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# Empowering Quantity Surveyors for Decarbonisation: Awareness and Role Prioritisation in Malaysia's Construction Sector

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**ABSTRACT**

The construction industry is a major contributor to global greenhouse gas emissions, accounting for 37 per cent of global emissions, with a significant share attributed to embodied carbon from construction materials. In Malaysia, the construction sector contributed approximately 24 per cent of national emissions, prompting the government to pursue a net-zero carbon target by 2050. Quantity surveyors (QSs) play a pivotal role in supporting the national decarbonisation agenda through cost planning, life cycle analysis, and procurement decisions, which influence the carbon outcomes of construction projects. However, limited empirical research has examined QS awareness of national climate policies or their readiness to support low-carbon practices. This study investigates two key areas: (1) the level of awareness among Malaysian QS professionals toward the national decarbonisation agenda, and (2) the perceived importance of QS roles in advancing decarbonised construction. A total of 89 responses were analysed using the Relative Importance Index and the Kruskal-Wallis test. Findings indicate that while QS professionals demonstrate a high awareness of general sustainability concepts, their awareness of Malaysia-specific policies and decarbonisation pathways remains limited. Cost-related roles, particularly project cost estimation and life cycle costing, were prioritised as central to supporting decarbonised construction. However, the perception of emerging roles, such as building performance reporting, varied significantly by experience level. The study highlights the need to embed decarbonisation competencies into professional frameworks, education, and policy. Strengthening role clarity and capacity building is essential to position quantity surveyors as strategic enablers in Malaysia's transition to a low-carbon construction sector.

***Keywords:*** *carbon efficiency, carbon emissions, decarbonisation, Malaysia, quantity surveyors (QS)*

## 1.0 INTRODUCTION

The construction industry plays a vital role in national development by supporting economic growth, delivering essential infrastructure, and creating employment opportunities. However, it is also the single most significant contributor to global greenhouse gas emissions, accounting for an estimated 37% of total emissions worldwide (United Nations Environment Programme, 2023). The carbon-intensive production and use of materials such as cement, steel, and aluminium primarily drive this footprint. While earlier efforts in the sector have focused on reducing operational emissions, which are emissions associated with heating, cooling, and lighting, these are projected to decline from 75% to 50% of total sectoral emissions in the coming decades. This shift places greater emphasis on reducing embodied carbon. In Malaysia, the construction sector's environmental impact is equally significant. Data on cradle-to-site emissions from construction activities between 2017 and 2019 accounted for approximately 24% of the country's total greenhouse gas emissions (Construction Industry Development Board, 2023). This alarming figure highlights the urgency of transforming construction practices, particularly as emissions are projected to rise due to rapid urbanisation and resource-intensive development. In response, Malaysia has pledged to achieve net-zero carbon emissions by 2050 and introduced several decarbonisation measures, including the Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCREST), the Low Carbon Cities Masterplan 2030, and the National Policy on Climate Change 2.0.

While the continued implementation of proactive sustainability measures marks progress, the adoption of decarbonisation strategies in the construction sector remains fragmented (Khan et al., 2024). The adoption of low-carbon practices in procurement, cost planning, and material selection remains limited. Decarbonisation involves the process of reducing greenhouse gas emissions throughout the entire lifecycle, from raw material extraction to operation, maintenance, and demolition (Sbahieh et al., 2023). Achieving meaningful decarbonisation progress requires a coordinated effort across built environment professionals, particularly quantity surveyors (QS) (Omotayo et al., 2022). Traditionally, QS play a dominant role in cost planning, procurement advice, contract administration, and financial control across all stages of construction projects. To date, the profession has evolved to address pressing needs in construction projects, including life cycle costing, cost-benefit analysis, and value management (Khairina et al., 2021; Spellacy et al., 2020). As such, QS is well-positioned to play a significant role in driving carbon-conscious decision-making in construction projects (Oke et al., 2019).

