PLANNING MALAYSIA:
Journal of the Malaysian Institute of Planners
VOLUME 21 ISSUE 5 (2023), Page 173 – 187

PERCEPTUAL DIFFERENCES OF TREE REMOVAL IN DEVELOPMENT AREAS AMONG LANDSCAPE PROFESSIONALS

Khalilah Hassan[1], Wan Saiful Nizam Wan Mohamad[2], Ramly Hasan[3], Najah Md Alwi[4]

[1,2,3]*Faculty of Architecture and Ekistics,*
UNIVERSITI MALAYSIA KELANTAN
[4]*Faculty of Built Environment,*
UNIVERSITI MALAYA

Abstract

Urban areas employ proactive strategies to effectively manage their urban tree population, aiming to enhance the overall coverage of tree canopies. This process involves certified landscape practitioners (ALP) and individuals without formal professional credentials (LP) who collectively contribute to decision-making processes. However, there is limited information on the perception among these LPs. Thus, this study employed a questionnaire survey to obtain empirical observations from the perceptions of landscape professionals in both groups about tree removal by comparing similarities and differences and identifying the factors influencing existing tree removal decisions in development areas. The study used simple random sampling involving 265 respondents, 102 ALPs and 163 LPs. Descriptive and exploratory factor analysis (EFA) were used to analyse the data. Results showed that the tree removal was a common decision in urban development. Both groups of respondents agreed on three factors influencing tree removal in development areas: institutional constraints, resource availability, and cost/benefit, with institutional constraints being the primary determinant of the decision-making process. Additionally, ALPs posited that the physical environment influences tree removal decision-making. On the other hand, The LPs contended that this decision was also motivated by preferences and tree characteristics. This research advances urban tree retention literature and provides pertinent information for tree retention and management planning and strategy. Future studies may consider investigating the perceptions of different landscape professional credentials related to site design and construction to strengthen the research findings.

Keywords: tree retention, tree removal, development area, advanced landscape professionals

[1] Phd Candidate. Email: khalilah.h@umk.edu.my

INTRODUCTION

Urban trees are one of the most important tools available in cities for addressing present and future environmental challenges and, ultimately, promoting well-being. Despite the significant impact that the trees have on a community quality of life (Hall & Dickson, 2011), many cities struggle to balance between ambitious tree canopy cover objectives and urban development pressures (Ordóñez et al., 2019). The ongoing urbanisation process has resulted in the removal of an increasing number of trees to accommodate new construction projects (Brunner & Cozens, 2013). Urban trees are routinely removed to make way for new buildings, roads, parking lots, and other structures, expand their footprint, or upgrade critical infrastructure systems such as utilities (Croeser et al., 2020; Haaland & van den Bosch, 2015). As a result, a significant number of trees are removed on properties undergoing redevelopment compared to undeveloped ones (Guo et al., 2018). As tree removal is costly (Roman et al., 2022), factor influencing tree removal decisions include the tree-related characteristics, particularly the size of trees (Croeser et al., 2020; Guo et al., 2018; Morgenroth et al., 2017) and the health of trees (Conway, 2016; Guo et al., 2019). For instance, large trees require technical support and specialised equipment (Guo et al., 2018). Another reason for removal is poor tree health or risk perception, such as concerns about the dangers of falling branches or trees (Conway, 2016; Roman et al., 2022). According to Morton (2006), a tree in good health and condition and with a long-life expectancy is considered the optimal choice for retention on a development site. However, not every tree can be retained due to space limitations and other site restrictions (Ames & Dewald, 2003). The most important spatial variable for removal is the tree's proximity to a building or driveway. According to Guo et al. (2018), the tree removal is influenced by conflicts related to demolition or construction. Emerging evidence also indicates that inadequate site selection during planting processes is the primary factor contributing to tree removal (Klobucar et al., 2021). A significant correlation exists between the quality of planting space and trees (Conway, 2016) and the associated safety risks, which are the primary justifications for tree removal.

