Terancang	Penyelenggaraan yang telah diatur sebelum terjadinya apa-apa kerosakan.
Penyelenggaraan Baik Pulih Terancang	Penyelenggaraan yang dilakukan apabila hanya berlaku kerosakan.
Penyelenggaraan Tidak Terancang	Penyelenggaraan yang dilakukan setelah berlaku kerosakan luar jangka (Bencana alam, banjir, kebakaran, tanah runtuh, dsb).

Sila tandakan (√) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah:

1. Adakah *Masjid kariah* ini mempunyai polisi penyelenggaraan bangunan bertulis?

☐ Ya ☐ Tidak

2. Strategi penyelenggaraan manakah yang digunakan oleh *Masjid kariah* ini?
(Tuan/Puan boleh menandakan lebih daripada satu sekiranya masjid ini mengamalkan lebih daripada satu strategi atau pilih tiada sekiranya tidak menggunakan mana-mana strategi dibawah)

☐ Penyelenggaraan Pencegahan Terancang

☐ Penyelenggaraan Baik Pulih Terancang

☐ Penyelenggaraan Tidak Terancang

☐ Tiada

3. Penyelenggaraan *Masjid kariah* ini dilakukan oleh?

☐ Pihak Pengurusan Masjid ☐ Kontraktor Luar

☐ Kontraktor Luar & Pihak Pengurusan Masjid secara bersama

4. Kekerapan penyelenggaraan di masjid ini?

☐ Tiada ☐ Apabila diperlukan

☐ Setiap minggu ☐ Setiap Bulan

☐ Setiap 3 Bulan ☐ Setiap 6 Bulan

☐ Setahun Sekali

BAHAGIAN C: PEMBINAAN PENGUKURAN HUBUNGAN ANTARA KRITERIA STRATEGI PENYENGGARAAN DAN PRESTASI PENYENGGARAAN SEMASA OPERASI AKTIVITI PENYELENGGARAAN DI *MASJID KARIAH*.

DEFINISI PENGUKURAN PRESTASI PENYELENGGARAAN

Pengukuran prestasi penyelenggaraan	: Proses mengukur kecekapan dan keberkesanan sesuatu pemboleh ubah

BAHAGIAN C ini mempunyai 7 Bahagian iaitu C1, C2, C3, C4, C5, C6, dan C7. Sila berikan tahap persetujuan tuan/puan dalam mengukur prestasi penyelenggaraan.

Bahagian ini menggunakan Kaedah Skala Likert:

Sila tandakan (√) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan yang diberikan.

BAHAGIAN C1: PENGURUSAN ORGANISASI

Senarai di bawah adalah berkenaan dimensi ukuran prestasi pengurusan organisasi di *Masjid kariah* ini. Sila nilaikan tahap persetujuan anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

1A: Penggunaan Dasar	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah mempunyai objektif, matlamat dan sasaran bertulis yang jelas di masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah menggunakan dasar penyelenggaraan yang berkesan di masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

1B: Pengurusan Sumber Manusia	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah menyediakan tenaga kerja yang mencukupi untuk menjalankan tugas penyelenggaraan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah memastikan bahawa sebarang kemudahan di masjid ini dijaga dengan baik.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

1C: Penambahbaikan Berterusan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memberi latihan dan pendidikan yang mencukupi untuk Ahli Jawatankuasa Masjid.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah didedahkan dengan pengetahuan asas kepada AJK Masjid melalui kursus pendek berkaitan penyelenggaraan Masjid.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C2: PERANCANGAN DAN PENJADUALAN

Senarai di bawah adalah berkenaan dimensi ukuran prestasi perancangan dan penjadualan di *Masjid kariah*. Sila nilaikan tahap persetujuan anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

DIMENSI

2A: Pendekatan Selenggara	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah mempunyai urutan kerja dan tempoh yang sesuai.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah mempunyai tempoh kerja penyelenggaraan yang tidak mengganggu waktu solat dan program yang dijalankan di *Masjid kariah* ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

2B: Pengurusan Rekod	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah direkodkan untuk diperiksa atau dikaji pada masa akan datang.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah mempunyai pengendalian fail yang berkesan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

2C: Komunikasi	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memudahkan cara komunikasi kepada semua pihak yang terlibat.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah membolehkan ahli jawatankuasa masjid berkomunikasi dengan jelas.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C3: PERUNTUKAN KEWANGAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi peruntukan kewangan di *Masjid kariah*. Sila nilaikan tahap kecukupan dan kecekapan peruntukan kewangan berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

DIMENSI

3A: Kecukupan Belanjawan	Sangat tidak mencukupi	Tidak mencukupi	Neutral	Mencukupi	Sangat mencukupi

(1) Strategi dibawah memperuntukkan belanjawan yang mencukupi dengan rancangan penyelenggaraan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah membuat pembayaran secukupnya kepada keperluan penyenggaraan Masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

3B: Kecekapan Dana	Sangat tidak cekap	Tidak cekap	Neutral	Cekap	Sangat Cekap

(1) Strategi dibawah cekap mengesan penjimatan dana.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah cekap mengagihkan dana yang diperuntukkan di Masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

3C: Peruntukan Dana	Sangat tidak cukup	Tidak cukup	Neutral	Cukup	Sangat cukup

(1) Strategi dibawah memperuntukkan dana mencukupi bagi kerja penyelenggaraan di Masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah memastikan peruntukan dana yang mencukupi dengan kerja tahunan yang ditetapkan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C4: KUALITI PERKHIDMATAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi kualiti perkhidmatan di *Masjid kariah*. Sila nilaikan tahap kepuasan hati anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

4A: Kebolehpercayaan	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah berupaya melaksanakan perkhidmatan mengikut jadual.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4B: Jaminan	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah dapat menjamin perkhidmatan penyelenggaraan dilakukan dengan cekap.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4C: Tangible	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah membolehkan kakitangan penyelenggaraan memberi perkhidmatan penyelenggaraan dengan baik.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5

Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4D: Empati	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah membolehkan kakitangan penyelenggaraan memberi perhatian khusus terhadap aduan yang diterima.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4E: Responsif	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah membolehkan kakitangan penyenggaraan berupaya membantu memberi perkhidmatan penyelenggaraan kepada masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C5: PENILAIAN PENYELENGGARAAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi penilaian di *Masjid kariah*. Sila nilaikan tahap persetujuan anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

5A: Penilaian keadaan bangunan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah dapat memelihara element-elemen fizikal bangunan di Masjid

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

5B: Penilaian keadaan sistem kelengkapan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah menilai keadaan sistem kelengkapan yang ada di masjid ini dengan baik.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

5C: Kewajipan Undang-Undang	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memenuhi kehendak undang-undang bangunan dalam menilai keadaan fizikal masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5

Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah memenuhi kehendak undang-undang bangunan dalam menilai sistem kelengkapan masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C6: PERUNTUKAN SUMBER

Senarai dibawah adalah berkenaan dimensi ukuran prestasi peruntukan sumber di *Masjid kariah*. Sila nilaikan tahap kecukupan dan tahap persetujuan anda terhadap peruntukan sumber berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

DIMENSI

6A: Pengurusan Kontrak	Sangat tidak cukup	Tidak cukup	Neutral	Cukup	Sangat cukup

(1) Strategi dibawah memberi kontrak yang mencukupi kepada kontraktor untuk melakukan penyelenggaraan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

6B: Pengurusan alat ganti	Sangat tidak cukup	Tidak cukup	Neutral	Cukup	Sangat cukup

(1) Strategi dibawah mempunyai jadual alat ganti yang berkala yang mencukupi bagi penyelenggaraan berulang.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

6C: Alat dan Peralatan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah menetapkan alatan yang kursus dan tersedia.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

D: Pengurusan Maklumat	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah sesuai menggunakan sistem pengurusan penyelenggaraan bersepadu (CMMS).

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C7: KESELAMATAN DAN KESIHATAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi persekitaran di *Masjid kariah*. Sila nilaikan tahap keselamatan dan kesihatan terhadap persekitaran berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

7A: Keselamatan	Sangat tidak selamat	Tidak selamat	Neutral	Selamat	Sangat selamat

(1) Strategi dibawah memastikan penyelenggaraan ini memberi keselamatan daripada kemalangan akibat terjatuh, dan tersandung.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah kerap memeriksa sistem kelengkapan *Masjid kariah* bagi memastikan keselamatan pengguna.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

7B: Kesihatan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memastikan Masjid ini bebas daripada sindrom bangunan sakit.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah memastikan kebersihan dan kecucian pada kawasan yang diselenggara.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

TERIMA KASIH ATAS KERJASAMA TUAN/PUAN
DI DALAM TINJAUAN RINTIS (PILOT SURVEY) INI.
SEGALA MAKLUMAT PIHAK TUAN/PUAN DIRAHSIAKAN

APPENDIX 11

UNIVERSITI TEKNOLOGI MARA

SUMMARIES RESULT FROM PILOT SURVEY FOR RELIABILITY ANALYSIS: CRONBACH'S ALPHA, EXPLORATORY FACTOR ANALYSIS (EFA) AND CONFIRMATORY FACTOR ANALYSIS (CFA)

The Reliability Analysis Result through PLS-SEM analysis

No.	Model Construct	Cronbach' Alpha	No.	Measurement Item	EFA (Factor Loading > 0.5)	CFA (AVE > 0.5, CR > 0.7
1.	Organization Management (OM)	0.823	*a. Policy Usage*			AVE = 0.621 CR = 0.859
			1.	C1_PD_01_PPT	0.658	
			2.	C1_PD_01_PBT	0.644	
			3.	C1_PD_01_PTT	0.611	
			4.	C1_PD_02_PPT	0.674	
			5.	C1_PD_02_PBT	0.662	
			6.	C1_PD_02_PTT	0.658	
			b. Management of Human Resources			
			7.	C1_HRM_01_PPT	0.703	
			8.	C1_HRM_01_PBT	0.697	
			9.	C1_HRM_01_PTT	0.685	
			10.	C1_HRM_02_PPT	0.702	
			11.	C1_HRM_02_PBT	0.684	
			12.	C1_HRM_02_PTT	0.691	
			c. Continual Improvement			
			13.	C1_C1_01_PPT	0.717	
			14.	C1_C1_01_PBT	0.711	
			15.	C1_C1_01_PTT	0.705	
			16.	C1_C1_02_PPT	0.733	
			17.	C1_C1_02_PBT	0.721	
			18.	C1_C1_02_PTT	0.712	
2.	Planning and Scheduling (PS)	0.816	*a. Maintenance Approach*			AVE = 0.603 CR = 0.859
			1.	C2_MA_01_PPT	0.723	
			2.	C2_MA_01_PBT	0.714	
			3.	C2_MA_01_PTT	0.702	
			4.	C2_MA_02_PPT	0.726	
			5.	C2_MA_02_PBT	0.709	
			6.	C2_MA_02_PTT	0.723	
			b. Records Management			
			7.	C2_RM_01_PPT	0.776	
			8.	C2_RM_01_PBT	0.764	
			9.	C2_RM_01_PTT	0.758	

			10.	C2_RM_02_PPT	0.743	
			11.	C2_RM_02_PBT	0.776	
			12.	C2_RM_02_PTT	0.764	
			c. Communication			
			13.	C2_Com_01_PPT	0.739	
			14.	C2_Com_01_PBT	0.728	
			15.	C2_Com_01_PTT	0.714	
			16.	C2_Com_02_PPT	0.721	
			17.	C2_Com_02_PBT	0.718	
			18.	C2_Com_02_PTT	0.709	
3.	Financial Provision (FP)	0.842	*a. Adequacy of the Budget*			AVE = 0.649 CR = 0.873
			1.	C3_AB_01_PPT	0.761	
			2.	C3_AB_01_PBT	0.744	
			3.	C3_AB_01_PTT	0.739	
			4.	C3_AB_02_PPT	0.732	
			5.	C3_AB_02_PBT	0.724	
			6.	C3_AB_02_PTT	0.761	
			b. Fund Efficiency			
			7.	C3_FE_01_PPT	0.704	
			8.	C3_FE_01_PBT	0.677	
			9.	C3_FE_01_PTT	0.695	
			10.	C3_FE_02_PPT	0.701	
			11.	C3_FE_02_PBT	0.683	
			12.	C3_FE_02_PTT	0.704	
			c. Fund Allocation			
			13.	C3_FA_01_PPT	0.715	
			14.	C3_FA_01_PBT	0.703	
			15.	C3_FA_01_PTT	0.697	
			16.	C3_FA_02_PPT	0.682	
			17.	C3_FA_02_PBT	0.674	
			18.	C3_FA_02_PTT	0.661	
4.	Service Quality (SQ)	0.869	*a. Reliability*			AVE = 0.688 CR = 0.889
			1.	C4_Ass_01_PPT	0.759	
			2.	C4_Ass_01_PBT	0.748	
			3.	C4_Ass_01_PTT	0.733	
			b. Empathy			
			4.	C4_Emp_01_PPT	0.752	
			5.	C4_Emp_01_PBT	0.741	
			6.	C4_Emp_01_PTT	0.726	
			c. Assurance			
			7.	C4_Rel_01_PPT	0.765	
			8.	C4_Rel_01_PBT	0.747	
			9.	C4_Rel_01_PTT	0.738	
			d. Responsive			
			10.	C4_Res_01_PPT	0.778	
			11.	C4_Res_01_PBT	0.761	
			12.	C4_Res_01_PTT	0.743	
			e. Tangible			
			13.	C4_Tan_01_PPT	0.771	
			14.	C4_Tan_01_PBT	0.757	

			15.	C4_Tan_01_PTT	0.739	
5.	Assessment (AS)	0.790	*a. Building condition assessment*			AVE = 0.573 CR = 0.824
			1.	C5_ALR_01_PPT	0.702	
			2.	C5_ALR_01_PBT	0.683	
			3.	C5_ALR_01_PTT	0.674	
			b. Assessment of equipment system conditions			
			4.	C5_ALR_02_PPT	0.694	
			5.	C5_ALR_02_PBT	0.672	
			6.	C5_ALR_02_PTT	0.668	
			c. Legal obligations			
			7.	C5_ASC_01_PPT	0.686	
			8.	C5_ASC_01_PBT	0.664	
			9.	C5_ASC_01_PTT	0.659	
			10.	C5_ABC_01_PPT	0.683	
			11.	C5_ABC_01_PBT	0.673	
			12.	C5_ABC_01_PTT	0.661	
6.	Resource Allocation (RA)	0.803	*a. Contract Management*			AVE = 0.592 CR = 0.837
			1.	C6_CM_01_PPT	0.725	
			2.	C6_CM_01_PBT	0.712	
			3.	C6_CM_01_PTT	0.701	
			b. Spare Parts Management			
			4.	C6_SP_01_PPT	0.736	
			5.	C6_SP_01_PBT	0.728	
			6.	C6_SP_01_PTT	0.715	
			c. Tools and Equipment			
			7.	C6_TE_01_PPT	0.722	
			8.	C6_TE_01_PBT	0.714	
			9.	C6_TE_01_PTT	0.703	
			d. Information management			
			10.	C6_IM_01_PPT	0.745	
			11.	C6_IM_01_PBT	0.729	
			12.	C6_IM_01_PTT	0.718	
7.	Safety and Health (SH)	0.811	*a. Safety*			AVE = 0.609 CR = 0.847
			1.	C7_Safety_01_PPT	0.733	
			2.	C7_Safety_01_PBT	0.721	
			3.	C7_Safety_01_PTT	0.709	
			4.	C7_Safety_02_PPT	0.726	
			5.	C7_Safety_02_PBT	0.713	
			6.	C7_Safety_02_PTT	0.705	
			b. Health			
			7.	C7_Health_01_PPT	0.742	
			8.	C7_Health_01_PBT	0.731	
			9.	C7_Health_01_PTT	0.719	
			10.	C7_Health_02_PPT	0.735	
			11.	C7_Health_02_PBT	0.727	
			12.	C7_Health_02_PTT	0.713	

APPENDIX 12

APPROVAL LETTER – UiTM RESEARCH ETHICS COMMITTEE

UNIVERSITI TEKNOLOGI MARA
Pejabat
Timbalan Naib Canselor
(Penyelidikan dan Inovasi)

Reference : 600-TNCPI(5/1/6)
Our reference : REC/12/2021 (MR/936)
Date : 14th December 2021

Ts Sr Dr Mohamad Ridzuan bin Yahya
(Azhar bin Yusof - 2017272712)
Faculty of Architecture, Planning & Surveying
Universiti Teknologi MARA
40450 Shah Alam
SELANGOR

Dear Ts Sr Dr Mohamad Ridzuan,

APPROVAL LETTER - UiTM RESEARCH ETHICS COMMITTEE

Thank you for submitting your research proposal to Research Ethics Committee (REC). After considering your application, the Committee approved your proposal entitled "Developing Maintenance Strategy Performance-Based Model for Masjid Kariah" in Kelantan.

