Towards Standardising Landscape Construction Quality in Malaysia: Integrating Design Content and Construction Workmanship for Holistic Assessment

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First submission: 19 October 2025 | **Accepted:** 31 December 2025 | **Published:** 30 June 2026

To cite this article: Noor Syarafina Mohd Fauzi, Mohd Sallehuddin Mat Noor, Norhuzailin Hussain and Siti Sarah Herman (2026). Towards standardising landscape construction quality in Malaysia: Integrating design content and construction workmanship for holistic assessment. *Journal of Construction in Developing Countries*, 31(1): 165–198. https://doi.org/10.21315/jcdc.2026.31.1.7

To link to this article: https://doi.org/10.21315/jcdc.2026.31.1.7

Abstract: The landscape industry has been wrestling with the intellectual and practical challenge of quantifying landscape quality for decades. The non-existence of a holistic framework for assessing physical landscape quality has severely restricted the Malaysian construction industry in evaluating the design, construction and operational quality, thereby limiting long-term benefits from the landscape industry subsector. Numerous deficiencies in landscape implementation and management result in the landscape quality being deemed substandard in construction evaluations. The problem stems from several interrelated factors, particularly the lack of a structured quality measurement system and the absence of established standards in the landscape and construction sector. This gap has contributed to inconsistent project outcomes, a lack of quality standards and persistent misconceptions on landscape scope of work. Therefore, this study aims to identify key criteria required to establish a comprehensive landscape physical quality assessment (LPQA) model that integrates both intangible design content (macro elements) and tangible construction workmanship (micro elements). A mixed-methods explanatory sequential design was employed. A total of 238 industry professionals participated in a structured survey to evaluate the importance of various macro and micro indicators. Subsequently, a focus group discussion involving 17 experts was conducted to verify findings, refine indicator adequacy and identify emerging dimensions relevant to Malaysia's landscape context. Findings reveal that design quality such as ecological sustainability, cultural and heritage values, territorial justice, collective memory and quality and health are highly significant macro-level contributors to physical landscape quality. At the micro level, construction workmanship, particularly bio-structural and bio-mechanical performance, emerged as a critical determinant of long-term quality. This study establishes a set of 27 key indicators and proposes a conceptual LPQA model to guide landscape quality benchmarking across diverse non-building projects in Malaysia. Strong correlations were found between macro elements and micro elements, affirming that high-quality landscapes require the integration of both design intent and construction execution.

Keywords: Landscape physical quality assessment, Workmanship quality, Landscape evaluation, Non-building projects, Quality standard

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INTRODUCTION

Currently, the community express concerns regarding their surrounding environment, particularly in proximity to their neighbourhood and workplace. Meanwhile, the natural area holds onto balanced ecosystems to ensure the long-term sustainability of flora and fauna. This situation underscores the necessity for high-quality landscape design and practices in modernisation. Nevertheless, the quality within a landscape context exhibits variability. Assessing landscape quality via aesthetics, sustainability practices and rigorous adherence to construction standards may be regarded as a challenging pragmatic approach to this issue. Similar to a long-running argument in aesthetics philosophy, the history of landscape quality assessment has seen a conflict between expert-or-design approach and perception-based approaches (Conrad et al., 2019; Chien, Carver and Comber, 2021). In environmental management practice, the expert method has predominated, while the perception-based approach has predominated more in research (Daniel, 2001). Both points of view typically agree that landscape quality derives from an interaction between biophysical features of the landscape and perceptual-or-judgmental processes of the human viewer (Dupont et al., 2017; Cai, Huang and Lin, 2022). This issue is critical in landscape development, as currently, there is no specific quality standard to monitor and control (Ibrahim, Rahman and Tahir, 2009; Qi et al., 2023) the overall quality aspect for landscape elements and sector in Malaysian construction industry as landscape project is considered unique for having form of construction that blend the inert materials with the living plants, or commonly known as the hardscape and the softscape, within the environment. This matter has deliberately fostered a long-running dispute among industry stakeholders, including landscape architects, contractors, developers and regulators, regarding the delineation of landscape work's scope. Debates remain recurring in determining the elements to be quantified in the quality assessment of non-building projects.

However, depending on ISO 9000:2000, quality was defined as a degree to which a set of inherent characteristic fulfils the requirement that causes the outcome to be either acceptable or not (Suratkon, Chan and Jusoh, 2016; Project Management Institute, 2017; Sani, Sharip and Ibrahim, 2020). Thus, in built environment context, the landscape designer's role in a landscape project is to perceive a site's potential and graphically represent the ideas in visuals while meeting the needs of the client. A landscape contractor, on the other hand, is required to possess a wide range of skills, including construction techniques, to be able to take ideas and transform them into a finished product. In its most basic form, a landscape contractor is responsible for determining the overall outcome of every construction job, while a landscape architect is responsible for envisioning and meeting the requirements of the public at large. Nevertheless, to date, Othman (2020) stated that the varying

scales of green spaces in the construction project reveal that both softscape and hardscape elements exhibit deficiencies in workmanship quality, warranting scrutiny during site visits and final inspections by local authorities and project team members, thus causing a poor landscape quality. Therefore, this study delineates the fundamental criteria for evaluating landscape design and construction components within the Malaysian construction sector. This study's underlying concept highlights a crucial need to standardise industry measurement standards and achieve a sustainable, high-quality landscape.

LITERATURE REVIEW

History of landscape quality and the approaches to quantify the quality aspects in landscape have been in debate and long-term research for a broad academic body, which defines the resource and understanding towards landscape assessment and the definition. It ranges from more fragmented and static to more holistic, dynamic and multisensory involvements in evaluating the specific landscape value and quality. The multidiscipline of landscape study defines that the spatial scale of the landscape is between the ecosystem and the region, and it is the broad spatial scale most closely related to human beings (Song et al., 2022).

Landscape is a result from the way that different components of our environment—both natural (the influences of geology, soils, climate, flora and fauna) and cultural (the historical and current impact of land use, settlement, enclosure and other human interventions)—interact together and are perceived by us. People's perceptions turn land into the concept of landscape (Swanwick and Land Use Consultants, 2002; Swanwick, Dunnett and Woolley, 2007 as cited in Davoudi and Brooks, 2019).

Landscape is a multi-dimensional concept that is often challenging to evaluate due to its broad scope and diverse components. To date, existing approaches have not fully captured its limits or complexities. Landscape architects are responsible to plan, design and also manage both natural and built environment – which means ensuring the provision of high-quality and functional spaces (Stauskis, 2020; Gkoltsiou and Forczek-Brataniec, 2024) that applies the concept and elements of aesthetic and specific design principle that suits the site condition (Ono, 2015). Additionally, the top priority for them to consider is addressing current and repetitive issues on site, such as ecological sustainability, landscape quality and health, depicting collective memory on site, conserving treasured heritage and culture, and focusing more on territorial justice (International Federation of Landscape Architects, 2022). As a result, by leading and coordinating multiple sources from various disciplines, landscape quality research in general aims to integrate and

interact between natural and cultural ecosystems, as well as community health and welfare, to create places that anticipate social and economic well-being. According to Wartmann et al. (2021a) and Schirpke et al. (2023), landscape quality is not only in terms of preserving landscape ecological patterns and following the preferences and human needs, but also in terms of their contribution to people's quality of life, i.e., mental therapy, health support through exercise, space to socialise, and emotional supports such as experiences and memories (Qiao, Liu and Feng, 2022; Tan et al., 2024).

Meanwhile, talking about the built environment element, the kinds of built structures or construction development often viewed and described as human material encroachment, associated with negative impacts on perception of landscape quality, or as part of a larger category of "disturbance" especially towards natural ecosystem (Brush, Chenoweth and Barman, 2000; Rechtman, 2013; Tveit, Ode and Fry, 2006 as cited in Davoudi and Brooks, 2019). Human disturbance has a greater impact on landscape quality than natural factors (Squires, 2002 as cited in Huang, Wang and Zhang, 2022). Although the importance of assessing contributions of nature and landscapes to people's quality of life is increasingly recognised through frameworks such as ecosystem services through ecological metrics are well advanced (Bieling, 2014; Gould et al., 2015; Scholte et al., 2015 as cited in Wartmann et al., 2021b), the landscape construction quality assessment has comparatively underdeveloped (Kamal et al., 2021).