The influence of cultural dynamics, specifically individual preferences, on the removal of healthy trees was examined by Kirkpatrick, Davison and Daniels (2013) and Kirkpatrick et al. (2012). The studies found that the society's lack of active support and failure to prioritise greening cities to perceiving other needs, particularly in developing grey infrastructure, as more pressing. Additionally, some individuals view trees as problematic due shade, allergies, and the needing to clean up leaves (Kronenberg, 2014). The presence of negative perceptions towards trees has also been recognised as a contributing factor in the removal of trees (Clark et al., 2020). This is often linked to insufficient risk assessment practises, which lead to the unnecessary removal of healthy trees. The availability of tree information, including the condition and number of trees

(Kronenberg, 2014) and specialised equipment such as sonic tomographs are important in influencing tree removal decisions in development areas (Ibrahim et al., 2019). Also, as some developers prioritise profit over environmental preservation (Hasan et al., 2016), they will act to minimise the cost of development by removing trees (Nor Hanisah & Hitchmough, 2015). Based on the findings of Guo et al. (2018), economically-related factors associated with property value are significant explanatory variables in predicting tree removal at the property scale. Retaining trees by transplanting demands an overhaul in concepts and skills (Jim, 2013). Kronenberg (2014) emphasised that the preservation of urban trees faces significant challenges due to insufficient financial resources and shortcomings in managing and overseeing tree maintenance.

Moreover, institutions are identified by Kronenberg (2014) as a barrier to urban greening. Clark et al. (2020) argue that the mechanism employed for tree retention is subjective, while Kronenberg (2014) points out that current regulations do not sufficiently prioritise urban greenness. Excluding certain factors can also influence the success of tree retention implementation (Clark et al., 2020; Lavy & Hagelman, 2019). Moreover, the insufficiency of penalties, punishments, and fines imposed are highlighted by Clark et al. (2020), indicating that they may not effectively address the issue at hand. Additionally, Ibrahim et al. (2019) argue that these measures may not be suitable for the present circumstances. According to Lavy and Hagelman (2017), removing trees is connected to property ownership and the power to make alterations to real estate. Thus, the absence of a dedicated law concerning the gazetting of trees and the lack of requirement for authorities' approval for removing trees in private areas have been noted (Hasan et al., 2016).

According to O'Herrin et al. (2023) credentialing is often the incentive for continuing education by requiring practitioners to obtain new knowledge to ensure that practitioners maintain their connection to the body of knowledge and utilise it in their service to society. It is argued that perception affects decision-making, therefore, the purpose of this study was to explore the perception of landscape architects based on their professional credentials. Despite the involvement of certified landscape practitioners (ALPs) and those without formal professional credentials (LPs) in the management of urban trees, research on how they perceive tree-removal decisions, particularly in development areas, is still lacking. Therefore, this study aimed to elucidate the perspectives of advanced landscape professionals and landscape professionals regarding tree removal practises and various factors that impact their decision-making in development areas. Additionally, the study sought to determine any discernible differences in their perceptions. The scope of the present study included urban trees that were subject to management by tree professionals on private and public lands, particularly relating to development activities in Malaysia.

METHODOLOGY

Study Sample

In mid-2022, we surveyed landscape practitioners registered with the Landscape Architect Institute of Malaysia (ILAM) as corporate and graduate members for the 2021–2022 session to assess their perceptions of tree retention and removal decision-making in development areas. From the population of 829 landscape professionals, the number of samples required, based on the Krejcie & Morgan (1970) formula, is 262. Accordingly, the researcher has used a total of 265 respondents as a study sample based on the formula for determining the sample size. The study used simple random sampling. The list of landscape architects in the ILAM directory was arranged according to the sequence of membership numbers. The respondents to the survey were selected alternately on the sequence of the list. The survey started with the landscape architect at number one on the list and was followed by the next number. The selection was moved to the next person if the researcher failed to reach the intended landscape architect. This process continued until the number of respondents reached a total of 265 people. The researcher then continued the survey and managed to get 102 ALPs and 163 LPs. Their detailed demographic characteristics are presented in Table 1. In this study, ALPs are defined as respondents were certified by the Institute of Landscape Architect Malaysia (ILAM) as Landscape Architect (LAr), the International Society of Arboriculture (ISA) as Certified Arborist (CA), or the Malaysia Board of Technologists (MBOT) as Professional Technologies (Ts). Meanwhile, LPs are defined as respondents who were registered with ILAM as graduate members. Descriptively, a higher proportion of the respondents were males, mainly aged between 31 and 40 years, with bachelors' degree educational qualification and working in the private sector.

