REGULAR ARTICLE

UTILISING THE URBAN TREE WASTE AS ALTERNATIVE FOR FURNITURE LUMBER: A CASE STUDY IN KUALA LUMPUR

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ABSTRACT

Most urban trees need a periodic process such as branch pruning to fulfil the requirements of the quintessential characteristics related to its longevity, safety, and removal, based on specific reasons. These processes contribute towards the increment of waste capacity and the cost of maintenance. Therefore, waste should be managed properly since might become a valuable resource for economic benefit. Thus, the study aims to identify the value of urban tree species whereas their waste can be utilised as an alternative for furniture lumber. Seven major roads were selected in Kuala Lumpur, Malaysia as the areas for the case study. Methods such as literature review and tree inventory were performed to gather significant data. The results acknowledged four valuable urban tree species that can be utilised as furniture lumber. These trees are under the big tree category within 10 to 45 m in height with more than 1m diameters of bolewood, which is their waste is suitable for lumber production. The finding also provides good practice in managing the waste of urban trees for economic worth.

Keywords: *Sustainability and wealth, green waste, environmentally friendly product, and furniture design*

1. INTRODUCTION

Trees are cultivated in public and private areas in many cities around the world, where they make a significant contribution to the increment of sustainable urban living. Urban trees also play an important role in the social and ecological welfare of cities and their residents. They provide ecosystem services to the cities such as aesthetics, ecological, and economic benefits, including flood control, shade and energy savings, and wildlife habitat (Gilbert, 2016) and associated with a higher priority value, reduced stress, and improved general well-being (McPerson et al., 2011). While waste utilisation of urban trees can also reduce the economic and environmental costs of disposal, increase urban trees sustainability, and even provide business opportunities for green industry professionals seeking to extract residual value from the waste. Also, utilising such as larger limbs and trunks for valuable furniture material would not only reduce the amount of green waste that goes to landfills but can reach significant value for an economic benefit.

Trees have been introduced within cities since early civilisation for functional and aesthetic purposes (Hasan, Othman & Ismail, 2018). The trees that grow in cities include a variety of species with different shapes, forms, colours, sizes, and wood properties. However, these trees require regular monitoring and proper management such as maintenance to increase their aesthetic, health, and to remove hazardous, dead, or dying branches and whole trees as compared to similar species that grow in the forest environment. For example, pruning activity eliminates diseased branches and is raised to display important street signs, thinned out to establish more filtered light, or possibly, removal, because the tree was unhealthy or unwanted. As refer to the National Landscape Department of Malaysia (2008) in the Book of National Landscape Guideline (2nd) also mentioned details of city landscape planning, management, and maintenance towards quality development and sustainability, and it has benefited as a source of reference for landscape

architecture, local authorities, and project developers in Malaysia. Therefore, the increase of the human population living in urban areas has also resulted in a greater emphasis on the maintenance and improvement of trees within these settings (Zainudin et al., 2012).

Moreover, urban trees have many economic benefits, which are well documented, while the planting program has also progressed as planned. However, the challenge undertaken nowadays focuses on the waste of urban trees, either it comes from branch removal, damaged trees, or cutting trunks off dead trees and construction work. It has resulted in an increasing amount of waste and the problem associated with it. Urban tree waste is usually dumped in the landfill by transporting it into specific trucks and separating it from domestic garbage collection that entails a higher cost (Khudyakova, Danilova & Khasanov, 2017). They also stated that the waste is brought to the landfill of solid household waste and moreover sorting and evaluation of the quantitative composition of wood waste is not carried out. Nevertheless, the waste wood from the cities lately constitutes 10 to 20 percent of the volume of materials going into landfills. A study by Hishamuddin (2021), shows that the waste volume of urban trees in Klang Valley collected around 300-500 tons per year and can reach up causes of environmental disaster.

Today, there is a movement to make use of the whole tree as part of their commitment towards sustainable urban trees. Some portions of these trees are best converted into wood chips, firewood, and lumber. According to Tinua and LaMana (2013), the wood of the urban trees has market value and can be milled for end uses. The utilisation of large branches and bolewood for furniture is currently being done by only a few woods processing plants. Lumber is a type of wood made from bolewood through the manufacturing process. According to Plumb et al., (1999), short or small bolewood with strongly figured wood can be more valuable than larger with no figures and flaws. Clear wood from trees and logs has the highest global demand and value for hardwood timber (Nolan et al., 2005).