Despite this difficulty, to date, more researchers have highlighted as much as possible related indicator for the landscape quality evaluation (as shown in Figure 1). This effort has underlined both the value of people's engagement (Motealleh et al., 2019; Van der Hoeven, 2019) and experience of landscape (Eskandari and Motamedi, 2021; Salem, Khalifa and Tarek, 2022), aesthetic appreciations and also landscape quality evaluation that is easily overlooked in detailed and inventorial techniques to monitor the natural environment and the construction elements. Perhaps, it is essential to understand how alterations in landscape composition transfer to the visible landscape; towards the sense of landscape connection, sustainability and identity, and how this influences public perception (Tveit, Ode and Fry, 2006; Roe et al., 2013 as cited in Saldias and McGlade, 2023), whether physical landscape elements and structures also relate to how people assess landscapes.

According to Lothian (1999), methods for evaluating landscapes are known as the objectivist or physical paradigm and the subjectivist or psychological paradigm, besides a new approach known as the "convergent approach" being invented and combined to create one that includes the opinions of both experts and the public at large (Mundher et al., 2022). Depending only on public perception may result in a deviation from the expertise and valued opinions of subject-matter experts.

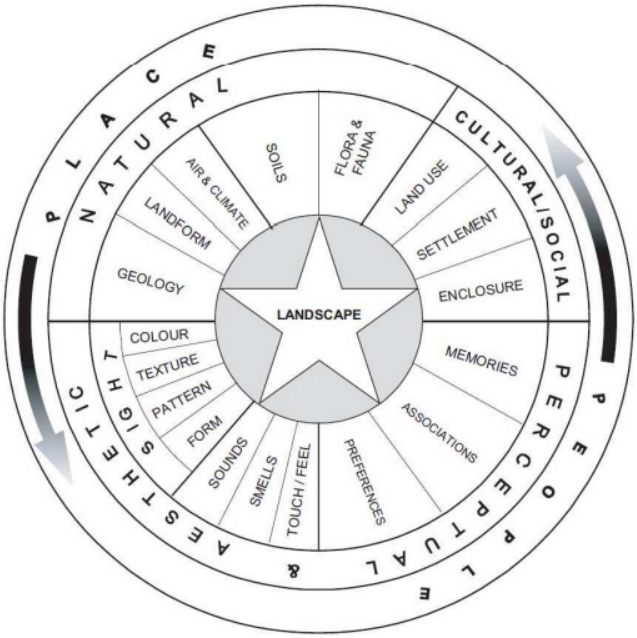

Figure 1. Indicators for landscape

Source: Kaymaz (2012)

Therefore, based on the literature study landscape quality is consistently discussed through a combination of environmental, perceptual, social and technical indicators. Commonly cited variables as synthesised in Figure 2, landscape quality indicators in the literature encompass a bigger picture which responded to the perspectives on ecological sustainability (e.g., habitat quality, biodiversity, soil and water condition), aesthetic and perceptual qualities, social and functional attributes and cultural dimensions. In construction-related studies, landscape quality is further linked to technical and workmanship-related variables such as material quality, installation methods, durability and maintenance performances. Thus, these indicators collectively inform the development of the holistic framework, which synthesises both design-related (macro) and construction-related (micro) landscape quality variables into a unified assessment structure.

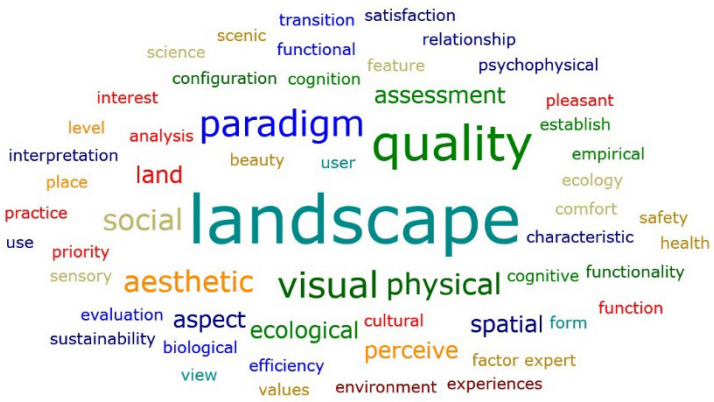

Figure 2. Word cloud defining the indicator synthesis to be inclusively considered in landscape physical quality assessment (LPQA) based on the literature study

METHODOLOGY

This research used a sequential explanatory design, which collects and analyses quantitative data before explaining quantitative findings with qualitative data (Ivankova, Creswell and Stick, 2006). The researcher used the qualitative data to clarify unexpected or contradictory results from the quantitative analysis (Dunwoodie, Macaulay and Newman, 2023), to clearly define that this selection is the most compatible to define the significant findings of the study that varies and have multidisciplinary thoughts. First, the study employed stratified purposive sampling (as shown in Figure 3) to ensure representation from key stakeholders within the Malaysian landscape and construction industry. Respondents were selected based on predefined inclusion criteria, namely: (1) a minimum of five years of professional experience (as shown in Figure 4), (2) involvement in landscape or construction-related projects and (3) possession of at least a bachelor's degree in a relevant discipline. The questionnaire survey was released to the industry stakeholders ranging from professionals from multiple sectors including landscape consultants, landscape contractors, government agencies, local authorities and academicians (as shown in Figure 5). This cross-sectoral representation ensured balanced expert input relevant to both design and construction workmanship aspects of landscape.

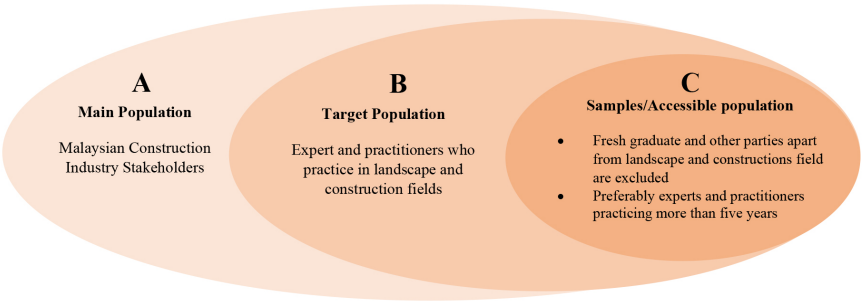

Figure 3. Population, target population and sample for the study

Source: Adopted from Shamsuri (2004)

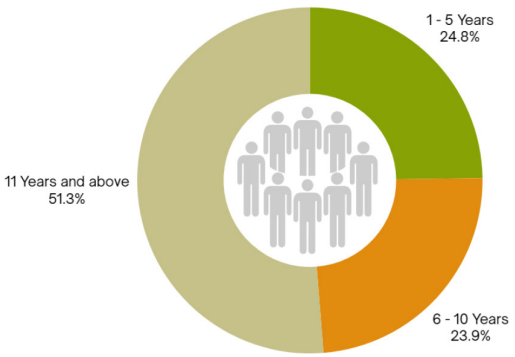

Figure 4. Distribution of respondents' working experiences (*n* = 238)

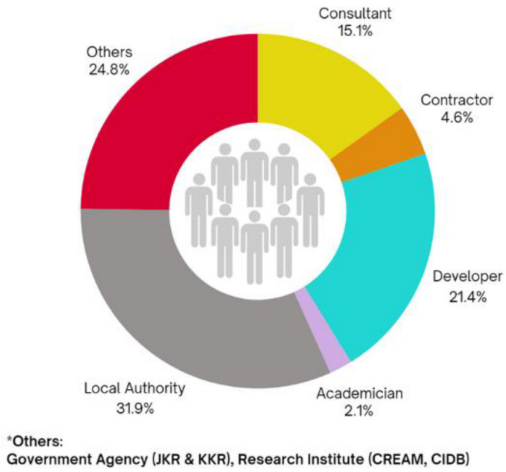

Figure 5. Distribution of respondents' business sectors (*n* = 238)

The survey was administered through a combination of online (Google Forms) and manual distribution methods between September 2023 to April 2024. While the online response rate was initially low (n = 7 within 3 months), the manual distribution significantly improved participation among targeted professional groups (n = 231 response out of 400 copies of hardcopy survey distributed). From the total questionnaires distributed, 238 complete and usable responses were obtained, which is considered statistically adequate for explanatory and factor-based analysis in construction and built environment research. To ensure the internal consistency and reliability of the questionnaire instrument, a Cronbach's alpha reliability analysis was conducted for each major construct within the survey.