Questionnaire Design

The questionnaires used in the study for respondents were based on a literature review. It consisted of three sections. The first section comprised questions about the respondents' sociodemographic characteristics. The second section elicited information about the tree removal decision practice using dichotomous responses such as 'yes' or 'no'. The responses were coded either as 1 or 0. A score of 1 indicated respondents' agreement that trees in development areas were usually removed (response 'yes'), and 0 indicating respondents' disagreement that trees in development areas were usually removed (response 'no'). The last section, which invited respondents to provide their opinion on the tree removal rationale in the development area, was presented with Likert-scale questions of 57 statements. The respondents expressed their opinion on each of the statements, with answers given on a 5-point Likert scale anchored by 'I fully disagree' and 'I fully agree'.

Table 1: Demographic profile of the respondents: ALP (N = 102), LP (N =163)

Variable	ALP (%)	LP (%)
Gender		
Male	73	69
Female	28	31
Age		
Under 30 years	8	26
31 to 40 years	42	63
41 to 50 years	36	10
51 to 60 years	14	1
Education		
Bachelor's Degree	50	79
Master's Degree	27	13
Doctoral Degree	24	9
Employment sector		
Public sector	2	15
Statutory body	17	7
Private sector	81	77
Work Experience		
1 to 5 years	14	41
6 to 10 years	24	36
11 to 15 years	20	14
16 to 20 years	20	7
Above 21 years	24	2

Data Analysis

Reliability test

This study used Cronbachs' alpha to check the internal consistency and reliability of the questionnaire. This reliability test was performed separately between ALPs and LPs. Cronbachs' alpha test revealed that the overall score for both ALPs and LPs data were 0.972 and 0.962, respectively, indicating the items in the instrument were highly reliable.

Bartlett test of sphericity and Kaiser-Meyer-Olkin test

The Bartlett test of sphericity was conducted on the ALP (chi-square = 7080.081) and LP data (chi-square = 7807.212), with 1596 degrees of freedom and a significance level of 0.000. Both results for the Kaiser-Meyer-Olkin test for ALP (KMO = 0.637) and LP data (KMO = 0.873), exceeded 0.5. The results indicated that the EFA was appropriate for these datasets.

Exploratory Factor Analysis (EFA)

This study examined the possibility of aggregating the 57 tree removal rationale items into multiple dimensions using an EFA. The EFA was performed using the

principal component method with varimax rotation according to an eigenvalue of 1.0. Items with loadings lower than 0.5 and higher than 0.4 on more than one factor were eliminated (Hair, 2010). The data were descriptively analysed, followed by testing the hypothesis to determine if there were any significant differences between groups regarding their perception of tree removal rationale. All the data analyses were performed using the Statistical Package for the Social Sciences (SPSS) software version 25.

RESULTS

Tree removal decision in development areas

Descriptive analysis

The respondents were asked, 'Are existing trees typically removed from the development area?' In this study, 'no' signified that the existing trees would be retained, as shown in Table 2. All ALP respondents reported that existing trees in development areas were typically removed, whereas 14 percent of LP respondents believed trees were usually retained in development areas.

Table 2: Respondents' perception regarding tree removal practice in development areas

Respondent	Tree removal	Frequency	%
Advanced Landscape Professional (ALP)	Yes	102	100
	No	0	0
Landscape Professional (LP)	Yes	140	86
	No	23	14

Tree removal rationale in the development areas

Exploratory factor analysis (ALP Data)

A four-factor solution with 39 variables was retained, explaining 58.1 percent of the total variance of the tree removal rationale, as presented in Table 3. Based on Table 4, the correlation between the four factors was less than 0.70 (r values between 0.330 and 0.602), indicating that the four factors were distinct constructs. Upon examining, it was determined that the items in Factor 1 were categorised in the 'Cost and Profit' construct, which related to the expenses incurred and financial gains. Similarly, the items associated with Factor 2 were found to be closely linked to 'Resource Availability', encompassing factors such as the availability of funds, staff, knowledge, expertise, and data. Furthermore, the items in Factor 3 were categorised as 'Spatial and Physical Characteristics', encompassing factors related to spatial conditions and physical elements on site. Lastly, the items within Factor 4 were classified within the construct of 'Institutional Constraints', which comprised factors relating to procedures and legislation.

Table 3: Total Variance Explained (ALP Data)

	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	22.58	39.62	39.62	22.58	39.62	39.62	9.25	16.23	16.23
2	4.59	8.05	47.67	4.59	8.05	47.67	9.19	16.13	32.36
3	3.10	5.44	53.11	3.10	5.44	53.11	9.09	15.94	48.30
4	2.85	4.99	58.10	2.85	4.99	58.10	5.59	9.80	58.10

Note: only eigenvalues of 1.0 or greater were listed.