In particular, the emerging roles for QS on Malaysia's decarbonisation agenda include advising on low-carbon materials, measuring embodied and operational carbon, and supporting life cycle assessments (Khan et al., 2024). Internationally, QS are recognised professionals to practice carbon estimation, carbon pricing, and sustainability appraisals for large construction developments (Ballesty & Sawhney, 2023; Omotayo et al., 2022). However, limited research has examined how QS are prepared to support national decarbonisation efforts, or how the responsibilities expand to support Malaysia's carbon reduction goal. Specifically, few empirical studies have explored how QS professionals perceive these emerging roles, especially across different levels of experience with sustainable construction initiatives.

This study examines two central issues: 1) investigating QS awareness on the national decarbonisation agenda and 2) exploring QS roles to support the national decarbonisation agenda. The study also examines how perception varies according to respondents' levels of experience with decarbonisation aspects of construction projects. By offering empirical insights into the evolving role of the QS, the study aims to inform policy development, strengthen professional frameworks, and support Malaysia's broader transition toward a low-carbon and climate-resilient construction sector.

## 2.0 LITERATURE REVIEW

### 2.1 Advancing Decarbonisation Awareness in Construction Practices

The urgency to mitigate climate change has elevated decarbonisation as a strategic imperative within the construction industry. Central to this agenda is the development of professional awareness, defined as the ability to recognise, understand, and respond to carbon emissions generated throughout the building life cycle (Ballesty & Sawhney, 2023). In construction project practices, decarbonisation awareness is not an optional competency but a foundational requirement for delivering sustainable construction projects (Sesana & Dell'Oro, 2024).

Decarbonisation awareness entails a comprehensive understanding of both operational and embodied carbon. Operational carbon refers to the emissions associated with the energy used in buildings for heating, cooling, ventilation, and lighting purposes. In contrast, embodied carbon encompasses emissions arising from material extraction, manufacturing, transportation, construction processes, maintenance, and end-of-life disposal (Sbahieh et al., 2023). As operational emissions are projected to decrease with advancements in energy efficiency and the integration of renewable energy, the relative contribution of embodied carbon is expected to rise significantly (Sesana & Dell'Oro, 2024). Consequently, professionals must recalibrate their focus toward life cycle-based thinking, where carbon mitigation is embedded across all stages of a building's development. Moreover, decarbonisation awareness must be situated within the context of policy alignment and industry standards. National frameworks, such as MyCREST in Malaysia, and international standards, like the International Cost Management Standard, provide structured approaches to carbon measurement and reporting (Sesana & Dell'Oro, 2024; Ballesty & Sawhney, 2023). Thus, awareness involves not just technical knowledge, but understanding of how to navigate and operationalise these frameworks in professional practice.

A critical aspect of decarbonisation awareness is familiarity with whole-life carbon assessment frameworks and life cycle assessment practices in construction projects. These tools enable the quantification of emissions throughout a building's lifespan, supporting data-driven decision-making (Massarweh & Abushaikha, 2022; Karlsson et al., 2020). However, despite the growing availability of such tools, practical application remains limited. Bridging this gap necessitates targeted upskilling and improved access to carbon databases, benchmarks, and digital modelling systems such as Building Information Modelling, which has the potential to facilitate integrated cost and carbon analysis (Ballesty & Sawhney, 2023; Sbahieh et al., 2023).

Equally, recognition of decarbonisation as an interdisciplinary undertaking is foundational to supporting the decarbonisation agenda in the construction sector. QS services are shifting further from reactive compliance to proactive leadership, with QS serving as key enablers of carbon-conscious construction (Khan et al., 2024). This presents both a challenge and an opportunity for QS. Effective engagement in these tasks requires not only technical understanding but also fluency in the broader regulatory, methodological, and collaborative dimensions of decarbonisation.

### 2.2 The Evolving Decarbonisation Roles of Quantity Surveyors

QSs have long played a critical role in managing costs and resources throughout the construction lifecycle. Traditionally, these professionals have been responsible for key project activities, including cost estimation, contract administration, procurement advice, and tender documentation (RISM, 2022; Salleh et al., 2020; Olanrewaju & Anahve, 2015). However, the increasing emphasis on sustainability and the urgent need to decarbonise the built environment has expanded the expectations placed on the profession.