This research used a Likert scale, which show a five-point rating scale for each section in the questionnaire survey. Parts 2 and 5 used a rating scale ranging from 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree. This is due to the objective on measuring the aspect of agreement, thus, determining their level of understanding towards the current state and condition of landscape and construction industry in Malaysia. Meanwhile, Parts 3 and 4 used a scale ranging from 1 = Not Important, 2 = Slightly Important, 3 = Moderately Important, 4 = Important and 5 = Very Important, to identify the level of significance of each indicator for both macro and micro elements. The survey consists of five parts (as shown in Table 1) and it takes about 10 min to 15 min to be completed by the respondents. The data were then recorded in Excel format and analysed using the Statistical Package for the Social Sciences (SPSS) version 29 (IBM Corp., Armonk, NY, US). Each part of the question was purposely designed to study the level of understanding and importance of assessment factor in evaluating the landscape quality, the category which reflect the design-elements and construction-elements to be considered in the quality assessment.

Table 1. The contents structure of the questionnaire survey

Part	Detail
1	Demographic profile
2	To study the perception and understanding of the respondents toward landscape and construction industry in Malaysia
3	To study the significance of design contents (intangible elements) assessment in defining higher quality of a physical landscape – Macro element
4	To study the significance of landscape construction workmanship (tangible elements) assessment in defining higher quality of a physical landscape – Micro element
5	To study the significance of design content (intangible elements) and construction workmanship (tangible elements) in LPQA

Subsequently, the reliability of the quantitative findings was strengthened through methodological triangulation, whereby the survey results were validated through focus group discussion (FGD). The researchers selected 30 expert personnel from the industry comprising contractors, consultants, regulators, academicians and local authority for the FGD. This FGD was aimed to gather additional information and emerging theory which might be overlooked in the quantitative survey. This is because, from a pragmatism stance, qualitative verification enhances the credibility and confirmability of the identified indicators and ensures alignment between statistical results and expert consensus. Unfortunately, only 17 personnel were able to attend the FGD on the stipulated date. During the FGD, they were divided into five different groups and five trained facilitators were assigned to moderate them. Each of them was given a hardcopy of the LPQA conceptual model and any emerging comments and consensus (possible missing indicator or inappropriate indicator) were discussed and recorded carefully by the facilitators. The researchers then transcribed all the data, sorting into themes and analysed using the Atlas.ti version 24 (ATLAS.ti GmbH, Berlin, Germany).

This study employed methodological triangulation to integrate findings from the quantitative questionnaire survey and the qualitative FGD. The survey data were first analysed to identify statistically significant landscape quality indicators and their relative importance between design-related and construction workmanship-related elements. Subsequently, the FGD was conducted to interpret, verify and refine these quantitative findings by drawing on expert knowledge and professional experience. Through this triangulation process, the final findings reflect both empirical consensus and expert validation, strengthening the credibility and applicability of the result of the study.

RESULTS

Findings of the Questionnaire Survey

In the initial stages, the researchers emphasised five primary categories or themes that were discovered during the metadata analysis study. The significance of each component that should be taken into account in LPQA has been highlighted by these five categories. The graphical results in Figure 6 are based on validated Likert-scale responses, with reliability confirmed through Cronbach's alpha analysis. The results indicate that all constructs achieved acceptable to excellent reliability, with Cronbach's alpha values exceeding the recommended threshold ranging from 0.70 to 0.92, confirming strong internal consistency of the measurement items. Mean values and frequency distributions are used to reflect the relative importance of each indicator. Each category was determined to be highly significant for evaluating landscape

quality based on the results. Finding the relative importance of each category is the first objective. This demonstrates that it is crucial to quantify the role of the design and construction quality depicted in landscapes. Aesthetic appeal, perceived character and landscape value demonstrate how people view and appreciate the landscape, while the landscape's overall quality, which benefits both humans and nature in the most sustainable way, is demonstrated by its function, condition and sustainability. The landscape architect and contractor are able to fully utilise the space and recognise the needs in their design as a result of the thorough preliminary study of the site's condition and sensitivity. As a result, an ideal landscape benefits the surrounding community and environment by being of high quality and functioning well.

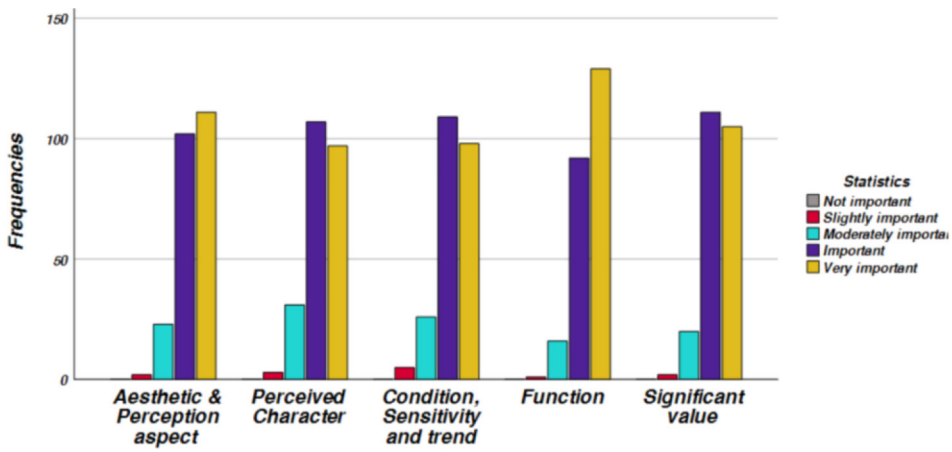

Figure 6. Level of importance of the significant factors in landscape assessment in LPQA (n = 238)

There are multiple elements need to be considered in landscape quality assessment. Hence, this research has come out with a theme, which is "Landscape Assessment" and is divided into two categories: design quality (macro elements) and construction workmanship quality (micro elements). The micro elements show the construction quality while the macro elements focus on the design quality in a landscape. Figure 7 illustrates respondents' perceptions of the importance of five macro elements in the LPQA framework: "Collective Memory", "Territorial Justice", "Ecological Sustainability", "Quality and Health" and "Heritage and Culture". Each category is evaluated across five levels of importance: "Not Important", "Slightly Important", "Moderately Important", "Important" and "Very Important". "Ecological Sustainability" emerged as the most highly valued element, with 56.7% of respondents rating it as very important. This reflects a strong prioritisation of environmental concerns in landscape quality assessments.

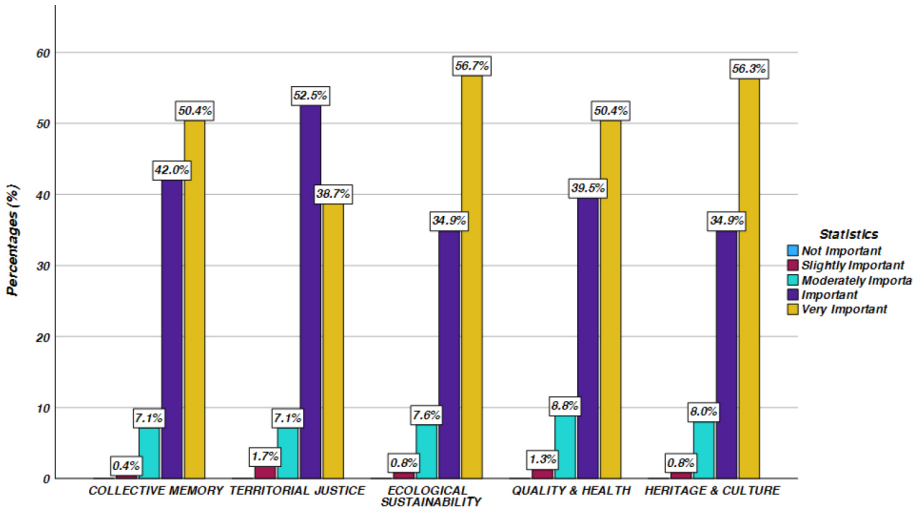

Figure 7. Mean and frequency distribution of respondents' ratings on the importance of five macro-level landscape quality categories (*n* = 238)

"Heritage and Culture" followed closely, receiving 56.3% under the very important category, suggesting a significant recognition of cultural identity and heritage in shaping meaningful landscapes. "Quality and Health" also received strong support, with 50.4% rating it as very important and 39.5% as important, indicating wide consensus on the importance of healthy and functional landscapes. "Territorial Justice" and "Collective Memory" received slightly lower, but still notable, very important ratings at 52.5% and 50.4%, respectively. These findings highlight growing attention to social equity and community memory in the design and assessment of landscapes. Meanwhile, responses for not important and slightly important categories were minimal (all under 2%), demonstrating overwhelming agreement on the relevance of all five macro elements.