Wood products are good for our environment and help to prevent climate change. Removal waste of urban trees is an expensive and difficult process when it involved large branches and bolewood. This waste is mostly an under-utilised resource with limited studies mentioning potential as furniture lumber. The main issue is why the valuable and quality of urban trees waste is being disposed of at the landfill if it can be utilised such as converting into furniture lumber? Hence, this study is significant to utilise urban trees waste for alternative raw material as well as reduce it to the landfills and provide an economic return.

2. RESEARCH BACKGROUND

2.1 The Value of Urban Trees

Trees have been part of the urban landscape for many centuries in the garden, open areas, and streets, while greatly influencing the character of individual cities (Lawrence, 2008). Urban trees mostly refer to the trees planted along the city streets or roads. The trees in the streets are in a different environment since they are planted in urban areas. Street trees require good management and maintenance such as pruning for them to maintain their aesthetic function (Clark & Matheny, 2010) since streets are harsh and stressful environments (Behrens, 2011). The understanding of urban trees' composition and their environment can help the local authorities and other agencies in managing their resource sustainably. Trees have been planted in the urban environment for so long and can be found either in private places, public spaces, gardens, public parks, streets, and more. According to Nitoslawski (2016), the planted tree in an urban area can be divided into four categories based on land type (see Table 1). The urban areas incorporate different types of spaces on which trees are planted. These spaces represent the differences in land use, tree planting practices, species selection decisions, and ownership (Kirkpatrick, Dainels & Davison, 2011; Bourne & Conway, 2014).

Table 1: *Tree in urban area by land type (Source by Nitoslawski, 2016)*

Land Type	Ownership	Description
Road	Public	Along roads and boulevards usually in a straight line; on tree lawns, medians; planted by the developer (contractor) or municipality and maintained by the municipality.
Property	Private	In front and back yards, can be planted in a row (hedges) or more randomly; established naturally or planted; the trees individually maintained by the property owner.
Park	Public	In parks and other open spaces otherwise dominated by lawn or impervious surfaces; planted and maintained by the city or municipality.
Remnant and/ or regenerated	Private or Public	In naturalised areas, which includes forest buffers and patches in parks, between houses or residential developments where the trees are generally not individually maintained.

In the past decade, there were many local authorities and property developers in Malaysia who planted the trees for greening programs and aesthetic purposes (Sreetheran et al., 2006; Abd Kadir & Othman, 2012; Hasan, Othman & Ismail, 2018). These programs were in line with the Malaysian government's agenda for creating and preserving beautiful landscapes in the country. Most of the trees have been planted along the roads in the urban areas.

***Table 2**: Trees species in urban areas*
(Source by Sreetheran et al., 2006; Sreetheran, Adnan & Khairil Azuar, 2011)

Specific Name	Local Name
Pterocarpus indicus	Angsana
Peltophorum pterocarpum	Batai Laut
Samanea saman	Hujan-hujan
Cinnamomum iners	Kayu Manis
Lagerstroemia speciosa	Bungor
Ficus benjamina	Beringin
Mimusops elengi	Tanjung
Millettia atropurpurea	Tulang Daing
Delonix regia	Semarak Api
Swietenia macrophylla	Tunjuk Langit

As reported by Sreetheran, Adnan and Khairil Azuar (2011) and Abd Kadir and Othman (2011), the earliest urban tree planted in Melaka and Penang, Malaysia, is known as Pterocarpus indicus or Angsana, was a popular urban tree species since 1778. Besides that, Sreetheran et al., (2006) and Sreetheran, Adnan and Khairil Azuar (2011), had also identified several well-known urban tree species planted in Malaysian urban areas as shown in Table 2. Sreetheran, Adnan and Khairil Azuar (2011), also acknowledged the popular tree species planted in Malaysian urban areas such as Peltophorum pterocarpum, Samanea saman, Cinnamomum iners, Lagerstroemia speciosa, Ficus benjamina, Mimusops elengi, Millettia atropurapurea, Delonix regia, and Swietenia marcophylla. In addition, Zainudin et al., (2012), investigated and identified five popular species, especially along the roadside in Kuching North City in Sarawak, which includes Mimusops elengi, Cinnamomum iners, Tabebuia rosea, Samanea saman, and Andira surinamensis. Abd Kadir and Othman (2012) also identified eight significant street trees planted in the Klang area, as Eugenia grandis, Enterolobium saman, Filicium decipiens, Peltophorum pterocarpum, Monoon longifolium var. pendula, Pterocarpus indicus, Spathodea campanulata, and Tabebuia rosea.

