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## **ASSESSMENT OF LANDSCAPE MAINTENANCE TOWARDS COST PLANNING: EXPERT VALIDATION ON THE CRITERIA OF SUSTAINABLE LANDSCAPE MAINTENANCE FOR PUBLIC PARK**

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### **Abstract**

In Malaysia, a substantial amount of money is spent yearly to maintain the public parks. However, there are still countless parks and open spaces that have been built with excellent facilities for the public but are being unkempt, deteriorating into disrepair and poorly maintained. Considering the importance of the public park to the community and how this is a critical link to landscape planning and maintenance, there is a need for a cost-efficiency study to set forth a strategy that best works to mitigate this issue. Adopting a quantitative research approach, the focus of this survey is to validate the expert's selection regarding attributes and parameters for the urban park maintenance checklist. The Percentage of Consensus of Agreement (PoCoA) analysis applied for this study has further demonstrated the significant sustainable landscape maintenance checklist criteria. The summary of these findings reveals the expert's preferences and validation process that further paved the conclusion on the need for sustainable landscape maintenance criteria that synergise to cost efficiency, linking to best practices for sustainable landscape planning and management.

**Keywords:** Sustainable landscape maintenance, Landscape maintenance criteria, Cost Implication, Landscape management

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## **INTRODUCTION**

Maintaining a landscape refers to the process of resisting deterioration. It means keeping the landscape in perfect condition. The aim of a landscape is many and varied, and gardens and open spaces seldom serve a single purpose. Thus, any area of amenity land may be managed to provide pleasant views or appearance, screening or shelter, nature conservation, horticultural excellence, botanical variety and education, space for sport and recreation, job-creation, or leisure gardening (Mohamed, Othman & Ariffin, 2012). Many of these purposes will be immediately self-evident from the layout of the land, but, in many others, the circumstances may have changed since the site was first laid and so obscured the original purpose. Therefore, whenever the maintenance is being planned or reviewed, it is essential to have a clear idea of the use and functions of the land.

For public open spaces, the maintenance process is somewhat more complicated (Parker & Bryan, 1989). Different individuals or groups will have other ideas and aspirations for the land, which have to be offset against the limitations of funds and even the political aspirations of the local authority. Some may favour nature conservation, and others seek relative formality or horticultural perfection. The style and intensity of maintenance will sometimes have a much more significant effect on the cost of upkeep than the organisation or efficiency of carrying it out. In general terms, Parker and Bryan (1989) highlighted that the more natural; or informal the layout and maintenance, the lower the cost. Conversely, the more formal or removed from nature, the more expensive the result. The detail or complexity of a site's layout will also influence its maintenance cost, apart from the type of landscape and its degree of formality (Cook & VanDerZanden, 2011). Simple designs are much more easily maintained by powerful machinery with fewer labour requirements for a given area. More complex layouts, with relatively small spaces, require much greater use of small equipment and manual labour and are consequently much more expensive to maintain.

Therefore, excellent and efficient maintenance plays an essential role in park safety. The issues of graffiti, garbage, vandalism, poorly maintained pathways, or planting contributed to a perception of lack of safety. These conditions insinuated that an area is uncared for and lacks supervision. If overlooked, a cycle of abuse is likely to occur in which legitimate users start to avoid an area as physical conditions deteriorate. The result is that parks can be taken over by inappropriate users and uses. Increased lighting, surveillance, maintenance and use of graffiti-resistant materials can decrease graffiti, vandalism, and inadvertent damage in a park. In turn, the area will project an image of being well cared for, and users will feel safer. In general, well-maintained areas enhance perceptions of security. Hence, considering the importance of the public park to the community and how this is a critical link to

landscape maintenance, there is a need for a cost-efficiency study that can set forth a strategy that best works to mitigate this issue.