Meanwhile, Table 2 shows in detail the data distribution (mean and median) for all the indicators studied under the five categories. All of the listed indicators are the common general aspect in landscape to show the overall picture of the significant element to be assessed which could be expanded further in future. The researchers have highlighted three top indicators that are the most considered in quantifying the landscape quality and key successful criteria for an ideal landscape design: "Nature preserve" (4.55), "Habitat creation, preservation and restoration" (4.54) and "Carbon, energy, water and air quality" (4.48). The main significant aspect that received the highest frequencies is nature preserve (as shown in Figure 8). This demonstrates that the nature preserve in cultural and heritage landscape is important to be assessed by providing benchmarks for naturalness, biodiversity and ecological integrity for the sake of contributing to overall landscape health and human well-

being. Natural environment offers mental calmness and treatment to heal human from stress and disturbing surrounding while preserving landscape through design and built by protecting and preserving the value of naturalness and services for a long term. Nature preserve is considered as instrumental assessment for ecological integrity that can later establish a baseline for what constitutes a healthy and functional ecosystem.

Table 2. Level of importance of an indicator in the five categories in landscape quality assessment

Category	Example of Indicator	Valid (*N*)	Mean	Median
Collective Memory	Land efficiency/preservation	238	4.34	4.00
	Scenic quality and views	238	4.42	5.00
	Character, identity and image restoration	238	4.42	5.00
	Cultural preservation/social value	238	4.43	5.00
	Perceptual and aesthetic	238	4.32	4.00
Territorial Justice	Safety and well-being	238	4.44	5.00
	Access and equity	238	4.26	4.00
	Spatial condition	238	4.33	4.00
	Spatial resources	238	4.12	4.00
	Settlement pattern and enclosure	238	4.16	4.00
Ecological Sustainability	Habitat creation, preservation and restoration	238	4.54	5.00
	Habitat quality	238	4.45	5.00
	Population and species richness	238	4.42	5.00
	Carbon, energy, water and air quality	238	4.48	5.00
	Soil creation, preservation and restoration	238	4.44	5.00
Quality and Health	Recreational and social values	238	4.43	5.00
	Food production	238	3.97	4.00
	Waste reduction	238	4.16	4.00
	Flood protection	238	4.42	5.00
	Operation and maintenance	238	4.34	4.00
	Pollution mitigation	238	4.42	5.00
	Biosafety	238	4.46	5.00

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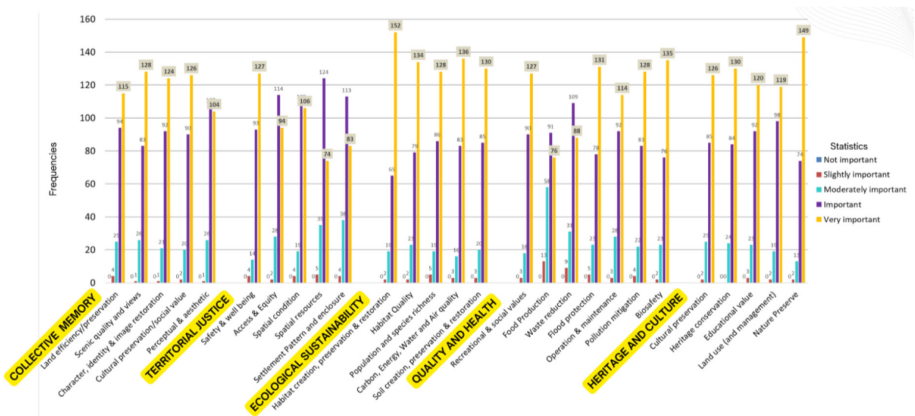
Table 2. *Continued*

Category	Example of Indicator	Valid (*N*)	Mean	Median
Heritage and Culture	Cultural preservation	238	4.41	5.00
	Heritage conservation	238	4.45	5.00
	Educational value	238	4.38	5.00
	Land use (and management)	238	4.40	4.50
	Nature preserve	238	4.55	5.00



Note: Frequencies based on number respondents.

Figure 8. The significance of all macro critical success factors in LPQA

Second, habitat creation, preservation and restoration are closely related to nature preserve. These frequencies showing how significantly related all of these categories and indicators are towards the landscape quality assessment. Nature integrity plays a significant role in ensuring a harmonious and healthy living environment in an area. Despite having rapid growth development, urban and suburban area should have accompanied by sustainable planning that helps to protect the habitat of all. Assessment focusing on soil stability, flora and faunas' preservation and even a restoration on biodiversity and ecosystem health can use a recent method ranging from on-the-ground assessments to sophisticated modelling using remote sensing and geographic information system data. These could completely examine the overall condition of vegetation, including its structure, composition and health, relative to a benchmark for an excellent habitat criterion.

Next, carbon, energy, water and air quality are a complex indicator to be measured. However, these assessments help in understanding the impact of land use changes, urban development and other projects on the environment and human well-being. Environmental sustainability is the foundation in landscape quality assessment. To achieve sustainability index, key aspect

such as carbon footprints, energy used, wastewater management and others need to be analysed comprehensively. Therefore, baseline study needs to be done by coordinating a strategic collaboration with various parties such as research groups, universities, non-governmental organisations and government agencies. Overall, Figure 8 shows the visual of all important criteria to be quantified in LPQA. The study has identified 27 significant indicators divided by five categories to be thoroughly assessed to determine high-quality physical landscape.

In continuation, the study has expanded to the micro elements part. The construction quality in this study has been highlighted by four data categories (micro elements): (1) "Foundation", (2) "System and Subsystem", (3) "Structural System" and (4) "Landscape Features". Each of these elements were strategically compared through three important aspects: (1) aesthetic value, (2) biomechanical value and (3) biostructure value. By referring to the data in Table 3, the frequency of respondents who answered all of the questions in Part 4, to study the significance of landscape construction workmanship (tangible elements) assessment shows that biostructure value is the most important factor in determining the construction workmanship quality for the LPQA rather than biomechanical and aesthetic value. The aesthetic value represents the importance of intrinsic beauty in workmanship, while biomechanical value represents the importance of sustainable modification and implementation of structure and functionality of the construction elements. Meanwhile, biostructure value represents the importance of sustainable system in enhancing the functionality of the construction elements in landscape context. This survey had given the chances to the respondents to either choose all three or just one important aspect to be considered in workmanship quality assessment in landscape.

According to the data analysis finding in Table 3, the "missing" column indicates the number of respondents who did not choose the variable as the key criteria for measuring the value in construction quality. Majority of the respondents found that aesthetic value is the least to be considered in construction workmanship quality whereas, biostructure value is the most important to be measured at the very first place for all four variables: (1) "Foundation", (2) "System and Subsystem", (3) "Structural System" and (4) "Landscape Features". Only a few of them were hesitant that biostructure and biomechanical aspects in construction workmanship should been neglected without proper assessment. Nevertheless, referring to the mean value, each indicator of assessment for construction quality were found to be significantly important to determine the construction quality in physical landscape. Therefore, LPQA might have developed a proper weightage to evaluate these three aspects. According to the data in Figure 9, 34.5% from 238 respondents opined that biostructure value is very important factor to be assessed in construction, followed by biomechanical value (32.5%) and aesthetic value (30.3%).