Table 4: Component Transformation Matrix of ALP Data

Component	1	2	3	4
1	.556	.541	.538	.330
2	-.345	.544	-.530	.552
3	.602	-.497	-.412	.470
4	-.458	-.406	.511	.604

Exploratory factor analysis (LP Data)

A total of five factors were extracted from 30 variables retained from the LP data. They predicted as much as 56.24 percent of the overall variance of the tree removal rationale, as presented in Table 5. Table 6 show that the five factors' correlation was less than 0.80 (r values between range of 0.081 and 0.818), suggesting that the five factors were separate constructs. This study revealed that the items categorised under Factor 1 were classified as 'Resource Availability', encompassing factors such as equipment availability, staff availability, expertise availability, and data availability. The items classified under Factor 2 were associated with 'Institutional Constraint', which included factors related to procedures and legislation. The items categorised under Factor 3 were referred to as the 'Cost and Profit' construct, representing factors related to incurred expenses and financial gain. The items classified under Factor 4 were placed under the 'Preference' construct, which pertains to factors related to social characteristics. Lastly, the items categorised under Factor 5 were referred to as the 'Tree Characteristic' construct, representing factors related to the characteristics and quality of the existing trees.

Table 5: Total Variance Explained (LP Data)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	19.35	33.95	33.95	19.35	33.95	33.95	9.52	16.70	16.70
2	3.77	6.61	40.56	3.77	6.61	40.56	6.29	11.03	27.73
3	3.22	5.64	46.20	3.22	5.64	46.20	5.96	10.45	38.18
4	2.94	5.16	51.36	2.94	5.16	51.36	5.21	9.13	47.31
5	2.79	4.89	56.24	2.79	4.89	56.24	5.09	8.93	56.24

Note: only eigenvalues of 1.0 or greater were listed.

Table 6: Component Transformation Matrix of LP Data

Component	1	2	3	4	5
1	.625	.438	.391	.378	.348
2	-.465	-.332	.751	.081	.320
3	.248	-.653	-.393	.255	.541
4	-.342	.468	-.263	-.340	.692
5	-.463	.229	-.242	.818	-.074

Mean ranking of tree removals' rationale

The results indicated that the respondents' levels of agreement with the group of factors related to the justification for tree removal fell into the categories of 'moderately agree', 'agree', and 'strongly agree', with an average value between 3.66 and 4.19, as presented in Table 7 and Table 8. The results suggested that both groups of respondents agreed that 'Institutional Constraint' (Rank 1, mean = 4.19 and 4.13, respectively) was the main reason for tree removal in development areas, followed by 'Resource Availability', (Rank 2, mean = 4.02 and 4.05, respectively). The factors 'Cost and Profit' received the lowest ranking (mean = 3.69 and 4.02, respectively). The physical environment (Rank 3, mean = 3.91) was another factor that ALPs believed affected decision-making regarding tree removal. The LPs, however, believed that the decision was also influenced by 'Preference' (Rank 3, mean = 4.01) and 'Tree Characteristic' (Rank 4, mean = 3.86).

Table 7: Result of EFA of tree removal rationale (ALP Data)

Tree removal rationale by ALP	Factor loadings				Mean
	1	2	3	4	
Factor 1: Cost and profit					**3.69**
High-value properties' trees aren't worth retaining.	0.77				3.54
Request by influential individuals.	0.77				3.71
Developers demanded tree removal.	0.74				3.95
Tree retention yields low profits.	0.67				3.72
Design changes to retain trees cost more.	0.67				3.79
Profit from tree-removed wood.	0.65				2.91
Trees can be replanted.	0.64				3.79
Lower removal costs than transplanting.	0.64				4.17
High tree maintenance costs	0.51				3.88
Factor 2: Resource availability					**4.02**
Insufficient funds to maintain retained trees.		0.78			4.01
Insufficient funding limits green management.		0.77			3.79
Lack of staff to manage development area trees.		0.77			3.80
Lack of economic incentives to protect urban trees.		0.73			4.09
Lack of knowledge on tree care and spp.		0.73			4.12
Tree transplantation requires an expert.		0.67			4.34
Urban tree care requires an expert.		0.66			4.14
Insufficient tree data.		0.65			3.67
Tree inventory requires an expert.		0.64			4.15
Lack of innovative tree integration.		0.60			4.09
Lack of community involvement in projects.		0.55			3.98
Factor 3: Spatial and physical characteristics					**3.91**
The area of the development site is small.			0.77		4.01
Tree growth space is limited.			0.77		4.04
Space constraints for tree transplants.			0.74		3.94
Storm-prone development area.			0.70		3.69
Retaining it threatens safety.			0.69		4.30
Retaining the tree makes it hard to adapt.			0.68		3.58
Closer construction vehicle routes.			0.66		3.63
Trees abound in the development.			0.64		3.74
Close proximity between trees and structures.			0.62		4.14
Trees with irreparable health issues.			0.54		4.35
Short tree lifespan.			0.52		3.60
Factor 4: Institutional barrier					**4.19**
Tree retention reports apply to certain projects.				0.76	4.27
Lack of comprehensive planning				0.71	4.39
Tree removal fines are disproportionate.				0.70	4.19
Planning requires fewer landscape units.				0.70	4.15
Existing laws are poorly enforced.				0.69	4.38
Tree replacement is disproportionate.				0.69	4.14
Constraints in changing existing policies.				0.51	3.80