***Table 3**: Tree species planted in Iskandar Malaysia, Johor*
(Source by Abdullah, Kanniah & Ho, 2018)

Specific Name	Local Name
Melaleuca cajuputi	Gelam
Dalbergia oliveri	Tamalan
Spondias pinnata	Mempari
Cassia fistula	Rajah Kayu
Delonix regia	Semarak Api
Saraca thaipingensis	Gapis
Khaya grandifoliola	Khaya
Cyrtophyllum fragrans	Tembusu
Syzygium polyanthum	Salam
Dyera costulata	Jelutong
Monoon longifolium var. pendula	Asoka
Acacia auriculiformis	Akasia Daun Kecil
Peltophorum pterocarpum	Batai Laut
Samanea saman	Hujan-hujan
Pterocarpus indicus	Angsana
Alstonia angustifolia	Pulai
Sweitenia macrophylla	Tunjuk Langit

Besides, Abdullah, Kanniah and Ho (2018), also identified several urban tree species planted in Iskandar Malaysia, Johor as shown in Table 3 above. The most popular tree species planted in Iskandar Malaysia, Johor is *Mimusops elengi, Cinnamomum verum, Hopea odorata,* and *Khaya senegalensis* because of their attractive shape and fragrant flowers. These trees are considered as trees with the strongest limbs also known as hardy wood among other urban tree species. Another reason why these trees were planted is that it causes fewer problems and requires low maintenance.

2.2 Wood Waste Utilisation for Furniture Lumber

Trees in urban areas have an aesthetic function, however, it also requires regular maintenance which has resulted in waste contribution like leaves, branches, as well as trunks (Bertolini et al., 2013). It also encourages tree growth with strong branch structures thus this help to minimize injuries from tree hazard such as damage caused by dead, hanging and detached branches falling from the tree (Ow, Ghosh & Sim, 2013). Meanwhile, Abd Kadir and Othman (2011) stated that the trees will be removed when have reached

the maturity level, the size of the roots will be expanded, and it affects the surrounding areas of the tree, especially on the sidewalk or paved areas. However, the healthy ones will be removed due to construction development, safety, and other specific reasons (see Figure 1).

Figure 1*: Tree removal for safety reason*
(Source by authors)

Most of the trees planted in suburban areas have an average lifespan of 32 years, unfortunately, the lifespan for a tree planted on the street only lasts seven to 13 years (Nowak et al., 1990). Most of the trees in urban areas are removed when they die or for health and safety reasons, or necessary changes in the landscape. According to Bertolini, Mcbride and Beatty (2013), tens of thousands of urban trees are removed from urban municipalities each year. Waste of urban trees happens when all wood supplies originate from trees in urban areas.

Urban trees are known as woody perennial plants growing in towns and cities, typically having a single stem or trunk, usually a district crown, growing to a considerable height, bearing later branches at some heights, with patches from the ground. Three main categories of urban tree waste are leaves, branches, and bolewood. The amount of waste generated by trees especially the bolewood and large branches will be diverted for other uses, like the furniture or high-end wood products market (Bertolini et al., 2013). Many alternative ways were thought of to ensure that the waste of urban trees could be utilised. They also stated that the amount of waste generated by the urban trees could reach a significant value for an economic benefit, such as shown in Table 4.

Table 4*: The economic benefit of urban trees*
(Source by Bertolini et al., 2013)

i.	Many urban trees offer a tremendous amount of forestland that is found in urban development and used as landscape trees.
ii.	Many ornamental species of urban trees contain beautiful and decorative wood, and this wood is used useable by artisans, craftsmen, and other wood-working enthusiasts.
iii.	Trees that have reached their useful lifespan may have value if they are logged before dying. Logging mature trees also give younger species space to thrive and mature.
iv.	Branches and bolewood of urban trees are often cut down when construction is too large or presents an unacceptable level of risk for an urban setting.
v.	Disposal of urban trees can be costly and difficult. Cities incur substantial disposal costs when they are forced to remove hundreds of trees from street rights-of-way and public land or parks each year.