Table 3. Data analysis summary of the significant value category of micro element in LPQA

Variable	Indicator/Critical Success Factor	Aesthetic			Biomechanical			Biostructure		
		N			*N*			*N*		
		Valid	Missing	Median	Valid	Missing	Median	Valid	Missing	Median
Foundation	Biodiversity and wetland treatment	228	10	4.00	230	8	4.00	236	2	4.00
	Soil and erosion treatment	226	12	4.00	228	10	4.50	237	1	4.00
	Ecotoxicology (study of the toxic effects of major pollutants on ecosystems, animals, vegetation and microbial organisms)	228	10	4.00	230	8	4.00	237	1	4.00
	Energy restoration	228	10	4.00	231	7	4.00	236	2	4.00
	Waste management	228	10	4.00	231	7	4.00	236	2	4.00
	Exotic species treatment	228	10	4.00	229	9	4.00	238	0	4.00

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Table 3. *Continued*

Variable	Indicator/Critical Success Factor	Aesthetic			Biomechanical			Biostructure		
		N			*N*			*N*		
		Valid	Missing	Median	Valid	Missing	Median	Valid	Missing	Median
System and Subsystem	Site grading and earthwork (land preservation or restoration)	229	9	4.00	229	9	4.00	235	3	4.00
	Stormwater management (drainage, reservoir, irrigation and sewage)	226	12	4.00	228	10	4.00	234	4	5.00
	Access and circulation	228	10	4.00	229	9	4.00	235	3	4.00
	Soil preservation and/or conservation	227	11	4.00	226	12	4.00	236	2	4.00
	Water preservation and/or conservation	228	10	4.00	227	11	5.00	236	2	4.50
	Habitat preservation and/or conservation	228	10	4.00	228	10	4.50	237	1	4.00
	Vegetation preservation and/ or conservation	228	10	4.00	226	12	5.00	237	1	4.00
Structural System	Retaining wall	226	12	4.00	226	12	4.00	235	3	4.00
	Fence, screen and wall	229	9	4.00	227	11	4.00	235	3	4.00
	Small dam	227	11	4.00	228	10	4.00	235	3	4.00
	Surfacing and paving	229	9	4.00	227	11	4.00	236	2	4.00
	Wood deck and boardwalk	227	11	4.00	226	12	4.00	234	4	4.00
	Bridge	226	12	4.00	226	12	4.00	236	2	4.00
	Irrigation and drainage	227	11	4.00	228	10	4.00	236	2	4.00

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Table 3. *Continued*

Variable	Indicator/Critical Success Factor	Aesthetic			Biomechanical			Biostructure		
		N			*N*			*N*		
		Valid	Missing	Median	Valid	Missing	Median	Valid	Missing	Median
Landscape Features	Site furniture/features (e.g. renovation work)	229	9	4.00	225	13	4.00	234	4	4.00
	Recreational and athletics (e.g. synthetic lawn/track)	229	9	4.00	225	13	4.00	234	4	4.00
	Pools and fountain	228	10	4.00	227	11	4.00	234	4	4.00
	Outdoor lighting	229	9	4.00	226	12	4.00	232	6	4.00
	Building facilities	229	9	4.00	226	12	4.00	233	5	4.00
	Plants	229	9	5.00	224	14	4.00	234	4	4.00

According to Figure 9, aesthetic value, biomechanical value (installation and modification) of an element and biostructure value (sustainable system) in landscape workmanship quality should have been well-assessed to maintain the functionality of the construction elements. Landscape design does not merely include the "cosmetic aspect" or literally called as the visual beauty of a place but poses a functional aspect for multipurpose intention to help in balancing the ecological system and human needs.

Therefore, detailed assessment on site foundation, soil works and treatment, structural system, stormwater management and landscape features are the example of thorough assessment that should be done to maintain the quality of an area. Specifically, sensitive area, culturally significant and historical area need a careful study to be developed. Hence, preliminary study needs to be done by integration of all specialists such as ecologist, naturalist, landscape architect, arborist and many more to gain much more insight. Broader knowledge and information gathered—soil toxicology index, water quality index, method of constructing and system—helps to increase the value and quality of a physical landscape.

Meanwhile, the correlations results (as shown in Table 4) present Spearman's rho correlation, indicate the significance value (*p* value) and the sample size (*n* = 238) that the calculation was based on. A Spearman's rank-order correlation was run to determine the relationship between the Macro elements and micro elements, as a significant success factor for LPQA in determining a high-quality landscape. According to all the results, both of the macro and micro elements have a significantly strong correlation as a success factor for LPQA. This analysis confirmed that there is a significant relationship among landscape content (macro elements) and landscape construction workmanship (micro elements) to deliver and experience higher landscape physical quality. Landscape design and construction project which adapted both design content and construction workmanship in a given landscape context are likely to have higher landscape physical quality.

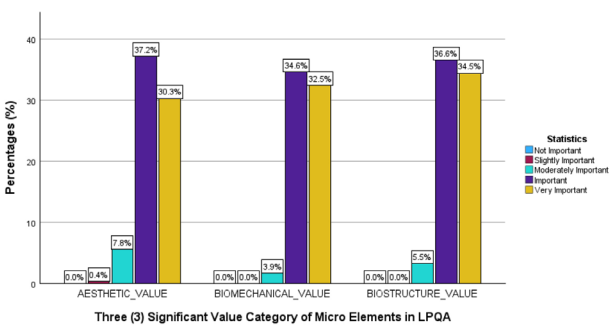

Figure 9. Level of importance of key physical quality landscape assessment criteria for measuring landscape construction workmanship (micro elements – tangible) (*n* = 238)

Table 4. Results of the Spearman's rho correlation-coefficient test (significant success factor for LPQA)

Critical Success Factor Macro Elements/Micro Elements			Collective Memory	Ecological Sustainability	Heritage and Culture	Quality and Health	Territorial Justice
Spearman's rho	Foundation	Correlation coefficient	0.407*	0.487*	0.561*	0.603*	0.404*
		Sig. (2-tailed)	–	–	–	–	–
		N	238	238	238	238	238
	System and subsystem	Correlation coefficient	0.510*	0.496*	0.557*	0.495*	0.425*
		Sig. (2-tailed)	–	–	–	–	–
		N	238	238	238	238	238
	Structural system	Correlation coefficient	0.434*	0.407*	0.480*	0.462*	0.432*
		Sig. (2-tailed)	–	–	–	–	–
		N	238	238	238	238	238
	Features	Correlation coefficient	0.434*	0.403*	0.452*	0.448*	0.425*
		Sig. (2-tailed)	–	–	–	–	–
		N	238	238	238	238	238

**Note*: Correlation is significant at the 0.01 level (two-tailed).

Findings of the Focus Group Discussion: Macro Elements

To test the criteria of landscape content and landscape construction workmanship that has been listed in the survey, the research has done an FGD to verify the results. The purpose of selecting professionals and experts in the industry to participate in this FGD is to confirm and establish the result of the survey. The validity of the collected data is considered accurate to be used for the LPQA in the future. Based on the result of questionnaire survey, most of the respondents strongly agreed upon the key criteria for the LPQA framework. The detailed comments on the macro elements for the LPQA framework are described as follows.

Macro element 1: Landscape contents as "Collective Memory"

Figure 10 illustrates the adequacy of indicators in defining landscape contents as a form of collective memory. It synthesises key thematic connections derived from the FGD discussion, Group 1: Collective Memory. Respondent 1 suggested that by dividing the project into a category such as according to their types of landscape criteria might help in determining the types of landscape project and can be easier to be assessed in future. According to all of the respondents, they are agreed that these LPQA indicators were adequate to be assessed especially when it encompasses perceptual and aesthetic values. Respondents 2 and 3 then added that contemplative or restorative landscape model, together with the landscape character assessment, they highlight the multidimensional nature of landscapes, where both tangible and intangible attributes inform their collective meaning. Therefore, these indicators of assessment were slightly important to determine the value and quality of a landscape contents. The adequacy of such indicators lies in their ability to capture the relationship between physical form, sensory perception, and cultural memory, which collectively shape public attachment and identity associated with a landscape. By integrating these aspects, the assessment framework not only evaluates visual and ecological attributes but also acknowledges the symbolic and experiential dimensions that define landscapes as shared collective memory.

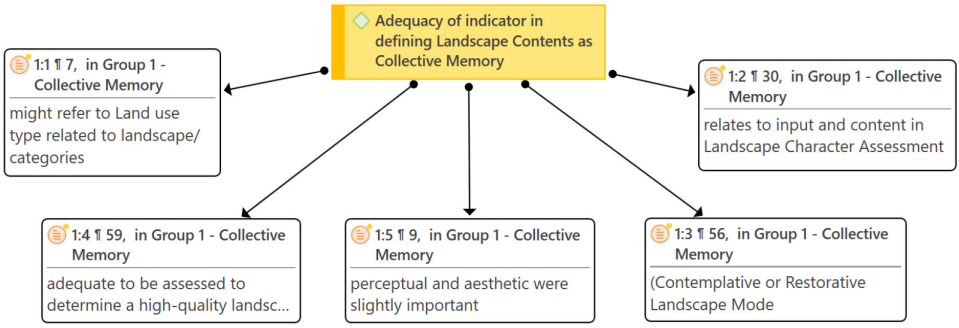

Figure 10. The adequacy of LPQA indicator: Landscape contents as collective memory in defining a high-quality physical landscape

Macro element 2: Landscape contents as "Ecological Sustainability"

Out of the five macro elements, the bigger scope and commonly highlighted in the significance of landscape quality is the ecological sustainability aspect (as shown in Figure 11). This element encompasses a multidimensional factor that integrates environmental, geological, biological and socioeconomic considerations. The findings from Group 2, Respondent 4 suggested that ecological sustainability assessments must be context-specific, the indicators should be flexible and scalable, allowing assessments to be categorised according to project types, subtopics, and spatial hierarchies to ensure contextual accuracy. This is to ensure that the variations in geographical areas that involve distinct ecological elements received more detailed and localised evaluation. By tailoring the assessment to these localised characteristics, the evaluation becomes more accurate and reflects the true ecological constraints and potentials of each site. This approach also allows landscape practitioners and decision makers to develop context-specific strategies rather than relying on generalised standards that may not be applicable. Respondent 3 also support the statement by saying that this implies that assessment frameworks should incorporate soil condition parameters, including terrain characteristics and geological sources, to capture the underlying environmental dynamics that influence landscape performance. Collaborative engagement with geologists and related experts is also essential to enhance the scientific robustness of data interpretation and ecological modelling.