Table 8: Result of EFA of tree removal rationale (LP Data)

Tree removal rationale by LP	Factor loadings					Mean
	1	2	3	4	5	
Factor 1: Resource availability						**4.05**
Urban tree care requires an expert.	0.81					4.15
Tree transplantation requires an expert.	0.80					4.25
Lack of tree protection equipment.	0.79					3.99
Tree inventory requires an expert.	0.77					4.22
Insufficient tree health testing equipment	0.77					4.06
Staff shortage to manage existing trees.	0.68					3.90
Insufficient tree data.	0.65					3.79
Factor 2: Institutional barrier						**4.13**
Lack of comprehensive planning		0.73				4.20
Existing laws are poorly enforced.		0.73				4.20
Tree removal fines are disproportionate.		0.66				4.28
No right to control removal on private land		0.66				4.24
No tree gazetting or retention law.		0.65				3.82
Planning requires fewer landscape units.		0.65				4.02
Factor 3: Cost and profit						**3.66**
Costly tree protection			0.85			3.75
Lower removal costs than retention costs			0.83			3.70
High tree maintenance costs			0.80			3.73
Design changes to retain trees cost more.			0.79			3.76
Lower removal costs than transplanting.			0.75			3.91
High-value properties' trees aren't worth retaining.			0.68			3.46
Tree retention yields low profits.			0.60			3.58
Profit from tree-removed wood.			0.50			3.34
Factor 4: Preferences						**4.01**
Request by influential individuals.				0.76		3.83
Developers demanded tree removal.				0.72		4.00
Lack of innovative tree integration.				0.69		4.20
Factor 5: Tree characteristic						**3.86**
Retaining the tree makes it hard to adapt.					0.70	3.82
Trees with irreparable health issues.					0.67	4.25
Retaining it threatens safety.					0.65	4.32
Short tree lifespan.					0.56	3.53
Non-native or insignificant tree.					0.54	3.74
Small canopy size or diameter.					0.52	3.53

DISCUSSION

Overall, the findings of this study suggest that the removal of existing trees is a common practice in development areas, which aligns with previous research that has identified a correlation between urban tree loss and development activities (Brunner & Cozens, 2013; Clark et al., 2020; Croeser et al., 2020; Guo et al.,

2018). Removing trees is a common practice in development areas, and ALPs surveyed shared the unanimous view. Although there were slight differences between LPs, most of respondents shared similarities in their perception of implementing tree removal practices in development areas. As was expected, the ALPs and LPs had slightly different perceptions, given their different development roles. This is expected since, in practice, ALPs are responsible for preparing landscape plans and tree maintenance reports for certain projects compared to LPs (KPKT, 2019). As Kirkpatrick, Davison, & Harwood (2013) stated, tree professionals engaged in planning and strategising may have different perspectives and motivations than those who directly manage trees on the ground. For example, in a different study, certified arborists are more inclined to suggest retaining a tree instead of removing it, with four times more than to non-certified arborists (Koeser & Smiley, 2017).

The findings from this study indicate that institutional barrier is the primary factors contributing to the removal of trees in development areas. As shown in Figure 1, resource availability was identified as the subsequent determinant, while cost and profit were ranked as the least influential factors. This finding provides further evidence in line with a previous investigation that emphasised the presence of institutional deficiencies impeding urban ecosystems (Kronenberg, 2014). The institutional constraint potentially be associated with the respondent's familiarity with current legislation relating to the retention and removal of trees. As Adlin et al. (2017) concludes, although Act 172 has been in place for more than two decades, it has made little progress in terms of implementation and enforcement. Furthermore, professionals in the construction industry have a lower level of awareness of Act 172 than personnel employed by local governments (Adlin et al., 2019).