In response to global climate commitments and Malaysia's national decarbonisation agenda, the role of the QS is evolving beyond traditional financial stewardship to include contributions to environmental performance. The progression of QS roles in the construction sector can be categorised into three domains: traditional roles, expanded roles, and emerging decarbonisation roles. Table 1 summarises the progression of QS roles. While traditional roles focus on project cost planning and financial controls, expanded roles encompass value management, life cycle costing, and sustainability-related consulting (PAQS, 2019; Noor et al., 2020; Wong, 2017). These functions are increasingly crucial in delivering low-carbon outcomes, as they offer opportunities to integrate environmental considerations into economic decision-making.

Emerging decarbonisation roles further extend QS responsibilities into environmental impact measurement and strategic carbon reduction. These include embodied carbon quantification, green cost planning, advising on low-carbon material selection, and participation in sustainability certifications and building performance evaluations (Johnston, 2020; Warner, 2022). In some countries, quantity surveyors are already practising these roles, leveraging their data handling capabilities and cost analysis expertise to support decarbonised construction.

Despite this potential, such expanded responsibilities are not yet widely institutionalised in Malaysia. While QS professionals are generally familiar with cost-related functions, such as life cycle costing and budget setting, there remains limited industry-wide adoption of tasks directly tied to carbon measurement and reporting (Salleh et al., 2020; Wong, 2017). This gap highlights the need for more robust professional development pathways and more explicit role definitions that align with national climate targets.

**Table 1.** The Progression of QS Roles

| Roles | Description | Authors |
|---|---|---|
| **Traditional Roles**<br>Core cost management activities such as cost estimation, procurement advice, tender documentation, and contract administration. | • Preparing cost estimates<br>• Contractual management<br>• Tender evaluation | RISM (2022); Salleh et al. (2020); Wong (2017); Olanrewaju & Anahve (2015) |
| **Expanded Roles**<br>Broader strategic contributions including life cycle costing, value engineering, sustainability advising, and BIM integration. | • Conducting life cycle cost analysis,<br>• Value engineering,<br>• Cost impact advice on green design | Warner (2022); Noor et al. (2020); PAQS (2019); Wong (2017) |
| **Emerging Decarbonisation Roles**<br>Advanced functions tied to carbon performance such as embodied carbon assessment, carbon footprint analysis, green cost planning, and advising on carbon reduction strategies. | • Measuring embodied carbon,<br>• Building performance reporting<br>• Low carbon material selection | Green Building Council of Australia (2022); Warner (2022); Johnston (2020); Salleh et al. (2020) |

As Malaysia continues its transition toward a low-carbon economy, quantity surveyors will be increasingly called upon to bridge the gap between economic and environmental objectives. To support this transformation, regulatory bodies and educational institutions must facilitate the integration of decarbonisation competencies into QS practice. Doing so will position the profession not only as a cost controller but also as a key enabler of sustainable construction.

## 3.0 METHODOLOGY

This study employs a quantitative survey to investigate awareness and QS roles in promoting decarbonisation efforts within the Malaysian construction industry. A structured questionnaire was developed based on an extensive review of existing literature on sustainability in construction, low-carbon practices, and QS professional competencies. The questionnaire consisted of three main sections, namely: 1) respondent background, 2) awareness of decarbonisation, and 3) QS roles in decarbonisation to strengthen QS involvement in the Malaysian decarbonisation initiatives.

A purposive sampling strategy was employed in this study to deliberately target quantity surveying professionals deemed relevant to the research objectives, particularly those with varying levels of experience and exposure to decarbonisation practices. This non-probability sampling approach allowed the researcher to focus on individuals who could provide meaningful insights into the awareness and evolving roles of quantity surveyors in the context of decarbonisation. The target population consisted of 5,496 registered quantity surveying professionals across Malaysia (Board of Quantity Surveyors Malaysia, 2024), and the recommended sample size for this study was 357 responses (Krejcie and Morgan, 1970).