Details of the approval are as follows:

Ref. number:	REC/12/2021 (MR/936)
Approval Period:	14th December 2021 until 30th April 2022
Authorised personnel:	1. Ts Sr Dr Mohamad Ridzuan bin Yahya 2. Azhar bin Yusof

The UiTM Research Ethics Committee operates in accordance to the ICH Good Clinical Practice Guidelines, Malaysian Good Clinical Practice Guidelines and the Declaration of Helsinki. The approval of this project is conditional upon your continuing compliance with these guidelines and declaration.

We draw to your attention the requirement that a report on this research, must be submitted every 12 months from the date of the approval or on the completion of the project, whichever occurs first. Failure to submit reports will result in withdrawal of consent for the project to proceed. Amendments, if any, to the study documents are to be submitted to REC for approval.

If you require further information, please contact REC Secretariat at 03-55448069/03-55442794 or email at recsecretariat@uitm.edu.my.

Yours sincerely,

PROFESSOR DATO' DR ABU BAKAR ABDUL MAJEED
Chairman
UiTM Research Ethics Committee

c.c.: Dean, Faculty of Architecture, Planning & Surveying, UiTM

Universiti Teknologi MARA
Aras 3, Bangunan Wawasan
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Tel: (+603) 5544 2004/2255
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ISO 9001:2015 No. Sijil: 10120156
UiTM di hatiku

APPENDIX 13

EMPIRICAL QUESTIONNAIRE SURVEY
(ENGLISH VERSION)

QUESTIONNAIRE FORM MEASURING THE RELATIONSHIP BETWEEN MAINTENANCE STRATEGY AND MAINTENANCE PERFORMANCE FOR MAINTENANCE PLANNING FRAMEWORK FOR *MASJID KARIAH*

To the Members of the *Masjid kariah* Committee, I am a Doctor of Philosophy's student from the Department of Built Environment, under the Faculty of Architecture, Planning and Surveying, UiTM Shah Alam, Selangor Darul Ehsan. The objective of this study is to identify which maintenance strategy is effective to be used as a maintenance planning framework in the *Masjid kariah*. This maintenance strategy is measured based on the level of maintenance performance in maintenance management in the *Masjid kariah* as a whole.

Dear members of the mosque committee, this survey form contains questions related to the maintenance study carried out in the selected *Masjid kariah*. Please answer the questions based on your actual assessment. Your assessment will affect the accuracy of the results of this study. This study is for academic purposes only. It is hoped that you will be able to give time and cooperation to enable this survey to be completed. This survey aims to measure the relationship between maintenance strategy criteria and maintenance performance during the operation of maintenance activities in the *Masjid kariah*. The respondent must be a member of the *Masjid kariah* committee responsible for maintenance management. The most accurate and honest information and facts are greatly appreciated to make this survey a success. This questionnaire is divided into Four (4) Sections namely (A) GENERAL INFORMATION, (B) IMPLEMENTATION OF MAINTENANCE STRATEGY, and (C) MEASUREMENT OF THE RELATIONSHIP BETWEEN MAINTENANCE STRATEGY AND MAINTENANCE PERFORMANCE.

NOTE: All respondent information will be kept confidential and there is no legal obligation for any views provided. It is intended to complete the study only.

AUTHORIZATION TO RESPOND TO SURVEYS

☐ I agree to participate in this survey.

☐ I also understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason.

PART A: GENERAL INFORMATION OF *MASJID KARIAH* AND RESPONDENT DEMOGRAPHICS.

PART I: GENERAL INFORMATION OF *MASJID KARIAH* IN KELANTAN STATE DARUL NAIM.

The following statement is about the *Masjid kariah* in your place. Please mark (√) in the appropriate box or fill in the space provided

1. NAME OF THIS *MASJID KARIAH*:

_____

_____

2. DISTRICT

☐	Kota Bharu	☐	Tanah Merah
☐	Pasir Puteh	☐	Pasir Mas
☐	Jeli	☐	Tumpat
☐	Machang	☐	Kuala Krai
☐	Gua Musang	☐	Bachok

3. TYPE OF OWNERSHIP

☐	Government	☐	Waqf
☐	Private	☐	Others

4. AVERAGE AGE OF THIS *MASJID KARIAH*

☐	1-5 years old	☐	11-15 years old
☐	6-10 years old	☐	>15 years old

5. REGISTERED UNDER THE DEPARTMENT OF ISLAMIC RELIGION & MALAY CUSTOMS OF KELANTAN (JAHEAIK)

☐	Yes	☐	No

PART II: GENERAL INFORMATION OF *MASJID KARIAH* COMMITTEE MEMBERS.

The following statement is about yourself. Please mark (√) in the appropriate box or fill in the space provided:

1. The Position Held in *Masjid kariah*

☐	Chairman / Nazir	☐	Secretary
☐	Deputy Chairman/Deputy Inspector	☐	Deputy Secretary
☐	Bureau of Development and Maintenance	☐	Treasurer

2. Race:

☐	Malay	☐	Indian
☐	Chinese	☐	Others

3. Gender:

☐	Male	☐	Female

4. Highest Academic Qualification:

☐	Not Applicable (N/A)	☐	Penilaian Menengah Rendah (PMR)
☐	Sijil Pelajaran Malaysia (SPM)	☐	Diploma
☐	Bachelor's Degree	☐	Master's Degree
☐	Doctor of Philosophy (PhD)	☐	Others

5. Age:

☐	21-30 years old	☐	31-40 years old
☐	41-50 years old	☐	51 years and above

6. Serving as:

☐	Fixed	☐	Contract
☐	Voluntary	☐	Others

PART B: IMPLEMENTATION OF THE MAINTENANCE STRATEGY IN THE *MASJID KARIAH*.

DEFINITION OF MAINTENANCE STRATEGY CRITERIA	
Planned Preventive Maintenance	Maintenance that has been arranged before any damage occurs.
Planned Corrective Maintenance	Maintenance that is performed only when damage occurs.
Unplanned Maintenance	Maintenance carried out after unforeseen damage (natural disasters, floods, fires, landslides, etc.).

Please tick (√) in the appropriate box to indicate your level of agreement with each statement below:

1. Does this *Masjid kariah* have a written building maintenance policy?

☐ Yes ☐ No

2. Which maintenance strategy is used by this *Masjid kariah*?
(Sir/Madam you can mark more than one if this mosque practices more than one strategy or select none if it does not use any of the strategies below)

☐ Planned Preventive Maintenance

☐ Planned Corrective Maintenance

☐ Unplanned Maintenance

☐ Not Applicable (N/A)

3. The maintenance of this *Masjid kariah* is done by?

☐ The Mosque Management ☐ Outside Contractor

☐ External Contractor & Mosque Management jointly

4. How often is maintenance at this mosque?

☐ Not Applicable (N/A) ☐ When needed

☐ Every week ☐ Every Month

☐ Every 3 Months ☐ Every 6 Months

☐ Once a year

PART C: CONSTRUCTION OF MEASURING THE RELATIONSHIP BETWEEN MAINTENANCE STRATEGIC CRITERIA AND MAINTENANCE PERFORMANCE DURING THE OPERATION OF MAINTENANCE ACTIVITIES IN THE *MASJID KARIAH*.

DEFINITION OF MAINTENANCE PERFORMANCE MEASUREMENT

Measurement of maintenance performance	: The process of measuring the efficiency and effectiveness of a variable

SECTION C has 7 Sections namely C1, C2, C3, C4, C5, C6, and C7. Please give your level of agreement in measuring maintenance performance.

This section uses the Likert Scale Method:

Please mark (√) in the appropriate box to reflect your level of agreement with each given statement.

PART C1: ORGANIZATIONAL MANAGEMENT

The list below is about the measurement dimensions of organizational management performance in this *Masjid kariah*. Please rate your level of agreement regarding the influence of maintenance strategy criteria on maintenance performance measurement dimensions below: -

1. DIMENSIONS

1A: Policy Usage	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below has clear written objectives, goals and targets in this mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below uses an effective maintenance policy in this mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

1B: Human Resource Management	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below provides sufficient manpower to carry out maintenance tasks.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below ensures that any facilities in this mosque are well maintained.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

1C: Continuous Improvement	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below provides adequate training and education for Mosque Committee Members.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below is disclosed with basic knowledge to the Mosque Committee through a short course related to the maintenance of the Mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

PART C2: PLANNING AND SCHEDULING

The list below is about the dimensions of performance measurement of planning and scheduling in the *Masjid kariah*. Please rate your level of agreement regarding the influence of maintenance strategy criteria on maintenance performance measurement dimensions below: -

DIMENSIONS

2A: Maintenance Approach	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below has an appropriate work sequence and duration.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below has a maintenance work period that does not interfere with prayer times and programs conducted in this *Masjid kariah*.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

2B: Records Management	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below is recorded for future inspection or review.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below has effective file handling.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

2C: Communication	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below facilitates communication for all parties involved.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below allows mosque committee members to communicate clearly.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

PART C3: FINANCIAL PROVISIONS

The list below is about the dimensions of performance measurement of financial allocation in the *Masjid kariah*. Please evaluate the level of adequacy and efficiency of financial allocation regarding the influence of maintenance strategy criteria on the dimension of maintenance performance measurement below: -

DIMENSIONS

3A: Budget Adequacy	Very inadequate	Not enough	Neutral	Adequate	Very sufficient

(1) The strategy below allocates a sufficient budget with a maintenance plan.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) The strategy below is to make sufficient payments for the maintenance needs of this Mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

3B: Fund Efficiency	Very inefficient	Inefficient	Neutral	Efficient	Very Efficient

(1) The strategies below efficiently track the savings of funds.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) The strategy below efficiently distributes the funds allocated in this Mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

3C: Fund Allocation	Very not enough	Not enough	Neutral	Enough	Very enough

(1) The strategy below allocates sufficient funds for maintenance work at this mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) The strategy below ensures the allocation of sufficient funds with the set annual work.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

SECTION C4: QUALITY OF SERVICE

The list below is about the measurement dimensions of service quality performance in the *Masjid kariah*. Please rate your level of satisfaction regarding the influence of maintenance strategy criteria on the maintenance performance measurement dimension below: -

1. DIMENSIONS

4A: Reliability	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied

(1) You are satisfied that the strategy below is able to perform the service according to the schedule.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

4B: Assurance	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied

(1) You are satisfied that the strategy below can guarantee the maintenance service is done efficiently.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

4C: Tangible	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied

(1) You are satisfied that the strategy below allows the maintenance staff to provide a good maintenance service.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5

Unplanned Maintenance	1	2	3	4	5

4D: Empathy	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied

(1) You are satisfied that the strategy below allows the maintenance staff to pay special attention to the complaints received.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

4E: Responsive	Very dissatisfied	Dissatisfied	Neutral	Satisfied	Very satisfied

(1) You are satisfied that the strategy below allows the maintenance staff to be able to help provide maintenance services to this mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

SECTION C5: MAINTENANCE ASSESSMENT

The list below is about the measurement dimensions of performance evaluation in the *Masjid kariah*. Please rate your level of agreement regarding the influence of maintenance strategy criteria on maintenance performance measurement dimensions below: -

1. DIMENSIONS

5A: Assessment of building condition	Strongly disagree	Disagree	Neutral	Agreed	Totally agree
(1) You agree that the strategy below can preserve the physical elements of the building in the Mosque					
Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

5B: Assessment of equipment system condition	Strongly disagree	Disagree	Neutral	Agreed	Totally agree
(1) You agree that the strategy below evaluates the condition of the equipment system in this mosque well.					
Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

5C: Legal Obligations	Strongly disagree	Disagree	Neutral	Agreed	Totally agree
(1) You agree that the strategy below meets the requirements of the building law in assessing the physical condition of this mosque.					
Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned	1	2	3	4	5

Maintenance					

(2) You agree that the strategy below meets the requirements of the building law in evaluating the equipment system of this mosque.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

SECTION C6: ALLOCATION OF RESOURCES

The list below is about the dimensions of resource allocation performance measurement in the *Masjid kariah*. Please rate the level of adequacy and your level of agreement with the allocation of resources regarding the influence of maintenance strategy criteria on the maintenance performance measurement dimension below: -

DIMENSIONS

6A: Contract Management	Very not enough	Not enough	Neutral	Enough	Very enough

(1) The strategy below gives a sufficient contract to the contractor to perform maintenance.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

6B: Spare parts management	Very not enough	Not enough	Neutral	Enough	Very enough

(1) The strategy below has a periodic spare parts schedule that is sufficient for repeated maintenance.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

6C: Tools and Equipment	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below sets the course and available tools .

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5

Unplanned Maintenance	1	2	3	4	5

D: Information Management	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below is appropriate for using an integrated maintenance management system (CMMS).