There was a significant distinction between ALPs and LPs in terms of the number of determinants proposed as factors influencing the decision to remove trees in development areas. The ALPs presented a set of four factors, while the LP posited a separate set of five factors. ALP also believed that the spatial and physical conditions of the development site were pivotal in determining whether or not trees should be removed. The ALPs believed that when determining whether to retain trees in development areas, it was important to consider the trees and the surrounding space as a single factor. On the other hand, LP considered tree characteristics as a factor in determining whether to remove them without considering the characteristics of the surrounding space. ALPs were usually involved in the evaluation of tree health, damage, and risk, which was closely tied to the planting space's quality, in preparing tree retention and removal reports could be linked to the results discussed earlier. This is due to the fact that risk assessment is a sequential process that requires careful consideration of various target, plant, and site factors, which are strongly influenced by professional experience (Koeser et al., 2015). According to Koeser

and Smiley (2017) professionals with training and possessed industry credentials are found to have lower risk ratings. They are less inclined to recommend more proactive mitigation measures such as tree removal. The findings also indicate that individual preferences factor impact tree removal decisions for LPs, which aligns with previous research conducted by Kirkpatrick, Davison, and Daniels (2013) and Kirkpatrick et al. (2012). On the other hand, the ALPs considered individual preference as a determinant factor in tree removal by incorporating this aspect into the cost and profit factor. In addition, a recent study conducted by O'herrin et al. (2022), found that developers often prioritise the removal of small trees over large trees. This preference is believed to be influenced by cost and profit considerations.

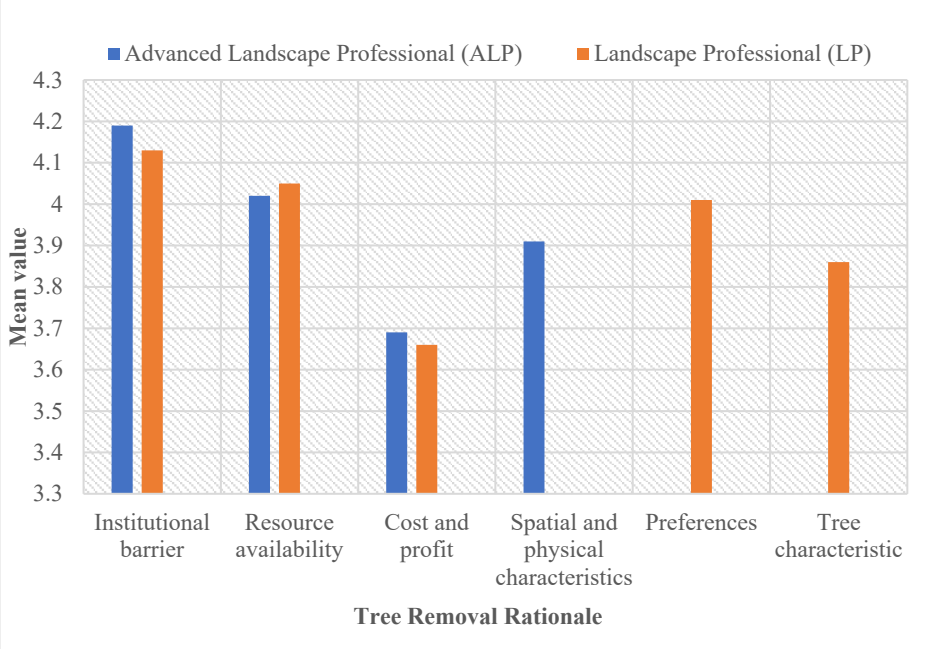

Figure 1: Group of factors pertinent to tree removal rationale

CONCLUSION

In conclusion, this study demonstrates that individuals possessing a certificate of accreditation exhibit a marginally distinct viewpoint in comparison to those lacking a professional certificate. This variety of perceptions leads to diverse actions and decisions within the profession regarding trees. Therefore, there is a possibility that diverse perceptions within the profession could lead to a variety of results, from the selection of which trees to plant, to the care of those trees, to the decision to retain or remove existing trees. This study also provides valuable

insights into the factors that contribute to tree removal in development areas. Institutional barriers are found the primary factor influencing tree removal decisions, followed by resource accessibility. Thus, careful consideration of institutional factors, particularly concerning the implementation and enforcement of Act 172, is necessary for the effective management of urban trees to achieve canopy goals. This study proves the necessitates of planning involving all pertinent departments, agencies, and units that are responsible for making decisions for tree retention in development areas. Future studies may consider investigating the perceptions of different landscape professional credentials related to site design and construction to strengthen the research findings.