Different area involves different element thus require more detail assessment. If we are to implement this framework for landscape project, multiple numbers of elements should be counted. Landscape elements are interrelated thus could create confusion to be assessed in detail (Respondent 2, Group 2).

According to Respondent 1, there is a need for comprehensive and data-driven research, were in-depth investigation and continuous monitoring support reliable ecological conclusions. In addition, the integration of emerging ecological facilities and infrastructure is crucial, as these developments shape environmental functionality and contribute to landscape resilience. Overall, the analysis highlights that all identified indicators are mutually reinforcing and of significant importance. Each plays a critical role in ensuring that landscape contents are adequately defined and sustainably managed through scientifically grounded, contextually responsive and economically relevant approaches.

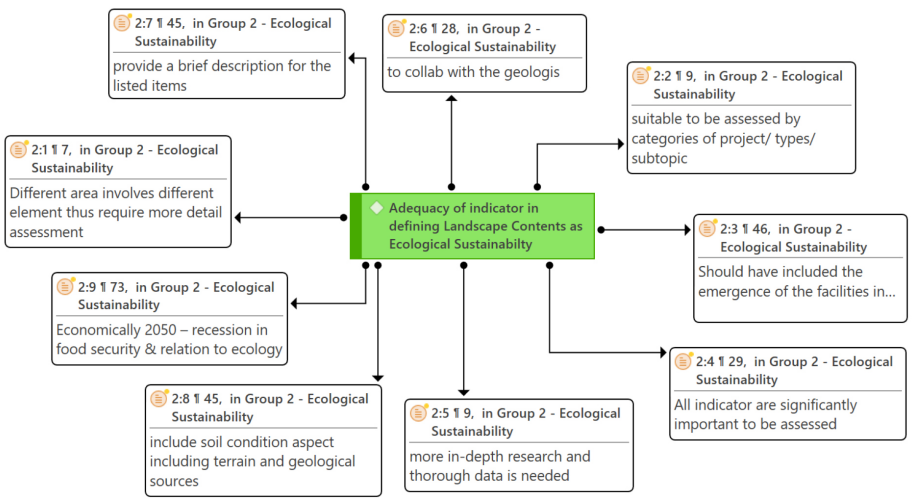

Figure 11. The adequacy of LPQA indicator – Landscape contents as ecological sustainability in defining a high-quality physical landscape

Macro element 3: Landscape contents as "Heritage and Culture"

Second, the discussion also emphasised on the quality in the heritage and cultural elements (as shown in Figure 12). This topic had bigger concern resulting from the loss of historical and cultural significance in recent development either in tangible or intangible aspect. The foundation of heritage and cultural indicators lies in the preservation of cultural and heritage elements to sustain their value over the long term. This emphasises continuity, ensuring that cultural identity and historical meanings embedded within landscapes are maintained across generations.

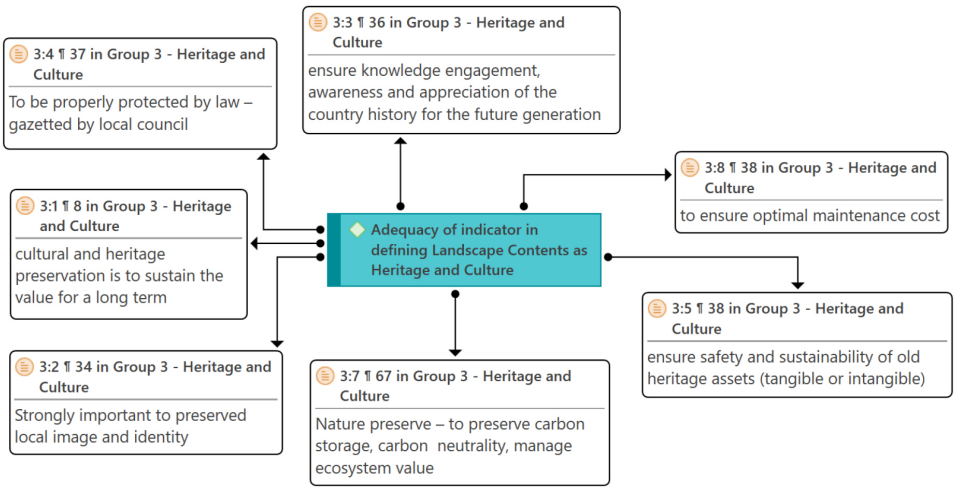

Figure 12. The adequacy of LPQA indicator: Landscape contents as heritage and culture in defining a high-quality physical landscape

Figure 12 illustrates the interrelation between several indicators that contribute to defining landscape contents under the theme of Heritage and Culture (FGD Group 3). The survey results emphasised the adequacy of indicators used to assess how landscapes embody and preserve cultural and historical significance. Each surrounding element represents a supporting dimension that reinforces the role of heritage and cultural values in landscape evaluation. According to Respondent 2, preserving landscape features (tangible elements) that reflect local character strengthens community belonging and regional distinctiveness. This underscores that landscapes are not only physical spaces but also carriers of social memory and collective identity (intangible elements) (Respondent 1). Therefore, Respondent 1 suggest that effective heritage preservation requires formal protection mechanisms, such as legal recognition or gazettement by local councils. This is because legal frameworks provide the institutional backing needed to prevent loss or alteration of heritage landscapes.

Macro element 4: Landscape contents as "Quality and Health in Landscape"

The discussion in Group 4, Quality and Health (as shown in Figure 13), highlights that these indicators are significant in promoting sustainable landscape development and align with sustainable approach and frameworks such as Sustainable Urban Drainage Systems and others (Respondent 2). This connection reinforces the ecological and environmental dimensions of landscape quality, emphasising that sustainability principles contribute directly

to human well-being. The indicators also support mental health and wellness, suggesting that well-designed landscapes serve as therapeutic environments that foster emotional balance and psychological recovery (Respondent 3). Respondent 1 highlight that this relationship between landscape design and health outcomes underscores the importance of integrating health-oriented objectives into planning and management processes.

They agreed that the interrelationship among indicators across various stages of landscape development, from design to management, demonstrates the holistic nature of quality assessment in landscape planning. The findings indicate that all items identified are strongly important for evaluating landscape quality, signifying that no single factor can sufficiently represent the complexity of quality and health in landscape settings. Instead, the adequacy of these indicators depends on their integration and mutual reinforcement, reflecting a systemic approach where design quality, ecological functionality and human well-being are interdependent.