Acknowledging the gap that relates landscape maintenance to cost-efficiency study in Malaysia, the main aim of this research is to evaluate the cost implication on the Malaysian public park. However, this paper will only focus on phase one data collection and findings that highlight the establishment of sustainable landscape maintenance criteria that best correspond to effective landscape maintenance, resulting in less maintenance cost. Significantly, the findings of this research can assist the local authorities in Malaysia in establishing the best maintenance criteria and practices with cost-efficient operation.

## **LITERATURE REVIEW**

Urban parks are essential components of everyday life and significantly contribute to users and urban residents, particularly for the quality of life of our increasingly urbanised society. The presence of natural assets and their components in the form of greeneries and water elements, and environmental services such as air, wind and microclimate stabilisation, provide social and psychological services, which are crucial for the comfort and wellbeing of urban dwellers (Rosli, Mohd Adzmi & Marzukhi, 2020; Chiesura, 2004). The Malaysian Government is fully aware of the importance of greeneries, urban parks and landscapes in the Nation's development. Acting on the awareness, the National Landscape Department (NLD) or Jabatan Landskap Negara (JLN) has intensified their effort and formulated strategies to achieve the Beautiful Garden Nation. The three strategies include:

- **Driving the Nation Towards a Higher Income Economy** – by providing a conducive landscape environment with its own identity to attract local and foreign investments.
- **Ensuring holistic and Sustainable Development** – through effective landscape planning, development and management.
- **Focusing on the well-being of the citizen** – by providing adequate landscape spaces for recreation and social interaction in Malaysian multi-cultural society.

(Jabatan Landskap Negara (JLN), 2011).

Subsequently, the National Landscape Department and the Institute of Landscape Architects Malaysia (ILAM) work collectively to materialise the Government's aspiration to build the "Malaysian Beautiful Garden Nation". Ever since, many urban parks and gardens have been developed throughout the nation, especially in Malaysian's major cities, to increase urban residents' quality of life and beautify the Nation (Ayob, Harun, & Mat Akhir, 2013). The aesthetic merit,

historical significance and recreational usefulness of urban parks enhance the attractiveness of an urban park in the eyes of potential users. Natural elements such as trees, water and greeneries in general increase the value of the land (Kolimenakis et al., 2021). Many empirical evidence signifies those parks and greeneries in the urban context contribute significantly to the urban residents' happiness and wellbeing (Saeedi & Dabbagh, 2021). Numerous studies have established the correlations between park design, physical characteristics of urban park elements and park maintenance with users' satisfaction (Chan, Si, & Marafa, 2018).

In addition, according to Bahriny & Bell (2020), park supervision, quality and effective maintenance, and access control in urban parks also contribute significantly to the feeling of safety, comfort and satisfaction among users. Liu & Xiao (2021) iterated that any well-used parks fulfil a certain level of users' satisfaction; thus, they require appropriately scheduled and effective maintenance to maintain the high level of users' satisfaction and safety. The operation and running of maintenance works involve a considerable chunk of the park's management budget. The current landscape practices and Standard Operation Procedure (SOP) in park maintenance may no longer be efficient as it requires a great extent of maintenance (Nam & Dempsey, 2020; R. Ibrahim, 2016; Zainol & Peng Au-Yong, 2016). The high maintenance cost triggered a financial burden on the states and federal governments, with smaller municipalities badly affected due to their limited maintenance budget.

As a result, proper and scheduled maintenance operations are often neglected or left out, causing significant declines in existing park quality. The rectification of run-down and poorly maintained parks has proven to be more complex and costly (Roziya Ibrahim et al., 2020). Besides being costly, the current maintenance practice of using a substantial amount of chemical fertilisers, pesticides, and fossil fuels for machinery and irrigation is also environmentally detrimental (Roziya Ibrahim et al., 2020). In addition to the national economic slowdown due to the current pandemic, budget for the landscape maintenance will continue to shrink (Mansor et al., 2019). Therefore, there is an imperative need for a paradigm shift to engage in more sustainable and effective landscape maintenance, specifically in our urban parks and other public green and open spaces.