The survey was administered online using Google Forms. Respondents rated their level of agreement on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), across items related to their understanding and perceptions of QS roles in decarbonisation. A total of 89 valid responses were successfully obtained. The sample included a diverse range of respondents from different professional categories, including technologists, provisional members, professional quantity surveyors, and consultants. Table 2 summarises the respondent demographics.

**Table 2.** Respondent Demographics

| Demographics | Frequency | Percentage (%) |
|---|---|---|
| **Education** | | |
| Diploma | 9 | 10.1 |
| Bachelor's degree | 68 | 76.4 |
| Master's degree | 9 | 10.1 |
| Doctorate | 3 | 3.4 |

| Demographics | Frequency | Percentage (%) |
|---|---|---|
| **Experience** | | |
| < 1 year | 13 | 14.6 |
| Between 1 to 5 years | 35 | 39.3 |
| Between 6 to 10 years | 6 | 6.7 |
| Between 11 to 15 years | 13 | 14.6 |
| Between 15 to 20 years | 4 | 4.6 |
| > 20 years | 18 | 20.2 |
| **Decarbonisation Knowledge** | | |
| Very low | 22 | 32.8 |
| Low | 13 | 19.4 |
| Medium | 13 | 19.4 |
| High | 10 | 14.9 |
| Very high | 6 | 9 |
| **Decarbonisation Experience** | | |
| No experience | 53 | 59.5 |
| < 1 year | 21 | 23.6 |
| Between 1 to 5 years | 12 | 13.5 |
| Between 6 to 10 years | 3 | 3.4 |
| > 10 years | 0 | 0 |
| **Total** | **89** | **100** |

Data analysis was conducted using IBM SPSS Statistics Version 27. To assess both the level of awareness and the perceived importance of quantity surveyors' roles in decarbonisation, the study employed the Relative Importance Index (RII). This method enabled the prioritisation of roles by identifying those most and least emphasised by respondents, offering insights into current professional focus areas within the industry. To examine whether perceptions varied based on respondents' experience with decarbonisation, the Kruskal-Wallis H test was applied. This non-parametric technique was selected due to the non-normal distribution of the dataset, as confirmed by the Kolmogorov-Smirnov test.

The hypothesis for this test was formulated as follows:

H1: There is no statistically significant difference in the perception of QS roles across different levels of decarbonisation experience.

The analysis was conducted at a 0.05 level of significance to determine whether the null hypothesis should be retained or rejected. Instrument reliability was confirmed through Cronbach's Alpha, which yielded an overall coefficient of 0.932, indicating excellent internal consistency. Content validity was established through expert review by academics and industry practitioners. A pilot test involving 15 participants helped refine the clarity and relevance of the items. These procedures ensured that the research instrument was both robust and methodologically sound for quantitative analysis.

## 4.0 FINDING AND DISCUSSION

### 4.1 Quantity Surveyor's Awareness Towards Malaysia's Decarbonisation Agenda

This study examined the level of awareness among Malaysian quantity surveyors (QS) regarding the national decarbonisation agenda, a crucial initiative aimed at achieving net-zero carbon emissions by 2050. The findings highlight that QS professionals demonstrate a moderate level of awareness of decarbonisation, particularly on global sustainability concerns. Table 3 summarises the QS awareness towards Malaysia's Decarbonisation Agenda. The top three ranked awareness-related topics regarding decarbonisation include sustainable construction (RII = 0.7618), the negative impact of carbon emissions (RII = 0.7416), and the global warming effects caused by carbon emissions (RII = 0.7281). Consistently, findings show Malaysian QS are highly aware of decarbonisation concepts, particularly those linked to environmental sustainability and global climate impacts.