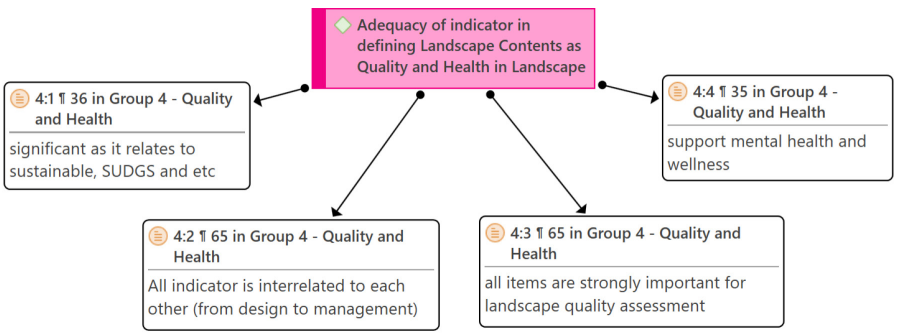

Figure 13. The adequacy of LPQA indicator: Landscape contents as quality and health in landscape in defining a high-quality physical landscape

Macro element 5: Landscape contents as "Territorial Justice in Landscape"

Next, the term territorial justice has been seriously argued along the discussion session (Group 5) (as shown in Figure 14). This is because, according to Respondent 1, it is quite unusual contents to be focused especially in this harmonious multiracial country. However, after a thorough discussion defining that the territorial justice is actually not only focusing on the segregation of a space due to races but considering the spatial equity, and sustainable planning aspect. Figure 14 highlights that territorial justice in landscape contents refers to the fair and balanced distribution of spatial resources, opportunities and environmental benefits across different territories or communities. In the Malaysian context, Respondent 1 agreed

that integrating territorial justice within landscape planning is essential to ensure that landscape resources contribute equitably to social well-being, ecological integrity, and cultural continuity and must importantly follow the governance and law. In addition, this LPQA element has provide an instrument for landscape designers and planners; evaluating how landscapes provide inclusive access to environmental quality, aesthetic value and cultural identity (Respondent 2). Therefore, this approach promotes planning practices that not only preserve ecological systems but also address spatial imbalances between urban and rural regions, indigenous and modern developments and protected versus developed lands.

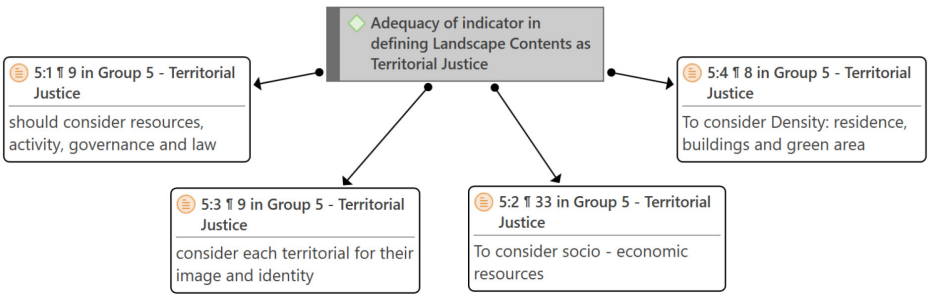

Figure 14. The adequacy of LPQA indicator: Landscape contents as territorial justice in defining a high-quality physical landscape

Finding of the Focus Group Discussion: Micro Elements

All of the groups were asked to discuss on the micro elements. Surprisingly, this LPQA model received a positive support saying that integration between tangible and intangible assessment in one holistic framework for landscape quality were strongly important to ensure the high-quality of landscape project, especially in construction aspect (as shown in Figure 15).

Respondent 1 from Group 4 highlighted the significance of preserving foundational groundwork and soil management to maintain the authenticity of original landscape settings. Meanwhile, Respondent 3 from Group 3 (Heritage and Culture) agreed that practicality, user-friendliness and safety are also emphasised as vital components of workmanship quality, ensuring that constructed landscapes should provide both functional value and aesthetic appeal. The listed indicator in LPQA model were adequate for workmanship quality assessment in landscape projects, nevertheless, a few items were suggested to be merged on or separated by categories (Respondent 4, Group 2, Ecological Sustainability).

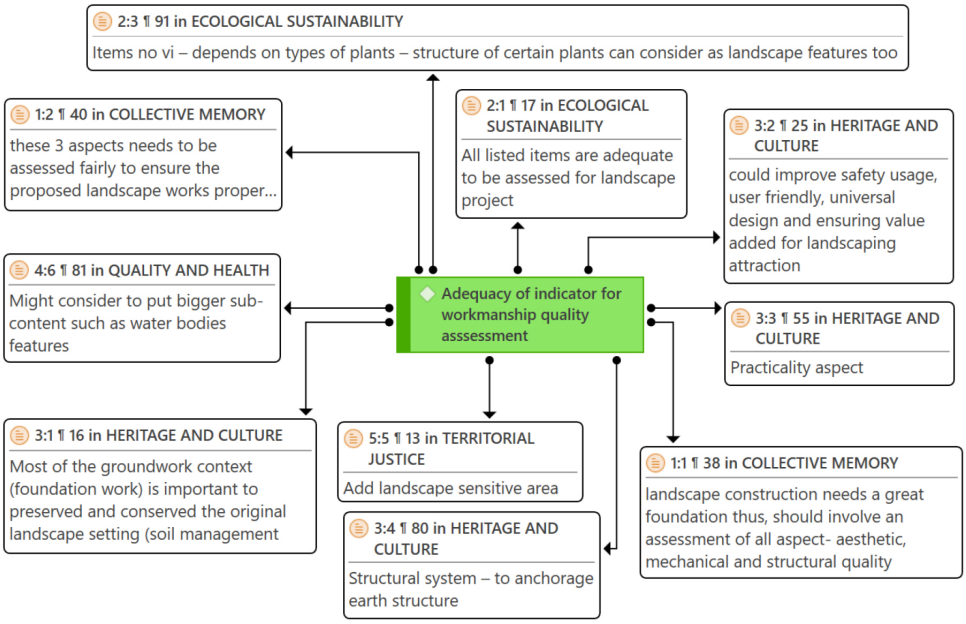

Figure 15. The adequacy of LPQA indicator in defining the workmanship quality in landscape project

Apart from that, there is a few comments on the terminology used in the LPQA model. For example, a few respondents highlighted the use of term "foundation" in workmanship assessment. According to them, term "foundation" use in construction refers to the structure of the lowest load-bearing part of the building. Hence, they think that this might not be suitable to be used in this model and due to causing confusion. Nevertheless, the term foundation in this model actually refers to the groundwork or soil work, the underlying basis referring to the site preparation work. After a few explanations, finally they were agreed upon the selection of terminology used in the LPQA model.

DISCUSSION

Based on the results of the study, the assessment indicator was deemed to be primarily critical, which indicated that the landscape evaluation in Malaysia needs modification. The list of indicators will continue to expand, as the criteria for each landscape project vary, resulting in differing features of the items to be assessed. This study has raised awareness that the present evaluation approaches may be insufficient in meeting the complex requirements of modern landscape design and construction, particularly in contexts like Malaysia's rapidly evolving built environment. In achieving the

nation's vision and objective on striving for sustainable cities and communities as stated in the Sustainable Development Goals, this research has outlined the approach to make cities and human settlements inclusive, safe, resilient and sustainable by considering the lived experiences of users, cultural narratives and socio-environmental dynamics in landscape design and construction. The proper assurance in the quality of landscape will determine on how they are actually perceived, used or valued by communities. To date, modifying landscape evaluation is not just necessary, it is urgent. Landscape evaluation and assessment factor must consider dynamic, inclusive elements and context-sensitive frameworks. Therefore, this study has proposed a conceptual model of LPQA for the Malaysian construction industry.

From a theoretical perspective, the proposed LPQA framework (as shown in Figure 16) is grounded in quality management theory and environmental aesthetics theory. In quality management, frameworks such as ISO 9000 and Project Management Institute define quality as the degree to which processes and outcomes fulfil stated requirements and stakeholder expectations. This study extends these principles beyond conventional building construction by conceptualising landscape quality as a function of both process quality (design intent and decision-making) and product quality (construction workmanship and physical performance). Therefore, this research suggests the integration of psychophysical, cognitive and experiential paradigms into landscape evaluation. These paradigms allow for a more nuanced understanding of how people interact with and interpret landscapes, accounting for memory, sensory experience and emotional connection (intangible elements). This shifts from a purely expert-led evaluation to a more user-centred and interdisciplinary approach. Accordingly, LPQA synthesises macro (intangible and experiential) and micro (tangible and technical) elements into a single framework, providing a theoretically grounded basis for assessing landscape quality in the Malaysian construction context. Moreover, as a result from the emerging issue on the loss of historical image and identity, the modern landscape development is aware on improving the landscape quality that involves intangible factors such as placeness, identity and collective memory. These are harder to quantify but critical for meaningful design.