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

SECTION C7: SAFETY AND HEALTH

The list below is about the measurement dimensions of environmental performance in the *Masjid kariah*. Please evaluate the level of safety and health in the environment regarding the influence of maintenance strategy criteria on the maintenance performance measurement dimension below: -

1. DIMENSIONS

7A: Safety	Very unsafe	Not safe	Neutral	Safe	Very safe

(1) The strategy below ensures that this maintenance provides safety from accidents due to falling, and tripping.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) The strategy below regularly inspects the equipment system of the *Masjid kariah* to ensure the safety of users.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

7B: Health	Strongly disagree	Disagree	Neutral	Agreed	Totally agree

(1) You agree that the strategy below ensures that this mosque is free from sick building syndrome.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

(2) You agree that the strategy below ensures the cleanliness and cleanliness of the maintained area.

Planned Preventive Maintenance	1	2	3	4	5
Planned Corrective Maintenance	1	2	3	4	5
Unplanned Maintenance	1	2	3	4	5

THANK YOU FOR YOUR COOPERATION.
ALL YOUR INFORMATION IS CONFIDENTIAL

APPENDIX 14

QUESTIONNAIRE
(VERSION BAHASA MELAYU)

BORANG SOAL SELIDIK PENGUKURAN HUBUNGAN ANTARA STRATEGI PENYELENGGARAAN DAN PRESTASI PENYELENGGARAAN UNTUK RANGKA KERJA PERANCANGAN PENYELENGGARAAN TERHADAP *MASJID KARIAH*

Kepada Ahli Jawatankuasa *Masjid kariah*, Saya merupakan pelajar Sarjana Doktor Falsafah daripada Jabatan Alam Bina, di bawah Fakulti Senibina Perancangan dan Ukur, UiTM Shah Alam, Selangor Darul Ehsan. Objektif kajian ini adalah untuk mengenalpasti strategi penyelenggaraan yang manakah yang berkesan untuk digunakan sebagai rangka kerja perancangan penyelenggaraan di *Masjid kariah*. Strategi penyelenggaraan ini diukur berdasarkan kepada tahap prestasi penyelenggaraan dalam pengurusan penyelenggaraan di *Masjid kariah* secara keseluruhan.

Ahli Jawatankuasa masjid yang dihormati, borang kaji selidik ini mengandungi soalan-soalan yang berkaitan dengan kajian penyelenggaraan yang dijalankan di *Masjid kariah* yang terpilih. Sila jawab soalan-soalan tersebut berdasarkan penilaian sebenar pihak tuan/puan. Penilaian tuan/puan akan mempengaruhi ketepatan hasil kajian ini. Kajian ini adalah untuk tujuan akademik semata-mata. Di harap tuan/puan dapat memberikan masa dan kerjasama bagi membolehkan kaji selidik ini dilengkapkan. Kaji selidik ini bertujuan mengukur hubungan antara kriteria strategi penyelenggaraan dan prestasi penyelenggaraan semasa operasi aktiviti penyelenggaraan di *Masjid kariah*. Responden hendaklah seorang ahli jawatankuasa *Masjid kariah* yang bertanggungjawab terhadap pengurusan penyelenggaraan. Maklumat dan fakta yang paling tepat dan jujur adalah amat dihargai bagi menjayakan kaji selidik ini. Soal selidik ini dibahagikan kepada Empat (4) Bahagian iaitu (A) MAKLUMAT AM, (B) PERLAKSANAAN STRATEGI PENYELENGGARAAN, dan (C) PENGUKURAN HUBUNGAN ANTARA STRATEGI PENYENGGARAAN DAN PRESTASI PENYELENGGARAN.

NOTA: Segala maklumat responden akan dirahsiakan dan tiada sebarang obligasi undang-undang atas segala pandangan yang diberikan. Ia adalah bertujuan untuk melengkapkan kajian semata-mata.

KEBENARAN UNTUK MENJAWAB KAJI SELIDIK

☐ Saya bersetuju mengambil bahagian dalam kaji selidik ini.

☐ Saya juga faham bahawa penyertaan saya adalah sukarela dan saya bebas menarik diri pada bila-bila masa tanpa memberi alasan.

BAHAGIAN A: MAKLUMAT AM *MASJID KARIAH* DAN DEMOGRAFI RESPONDEN.

BAHAGIAN I: MAKLUMAT AM *MASJID KARIAH* DI NEGERI KELANTAN DARUL NAIM.

Pernyataan berikut adalah tentang *Masjid kariah* pihak tuan/puan. Sila tandakan (√) pada petak yang sesuai atau mengisi ruang yang disediakan

1. NAMA *MASJID KARIAH* INI:

_____

_____

2. DAERAH

☐	Kota Bharu	☐	Tanah Merah
☐	Pasir Puteh	☐	Pasir Mas
☐	Jeli	☐	Tumpat
☐	Machang	☐	Kuala Krai
☐	Gua Musang	☐	Bachok

3. JENIS PEMILIKAN

☐	Kerajaan	☐	Wakaf
☐	Persendirian	☐	Lain-lain

4. PURATA USIA *MASJID KARIAH* INI

☐	1-5 Tahun	☐	11-15 Tahun
☐	6-10 Tahun	☐	>15 Tahun

5. BERDAFTAR DIBAWAH JABATAN AGAMA ISLAM & ADAT ISTIADAT MELAYU KELANTAN (JAHEAIK)

☐	Ya	☐	Tidak

BAHAGIAN II: MAKLUMAT AM AHLI JAWATANKUASA *MASJID KARIAH*.

Pernyataan berikut adalah tentang diri anda. Sila tandakan (√) pada petak yang sesuai atau mengisi ruang yang disediakan:

1. Jawatan Yang Disandang Di *Masjid kariah* Ini

☐	Pengerusi /Nazir	☐	Setiausaha
☐	Timbalan Pengerusi/Timbalan Nazir	☐	Timbalan Setiausaha
☐	Biro Pembangunan dan Penyelenggaraan	☐	Bendahari

2. Bangsa:

☐	Melayu	☐	India
☐	Cina	☐	Lain-lain

3. Jantina:

☐	Lelaki	☐	Perempuan

4. Kelayakan Akademik Tertinggi:

☐	Tiada	☐	Penilaian Menengah Rendah (PMR)
☐	Sijil Pelajaran Malaysia (SPM)	☐	Diploma
☐	Ijazah Sarjana Muda	☐	Ijazah Sarjana
☐	Doktor Falsafah (PhD)	☐	Lain-lain

5. Umur

☐	21-30 Tahun	☐	31-40 Tahun
☐	41-50 Tahun	☐	51 Tahun ke atas

6. Berkhidmat secara:

☐	Tetap	☐	Kontrak
☐	Sukarela	☐	Lain-lain

BAHAGIAN B: PERLAKSANAAN STRATEGI PENYELENGGARAAN DI *MASJID KARIAH*.

DEFINISI KRITERIA STRATEGI PENYELENGGARAAN

Penyelenggaraan Pencegahan Terancang	Penyelenggaraan yang telah diatur sebelum terjadinya apa-apa kerosakan.
Penyelenggaraan Baik Pulih Terancang	Penyelenggaraan yang dilakukan apabila hanya berlaku kerosakan.
Penyelenggaraan Tidak Terancang	Penyelenggaraan yang dilakukan setelah berlaku kerosakan luar jangka (Bencana alam, banjir, kebakaran, tanah runtuh, dsb).

Sila tandakan (√) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan di bawah:

1. Adakah *Masjid kariah* ini mempunyai polisi penyelenggaraan bangunan bertulis?

☐ Ya ☐ Tidak

2. Strategi penyelenggaraan manakah yang digunakan oleh *Masjid kariah* ini?
(Tuan/Puan boleh menandakan lebih daripada satu sekiranya masjid ini mengamalkan lebih daripada satu strategi atau pilih tiada sekiranya tidak menggunakan mana-mana strategi dibawah)

☐ Penyelenggaraan Pencegahan Terancang

☐ Penyelenggaraan Baik Pulih Terancang

☐ Penyelenggaraan Tidak Terancang

☐ Tiada

3. Penyelenggaraan *Masjid kariah* ini dilakukan oleh?

☐ Pihak Pengurusan Masjid ☐ Kontraktor Luar

☐ Kontraktor Luar & Pihak Pengurusan Masjid secara bersama

4. Kekerapan penyelenggaraan di masjid ini?

☐ Tiada ☐ Apabila diperlukan

☐ Setiap minggu ☐ Setiap Bulan

☐ Setiap 3 Bulan ☐ Setiap 6 Bulan

☐ Setahun Sekali

BAHAGIAN C: PEMBINAAN PENGUKURAN HUBUNGAN ANTARA KRITERIA STRATEGI PENYENGGARAAN DAN PRESTASI PENYENGGARAAN SEMASA OPERASI AKTIVITI PENYELENGGARAAN DI *MASJID KARIAH*.

DEFINISI PENGUKURAN PRESTASI PENYELENGGARAAN

Pengukuran prestasi penyelenggaraan	: Proses mengukur kecekapan dan keberkesanan sesuatu pemboleh ubah

BAHAGIAN C ini mempunyai 7 Bahagian iaitu C1, C2, C3, C4, C5, C6, dan C7. Sila berikan tahap persetujuan tuan/puan dalam mengukur prestasi penyelenggaraan.

Bahagian ini menggunakan Kaedah Skala Likert:

Sila tandakan (√) pada petak yang sesuai bagi menggambarkan tahap persetujuan anda pada setiap pernyataan yang diberikan.

BAHAGIAN C1: PENGURUSAN ORGANISASI

Senarai di bawah adalah berkenaan dimensi ukuran prestasi pengurusan organisasi di *Masjid kariah* ini. Sila nilaikan tahap persetujuan anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

1A: Penggunaan Dasar	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah mempunyai objektif, matlamat dan sasaran bertulis yang jelas di masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah menggunakan dasar penyelenggaraan yang berkesan di masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

1B: Pengurusan Sumber Manusia	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah menyediakan tenaga kerja yang mencukupi untuk menjalankan tugas penyelenggaraan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah memastikan bahawa sebarang kemudahan di masjid ini dijaga dengan baik.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

1C: Penambahbaikan Berterusan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memberi latihan dan pendidikan yang mencukupi untuk Ahli Jawatankuasa Masjid.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah didedahkan dengan pengetahuan asas kepada AJK Masjid melalui kursus pendek berkaitan penyelenggaraan Masjid.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C2: PERANCANGAN DAN PENJADUALAN

Senarai di bawah adalah berkenaan dimensi ukuran prestasi perancangan dan penjadualan di *Masjid kariah*. Sila nilaikan tahap persetujuan anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

DIMENSI

2A: Pendekatan Selenggara	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah mempunyai urutan kerja dan tempoh yang sesuai.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah mempunyai tempoh kerja penyelenggaraan yang tidak mengganggu waktu solat dan program yang dijalankan di *Masjid kariah* ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

2B: Pengurusan Rekod	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah direkodkan untuk diperiksa atau dikaji pada masa akan datang.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah mempunyai pengendalian fail yang berkesan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

2C: Komunikasi	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memudahkan cara komunikasi kepada semua pihak yang terlibat.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah membolehkan ahli jawatankuasa masjid berkomunikasi dengan jelas.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C3: PERUNTUKAN KEWANGAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi peruntukan kewangan di *Masjid kariah*. Sila nilaikan tahap kecukupan dan kecekapan peruntukan kewangan berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

DIMENSI

3A: Kecukupan Belanjawan	Sangat tidak mencukupi	Tidak mencukupi	Neutral	Mencukupi	Sangat mencukupi

(1) Strategi dibawah memperuntukkan belanjawan yang mencukupi dengan rancangan penyelenggaraan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah membuat pembayaran secukupnya kepada keperluan penyenggaraan Masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

3B: Kecekapan Dana	Sangat tidak cekap	Tidak cekap	Neutral	Cekap	Sangat Cekap

(1) Strategi dibawah cekap mengesan penjimatan dana.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah cekap mengagihkan dana yang diperuntukkan di Masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

3C: Peruntukan Dana	Sangat tidak cukup	Tidak cukup	Neutral	Cukup	Sangat cukup

(1) Strategi dibawah memperuntukkan dana mencukupi bagi kerja penyelenggaraan di Masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah memastikan peruntukan dana yang mencukupi dengan kerja tahunan yang ditetapkan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C4: KUALITI PERKHIDMATAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi kualiti perkhidmatan di *Masjid kariah*. Sila nilaikan tahap kepuasan hati anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

4A: Kebolehpercayaan	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah berupaya melaksanakan perkhidmatan mengikut jadual.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4B: Jaminan	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah dapat menjamin perkhidmatan penyelenggaraan dilakukan dengan cekap.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4C: Tangible	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah membolehkan kakitangan penyelenggaraan memberi perkhidmatan penyelenggaraan dengan baik.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5

Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4D: Empati	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah membolehkan kakitangan penyelenggaraan memberi perhatian khusus terhadap aduan yang diterima.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

4E: Responsif	Sangat tidak puas hati	Tidak puas hati	Neutral	Puas hati	Sangat puas hati

(1) Anda berpuas hati bahawa strategi dibawah membolehkan kakitangan penyenggaraan berupaya membantu memberi perkhidmatan penyelenggaraan kepada masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C5: PENILAIAN PENYELENGGARAAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi penilaian di *Masjid kariah*. Sila nilaikan tahap persetujuan anda berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

5A: Penilaian keadaan bangunan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah dapat memelihara element-elemen fizikal bangunan di Masjid

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

5B: Penilaian keadaan sistem kelengkapan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah menilai keadaan sistem kelengkapan yang ada di masjid ini dengan baik.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

5C: Kewajipan Undang-Undang	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memenuhi kehendak undang-undang bangunan dalam menilai keadaan fizikal masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5

Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah memenuhi kehendak undang-undang bangunan dalam menilai sistem kelengkapan masjid ini.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C6: PERUNTUKAN SUMBER

Senarai dibawah adalah berkenaan dimensi ukuran prestasi peruntukan sumber di *Masjid kariah*. Sila nilaikan tahap kecukupan dan tahap persetujuan anda terhadap peruntukan sumber berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

DIMENSI

6A: Pengurusan Kontrak	Sangat tidak cukup	Tidak cukup	Neutral	Cukup	Sangat cukup

(1) Strategi dibawah memberi kontrak yang mencukupi kepada kontraktor untuk melakukan penyelenggaraan.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

6B: Pengurusan alat ganti	Sangat tidak cukup	Tidak cukup	Neutral	Cukup	Sangat cukup

(1) Strategi dibawah mempunyai jadual alat ganti yang berkala yang mencukupi bagi penyelenggaraan berulang.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

6C: Alat dan Peralatan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah menetapkan alatan yang kursus dan tersedia.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

D: Pengurusan Maklumat	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah sesuai menggunakan sistem pengurusan penyelenggaraan bersepadu (CMMS).