**Table 3.** Relative Importance Index for Awareness of Quantity Surveyors Towards Malaysia's Decarbonisation Agenda.

| QS Decarbonization Awareness | Mean | RII | Rank |
|---|---|---|---|
| QS is aware about sustainable construction | 3.809 | 0.7618 | 1 |
| QS is aware that the carbon emission issue brings huge negative impact | 3.708 | 0.7416 | 2 |
| QS is aware about the serious global warming issues caused by carbon emissions | 3.640 | 0.7281 | 3 |
| QS is aware about the carbon emission issue from Malaysian construction industry | 3.551 | 0.7101 | 4 |
| QS is aware about the social responsibility in the decarbonised construction industry | 3.169 | 0.6337 | 5 |
| QS is aware about the decarbonisation pathways in Malaysian construction industry | 2.989 | 0.5978 | 6 |

However, lower rankings were observed for items directly related to Malaysia's decarbonisation agenda, such as "QS is aware about the carbon emission issue from the Malaysian construction industry" (RII = 0.7101), "QS is aware about the social responsibility in the decarbonised construction industry" (RII = 0.6337), and "QS is aware about the decarbonisation pathways in Malaysian construction industry" (RII = 0.5978). This contrast highlights a gap between general environmental awareness and specific understanding of Malaysia's national strategies. Consistent with the observations of Khan et al. (2024) and Crippa et al. (2020), awareness of decarbonisation tends to be more advanced in industrialised nations with stronger regulatory communication. Addressing this gap through continuing professional development, industry briefings, and curriculum integration is crucial to strengthening the role of QS in achieving Malaysia's decarbonisation targets.

These results suggest that although Malaysian quantity surveying professionals generally exhibit environmental awareness, there is a need to strengthen their understanding of Malaysian-specific decarbonisation mechanisms, including national carbon policies, regulatory frameworks, and industry-focused reduction strategies. Improving awareness in these areas is a critical step toward enabling more meaningful contributions to national carbon reduction efforts and supporting the construction sector's transition toward a low-carbon future.

### 4.2 Roles of Quantity Surveyors in Advancing Malaysia's Decarbonisation Agenda

To examine the contribution of Malaysian quantity surveyors to the national decarbonisation agenda, this study evaluated sixteen key professional functions using the Relative Importance Index (RII) and Kruskal-Wallis test. Table 4 summarises the findings on the Relative Importance and Perception Differences of Quantity Surveyor Roles in Supporting Malaysia's Decarbonisation Agenda. The findings highlight the prioritised roles and the extent to which perceptions differ based on experience. Specifically, "updating project cost estimation" was ranked as the most important role (RII = 0.8315), followed by "setting realistic budget for project" (RII = 0.8202) and "life cycle costing analysis (LCCA)" (RII = 0.8045). These findings reinforce the importance of cost-related competencies in quantity surveying practice, particularly in ensuring the financial viability of low-carbon design solutions and technologies. This finding is consistent with Salleh et al. (2020) and Wong (2017) on the importance of cost management as a critical enabler in achieving the effective implementation of green and decarbonised construction projects.

**Table 4.** Relative Importance and Perception Differences of Quantity Surveying Roles in Supporting Malaysia's Decarbonisation Agenda

| QS Role in Decarbonisation | Kruskal-Wallis p-value | Decision ($H_0$) | Mean | RII | Rank |
|---|---|---|---|---|---|
| Updating project cost estimation | 0.996 | Retain | 4.157 | 0.8315 | 1 |
| Setting realistic budget for project | 0.912 | Retain | 4.101 | 0.8202 | 2 |
| Life cycle costing analysis (LCCA) | 0.042 | Reject | 4.022 | 0.8045 | 3 |
| Cost benefit analysis (CBA) | 0.157 | Retain | 4.011 | 0.8022 | 4 |

| QS Role in Decarbonisation | Kruskal-Wallis p-value | Decision ($H_0$) | Mean | RII | Rank |
|---|---|---|---|---|---|
| Cost estimation for each building design iteration | 0.926 | Retain | 4.011 | 0.8022 | 4 |
| Review final bid documents with design team | 0.719 | Retain | 3.978 | 0.7955 | 6 |
| Green costing | 0.626 | Retain | 3.921 | 0.7843 | 7 |
| Building information modelling (BIM) | 0.833 | Retain | 3.921 | 0.7846 | 8 |
| Ensure costs and credits for low carbon features are accounted for | 0.259 | Retain | 3.843 | 0.7685 | 9 |
| Low carbon materials pricing and cost estimation | 0.709 | Retain | 3.831 | 0.7663 | 10 |
| Value engineering on low carbon materials | 0.662 | Retain | 3.798 | 0.7596 | 11 |
| Maintain database for low carbon products | 0.407 | Retain | 3.685 | 0.7371 | 12 |
| Carbon footprint management | 0.596 | Retain | 3.427 | 0.6854 | 13 |
| Low carbon footprint strategy development | 0.982 | Retain | 3.371 | 0.6742 | 14 |
| Low carbon building rating assessment | 0.632 | Retain | 3.303 | 0.6607 | 15 |
| Building performance reporting | 0.012 | Reject | 3.191 | 0.6382 | 16 |