## **METHODOLOGY**

In evaluating the cost implication on public park maintenance, this research applied a mixed-method approach, adopting Creswell and Plano Clark (2011) explanatory sequential design. However, the quantitative method was used to select the phase one data collection and analysis (expert validation on the landscape maintenance checklist) before proceeding to the second data collection

phase through a qualitative enquiry. Since this paper will only discuss phase one data collection and findings, the questionnaire survey's focus is to validate the expert's selection regarding significant attributes and parameters for the urban park maintenance checklist. In establishing the criterion and parameters for the checklist, the focus of the respondent for this questionnaire survey will be drawn to experts who practise within the Malaysia landscape industry. These experts range from academics, government sectors (including the local authority), landscape firms, landscape contractors, developers and nursery operators. With their experiences and knowledge about landscape planning and design, with construction and maintenance, it is expected that the responses received from these experts can establish a reliable and valid criterion for the landscape maintenance checklist.

Nevertheless, the sample size for the expert validation respondent, as suggested by scholars' ranges between 2 – 20 individuals (Armstrong, Cohen, Eriksen, & Cleeland, 2005; Colson & Cooke, 2017; Rodrigues, Adachi, Beattie, & MacDermid, 2017). However, due to the 'varies application of and implementation by', namely, Consultant, Contractors, Local Authorities and Private Agencies, we opt for Rodrigues's and Armstrong's approach by having 15 expert panels for the validation process. These expert panels were identified based on ILAM (Institute Landscape Architecture Malaysia) directory members. Notably, two sections were developed for this questionnaire: Part A - Respondent background and Part B- Criteria of the public park maintenance. A Likert scale of 1 to 10-point was used to identify the expert's rating pattern toward the outlined criteria for Part B. Ten parameters were outlined in this questionnaire sheet, with detailed attributes listed for each category. These criteria were organised based on the specific theme derived from the literature review exercise. All criteria highlighted in this questionnaire survey have comprehensively covered the initial landscape planning and design development phase, construction and implementation phase, and the scheduled maintenance period. Expert respondents were encouraged to highlight or suggest additional criteria that best support the presently outlined parameters. This explanatory sequential design analysed this quantitative data using the Percentage of Consensus of Agreement (PoCoA) and further described it through a descriptive quantitative approach. Through PoCoA, the percentage value considered as consensus was arbitrarily set at either 66.7%, 75%, 80% or 100% agreement among respondents (Ayob, 2020; Lau, 2010; Watson, Watson, Ackerman, & Gronvall, 2017). Utilising this basis, all attributes with a Percentage of Agreement equal to or higher than a Cut-off Point Percentage of 80.0% were further included in the final established landscape maintenance checklist.

### EXPERT VALIDATION ON THE CRITERIA OF SUSTAINABLE LANDSCAPE MAINTENANCE: ANALYSIS AND DISCUSSION

General information was asked in Part A of this questionnaire to establish expert bonding for this survey. 53% of the respondents in this survey were female, and 47% were male. Figure 1 illustrates that 53% of this sample is between 41-50 years old. This was followed by 34% of the experts aged between 31- 40 years and only 13% from this survey sample aged below 30. Furthermore, the majority of the expert stated that they have been practising in the landscape industry for more than seven years, with three respondents claiming to have 20 years of working experience in this industry. This information has further signified the expert's knowledge and ability regarding Malaysia's landscape maintenance operation practice. The final question for this section has illustrated that the variety of respondent backgrounds with 34% of them practise as landscape consultants, 20% of the sample practise as landscape contractors as well as working with the local authority (Landscape Department), and the remaining balance of the respondent work with the government sector and also practise as academic from the local higher institution (see Figure 1).