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

BAHAGIAN C7: KESELAMATAN DAN KESIHATAN

Senarai dibawah adalah berkenaan dimensi ukuran prestasi persekitaran di *Masjid kariah*. Sila nilaikan tahap keselamatan dan kesihatan terhadap persekitaran berkenaan pengaruh kriteria strategi penyelenggaraan terhadap dimensi pengukuran prestasi penyenggaraan dibawah: -

1. DIMENSI

7A: Keselamatan	Sangat tidak selamat	Tidak selamat	Neutral	Selamat	Sangat selamat

(1) Strategi dibawah memastikan penyelenggaraan ini memberi keselamatan daripada kemalangan akibat terjatuh, dan tersandung.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Strategi dibawah kerap memeriksa sistem kelengkapan *Masjid kariah* bagi memastikan keselamatan pengguna.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

7B: Kesihatan	Sangat tidak setuju	Tidak setuju	Neutral	Setuju	Sangat setuju

(1) Anda bersetuju bahawa strategi dibawah memastikan Masjid ini bebas daripada sindrom bangunan sakit.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

(2) Anda bersetuju bahawa strategi dibawah memastikan kebersihan dan kecucian pada kawasan yang diselenggara.

Penyelenggaraan Pencegahan Terancang	1	2	3	4	5
Penyelenggaraan Baik Pulih Terancang	1	2	3	4	5
Penyelenggaraan Tidak Terancang	1	2	3	4	5

TERIMA KASIH ATAS KERJASAMA TUAN/PUAN.
SEGALA MAKLUMAT PIHAK TUAN/PUAN DIRAHSIAKAN

APPENDIX 15

VALIDATION FORM FOR A FRAMEWORK OF MAINTENANCE STRATEGIES PERFORMANCE-BASED FOR THE *MASJID KARIAH* MAINTENANCE PLANNING

Serial No. *No. Siri*	
Date *Tarikh*	

Kolej Pengajian Alam Bina, Universiti Teknologi MARA (UiTM)
40450 Shah Alam, Selangor

VALIDATION FORM

Borang Pengesahan

PhD Thesis: Developing Maintenance Strategy Framework for Masjid Kariah in Kelantan State, Malaysia / ***Tesis PhD:*** *Membangunkan Rangka Kerja Perancangan Penyelenggaraan untuk Masjid Kariah di Negeri Kelantan, Malaysia*

This student is conducting a validation for Framework of Maintenance Strategies for the Masjid Kariah. All information gathered in this survey is solely for academic purposes. It will be treated as confidential and shall not be misused for other purposes. Your cooperation is greatly appreciated. Thank you. / *Pelajar ini sedang membuat pengesahan bagi Rangka Kerja Strategi Penyelenggaraan Masjid Kariah. Semua maklumat yang dikumpulkan dalam kaji selidik ini semata-mata untuk tujuan akademik. Ia akan dianggap sebagai sulit dan tidak akan disalahgunakan untuk tujuan lain. Kerjasama anda amatlah dihargai. Terima kasih.*

Expert Information:
Maklumat Pakar:

Expert Code: *Kod Pakar:*	**EA** – Expert Academic **EB** – Expert Agency/Industry
Organization: *Organisasi:*	
Address: *Alamat:*	
Position/Designation: *Jawatan:*	
Field of Expertise: *Bidang Kepakaran:*	
Years of Experience: *Tahun Pengalaman:*	
Email Address: *Alamat Emel:*	
Telephone No.: *No. Telefon:*	
Date: *Tarikh:*	

Please send your comments either through telephone no. or email address below:
Sila hantar ulasan anda sama ada melalui no. telefon atau alamat emel dibawah:

Telephone No. :
No. Telefon:

Email Address : azharbinyusof@gmail.com
Alamat Emel:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

1

Instructions:
Arahan :

There are two (2) sections that need to be filled in by the expert:
Terdapat dua (2) bahagian yang perlu diisi oleh pakar:

Section A

Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Section B

Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Section A
Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Question: Do you agree with the development of a Maintenance Strategy Framework for Masjid Kariah, as suggested by the study's findings? / *Soalan: Adakah anda bersetuju dengan pembangunan Rangka Kerja Strategi Penyelenggaraan bagi Perancangan Penyelenggaraan Masjid Kariah, seperti yang dicadangkan oleh dapatan kajian?*

Table 1.
Hypotheses Testing

Hypotheses	Path Co-Efficient (β)	Standard Deviation	*t*-Value	*p*-Value	Bias Confidence Interval (BCI)		Results
					5.0%	95.0%	
H1: OM → MKMP	-0.058	0.169	0.344	0.365	-0.595	0.031	Not Supported
H2: PS → MKMP	0.254	0.184	1.385	0.000	0.103	0.588	Supported
H3: FP → MKMP	-0.203	0.053	3.814	0.000	-0.292	-0.116	Not supported
H4: SQ → MKMP	0.070	0.076	0.929	0.000	0.066	0.179	Supported
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Note: Masjid Kariah Maintenance Planning (MKMP), Organization Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Service Quality (SQ), Assessment (AS), Resources Allocation (RA) and Safety and Health (SH)

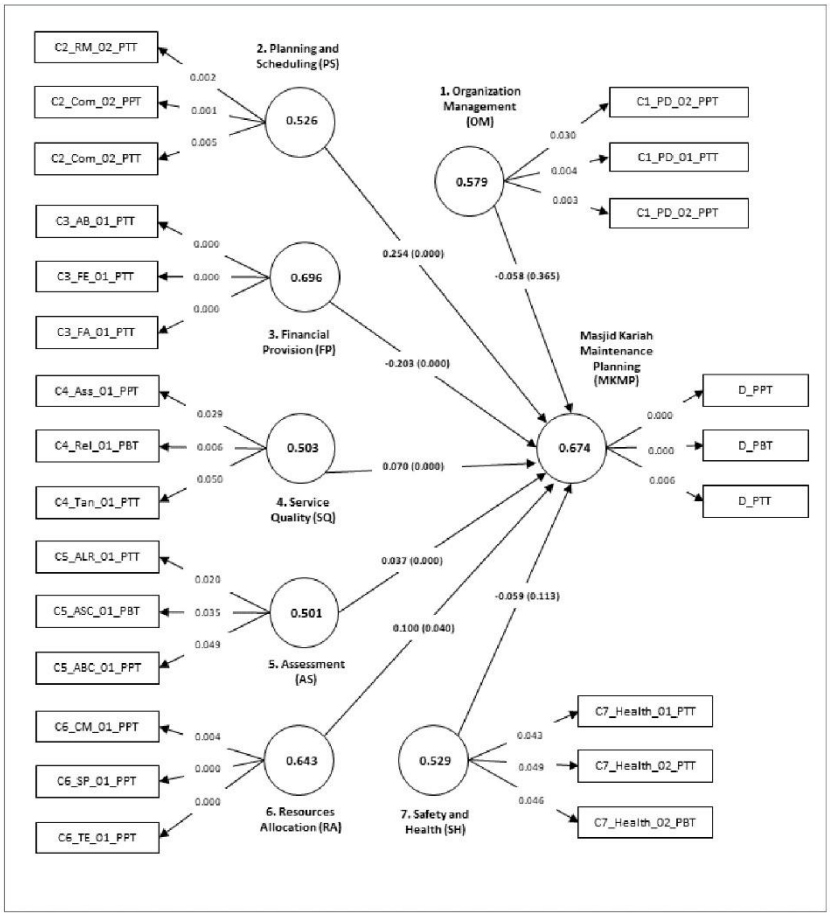

Figure 1. The Research Framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators

Feedback from the expert:
Maklum balas daripada pakar:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

Section B
Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Question: In your view, which variable is currently the most significant? Please provide a more detailed justification for your answer. / **Soalan:** *Pada pandangan anda, pembolehubah manakah yang paling ketara pada masa ini? Sila berikan justifikasi yang lebih terperinci untuk jawapan anda.*

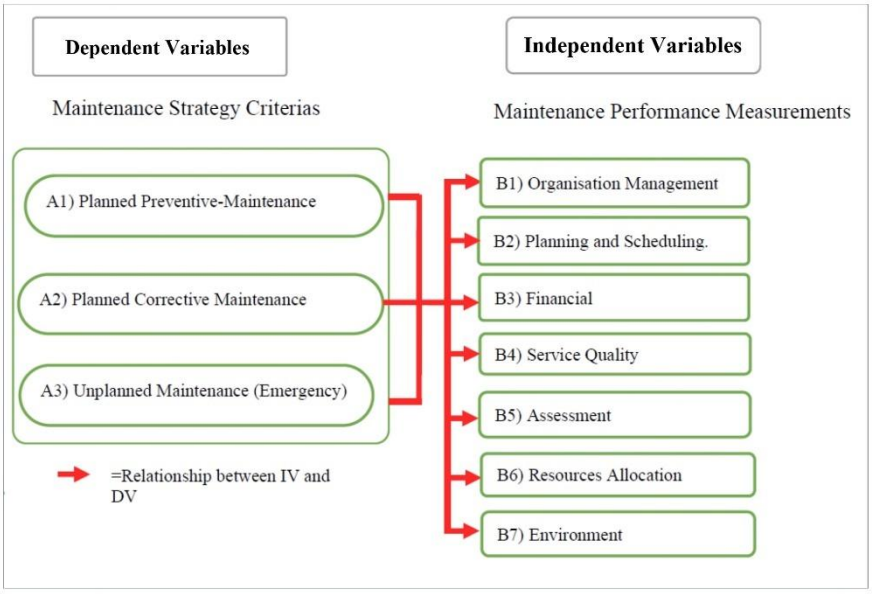

Figure 2. Theoretical Frameworks for Masjid Kariah

6

Feedback from the expert:
Maklum balas daripada pakar:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Overall Comments / Suggestions	**Expert's Signature and Official Stamp**

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

8

APPENDIX 16

EXPERT VALIDATION RESULT FOR A FRAMEWORK OF MAINTENANCE STRATEGIES PERFORMANCE-BASED FOR THE *MASJID KARIAH* MAINTENANCE PLANNING

Serial No. *No. Siri*	001
Date *Tarikh*	31.12.25

Kolej Pengajian Alam Bina, Universiti Teknologi MARA (UiTM)
40450 Shah Alam, Selangor

VALIDATION FORM

Borang Pengesahan

PhD Thesis: Developing Maintenance Strategy Framework for Masjid Kariah in Kelantan State, Malaysia / ***Tesis PhD:*** *Membangunkan Rangka Kerja Perancangan Penyelenggaraan untuk Masjid Kariah di Negeri Kelantan, Malaysia*

This student is conducting a validation for Framework of Maintenance Strategies for the Masjid Kariah. All information gathered in this survey is solely for academic purposes. It will be treated as confidential and shall not be misused for other purposes. Your cooperation is greatly appreciated. Thank you. / *Pelajar ini sedang membuat pengesahan bagi Rangka Kerja Strategi Penyelenggaraan Masjid Kariah. Semua maklumat yang dikumpulkan dalam kaji selidik ini semata-mata untuk tujuan akademik. Ia akan dianggap sebagai sulit dan tidak akan disalahgunakan untuk tujuan lain. Kerjasama anda amatlah dihargai. Terima kasih.*

Expert Information:
Maklumat Pakar:

Expert Code: *Kod Pakar:*	EA-1 – Industry Practician Expert
Organization: *Organisasi:*	Amas FM Consultant Sdn Bhd
Address: *Alamat:*	55-4, Jalan Udang Kara, Kampung Sungai Udang, 41250 Klang, Selangor
Position/Designation: *Jawatan:*	Director
Field of Expertise: *Bidang Kepakaran:*	• Pengalaman dalam FM dan Building Maintenance di Jabatan Pembangunan/FM UiTM • Practice pengurusan bangunan
Years of Experience: *Tahun Pengalaman:*	10
Email Address: *Alamat Emel:*	amasfm@gmail.com
Telephone No.: *No. Telefon:*	[redacted]
Date: *Tarikh:*	31 Dec 2025

Please send your comments either through telephone no. or email address below:
Sila hantar ulasan anda sama ada melalui no. telefon atau alamat emel dibawah:

Telephone No. :
No. Telefon:

Email Address : azharbinyusof@gmail.com
Alamat Emel:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

1

Instructions:
***Arahan* :**

There are two (2) sections that need to be filled in by the expert:
Terdapat dua (2) bahagian yang perlu diisi oleh pakar:

Section A

Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Section B

Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Section A

Seksyen A

Research Recommendations: A Framework of Maintenance Strategies for the Masjid Kariah

Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Question: Do you agree with the development of a Maintenance Strategy Framework for Masjid Kariah, as suggested by the study's findings? / ***Soalan:*** *Adakah anda bersetuju dengan pembangunan Rangka Kerja Strategi Penyelenggaraan bagi Perancangan Penyelenggaraan Masjid Kariah, seperti yang dicadangkan oleh dapatan kajian?*

Table 1.
Hypotheses Testing

Hypotheses	Path Co-Efficient (β)	Standard Deviation	*t*-Value	*p*-Value	Bias Confidence Interval (BCI)		Results
					5.0%	95.0%	
H1: OM → MKMP	-0.058	0.169	0.344	0.365	-0.595	0.031	Not Supported
H2: PS → MKMP	0.254	0.184	1.385	0.000	0.103	0.588	Supported
H3: FP → MKMP	-0.203	0.053	3.814	0.000	-0.292	-0.116	Not supported
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Note: Masjid Kariah Maintenance Planning (MKMP), Organization Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Service Quality (SQ), Assessment (AS), Resources Allocation (RA) and Safety and Health (SH)