According to Cassens (2011), the cost of converting urban trees to lumber is generally less competitive with the cost of creating lumber from forest-grown trees. However, Chris and Doria (2014), indicated that the three main wood products derived from urban tree waste are firewood and wood chips, while the bolewood is significant to produce sawlogs for solid-sawn lumber. Besides, sawlogs are large and the whole piece of woodcut comes from the bolewood of the tree. Most of the average urban trees are about 20 inches in diameter at 41/2 feet above the ground and a 10-foot solid log should yield 150 to 200 board feet of lumber. Also, good quality urban cut-offs can be milled and sold for furniture or high-end wood production.

2.1 Wood Lumber Characteristics

Woods are categorized for use in different applications. According to Pinto, Pereira and Usenius (2003), heartwood and sapwood have different properties and their proportion within the tree will have a significant impact on the utilization of wood. The heartwood of the tree is generally considered desirable in construction timber, high-quality veneer, and joinery (Hillis, 1987). The wood of species can be identified by its unique features such as strength, density, hardness, odor, texture, and colour. The strength of wood depends on its species and the effects of certain growth characteristics (Yeomas, 2003). While, wood processing usually focuses on quality or grade, where quality means properties and wood features, and grade the level of quality. As a raw material source, wood residues used for composted products must meet eye to eye to the following key requirements:

a. Any type of clean wood waste can be processed if no more than 5 percent (by volume) of load contains chemical or organic contaminants.

b. The initial moisture content of the wood waste is not critical - The particle sizes of the raw materials in a composting mix range from 3 mm to 50 mm in diameter depending on the composting product requirements.

c. Composting composite wood products is possible but not in isolation. Also, the use of composite wood products involves a series of extra precautions in the manufacturing process.

d. The size, shape, and quantity of the feedstock depend upon the technology types and sizes a composting facility uses in the size reduction of residual wood and timber.

Nevertheless, harvesting and processing the wood waste from urban trees are not well established. It is because most sawmill generally declines to cut urban trees into lumber for uses due to the wear and tear of cutting machine. Moreover, the urban tree especially bolewood and large branches are usually not ideal for usage in sawmills and veneer manufacturers because of their small volumes available at any one location.

3. MATERIALS AND METHODS

Secondary data was used in this research concerning the literature review and tree inventory data. The tree inventory data was taken from the Department of Landscape and Recreation Development, Kuala Lumpur City Hall (DBKL) in 2018. The DBKL is responsible as local authority under Ministry of Federal Territories. The research strategy has begun with a literature review followed by site validation of tree inventory data (see Figure 2). The research methodology framework provides on what to include in the research, how to conduct the research, and what types of inferences are likely based on the data.

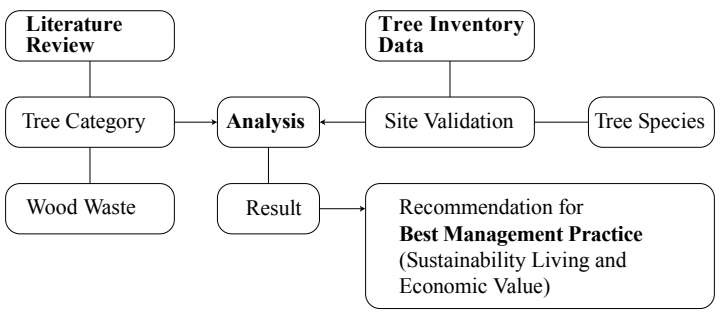

***Figure 2**: Research methodology framework (Source by authors)*

Kuala Lumpur is chosen as the area of study because it is the capital and largest city in Malaysia. The city is made up of an area of 244 km^2 (94 sq. mi), has an estimated population of more than 1.6 million. DBKL has taken various efforts to increase the urban green in Kuala Lumpur and transform it into one of the top-twenty most liveable cities in the world.