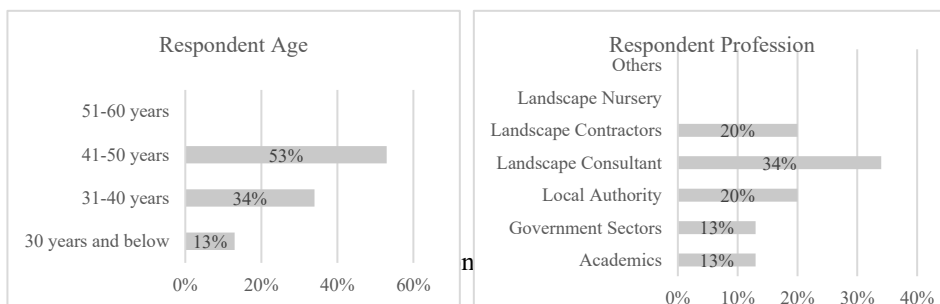


Figure 1: Respondent Profile

#### *Verifying The Criteria for Public Park Maintenance: Expert Selections*

In Part B of this questionnaire survey, the experts were asked to rank between 1–10-point Likert Scale criteria for sustainable landscape maintenance based on their knowledge, understanding and expertise. Under this section, ten landscape maintenance themes have been outlined, and these include: 1- Plant strategically; 2- Fertilise organically; 3- Soil and composting; 4- Water efficiency; 5- Pruning and shearing strategically; 6- Pest and weed control; 7- Sustainable hardscape materials; 8- Minimising fuel consumption; 9- Sustainable drainage system (SuDs); and 10- Sustainable tools and equipment. All criteria highlighted in this questionnaire survey have comprehensively covered the initial landscape planning and design development phase, construction and implementation phase,

and the scheduled maintenance period. Under Theme I-Plant Strategically, nine criteria have been developed for the expert validation process. The findings of this quantitative survey show that most of the respondents strongly agree with these criteria highlighted in Table 1. Criteria 1(a) to (l) maintain a high score rating that ranges only between 7-10 points. The majority of results (except for criteria (g) pointed out from the Likert Scale score 10 (strongly agree) were above 50%, thus indicating the validity of criteria developed under this theme. Interestingly, parameters (a), (b), (d), (e), and (l) received a consistent score rating of 9-10 points (strongly agree). These results assertively portrayed the critical activities that must be considered by all related parties involved in landscape projects for further success of the landscape maintenance operation.

For Theme II: Fertilise Organically, only one highlighted criterion has been developed. This criterion emphasises- (a) Applying organic fertiliser instead of chemical. Interestingly, experts have validated this criterion with strongly agree where 93% of the experts confirm that this criterion can successfully link to effective and sustainable landscape maintenance operation. For Theme Three: Soil and Composting, the findings of this expert survey have demonstrated that criteria 3 (a) and (b) received an excellent of 9-10 points scoring range, thus indicating that recycling garden disposal material and reasonable practice of mulching can improve soil condition while retaining the soil moisture. This scoring and percentage results portray that expert acknowledge the activities outlined through items (a) and (b) as these can successfully link to sustainable landscape maintenance practice. Experts also validated that applying soil aeration helps fertile soil and improves drain soil, with 60% of the survey sample agreeing strongly with this statement.

Another essential parameter developed for the sustainable landscape maintenance checklist is water efficiency. It is undeniable that water plays a vital role that links to plant growth and its survival. Hence, five criteria have been developed to support Theme IV: Water Efficiency. Interestingly, 93% of the experts strongly agree (rated between 9-10 points) with criteria (a) applying drip irrigation system being validated by the experts as it contributes to sustainable landscape maintenance. The same percentage of experts (rated between 9-10 points) have validated that creating irrigation zones can contribute to an efficient watering system. A similar percentage (93% with rated score 9-10 points) goes to criteria (d) applying super absorbent polymer (SAP) where experts have strongly agreed that this growing gel helps to retain and improve the usage of water if it is added in planting media, especially during the initial plant growth (see Figure 2). A significant score is manifested for criteria (e), where most experts strongly agreed and validated rainwater harvesting as an effective and sustainable watering system, thus synergising to water efficiency practice.