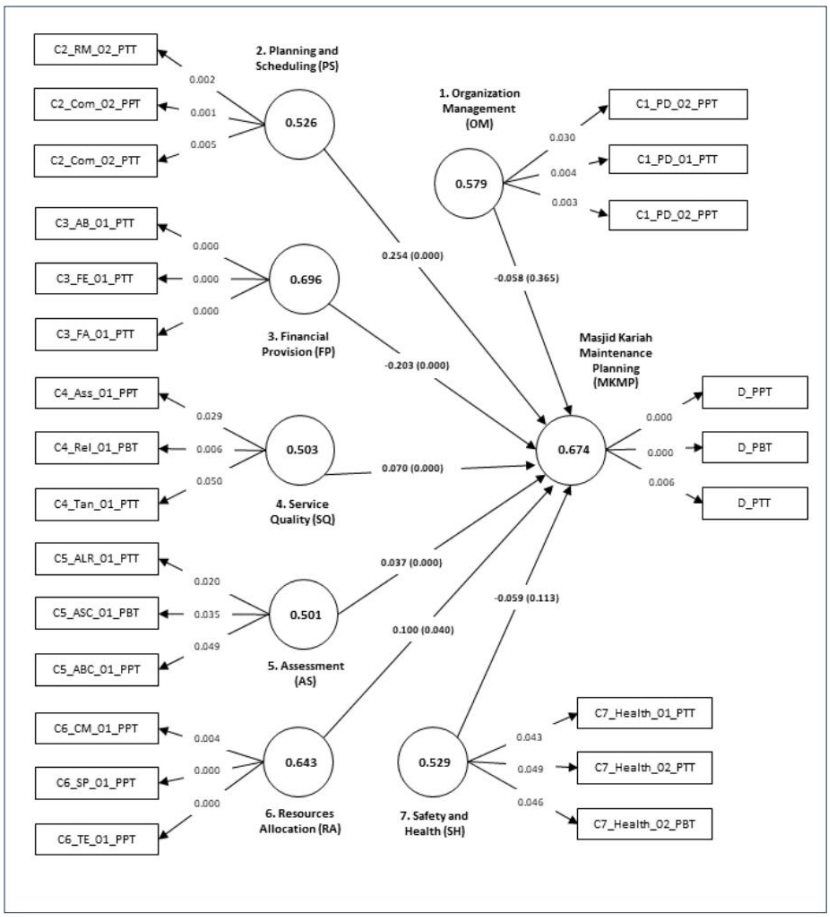

Figure 1. The Research Framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators

Feedback from the expert:
Maklum balas daripada pakar:

Answer: *Yes, I agree.*

I agree with the proposed *Masjid kariah* Maintenance Strategy Framework as it supports a more systematic, transparent, and consistent approach to maintenance management. However, implementation at *Masjid kariah* level should be strengthened with a **simple but workable guideline** aligned with Malaysia's Public Works Department (JKR) administrative guidance, namely the Garis Panduan Pengurusan Operasi dan Penyenggaraan (GPOP) and Garis Panduan Pengurusan Ruang (GPPR), particularly on:

(i) Establishing a **Dedicated Maintenance Fund**,
(ii) Conducting periodic **Building Condition Assessment (BCA)** to set maintenance priorities,
(iii) Applying a clear **procurement process/SOP** based on work categories (minor/medium/major), and
(iv) Developing a **Maintenance Schedule of Rates** (unit price list) for common works to improve cost control and decision-making.

In addition, maintenance works should be classified into **Planned Maintenance** and **Unplanned Maintenance**. Planned maintenance refers to scheduled preventive/cyclical works based on time and/or condition assessment (e.g., air-conditioning servicing, roof/dome inspection, PA system testing, painting cycle, carpet deep-cleaning/replacement, water tank cleaning, gutter cleaning, and pest control). Unplanned maintenance refers to reactive corrective or emergency repairs carried out on-the-spot due to failures or incidents (e.g., replacing faulty lamps, fixing roof leaks, repairing plumbing leaks/burst pipes, electrical faults/short circuits, and other urgent defects). This classification supports budgeting, procurement routing, and the development of the Schedule of Rates.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

Section B

Seksyen B

Overall Feedback and Suggestions for Future Improvement

Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Question: In your view, which variable is currently the most significant? Please provide a more detailed justification for your answer. / **Soalan:** *Pada pandangan anda, pembolehubah manakah yang paling ketara pada masa ini? Sila berikan justifikasi yang lebih terperinci untuk jawapan anda.*

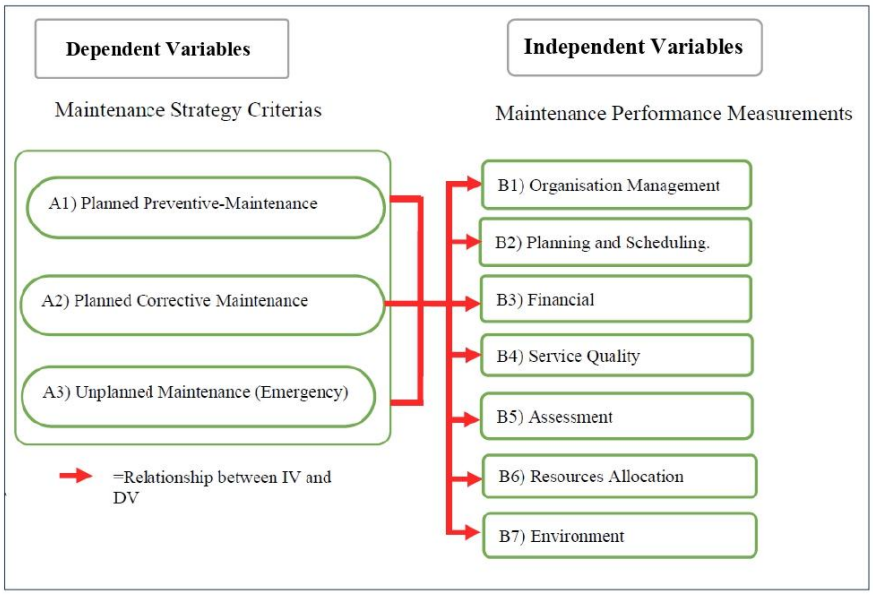

Figure 2. Theoretical Frameworks for Masjid Kariah

Feedback from the expert:
Maklum balas daripada pakar:

Answer for the Most significant variable at this stage:
B3) Financial / Financial Provision (FP).

Financial Provision is the most critical variable because without a dedicated budget, *Masjid kariah* maintenance tends to be reactive (complaint-based) and frequently deferred. It is recommended that the *Masjid kariah* allocates **a minimum of 10% of its annual income/collections** into a **Dedicated Maintenance Fund** (separate account/record). This percentage may be adjusted (e.g., **15%–20%**) for older *Masjid kariah* or those with higher critical defects based on Building Condition Assessment (BCA) findings. The maintenance fund should be integrated with periodic BCA (priority list and budgeting), a transparent procurement SOP, and a Schedule of Rates to ensure cost efficiency, value for money, and reduced recurring defects.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Overall Comments / Suggestions	**Expert's Signature and Official Stamp**
1. It is recommended to include a **Simple Mosque *Masjid kariah* Maintenance Guideline (simple but workable)** covering: • **Maintenance Fund policy** (minimum 10% of annual income; Dedicated Maintenance Fund). • **Periodic BCA** (1–2 times per year) to generate a priority list and budget planning. • **Procurement SOP**: minor works (direct purchase/simple quotation), medium works (minimum 3 quotations with technical-cost comparison), major works (tender/registered contractor with clear scope, timeline, warranty, and payment terms). • **Maintenance Schedule of Rates** (unit rates) for common works such as air-conditioning servicing, electrical, plumbing, painting, toilets, roofing, water tank cleaning, and landscaping; reviewed/updated at least annually based on market rates and past quotations. • **Planned vs Unplanned Maintenance:** Include a short list of typical items under both categories to help mosque committees plan, prioritise, and manage response time and cost control. 2. Additional suggestion: emphasise minimum documentation requirements (work order, committee approval minutes, contractor appointment, completion verification, and payment records) to strengthen governance and internal auditability. 3. Suggested supporting references/documents: • Building Condition Assessment (BCA) guideline/manual (relevant agency/standard). • Procurement SOP/guideline adaptable for mosque/NGO maintenance management. • Sample Maintenance Schedule of Rates (unit price list) for building maintenance works. • JKR (2021). Garis Panduan Pengurusan Operasi dan Penyenggaraan (GPOP). • JKR (2021). Garis Panduan Pengurusan Ruang (GPPR).	-

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

Berdaftar Dengan KKM & RISM

AFC
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Sr Ts Dr Abdul Mutalib Bin Aman Shah
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Perundingan
- Pengurusan Dan Penyelengaraan Harta
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- Operasi Bangunan & Audit
- Pengurusan Ruang & Audit
- Pemeriksaan Bangunan & Audit
- Pengurusan Penyerahan Bangunan
- Penilaian Prestasi Bangunan
- Latihan

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Sr Ts Dr Abdul Mutalib Bin Aman Shah
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: 03-3885 3230 : amasfm@gmail.com : AMAS FM Consultant
: **www.amasfm.com**

Serial No. *No. Siri*	002
Date *Tarikh*	12.02.26

Kolej Pengajian Alam Bina, Universiti Teknologi MARA (UiTM)
40450 Shah Alam, Selangor

VALIDATION FORM

Borang Pengesahan

PhD Thesis: Developing Maintenance Strategy Framework for Masjid Kariah in Kelantan State, Malaysia / ***Tesis PhD:*** *Membangunkan Rangka Kerja Perancangan Penyelenggaraan untuk Masjid Kariah di Negeri Kelantan, Malaysia*

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Expert Information:
Maklumat Pakar:

Expert Code: *Kod Pakar:*	EA-2 – Industry Practician Expert
Organization: *Organisasi:*	Vertex Central Industries Sdn. Bhd.
Address: *Alamat:*	4335D, Lot 1006, Section 27, Jalan Pengkalan Chepa, 15400 Kota Bharu, Kelantan
Position/Designation: *Jawatan:*	• Pengarah Urusan / Group Managing Director, Vertex Central Industries Sdn. Bhd. • Pengerusi Koperasi Dewan Melayu Kelantan Berhad
Field of Expertise: *Bidang Kepakaran:*	• Pengurusan pembinaan / kontraktor (civil & structural works) • Pengurusan projek pembinaan
Years of Experience: *Tahun Pengalaman:*	9
Email Address: *Alamat Emel:*	hr@vci.my
Telephone No.: *No. Telefon:*	[redacted]
Date: *Tarikh:*	12 Feb 2026

Please send your comments either through telephone no. or email address below:
Sila hantar ulasan anda sama ada melalui no. telefon atau alamat emel dibawah:

Telephone No. :
No. Telefon:

Email Address : azharbinyusof@gmail.com
Alamat Emel:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Seksyen B

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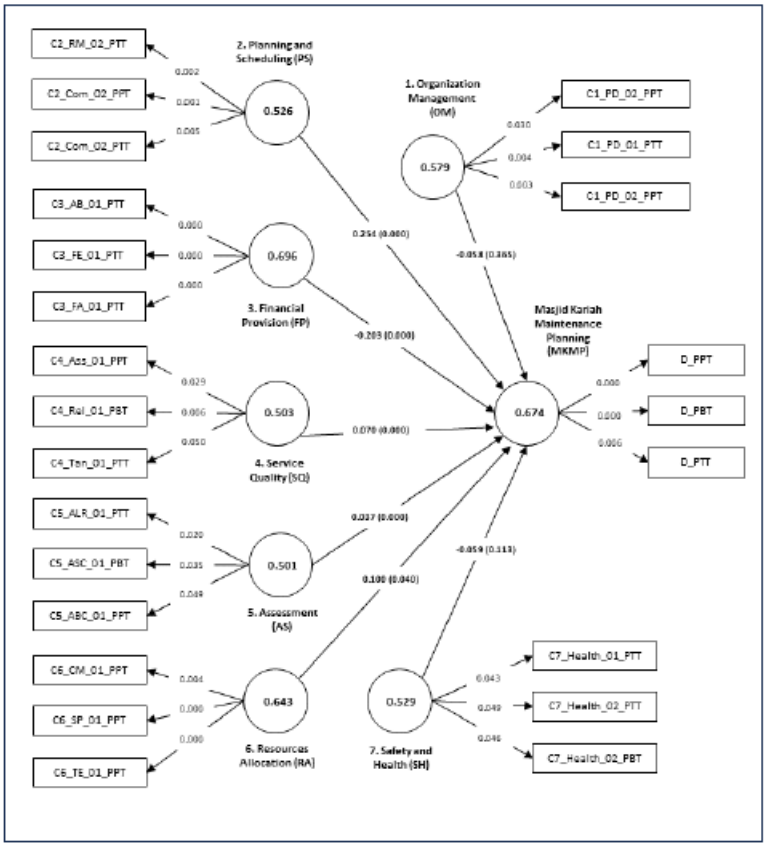

Figure 1. The Research Framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators

4

Feedback from the expert:
Maklum balas daripada pakar:

Answer: Yes, I agree.

I agree with the proposed maintenance planning framework because it offers a structured route for Masjid Kariah committees to plan, prioritise, and justify maintenance decisions rather than relying on ad-hoc complaints or urgent breakdowns. From an industry practitioner perspective, the framework is relevant; however, its effectiveness will depend on how well it is translated into workable financial governance, procurement discipline, and evidence-based prioritisation at the mosque level.

To strengthen implementation, I recommend placing stronger emphasis on **financial execution and cost control** as follows:

1. **Ring-fenced maintenance budgeting** – establish a dedicated maintenance allocation that is planned annually and protected for maintenance purposes (planned and emergency). Without ring-fencing, maintenance becomes reactive and deferred, which increases total lifecycle cost and safety risk.
2. **End-to-end linkage (Condition → Priority → Budget → Procurement)** – the framework should explicitly show the operational chain: basic condition checking/defect register → prioritised list → annual budget allocation → procurement/work packages. This improves transparency and avoids "first-come, first-served" spending.
3. **Procurement routes by work category** – define a simple SOP for minor/medium/major works (including scope writing, minimum quotations/tender route, evaluation criteria, supervision, acceptance, and payment release). This ensures consistency, reduces overpricing, and improves accountability.
4. **Cost benchmarking** – introduce a practical **Schedule of Rates / unit-rate list** for common mosque works (e.g., plumbing, electrical, roofing, toilets, painting, AC servicing). This will speed up quotation comparison and prevent price variability without justification.
5. **Planned vs Unplanned maintenance discipline** – separate planned preventive/cyclical work from reactive/emergency work, with clear budget proportions and approval thresholds. This is critical for cashflow planning and for reducing repeat defects.

Overall, the framework is suitable, but it should be accompanied by short templates/checklists so that non-technical committees can execute the process consistently and keep a clear audit trail.

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Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

Section B
Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

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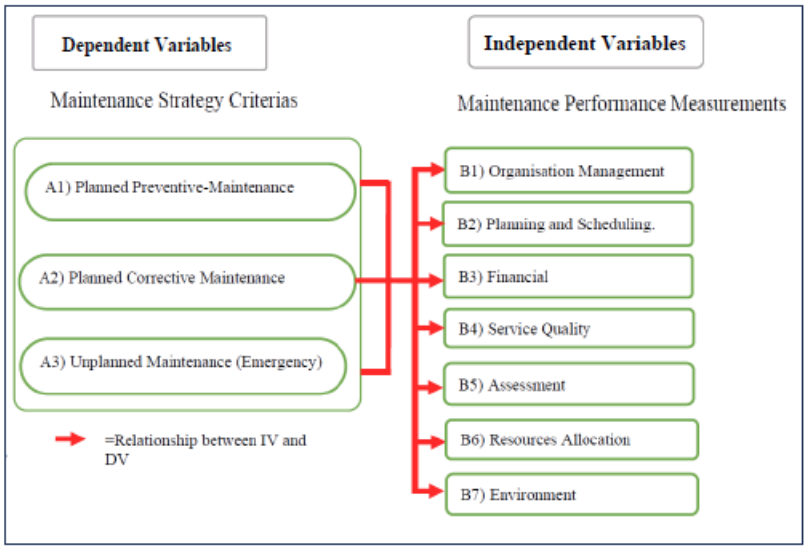

Figure 2. Theoretical Frameworks for Masjid Kariah

Feedback from the expert:
Maklum balas daripada pakar:

Answer for the Most significant variable at this stage:

B3) Financial / Financial Provision (FP)

Financial Provision is the most significant variable at this stage because it functions as the enabling resource for every other maintenance action within the framework. In practice, many maintenance failures in community facilities occur not because defects are unknown, but because funding is not systematically planned, not ring-fenced, and not governed through consistent procurement and approval controls.