ACKNOWLEDGEMENTS

This research was funded by the SLAB/SLAI Unit of the Malaysian Ministry of Higher Education and Universiti Malaysia Kelantan. The authors are grateful to the research respondents for their generous time contributions.

REFERENCES

Adlin, N., Sukri, N. M., Othman, N., Tarmeze, W., & Ariffin, W. (2017). A review on the needs to improve Malaysian Tree Preservation Order (TPO) (ACT 172). *Journal of the Malaysian Institute of Planners*, *15*(4), 105–114.

Adlin, N., Sukri, N. M., Tarmeze, W., Ariffin, W., & Othman, N. (2019). Awareness and knowledge of TPO (Act 172) among construction industry professionals and local planning authority personnel in Klang Valley. *Journal of the Malaysian Institute of Planners*, *17*(2), 267–279. www.mpkj.gov.my

Ames, B., & Dewald, S. (2003). Working proactively with developers to preserve urban trees. *Cities*, *20*(2), 95–100. https://doi.org/10.1016/S0264-2751(02)00117-8

Brunner, J., & Cozens, P. (2013). "Where have all the trees gone?" Urban consolidation and the demise of urban vegetation: A case study from Western Australia. *Planning Practice and Research*, *28*(2), 231–255. https://doi.org/10.1080/02697459.2012.733525

Clark, C., Ordóñez, C., & Livesley, S. J. (2020). Private tree removal, public loss: Valuing and enforcing existing tree protection mechanisms is the key to retaining urban trees on private land. *Landscape and Urban Planning*, *203*, 1–11. https://doi.org/10.1016/j.landurbplan.2020.103899

Conway, T. M. (2016). Tending their urban forest: Residents' motivations for tree planting and removal. *Urban Forestry and Urban Greening*, *17*, 23–32. https://doi.org/10.1016/j.ufug.2016.03.008

Croeser, T., Ordóñez, C., Threlfall, C., Kendal, D., van der Ree, R., Callow, D., & Livesley, S. J. (2020). Patterns of tree removal and canopy change on public and private land in the City of Melbourne. *Sustainable Cities and Society*, *56*. https://doi.org/10.1016/j.scs.2020.102096

Guo, T., Morgenroth, J., & Conway, T. (2018). Redeveloping the urban forest: The effect of redevelopment and property-scale variables on tree removal and retention.

Urban Forestry and Urban Greening, *35*, 192–201. https://doi.org/10.1016/j.ufug.2018.08.012

Guo, T., Morgenroth, J., & Conway, T. (2019). To plant, remove, or retain: Understanding property owner decisions about trees during redevelopment. *Landscape and Urban Planning*, *190*. https://doi.org/10.1016/j.landurbplan.2019.103601

Haaland, C., & van den Bosch, C. K. (2015). Challenges and strategies for urban green-space planning in cities undergoing densification: A review. In *Urban Forestry and Urban Greening* (Vol. 14, Issue 4, pp. 760–771). Elsevier GmbH. https://doi.org/10.1016/j.ufug.2015.07.009

Hair, J. F. (2010). *Multivariate Data Analysis*. Prentice Hall.

Hall, C. R., & Dickson, M. W. (2011). Economic, environmental, and health/well-being benefits associated with green industry products and services: A review. *J. Environ. Hort*, *29*(2), 96–103. https://doi.org/https://doi.org/10.24266/0738-2898-29.2.96

Hasan, R., Othman, N., & Ahmad, R. (2016). Tree preservation order and its role in enhancing the quality of life. *Procedia - Social and Behavioral Sciences*, 493–501. https://doi.org/10.1016/j.sbspro.2016.05.140

Ibrahim, P. H., Zahrull Pauzi, H. F., & Mohd Masri, N. N. (2019). The implementation of Tree Preservation Order in urban environment: public and local authority perception. *Journal of Architecture, Planning & Construction Management*, *9*(1), 94–111.