**Figure 2:** SAP- industrial-grade water retention material for new planting  
Source: Author, 2021

Furthermore, Theme V: Pruning and Shearing Strategically is among the primary task involved during the operational maintenance phase. The results for both criteria demarcate the importance of pruning strategy and tree risk assessment as the sustainable activities included in the landscape maintenance operation checklist. Considerably important, Theme VI: Pest and Weed Control indicate that the experts acknowledge IPM, pest and disease control maintenance programs and weeding and loosening of the soil as the essential activities that result in sustainable landscape maintenance practices. The criteria developed for this study do not cater only for soft landscape purposes but are comprehensive enough to include hard landscape, labour skill (quality), and machinery. Hence, the focus of Theme VII- Sustainable Hardscape Materials emphasises the selection of walkway materials, energy-saving and reclaim items, and workmanship quality. Similar to criteria VI, experts have rated 8-point scoring and above, thus indicating that they confirm all six measures constructed under the theme of sustainable landscape materials are relevant. Notwithstanding, the high rated score is evident by criteria (c) use of energy-saving equipment, (e) use of local materials, and (f) ensuring the quality of materials and workmanship. These three parameters are getting 9 to 10 points scoring while the remaining criteria (a), (b), and (d) were also relevant as experts rated a high score (8-point and above) that explain their recognition toward these criteria establishment.

Further in Theme VIII, this section focuses on fuel consumption related to a green and sustainable environment. This parameter is developed to align and support the current Malaysian aspiration toward a low-carbon city goal. Hence, only one criterion was established under this section - (a) Choosing hybrid vehicles and alternative energy sources for landscape maintenance tools and equipment. Significantly, the experts rated a high score with 8-points and above (strongly agree), with 53% of the expert sample rated 10-points for this criterion.



The result confirms that experts recognise this attribute that dynamically synergises with a sustainable approach, linking to landscape maintenance practices.

Since the drainage system is also a part of the landscape maintenance focus, Theme IX: Sustainable Drainage System received a significant scoring result, where 93% of the experts rated 8-points and above (strongly agree) for this criteria rating. Subsequently, the findings of this survey exhibit the experts' recognition of Theme IX establishment. The final theme designed for this checklist emphasises sustainable tools and equipment. The criterion designed under Theme X focuses on (a) using advanced technology in maintenance, such as woodchippers machines, to solve the problem of large dumping ground space and support recycling practices. Using advanced technology in landscape maintenance operations can offer significant benefits to maintenance operators. With this focus, the experts have rated a high score of 8-points and above (strongly agree), thus portraying this criterion's significance and relevancy in the sustainable landscape maintenance checklist. This result confirms the benefit of utilising advanced technology for landscape maintenance while supporting recycling practices that collaborate with sustainable and green approaches.

## CONCLUSION

The findings based on the expert validation process enhanced the relevancy of the designed criteria as most experts have validated and confirmed that these criteria are significant for landscape maintenance checklist that comprehend the present green and sustainable approaches. Applying the Percentage of Consensus of Agreement (PoCoA) analysis, each expert is required to rank using the 10-point Likert Scale according to their knowledge and expertise, guided by the outlined checklist presented in the questionnaire. With the Cut-off Point Percentage of 80%, the PoCoA analysis has demonstrated that this Phase 1 result indicated 91% validity. The suggestion of the sustainable landscape maintenance checklist is depicted in Table 1 below. Hence it is evident that experts acknowledged these criteria, linking them to effective operational maintenance associated with cost-efficiency operation.