To strengthen Financial Provision, three practical mechanisms are recommended:

1. **Dedicated Maintenance Fund** – allocate a fixed annual portion of mosque income to maintenance and maintain a separate record line for planned and emergency spending to ensure availability and transparency of funds.
2. **Cost-control mechanisms** – standardise quotation comparison using a unit-rate benchmark (Schedule of Rates) and apply clear approval thresholds (e.g., committee approval levels) prior to awarding work to reduce pricing variability and improve value-for-money.
3. **Payment governance** – release payment only after completion verification (site inspection/photographic evidence, sign-off, and minimum documentation) to reduce rework risk and strengthen contractor accountability.
4. **Committee capacity-building, training, and knowledge-sharing (OM)** – conduct periodic briefing/training sessions for AJKs (e.g., every six months) as an induction and refresher to standardise role clarity, strengthen documentation discipline, and ensure consistent application of key tools such as the defect register, priority scoring, quotation comparison, work order, completion verification, and payment checklist prior to payment release.

When Financial Provision is supported by these controls, the mosque committee can shift from reactive spending toward planned maintenance, thereby improving safety, service quality, and overall facility performance.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Overall Comments / Suggestions	Expert's Signature and Official Stamp
1. **Create an implementation pack (guideline) to operationalise the framework** Attach simple templates: defect register, priority scoring sheet, annual maintenance budget sheet, quotation comparison sheet, work order, completion verification form, and payment checklist. This will help committees implement the framework consistently and maintain a clear audit trail. 2. **Committee capacity-building, training, and knowledge-sharing (for AJKs)** Introduce short briefing/training and knowledge-sharing sessions for committee members (e.g., every six months) to standardise maintenance knowledge and decision-making practices. These sessions function as induction and refresher to strengthen role clarity, consistent defect interpretation and prioritisation, and documentation discipline. Where relevant, include practical walkthroughs on using the implementation templates (defect register, priority scoring, quotation comparison, work order, completion verification, and payment checklist) to ensure continuity even when committee membership changes.	--

9

3. **Strengthen financial governance through a planned vs emergency budget structure** Separate allocations for planned (preventive/cyclical) maintenance and emergency/reactive maintenance, with clear approval thresholds for each spending category. This improves cashflow planning, prevents ad-hoc spending, and reduces repeated breakdown-related costs. 4. **Work packaging (bundle similar works to reduce cost)** Instead of awarding many small ad-hoc jobs, bundle related items into packages (e.g., toilets & plumbing package, electrical & lighting package, roof & rainwater goods package). Bundling improves contractor accountability, reduces mobilisation cost, and simplifies monitoring. 5. **Procurement SOP by category + contractor accountability** • Minor works: simplified quotation + capped value + basic work order • Medium works: minimum three quotations + technical-cost evaluation + unit-rate check • Major works: tender/registered contractor route + clear scope, timeline, supervision plan, warranty/defect liability, and staged payment Include "defect liability / rectification responsibility" to reduce repeated repairs and ensure workmanship quality. 5. **Introduce a Schedule of Rates / unit cost benchmark for common mosque works** Develop a simple unit-rate list for recurring items (e.g., plumbing, electrical, roofing, toilets, painting, AC servicing) and use it to support quotation comparison. This reduces price variability, improves value-for-money decisions, and strengthens cost control.	

10

6. **Documentation & audit trail (minimum requirement)** Minimum documents should include: scope/work request, approval minutes, quotations, evaluation sheet, award letter/work order, progress/completion evidence, and payment record. This supports governance and protects committee members. 7. **Performance monitoring (simple KPIs linked to spending)** Track a few simple indicators: number of repeat defects, response time for critical defects, planned vs reactive spending ratio, and annual maintenance expenditure vs budget. This shows whether the framework is improving outcomes. 8. **Payment governance and completion verification before release of funds** Require site inspection/photo evidence and sign-off before payment release. For staged payments, link each payment to measurable deliverables and acceptance criteria to minimise rework risk.	

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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ISO 9001
ISO 37001
ISO 14001

12

Serial No. *No. Siri*	003
Date *Tarikh*	12.02.26

Kolej Pengajian Alam Bina, Universiti Teknologi MARA (UiTM)
40450 Shah Alam, Selangor

VALIDATION FORM

Borang Pengesahan

PhD Thesis: Developing Maintenance Strategy Framework for Masjid Kariah in Kelantan State, Malaysia / ***Tesis PhD: Membangunkan Rangka Kerja Perancangan Penyelenggaraan untuk Masjid Kariah di Negeri Kelantan, Malaysia***

This student is conducting a validation for Framework of Maintenance Strategies for the Masjid Kariah. All information gathered in this survey is solely for academic purposes. It will be treated as confidential and shall not be misused for other purposes. Your cooperation is greatly appreciated. Thank you. / *Pelajar ini sedang membuat pengesahan bagi Rangka Kerja Strategi Penyelenggaraan Masjid Kariah. Semua maklumat yang dikumpulkan dalam kaji selidik ini semata-mata untuk tujuan akademik. Ia akan dianggap sebagai sulit dan tidak akan disalahgunakan untuk tujuan lain. Kerjasama anda amatlah dihargai. Terima kasih.*

Expert Information:
Maklumat Pakar:

Expert Code: *Kod Pakar:*	EA-3 – Industry Practician Expert
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Position/Designation: *Jawatan:*	Managing Director
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Alamat Emel:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

1

Instructions:
Arahan :

There are two (2) sections that need to be filled in by the expert:
Terdapat dua (2) bahagian yang perlu diisi oleh pakar:

Section A

Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Section B

Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Section A
Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Question: Do you agree with the development of a Maintenance Strategy Framework for Masjid Kariah, as suggested by the study's findings? / *Soalan: Adakah anda bersetuju dengan pembangunan Rangka Kerja Strategi Penyelenggaraan bagi Perancangan Penyelenggaraan Masjid Kariah, seperti yang dicadangkan oleh dapatan kajian?*

Table 1.
Hypotheses Testing

Hypotheses	Path Co-Efficient (β)	Standard Deviation	*t*-Value	*p*-Value	Bias Confidence Interval (BCI)		Results
					5.0%	95.0%	
H1: OM → MKMP	-0.058	0.169	0.344	0.365	-0.595	0.031	Not Supported
H2: PS → MKMP	0.254	0.184	1.385	0.000	0.103	0.588	Supported
H3: FP → MKMP	-0.203	0.053	3.814	0.000	-0.292	-0.116	Not supported
H4: SQ → MKMP	0.070	0.076	0.929	0.000	0.066	0.179	Supported
H5: AS → MKMP	0.037	0.073	0.511	0.000	0.111	0.129	Supported
H6: RA → MKMP	0.100	0.057	1.754	0.040	0.056	0.169	Supported
H7: SH → MKMP	-0.059	0.049	1.210	0.113	-0.100	0.140	Not Supported

Note: Masjid Kariah Maintenance Planning (MKMP), Organization Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Service Quality (SQ), Assessment (AS), Resources Allocation (RA) and Safety and Health (SH)

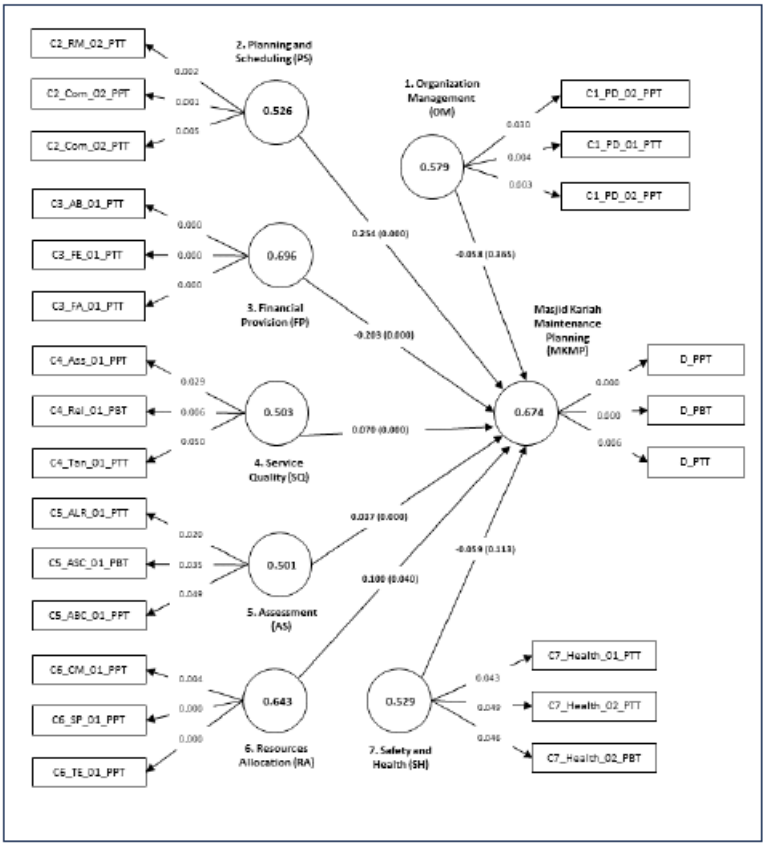

Figure 1. The Research Framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators

Feedback from the expert:
Maklum balas daripada pakar:

Answer: *Yes, I agree.*

I agree with the development of the Masjid Kariah Maintenance Strategy Framework because it supports a more systematic and transparent approach to facility maintenance. From a building services (M&E) practitioner perspective, the framework will be stronger if it explicitly highlights the maintenance requirements of **critical services systems**—particularly ACMV, electrical, plumbing/sanitary, and fire protection—because service failures in these systems directly affect user comfort, safety, hygiene, and operational continuity.

To strengthen implementation at Masjid Kariah level, I recommend adding a practical building-services component that includes:

1. A simple asset register for M&E systems (AC units, pumps, DB panels, lighting circuits, fire equipment, water tanks),
2. Service-based preventive maintenance scheduling (monthly/quarterly/annual), and;
3. Clearer work-scoping and supervision requirements for M&E works to ensure workmanship quality and compliance.

In addition, classifying works into **Planned Maintenance** and **Unplanned Maintenance** is important, but for building services this should be further operationalised into: preventive servicing (routine), corrective repair (non-emergency), and emergency response (critical breakdown) with defined response time and approval thresholds. This classification helps procurement routing, budgeting discipline, and reduces repeated failures for service systems.

.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

Section B
Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Question: In your view, which variable is currently the most significant? Please provide a more detailed justification for your answer. / **Soalan:** *Pada pandangan anda, pembolehubah manakah yang paling ketara pada masa ini? Sila berikan justifikasi yang lebih terperinci untuk jawapan anda.*

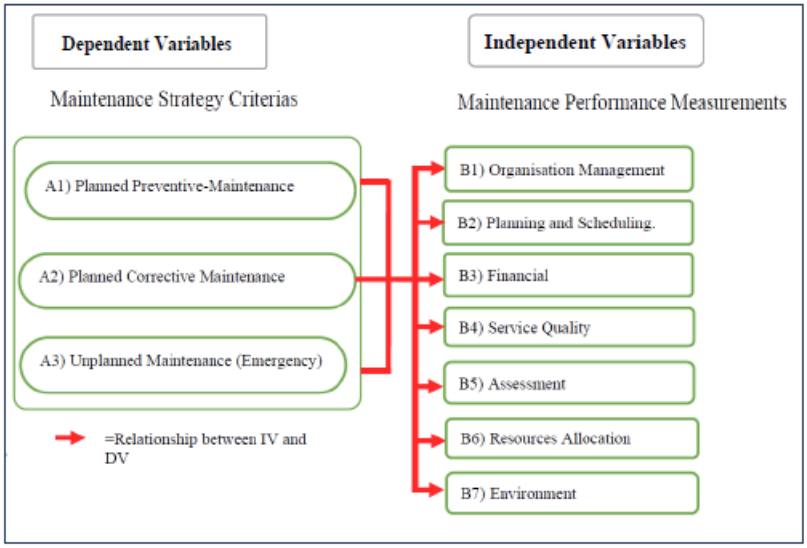

Figure 2. Theoretical Frameworks for Masjid Kariah

Feedback from the expert:
Maklum balas daripada pakar:

Answer for the Most significant variable at this stage:

B3) Financial / Financial Provision (FP).

Financial Provision is the most significant variable at this stage because building services maintenance (especially ACMV and electrical systems) requires **consistent recurring expenditure** for servicing, inspection, consumables, and competent contractors. In practice, service systems degrade quickly when budgets are not planned or ring-fenced, causing higher repair costs, frequent downtime, and safety/hygiene risks (e.g., electrical faults, plumbing leaks, pump failure, or non-functional fire protection items).

To strengthen FP specifically for building services, three mechanisms are recommended:

1. **Dedicated Maintenance Fund (ring-fenced)** – allocate a fixed annual portion of mosque income with a clear sub-allocation for recurring building services servicing (ACMV, electrical, plumbing, fire protection).
2. **Service-based budget planning** – budget by service system (ACMV, electrical, plumbing, fire protection) using an annual service schedule (routine vs corrective vs emergency) so committees can predict cashflow and avoid ad-hoc spending.
3. **Cost and payment governance** – use unit-rate benchmarking for common building services works, require quotation comparison, and release payment only after service completion verification (inspection/photo evidence, sign-off, basic documentation).

When FP is strengthened with these controls, Masjid Kariah can shift from reactive repair spending to planned servicing, improving service reliability, user comfort, safety compliance, and overall facility performance.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

The purpose of this feedback form is to obtain your comments and suggestions on this study. Your feedback will help ensure the study's relevance. You may also recommend any references or documents to support your comments.
Tujuan borang maklum balas ini adalah untuk mendapatkan komen dan cadangan tuan/puan berkaitan kajian ini. Maklum balas tuan/puan akan membantu memastikan kajian ini relevan. Tuan/puan juga dialu-alukan untuk mencadangkan sebarang rujukan atau dokumen yang dapat menyokong komen yang diberikan.