Jim, C. Y. (2013). Sustainable urban greening strategies for compact cities in developing and developed economies. *Urban Ecosystems*, *16*(4), 741–761. https://doi.org/10.1007/s11252-012-0268-x

Kirkpatrick, J. B., Davison, A., & Daniels, G. D. (2012). Resident attitudes towards trees influence the planting and removal of different types of trees in eastern Australian cities. *Landscape and Urban Planning*, *107*(2), 147–158. https://doi.org/10.1016/j.landurbplan.2012.05.015

Kirkpatrick, J. B., Davison, A., & Daniels, G. D. (2013). Sinners, scapegoats or fashion victims? Understanding the deaths of trees in the green city. *Geoforum*, *48*, 165–176. https://doi.org/10.1016/j.geoforum.2013.04.018

Kirkpatrick, J. B., Davison, A., & Harwood, A. (2013). How tree professionals perceive trees and conflicts about trees in Australia's urban forest. *Landscape and Urban Planning*, *119*, 124–130. https://doi.org/10.1016/j.landurbplan.2013.07.009

Klobucar, B., Östberg, J., Wiström, B., & Jansson, M. (2021). Residential urban trees – socio-ecological factors affecting tree and shrub abundance in the city of Malmö, Sweden. *Urban Forestry and Urban Greening*, *62*. https://doi.org/10.1016/j.ufug.2021.127118

Koeser, A. K., Klein, R. W., Hasing, G., & Northrop, R. J. (2015). Factors driving professional and public urban tree risk perception. *Urban Forestry and Urban Greening*, *14*(4), 968–974. https://doi.org/10.1016/j.ufug.2015.09.004

Koeser, A. K., & Smiley, E. T. (2017). Impact of assessor on tree risk assessment ratings and prescribed mitigation measures. *Urban Forestry and Urban Greening*, *24*, 109–115. https://doi.org/10.1016/j.ufug.2017.03.027

KPKT. (2019). *Manual OSC 3.0 Plus Proses dan Prosedur Cadangan Pemajuan Serta Pelaksanaan Pusar Setempat (OSC)* (1st ed.).

Krejcie, R. V, & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, *30*, 607–610.

Kronenberg, J. (2014). Why not to green a city? Institutional barriers to preserving urban ecosystem services. *Ecosystem Services*, *12*, 218–227. https://doi.org/10.1016/j.ecoser.2014.07.002

Lavy, B. L., & Hagelman, R. R. (2019). Protecting the urban forest: Variations in standards and sustainability dimensions of municipal tree preservation ordinances. *Urban Forestry and Urban Greening*, *44*. https://doi.org/10.1016/j.ufug.2019.126394

Morgenroth, J., O'Neil-Dunne, J., & Apiolaza, L. A. (2017). Redevelopment and the urban forest: A study of tree removal and retention during demolition activities. *Applied Geography*, *82*, 1–10. https://doi.org/10.1016/j.apgeog.2017.02.011

Morton, A. (2006). Determining the retention value of trees on development sites. *7th National Street Tree Symposium*, 110–123.

Nor Hanisah, M. H., & Hitchmough, J. D. (2015). The comparisons of perceptions among landscape professionals' on tree retention and legislation article information. *International Academic Research Journal of Social Science*, *1*(2), 164–176.

O'Herrin, K., Bassett, C., Day, S., Ries, P., & Wiseman, P. E. (2023). Borrowed Credentials and Surrogate Professional Societies: A Critical Analysis of the Urban Forestry Profession. *Arboriculture & Urban Forestry*, *49*(3), 107–136. https://doi.org/10.48044/jauf.2023.009

O'herrin, K., Hauer, R., Pike, K., & Vogt, J. (2022). Homebuilder Activities and Knowledge of Tree Preservation during Construction: Comparison of Practitioners in Rural and Urban Locations. *Sustainability (Switzerland)*, *14*(5). https://doi.org/10.3390/su14052753

Ordóñez, C., Threlfall, C. G., Kendal, D., Hochuli, D. F., Davern, M., Fuller, R. A., van der Ree, R., & Livesley, S. J. (2019). Urban forest governance and decision-making: A systematic review and synthesis of the perspectives of municipal managers. *Landscape and Urban Planning*, *189*, 166–180. https://doi.org/10.1016/j.landurbplan.2019.04.020

Roman, L. A., Fristensky, J., Lundgren, R., Cerwinka, C., & Lubar, J. (2022). Construction and proactive management led to tree removals on an urban college campus. *Forests*, *13*(6). https://doi.org/10.3390/f13060871

Received: 7th June 2023. Accepted: 5th September 2023