**Table 1:** The established Criteria for Sustainable Landscape Maintenance

NO	CRITERIA FOR SUSTAINABLE LANDSCAPE MAINTENANCE
<b>1</b>	<b>Plant Strategically</b>
a.	Applying native and local species in landscape design.
b.	Landscape design should retain as much as possible the existing plants and vegetation.
c.	Applying the less-water consumption landscape design (Xeriscaping).
d.	Planting selection (in landscape design) should include various heights and habits to enhance the ecological value and biodiversity.

e.	Applying hydro zoning (group shrub planting) for effective water consumption.
f.	Trees to be the main component of plant's collection since it requires less maintenance in comparable to shrub and ground cover.
g.	Applying slow growing species in planting scheme for less maintenance.
h.	Plant selection should be based on the prevailing environment condition.
i.	Utilise the nitrogen-produced plants from Fabaceae or Leguminosae family especially for an unproductive soil (symbiosis approach-plants that can provide minerals to other plants).
j.	Applying rain garden or bioretention area.
k.	Applying bigger size planting holes for new planting and to the areas with low annual rainfall. The suggested planting hole size is between 2-3 sizes of the root ball.
l.	Consider to apply root barriers to control fast root development, especially in urban landscape.
<b>2.</b>	<b>Fertilise Organically</b>
a.	Applying mix use of organic and chemical fertilisers to encourage plant growth.
<b>3</b>	<b>Soil and Composting</b>
a.	Recycling garden disposal materials to be used as mulching or organic fertilisers (cut grasses/grass clipping and dead leaves could be used for mulching. This helps to improve the soil texture and reduce the cost of disposal).
b.	Effective practice of mulching for retention of soil moisture. Suggested for compost mulching (include dried leaves, grass clipping, branches, crushed stone, shredded bark, coconut mulch, etc.).
c.	Applying soil aeration (for rich, fertile and properly drain soil).
<b>4</b>	<b>Water Efficiently</b>
a.	Applying drip irrigation system to reduce overspray towards other plants or structures.
b.	Applying root watering system for high efficiency (enable water, oxygen, and nutrients to bypass compacted soil thus easily reach the tree root system).
c.	Creating irrigation zones for efficient watering system.
d.	Utilising super absorbent polymer (SAP) for improving water use efficiency (growing gel for water retention). This additional water-holding material can be added in planting media as natural fibres and no-toxic gel (especially during initial plant growth).
e.	Practice rainwater harvesting for effective use of water source especially for watering the plants.
<b>5</b>	<b>Pruning and Shearing Strategically</b>
a.	Pruning is a long-term maintenance strategy and should be done by trained personnel. Types of pruning may include structural pruning, crown cleaning, crown thinning, crown restoration, etc.
b.	Conducting tree risk assessment for tree safety management.
<b>6</b>	<b>Pest and Weed Control</b>
a.	Applying the Integrated Pest Management (IPM) for an effective and environmentally sensitive approach to pest management.
b.	Include the maintenance program for pest and disease control.
c.	Perform weeding and loosening the soil.
<b>7</b>	<b>Sustainable Hardscape Materials</b>
a.	Reuse of old building materials in new construction.
b.	Applying permeable paving (pervious concrete and asphalt) that easily allow filtration and flow of stormwater runoff.
c.	Use energy saving equipment such as solar energy lighting or solar water pump system.
d.	Use reclaimed materials as part of landscape design (reuse and recycle vegetation, rocks, and soil generated during construction).
e.	Use of local materials to promote sustainability while enhancing the local character of the place.
f.	Ensure quality of materials and workmanship (to enable all works on the ground are according to design standards and specification).

<b>8</b>	<b>Minimising Fuel Consumption</b>
a.	Choosing hybrid vehicles and alternative energy source for landscape maintenance tools and equipment.
<b>9</b>	<b>Sustainable Drainage System (SuDS)</b>
a.	Applying the sustainable drainage system (SuDS) for better surface management and control.
<b>10</b>	<b>Sustainable Tools and Equipment</b>
a.	Use advanced technology in maintenance such as woodchippers machines to solve the problem of large dumping ground space and support recycling practices.

Source: Author.

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