Overall Comments / Suggestions	Expert's Signature and Official Stamp
1. **Strengthen the framework with a "Building Services (M&E) Maintenance Module"** Include a simple M&E asset register and minimum preventive maintenance schedule for ACMV, electrical, plumbing/sanitary, and fire protection systems. 2. **Prioritise recurring service budgets for critical M&E systems** Ring-fence part of the maintenance fund for routine services (e.g., ACMV servicing, electrical inspection, pump/water tank upkeep, fire equipment checks) to prevent system deterioration and costly breakdowns. 3. **Service-based planned maintenance schedule + response time** Define routine servicing frequency (monthly/quarterly/annual) and minimum response time for critical breakdowns (electrical faults, major leaks, pump failure, etc.) to protect safety and continuity of operations. 4. **Procurement SOP for M&E works (scope clarity + competent contractor)** Ensure scope specifications include materials, testing/commissioning (where relevant), and supervision/acceptance criteria, and appoint contractors with proven competency for M&E works to reduce repeated defects. 5. **Completion verification before payment (M&E quality control)** Require verification (site inspection/photo evidence, sign-off, and minimum documentation) before payment release, especially for M&E works where hidden defects and repeat failures are common.	

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

UNIVERSITI TEKNOLOGI MARA

Serial No. *No. Siri*	004
Date *Tarikh*	21.02.26

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VALIDATION FORM

Borang Pengesahan

PhD Thesis: Developing Maintenance Strategy Framework for Masjid Kariah in Kelantan State, Malaysia / ***Tesis PhD:*** *Membangunkan Rangka Kerja Perancangan Penyelenggaraan untuk Masjid Kariah di Negeri Kelantan, Malaysia*

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Expert Information:
Maklumat Pakar:

Expert Code: *Kod Pakar:*	**EB-1** – Academician Expert
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Field of Expertise: *Bidang Kepakaran:*	• 10 years of experience in the property management industry • 2 years of experience in academia (as a lecturer)
Years of Experience: *Tahun Pengalaman:*	12 years
Email Address: *Alamat Emel:*	drfirdausishak@gmail.com
Telephone No.: *No. Telefon:*	
Date: *Tarikh:*	21 Feb 2026

Please send your comments either through telephone no. or email address below:
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Telephone No. :
No. Telefon:

Email Address : azharbinyusof@gmail.com
Alamat Emel:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Seksyen B

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Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

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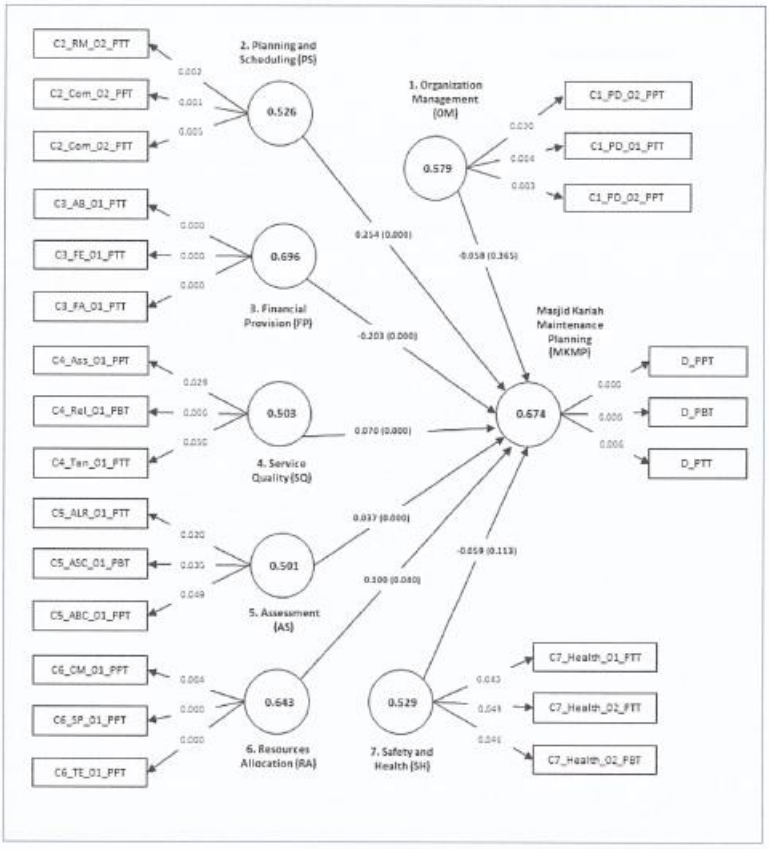

Figure 1. The Research Framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators

4

Feedback from the expert:
Maklum balas daripada pakar:

Answer: Yes, I agree.

I agree with the proposed maintenance planning framework as it provides a structured and evidence-based guide for Masjid Kariah maintenance implementation, and it is practical for committee-level decision-making where resources and technical capacity may be limited.

1. Based on the hypotheses testing, four (4) significant elements should be retained in the framework: Planning & Scheduling (PS), Service Quality (SQ), Assessment (AS), and Resource Allocation (RA), as these components reflect the core operational pathway from identifying maintenance needs to delivering measurable service outcomes.
2. Although these elements are important, their operational priority may differ depending on defect criticality, urgency, service disruption, and resource constraints at Masjid Kariah level; therefore, flexibility in sequencing and prioritisation is necessary to ensure timely action for critical defects while routine maintenance remains systematic.
3. In addition, Organisational Management (OM), Financial Provision (FP), and Safety & Health (SH) should still be highlighted as key implementation enablers, as they influence governance clarity, budget feasibility, and safety-based decision-making, and they often determine whether the planned maintenance activities can be executed consistently and transparently.

Overall, I agree with the proposed framework and support its implementation, as it strengthens accountability, improves coordination of maintenance actions, and enhances the reliability and safety of Masjid Kariah facilities for users.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

5

Section B

Seksyen B

Overall Feedback and Suggestions for Future Improvement

Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Question: In your view, which variable is currently the most significant? Please provide a more detailed justification for your answer. / **Soalan:** *Pada pandangan anda, pembolehubah manakah yang paling ketara pada masa ini? Sila berikan justifikasi yang lebih terperinci untuk jawapan anda.*

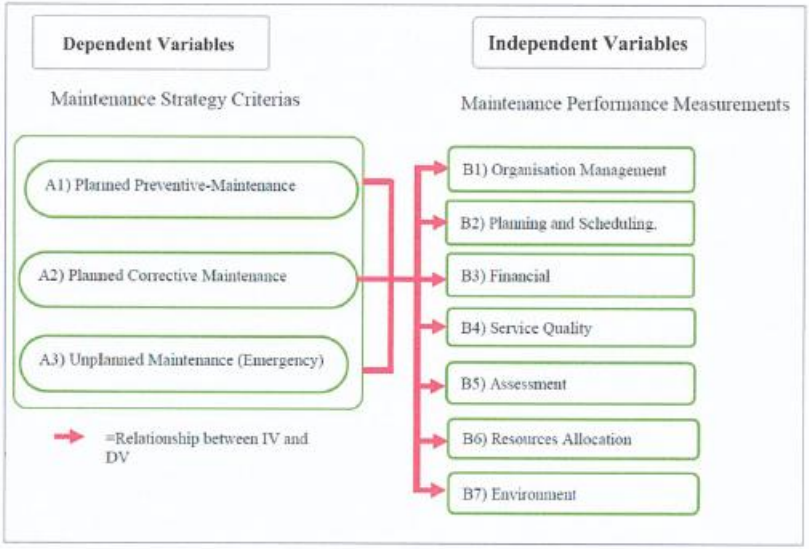

Figure 2. Theoretical Frameworks for Masjid Kariah

Feedback from the expert:
Maklum balas daripada pakar:

Answer for the Most significant variable at this stage:

B2) Planning and Scheduling (PS)

Planning and Scheduling is the most significant variable at this stage because it functions as the "control centre" that coordinates maintenance delivery and determines whether other elements can produce real outcomes. Even when assessment identifies the correct problems, and even when service quality targets are clearly defined, maintenance performance will still deteriorate if there is no structured plan that specifies *what must be done first*, *who is responsible*, *how tasks are sequenced*, and *when the work is expected to be completed*. In practical terms, PS is the mechanism that prevents maintenance from becoming purely reactive, fragmented, and dependent on ad-hoc decisions—especially when committees face limited budgets and multiple competing needs.

PS is also critical because it provides a structured route for prioritisation and risk control. Without PS, maintenance often suffers from repeated minor fixes that do not address root causes, delayed responses to critical defects, and inconsistent contractor coordination. With effective planning and scheduling, Masjid Kariah committees can establish a clear workflow: defects are identified and verified, priority is assigned based on safety and user impact, resources are matched to the plan, and outcomes are checked for quality and completion. This reduces disruptions, improves transparency, and supports better governance and accountability.

Importantly, PS enables committees to target the **most urgent items** through a structured priority system such as **urgent / moderately urgent / non-urgent**. This is necessary because not all defects carry the same risk. Urgent items typically involve safety hazards, functional breakdown of essential systems, or disruptions that affect large numbers of users. Moderately urgent items may include defects that reduce service comfort or could escalate if ignored. Non-urgent items can be scheduled as routine works within the available maintenance cycle. This classification ensures that the committee's limited resources are used strategically and that critical risks are addressed first.

Example: In facility operations, a **sudden breakdown of essential facilities such as lifts/escalators** (or equivalent critical systems that affect mosque accessibility and safety) should be treated as urgent because it can affect vulnerable users, increase safety risk, and disrupt service continuity. Similarly, defects involving electrical safety, slipping hazards, structural concerns, or essential sanitary services should be prioritised and scheduled immediately to protect congregants and maintain operational readiness.

To strengthen Planning & Scheduling for Masjid Kariah implementation, I recommend the following mechanisms:

1. **Defect register with priority scoring** – maintain a simple log that records defect description, location, date, severity, safety risk, user impact, and recommended action; include a basic scoring rubric so prioritisation is consistent across committee members.
2. **Planned maintenance structure (routine–corrective–emergency)** – establish three scheduling tracks with defined response targets: routine servicing (planned), corrective repairs (prioritised but non-emergency), and emergency response (immediate action).
3. **Work packaging and sequencing** – group similar works and schedule them logically (e.g., servicing + minor repairs in the same mobilisation window) to reduce contractor mobilisation cost, improve monitoring, and ensure better workmanship continuity.
4. **Responsibility and timeline clarity** – define who approves, who monitors, and who verifies completion; include simple milestones (planned date, start date, completion date) to strengthen accountability.
5. **Integration with resource allocation** – ensure each scheduled task is linked to budget availability, labour capacity, and procurement lead time to minimise the risk of postponement and repeated delays.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Overall Comments / Suggestions	Expert's Signature and Official Stamp
1. **Position PS as the framework "driver" for execution** Make Planning & Scheduling the main coordinating element that links the framework components into a clear operational workflow: **Assessment → Prioritisation → Plan & Schedule → Resource Allocation → Service Quality verification**. This will reduce ad-hoc decision-making and strengthen governance at Masjid Kariah level. 2. **Introduce a clear priority classification with response targets** Include **urgent**, **moderately urgent**, and **non-urgent** categories with indicative response time targets (e.g., **immediate / within days / within weeks**) and clear escalation rules for safety-related defects. This helps committees apply the framework consistently even when leadership changes. 3. **Provide simple implementation tools and minimum documentation for governance** Include a defect register, priority list, quarterly/annual schedule template, work order form, approval record, completion evidence, and post-maintenance verification checklist to ensure consistency, transparency, and auditability. 4. **Strengthen the "assessment-to-action" translation** Ensure assessment outputs are actionable and directly generate a prioritised work plan. Assessment records should include the **recommended action type (routine/corrective/emergency)**, **estimated resources**, and a **suggested schedule window** to support realistic execution. 5. **Ensure resource realism and feasibility at committee level** Resource Allocation should explicitly reflect typical constraints in Masjid Kariah settings (budget cycle, donation-based funding, limited technical staff, contractor availability). Practical approaches such as **phased works**, **bundling similar tasks**, and **basic procurement planning** should be highlighted to minimise delays.	

6. **Embed service quality verification and a feedback loop**
   Service Quality should be operationalised through simple verification (e.g., **completion checks, photo evidence, short user feedback**) so outcomes can be confirmed and used to improve future planning. This strengthens accountability and continuous improvement.

7. **Enhance transparency and documentation for governance**
   Maintain minimum documentation to support auditability and reduce repeated defects, such as **approval records, maintenance schedule, completion evidence**, and **post-maintenance verification**. This also supports continuity when committee membership changes.

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

Serial No. *No. Siri*	005
Date *Tarikh*	23.02.26

Kolej Pengajian Alam Bina, Universiti Teknologi MARA (UiTM)
40450 Shah Alam, Selangor

VALIDATION FORM

Borang Pengesahan

PhD Thesis: Developing Maintenance Strategy Framework for Masjid Kariah in Kelantan State, Malaysia / ***Tesis PhD**: Membangunkan Rangka Kerja Perancangan Penyelenggaraan untuk Masjid Kariah di Negeri Kelantan, Malaysia*

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Expert Information:
Maklumat Pakar:

Expert Code: *Kod Pakar:*	**EB-2** – Academician Expert
Organization: *Organisasi:*	Universiti Teknologi MARA
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Date: *Tarikh:*	23 Feb 2026

Please send your comments either through telephone no. or email address below:
Sila hantar ulasan anda sama ada melalui no. telefon atau alamat emel dibawah:

Telephone No. :
No. Telefon:

Email Address : azharbinyusof@gmail.com
Alamat Emel:

Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Instructions:
Arahan :

There are two (2) sections that need to be filled in by the expert:
Terdapat dua (2) bahagian yang perlu diisi oleh pakar:

Section A

Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Section B

Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Section A
Seksyen A

Research Recommendations:
A Framework of Maintenance Strategies for the Masjid Kariah
Cadangan Penyelidikan: Rangka Kerja Strategi Penyelenggaraan bagi Masjid Kariah

Question: Do you agree with the development of a Maintenance Strategy Framework for Masjid Kariah, as suggested by the study's findings? / ***Soalan:*** *Adakah anda bersetuju dengan pembangunan Rangka Kerja Strategi Penyelenggaraan bagi Perancangan Penyelenggaraan Masjid Kariah, seperti yang dicadangkan oleh dapatan kajian?*

Table 1.
Hypotheses Testing

Hypotheses	Path Co-Efficient (β)	Standard Deviation	*t*-Value	*p*-Value	Bias Confidence Interval (BCI)		Results
					5.0%	95.0%	
H1: OM → MKMP	-0.058	0.169	0.344	0.365	-0.595	0.031	Not Supported
H2: PS → MKMP	0.254	0.184	1.385	0.000	0.103	0.588	Supported
H3: FP → MKMP	-0.203	0.053	3.814	0.000	-0.292	-0.116	Not supported
H4: SQ → MKMP	0.070	0.076	0.929	0.000	0.066	0.179	Supported
H5: AS → MKMP	0.037	0.073	0.511	0.000	0.111	0.129	Supported
H6: RA → MKMP	0.100	0.057	1.754	0.040	0.056	0.169	Supported
H7: SH → MKMP	-0.059	0.049	1.210	0.113	-0.100	0.140	Not Supported