The Kruskal-Wallis test revealed statistically significant differences in two roles based on respondents' level of experience in decarbonisation: LCCA ($p = 0.042$) and building performance reporting ($p = 0.012$). The differences infer greater exposure to decarbonised projects influences the recognition of specific QS responsibilities. In the case of LCCA, experienced professionals may better appreciate its role in long-term cost and carbon efficiency (PAQS, 2019; Olanrewaju & Anahve, 2015).

Furthermore, "building performance reporting" not only ranked lowest (RII = 0.6382) but also showed significant variation in perception. This reflects the conventional view that such reporting falls under the purview of facility managers or building owners (Salleh et al., 2020; Wong, 2017). However, as operational carbon becomes a central focus in Malaysia's construction decarbonisation efforts, re-evaluating professional boundaries and responsibilities becomes increasingly essential (Khan et al., 2024; Ballesty & Sawhney, 2023).

Overall, the findings highlight that QS professionals in Malaysia are well aligned with cost-related roles in low-carbon projects and are gradually recognising sustainability-linked responsibilities. However, the limited recognition of certain functions, particularly those beyond traditional scopes, highlights the need to professionalise further and adapt the QS role in line with Malaysia's decarbonization agenda. Strengthening policy alignment, providing structured competency frameworks, and encouraging interprofessional collaboration will be essential to enable QS practitioners to make meaningful contributions to national carbon reduction goals.

## 5.0 CONCLUSION

This study examined the awareness and roles of Malaysian QSs in supporting the national decarbonisation agenda, which targets net-zero carbon emissions by 2050. The findings highlight that QS professionals possess a strong foundational understanding of general decarbonisation concepts, particularly in areas related to sustainable construction and the broader environmental impacts of carbon emissions. However, the study also identified limited awareness of Malaysia-specific decarbonisation strategies, policies, and implementation pathways. This indicates a critical gap between global environmental knowledge and the practical understanding required to contribute effectively to national carbon reduction efforts.

In evaluating sixteen key QS functions, the study confirmed the continued prominence of cost-related roles in decarbonised construction projects. Roles such as updating project cost estimation, setting realistic budgets, and conducting life cycle costing analysis (LCCA) were ranked most important, reinforcing the QS profession's financial stewardship in advancing low-carbon initiatives. Notably, the Kruskal-Wallis test

revealed significant differences in perception for LCCA and building performance reporting, suggesting that experience in decarbonised projects influences the recognition of more specialised or emerging responsibilities. These findings underscore the need to expand the traditional QS role to include sustainability-linked functions that align with the evolving demands of Malaysia's decarbonisation agenda.

To address these challenges and fully mobilise QS professionals in the national decarbonisation effort, stronger policy integration is required. This includes embedding decarbonisation-related competencies into professional accreditation frameworks and national competency standards. Regulatory bodies such as the Board of Quantity Surveyors Malaysia (BQSM) and the Construction Industry Development Board (CIDB) are well-positioned to drive these changes by enhancing continuing professional development programmes and promoting interdisciplinary collaboration. Encouraging QS involvement in early-stage sustainability planning can also accelerate carbon reduction outcomes. Ultimately, aligning policy, education, and practice is crucial to empowering QS professionals to make meaningful contributions to Malaysia's low-carbon transition and long-term climate commitments.

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## 7.0 AUTHOR CONTRIBUTIONS

Hsiao Yun is a Bachelor of Quantity Surveying candidate who works on this research, and Saipol Bari Abd Karim is the supervisor.

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