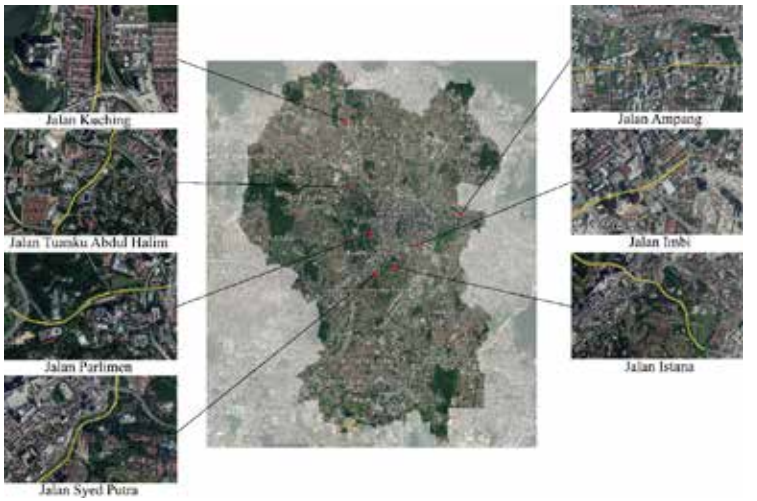

***Figure 3**: Seven major roads of study sites in Kuala Lumpur (Adopted from http://www.google.com/maps/place/Kuala Lumpur© 2021 Google)*

Seven major roads in Kuala Lumpur were selected as the area for the case study namely, Jalan Imbi, Jalan Istana, Jalan Parlimen, Jalan Tuanku Abdul Halim, Jalan Syed Putra, Jalan Kuching, and Jalan Ampang (see Figure 3). The roads were chosen based on tree inventory data provided by DBKL and several big trees available that have more applicability to the subject under investigation. The trees under investigation were identified and found on the road verge located between the street and the sidewalk, or, in the case of no sidewalk, located between the curb and private properties. The decision made is also based on numerous tree species planted and the external attributes of wood such as sizes (length and dimensional stability), shape (straightness), and wood structure and property.

4. RESULTS AND DISCUSSION

Many types of trees and species are planted along the roads in Kuala Lumpur. They are generally planted by a developer or contractor and maintained by the local authorities. According to Sreetheran, Adnan and Khairil Azuar

(2011), more than 400,000 trees and six million shrubs have been planted in Kuala Lumpur. Their study also identified 2291 trees with 35 species based on a previous study on five major roads namely, Jalan Ampang, Jalan Sultan Ismail, Jalan Cheras, Jalan Raja Laut, and Jalan Kuching. As reported by Nair (2019), the Kuala Lumpur City Hall has planted some 600,000 trees in the capital since 2010.

4.1 Trees Population and Species

The trees in Kuala Lumpur are categorised as the oldest and newest trees, whereby the oldest tree refers to a tree that has been planted in Kuala Lumpur from 1972 to 1988, while the new trees are the trees that have been planted later. As reported by the Department of Landscape and Recreation Development, DBKL in 2018, most of the urban trees were planted between 1998 to 2013 has resulted in a tree age average of between six to 20 years. Site validation was conducted in November and December 2019 to validate the site of study on seven major roads in Kuala Lumpur namely, Jalan Imbi, Jalan Istana, Jalan Parlimen, Jalan Tuanku Abdul Halim, Jalan Syed Putra, Jalan Kuching, and Jalan Ampang (see Figure 4). The site validation was performed in the location to ensure that the trees species available on the site were based on data provided by DBKL and photos of trees were also taken for further reference.

(a) Jalan Imbi

(b) Jalan Istana

(c) Jalan Parlimen

(d) Jalan Tuanku Abdul Halim

(e) Jalan Syed Putra

(f) Jalan Kuching

(g) Jalan Ampang

***Figure 4**: Street trees at the study sites in Kuala Lumpur (Source by authors)*

Many tree species have been planted along the roads in Kuala Lumpur. The results acknowledged that Jalan Kuching (2358) has the highest number of urban trees planted followed by Jalan Istana (896), Jalan Syed Putra (785), Jalan Ampang (679), Jalan Tunku Abdul Halim (606), Jalan Parlimen (562) and Jalan Imbi (120). The detail on urban trees population and species planted at seven major roads in Kuala Lumpur is stated in Table 5 (Appendix 1 - List of Trees Population in Seven Major Roads in Kuala Lumpur). A total of 6,006 trees, represented by 44 species were found in the urban environment of seven major roads in Kuala Lumpur. The results also recognised the nine highest urban tree species with more than 200 trees have been planted in the seven major roads namely, *Samanea saman* (1028) followed by *Hopea odorata* (957), *Tabebuia rosea* (431), *Peltophorum pterocorpum* (404), *Alstonia angustiloba* (384), *Syzygium myrtifolium* (279), *Terminalia mantaly* (267), *Schizolobium parahyba* (228) and *Cinnamomum iners* (205).