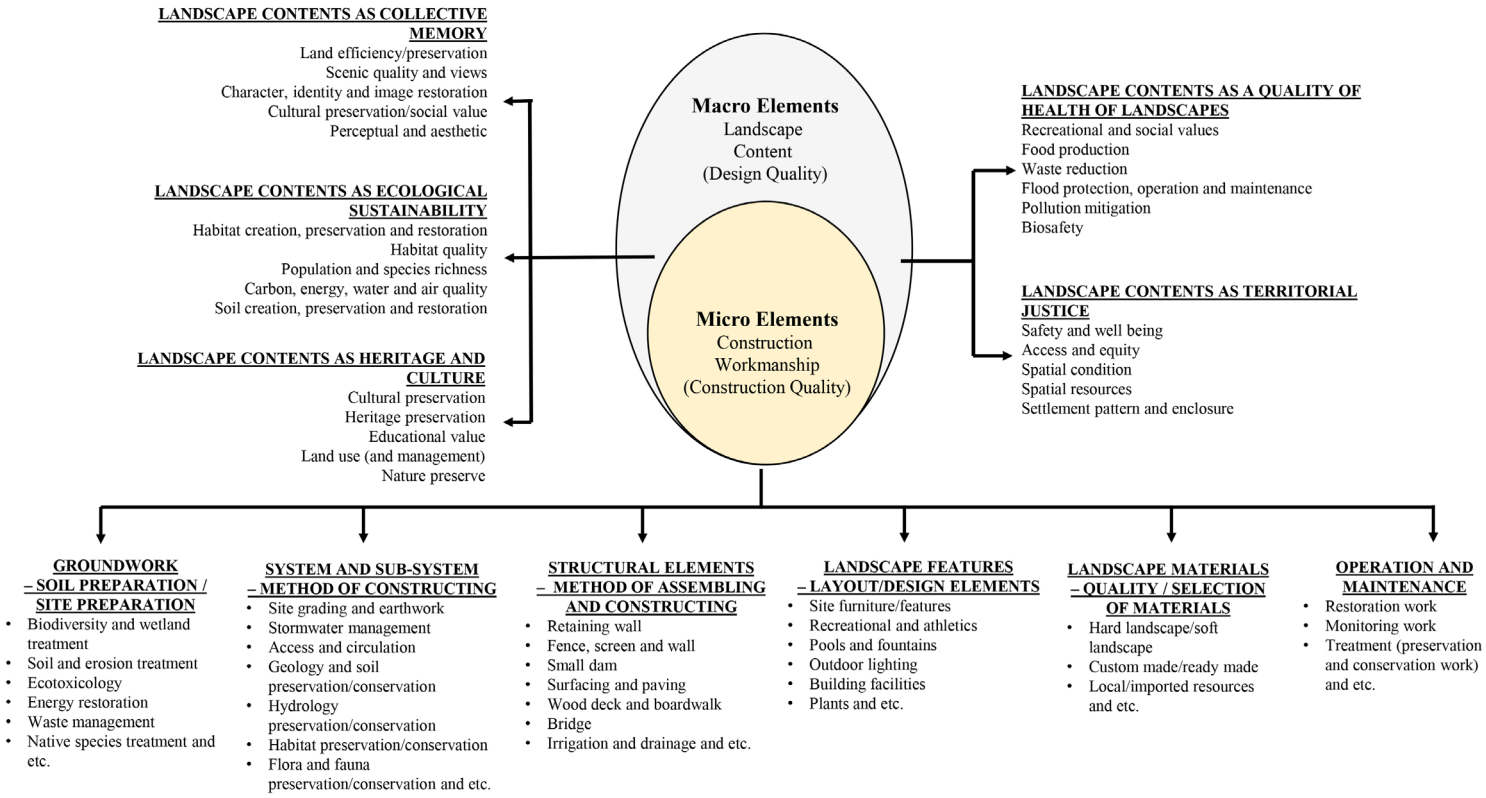

Figure 16. The proposed conceptual LPQA model

Besides, according to the proposed model, construction workmanship is categorised under micro elements, highlighting its foundational role in determining the physical integrity, functionality and long-term success of any landscape project. Historically, landscape evaluation has tended to focus on the end result, how a landscape looks and feels, while overlooking how well it was constructed. Hence, this research has stressed that the assessment should integrate technical performance indicators specific to workmanship, such as foundation stability, installation method and processes (e.g., paving, retaining walls and irrigation systems), material quality and durability of the landscape features. Without assessing these elements, the evaluation remains aesthetic-biased and ignores the very systems that make the landscape safe, durable and maintainable.

Therefore, modifying evaluation systems to include both tangible and intangible criteria, as outlined in the LPQA model, ensures more holistic and culturally relevant assessments. Furthermore, this proposed model was intended to be flexible, locally-informed and sensitive to diverse environmental and societal contexts. As climate change and urbanisation intensify, landscapes must perform not just aesthetically but ecologically, socially and economically. Modified evaluation systems should incorporate performance metrics, including sustainability, resilience and health impact indicators, beyond what traditional assessments often consider. For example, in the context of Malaysia, the LPQA model offers a structured benchmark that can complement existing construction governance mechanisms led by agencies such as the Construction Industry Development Board (CIDB), local authorities and landscape-related professional councils. Practically, LPQA may be adopted as (1) an assessment checklist during design approval stages, (2) a quality audit tool during construction and post-completion inspection or (3) a supplementary evaluation module alongside existing rating systems that currently under-represent landscape workmanship quality. This positions LPQA as a feasible decision-support tool rather than a stand-alone rating system, allowing flexibility in its application across different project scales and jurisdictions.

At a broader level, the proposed model addresses a critical gap in Southeast Asian construction practice, where rapid urban development often prioritises delivery speed and visual outcomes over long-term landscape performance and maintenance quality. By explicitly linking design intent, construction processes and experiential outcomes, LPQA provides a pathway for local authorities and practitioners to operationalise landscape quality in a manner that is measurable, context-sensitive and aligned with sustainability and quality management principles. Overall, the LPQA model serves as a foundational benchmarking model that bridges policy aspirations, professional practice and on-site construction realities. While future research may focus on empirical application and performance testing across multiple projects, this study

establishes an essential first step towards institutionalising landscape quality as a measurable and enforceable component of construction assessment in Malaysia.

CONCLUSION

In the Malaysian construction context, the proposed LPQA model aligns with current government-led initiatives that emphasise construction quality, sustainability and professional competency, particularly those under the purview of the CIDB. The LPQA highlights the essential duality of landscape quality through the integration of macro and micro components, complementing existing construction quality initiatives led by government agencies by extending quality assessment principles to landscape works, which are currently underrepresented in formal construction evaluation mechanisms. The LPQA model contributes both conceptually and practically to landscape evaluation within the Malaysian and broader Southeast Asian construction context, where landscape works are often evaluated in a fragmented non-standardised manner or treated as secondary to building components. The LPQA addresses this gap by providing a structured benchmark for assessing landscape design intent and construction workmanship quality, thereby supporting national aspirations such as National Landscape Policy, Construction Industry Master Plan and Construction Industry Transformation Programme to enhance construction standards, lifecycle performance and accountability across built environment projects, especially on non-building project components.

By integrating both macro and micro elements, ranging from ecological sustainability and cultural values to construction workmanship and design experiences, the finalised framework establishes a multi-dimensional perspective that is essential for achieving high-quality, context-sensitive landscapes which aligns with regional sustainability agendas. The LPQA model will establishes a clear structure for assessing both the intangible and tangible elements that contribute to the overall landscape experience and offering a balance between expert evaluation and experiential, cognitive and psychophysical dimensions of landscape perception. At the macro level, intangible aspects such as memory, experience, visual quality, senses and placeness are recognised as critical factors influencing user perception and emotional connection to a space. Simultaneously, the micro level emphasises tangible attributes like materials, construction methods and labour quality, components that ensure the physical integrity and longevity of the landscape. This dual-layered approach ensures a holistic evaluation, allowing both subjective and objective quality parameters to be considered.

By identifying the key attributes and factors that interlink these elements, the framework offers a practical yet comprehensive guide for landscape professionals, contractors and policymakers to elevate the standards of landscape development in Malaysia. Moreover, the LPQA model supports the development of performance indicators and classification criteria that can be applied through a variety of assessment methods. This flexibility allows it to be tailored to diverse landscape projects and stakeholders, promoting a more holistic and informed decision-making process in landscape planning, design and construction. In essence, this framework not only serves as a tool for quality assurance and strategic guide, promotes accountability and consistency in landscape assessment, but also fosters a deeper understanding of how design and construction practices collectively shape meaningful and resilient outdoor environments.

ACKNOWLEDGEMENTS

The authors would like to acknowledge the support from the Ministry of Higher Education for this research via the Fundamental Research Grant Scheme (FRGS, reference code: FRGS/1/2021/SSI02/UPM/02/7).

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