Note: Masjid Kariah Maintenance Planning (MKMP), Organization Management (OM), Planning and Scheduling (PS), Financial Provision (FP), Service Quality (SQ), Assessment (AS), Resources Allocation (RA) and Safety and Health (SH)

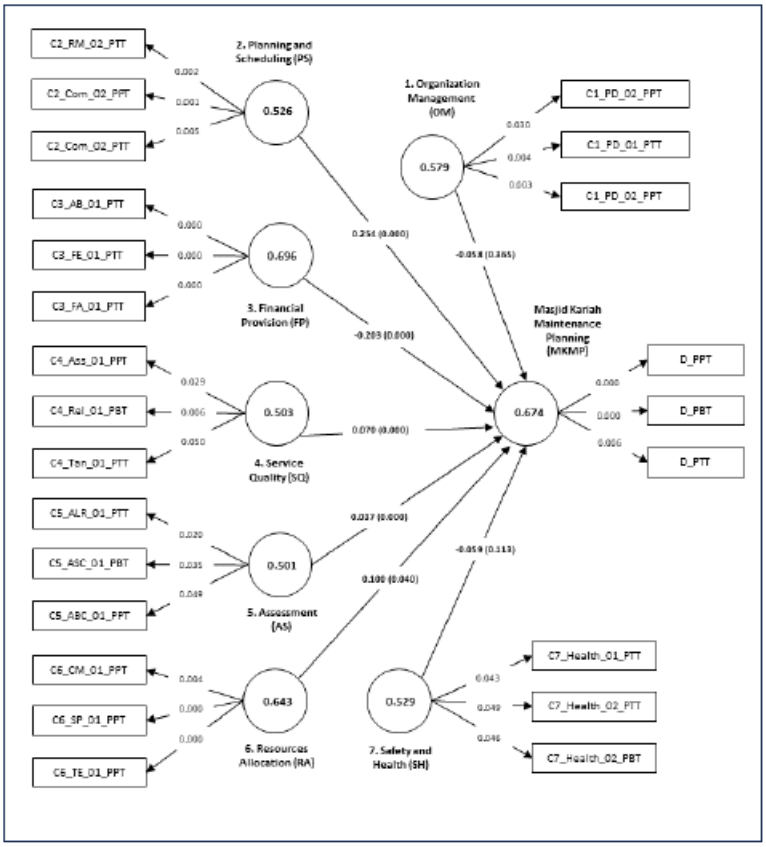

Figure 1. The Research Framework of relationship between Maintenance Strategy Criteria's indicators and Maintenance Planning via Maintenance Performance Measurement's indicators

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Feedback from the expert:
Maklum balas daripada pakar:

Answer:
Yes, I agree.

I agree with the proposed Masjid Kariah Maintenance Planning framework and support retaining all seven indicators within a single integrated model. Although three indicators—Organisational Management (OM), Financial Provision (FP), and Safety & Health (SH)—were reported as non-significant in the hypotheses testing, I emphasise that these constructs remain critical interdependent implementation enablers. In practice, effective maintenance planning at mosque level requires all indicators to operate together as an integrated system, because weaknesses in governance, funding, or safety oversight can undermine the delivery of planning, scheduling, assessment, service quality, and resource allocation.

In addition, I recommend strengthening the framework through digital enablement at Masjid Kariah level by developing an official website or mobile application. The proposed digital platform should function as an operational support tool and a transparency mechanism, with minimum features such as:

1. **Updated mosque information and announcements** (real-time communication),
2. **Committee contact directory** (clearly displayed contact numbers for quick coordination and reporting),
3. **Donation and maintenance fund channel** (QR code and/or bank details with a clear fund purpose), and
4. **Basic financial transparency cues** (simple reporting/updates to strengthen trust and encourage recurring contributions).

I believe that a structured digital donation mechanism can help address persistent funding constraints—particularly where many Masjid Kariah rely heavily on special allocations—by widening community participation and enabling faster mobilisation of resources for urgent and planned maintenance works.

Overall, I support the framework's implementation as it strengthens governance clarity, improves operational coordination, and enhances the safety and comfort of Masjid Kariah

facilities for users.

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Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

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Section B
Seksyen B

Overall Feedback and Suggestions for Future Improvement
Maklum Balas Keseluruhan dan Cadangan untuk Penambahbaikan Masa Hadapan

Question: In your view, which variable is currently the most significant? Please provide a more detailed justification for your answer. / **Soalan:** *Pada pandangan anda, pembolehubah manakah yang paling ketara pada masa ini? Sila berikan justifikasi yang lebih terperinci untuk jawapan anda.*

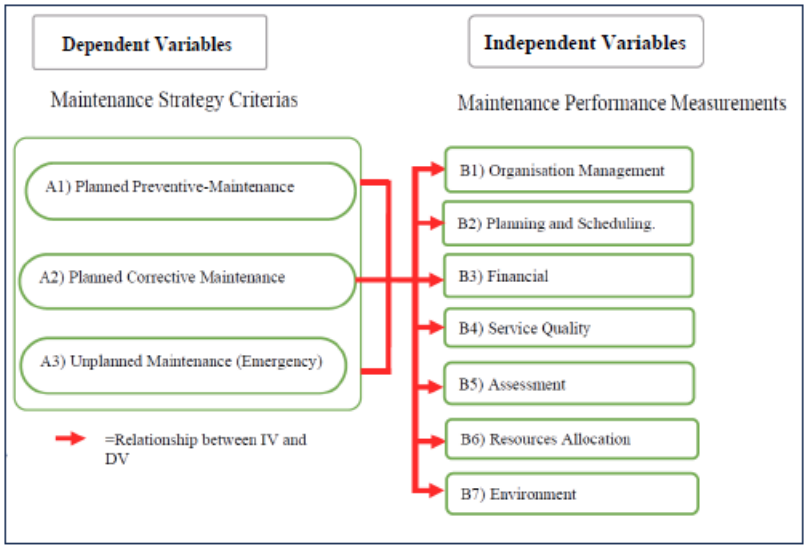

Figure 2. Theoretical Frameworks for Masjid Kariah

Feedback from the expert:
Maklum balas daripada pakar:

Answer for the Most significant variable at this stage:
Maintenance is the central priority, supported by **B2) Planning and Scheduling** as the key coordinating mechanism and **B5) Assessment** as the routine control for safety and condition.

I prioritise **maintenance as the core outcome** because the usability, safety, and comfort of Masjid Kariah are directly determined by the condition of the building and its services. In my view, **strong planning intentions will not translate into real outcomes if the facility condition deteriorates**—for example, poor cleanliness, unsafe elements, visible defects, structural concerns, or non-functioning systems. This creates a practical "chicken-and-egg" relationship: **weak maintenance reduces user confidence and attendance**, which can weaken community engagement and willingness to contribute, ultimately worsening maintenance capacity.

From an operational perspective, I position **Planning and Scheduling (PS) as a critical coordinating mechanism** after recognising maintenance as the central priority. **Planning and Scheduling links identification of issues, prioritisation, task sequencing, responsibility assignment, and timelines into implementable actions**, ensuring that maintenance activities are executed systematically rather than on an ad-hoc basis.

I further emphasise the importance of **periodic Assessment (AS) and Resource Allocation (RA)** to prevent the mosque from reaching unsafe or unacceptable conditions. Where defects remain unmanaged—especially those involving electrical systems and building safety—**risks such as fire hazards and unsafe occupancy can increase**. Therefore, **Safety and Health (SH) should remain a core decision lens for prioritisation and approval**, even if statistical significance is low in the model, because it directly protects users and supports risk-based maintenance decisions.

In addition, I highlight a **governance and compliance perspective**. Masjid Kariah facilities should be evaluated in terms of **regulatory legitimacy and occupancy readiness**, including whether the building has appropriate planning permission and whether key compliance documentation (e.g., CF) is in place. If the facility is not eligible or lacks formal compliance standing, **accountability and risk coverage, including insurance feasibility, may become**

unclear during incidents such as fire. Hence, I recommend that **relevant local authorities (PBT) and data-supplying agencies support committees** by clarifying operational status and assisting regularisation efforts where needed, so that **risk, safety, and responsibility pathways** can be strengthened.

Finally, I conclude that **financial capability is inseparable from maintenance delivery**. Maintenance requires reliable funding; therefore, **Financial Provision (FP) should be strengthened through a practical and transparent fundraising approach**. I recommend using the proposed website/app as an operational platform to implement a targeted donation strategy, including promotion and easy payment channels, so that Masjid Kariah can **supplement reliance on state allocations with sustainable community-based contributions**.

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Thank you for participating in this feedback
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The purpose of this feedback form is to obtain your comments and suggestions on this study. Your feedback will help ensure the study's relevance. You may also recommend any references or documents to support your comments.
Tujuan borang maklum balas ini adalah untuk mendapatkan komen dan cadangan tuan/puan berkaitan kajian ini. Maklum balas tuan/puan akan membantu memastikan kajian ini relevan. Tuan/puan juga dialu-alukan untuk mencadangkan sebarang rujukan atau dokumen yang dapat menyokong komen yang diberikan.

Overall Comments / Suggestions	Expert's Signature and Official Stamp
1. **Strengthen Financial Provision through a digital fundraising mechanism** Develop an official Masjid Kariah website/mobile application that includes a dedicated maintenance fund channel (e.g., QR code and bank details) supported by a simple promotion strategy. This will widen community donations (sadaqah), improve transparency, reduce over-reliance on special state allocations, and enable timely maintenance execution. 2. **Position Maintenance as the core outcome and make Planning & Scheduling the coordinating "driver"** Maintain Planning & Scheduling as the main coordinating element that translates maintenance needs into an operational workflow (Assessment → Prioritisation → Plan & Schedule → Resource Allocation → Verification). This improves consistency, reduces ad-hoc decision-making, and strengthens governance at Masjid Kariah level. 3. **Reinforce periodic Assessment and preventive action for safety-critical systems** Implement scheduled assessments and preventive maintenance, prioritising high-risk building systems (especially electrical services) to minimise fire hazards and safety incidents. Clear assessment records should support prioritisation and ensure the mosque remains safe, comfortable, and suitable for public use. 4. **Integrate compliance readiness into prioritisation and governance (eligibility, planning permission, CF)** Include compliance/eligibility checks as part of decision-making because incomplete approval status (e.g., planning permission/occupancy documentation) may increase liability risk and complicate insurance coverage. Where gaps exist, collaborative support with relevant local authorities (PBT) should be encouraged to regularise safety requirements ("pemutihan") and strengthen accountability.	TPr Dr Siti Kartina Binti Juhari Pensyarah Kanan Bidang Perancangan Bandar & Wilayah Fakulti Alam Bina Universiti Teknologi MARA(UiTM) Cawangan Selangor Kampus Puncak Alam

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5. **Improve accessibility and responsiveness through structured communication and contact directory**
   Use the proposed digital platform to provide updated mosque information and a committee contact directory to support faster reporting, coordination, and response. This improves service responsiveness, stakeholder access, and community confidence in the mosque's management and maintenance performance.

6. **Add a simple priority classification with safety escalation rules**
   Introduce urgent / moderate / routine categories with indicative response targets (immediate / within days / within weeks). Safety-related defects (electrical, structural, fire risks) should trigger fast-track approval and escalation to competent parties.

7. **Provide minimum evidence and record-keeping requirements for transparency**
   Standardise minimum documentation: defect log, assessment record, photo evidence (before/after), work approval note, completion verification, and basic cost record. This strengthens auditability, accountability, and trust—especially when donations are involved.

8. **Clarify roles and ownership structure for governance (committee vs authority)**
   Include a short governance map: who manages daily operations (committee), who provides technical approval/oversight (relevant agencies/competent persons), and who holds authority for compliance actions. This reduces confusion on responsibility when incidents occur.

9. **Promote preventive maintenance culture to avoid "reactive-only" practice**
   Highlight preventive maintenance scheduling (especially for M&E systems) to reduce long-term cost and repeated breakdowns. This supports sustainable service quality and keeps the mosque safe and comfortable.

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Thank you for participating in this feedback
Terima kasih kerana mengambil bahagian dalam maklum balas ini

AUTHOR'S PROFILE

Ts. Sr Azhar Bin Yusof, PQS completed his PhD in Built Environment at the Faculty of Architecture, Planning and Surveying, Universiti Teknologi MARA Shah Alam, Selangor Darul Ehsan. Previously, he received his Master in Property Investment also from Faculty of Architecture, Planning & Surveying, and Universiti Teknologi MARA in 2015. He is member of Malaysian Board of Technologist (MBOT), registered Professional quantity surveyor of Board of Quantity Surveyor Malaysia (BQSM) and member of Malaysian Royal of Surveyor Malaysian (RISM). Currently he is practising quantity surveying in construction industry as a Professional Quantity Surveyor in various disciplines and typology of buildings, and infrastructure projects. However, his research is focused on the facilities related to the masjid, specifically on maintenance management and maintenance planning.

LIST OF PUBLICATION

Mohamad Ridzuan, Y., Azhar, Y. & Nurzafira, Z. A. (2017). Masjid's maintenance management implementation. Case study: Masjids in Klang Valley, Malaysia. *Academy of Contemporary Islamic Studies (ACIS) Universiti Teknologi MARA.*

Mohamad Ridzuan, Y., Nurzafira, Z. A. & Azhar, Y. (2017). Muslim employees awareness towards Waqf. Case Study: Public sector in Klang Valley, Malaysia. *Academy of Contemporary Islamic Studies (ACIS) Universiti Teknologi MARA*.

Yusof, A., Yahya, M. R. & Misnan, M. S. (2025). Determining the key elements in Maintenance Planning of the *Masjid kariah* in Malaysian Perspective. *Built Environment Journal. 22*(1), 56-70. https://doi.org/10.24191/bej.v22i1.928

Yusof, A., Yahya, M. R., Ismail, F., & Hashim, S. F. (2025). Maintenance Planning for Masjid Kariah in Malaysian Perspective: A Systematic Literature Review and PRISMA Method. *Built Environment Journal. 22*(SP), 253-265. https://doi.org/10.24191/bej.v22iSI.5454.

Yusof, A., Yahya, M. R., Ismail, F., & Hashim, S. F. (2026). Key Indicators Influencing The Maintenance Planning of Masjid Kariah's Framework in Kelantan, Malaysia. *Planning Malaysia, 24*(40). https://doi.org/10.21837/pm.v24i40.1973.