4.2 Tree Features and Characteristics

The physical characteristics of urban trees, especially in Malaysia are varies depending on the tree species. Some of the trees can grow faster and some do not. However, the location and condition of land areas also influenced the growth of the trees. Urban trees naturally grow in close competition with one another and develop tall, straight trunks with little side branching. As a result, their crowns are fuller with more lateral branches and shorter main bolewood.

Samanea saman (left) and Hopea odorata (right)

Tabebuia rosea (left) and Peltophorum pterocarpum (right)

***Figure 5**: Four most trendy urban tree species (Source by authors)*

Figure 5 shows the four most trendy urban tree species in the urban area. The results found that 43.1 percent of the urban tree population was dominated by four big tree species namely, *Samanea saman* (17.1%), *Hopea odorata* (15.9%), *Tabebuai rosea* (7.2%), and *Peltophorum pterocarpum* (6.7%). *Samanea saman* (Sreetheran, Adnan & Khairil Azuar, 2011; Zainuddin et al., 2012; Abdullah, Othman & Ismail, 2018), *Peltophorum pterocarpum* (Wee,

2003; Sreetheran, Adnan & Khairil Azuar, 2011; Abd. Kadir & Othman, 2012), *Tabebuia rosea* (Abd. Kadir & Othman, 2012; Zainuddin et al., 2012) and *Hopea odorata* (Abdullah, Othman & Ismail, 2018) were the trendy urban trees planted in Malaysia.

While trees such as the *Samanea saman* are among the most popular species planted in urban areas due to their dense and wide-spreading foliage that is suitable for shading. In comparison, *Hopea odorata* is widely planted because of low maintenance *Tabebuia rosea* is planted in urban areas because it is attractive and is a fast-growing species that can reach a height of over 9 m in three years and has a clean trunk that would eventually be suitable as a timber log. Finally, *Peltophorum pterocarpum* is an indigenous species, an attractive ornamental tree whereby when in bloom its crown is covered with yellow flowers (Wee, 2003). Table 6 shows the features and characteristics of the urban tree species for lumber production. The four selected of urban tree species are based on numerous tree species planted, the size and shape of the bolewood, and as well as wood structure and property.

***Table 6**: The features and characteristics of the urban tree species for lumber production (Source by authors)*

Name of Species	Trunk Diameter	Height	Branches	Wood Structure/ Intersection
Samanea saman	1-2 m	15-30 m	High density and bumpy	The wood is light in weight, soft but strong, and durable. The heartwood is a brown colour when freshly cut and it turns golden-brown upon exposure. Meanwhile, the thin layer of sapwood is a cream colour.
Hopea odorata	2-4.5 m	12-45 m	Small and straight	The heartwood is yellowish-brown to brownish-red sometimes with dark streaks, turning purplish on exposure, with lustrous white resin canals at irregular intervals, becoming dull with age; it is demarcated from the pale yellow or greyish-yellow sapwood that turns pale brown on exposure.
Tabebuia rosea	1 m	15-25 m	Fragile	The wood is a rather dull greyish brown with a fine striping of deep brown, often in a conspicuous pattern on the tangential surface. It is without distinctive odor or taste; the grain is usually straight, but sometimes roey or wavy; the texture medium
Peltophorum pterocarpum	1 m	15-24 m	Small and fragile	The sapwood is greyish-white, turning grey-brown on aging, the heartwood is light reddish-brown or black. The wood is moderately hard, moderately heavy, and somewhat lustrous, with a straight to interlocking grain.

4.3 Lumber Production from Waste of Urban Tree

Wood from urban trees was typically seen as an expensive waste and ecological problem for local authorities. The reason is mostly the waste is not marketable. However, utilising the large branches and bolewood is more valuable for lumber production Tinua and LaMana (2013). It would not only reduce the amount of waste of urban trees that go to landfills but also provides an economic return for this material. Furthermore, this would prove beneficial to extend valuable waste of urban trees that can be collected from activities such as pruning and removal especially due to construction and other specific reasons. Other popular uses of urban tree waste have included firewood and chips for mulch. According to Nowak, Greenfield and Ash (2019), the big branches and trunk were generally converted to firewood or lumber, while brush and chips were used for mulch and composite.

To date, several economic and environmental benefits could be achieved by utilising larger woody waste (sawlog) for furniture lumber and other solid wood products. The requirement for converting urban tree waste into wood lumber should have these criteria's where the tree above has within 10 to 45 m in height with more than 1m of the diameter of the bolewood, while the logs as short as 1m can be processed and considered for potential logs. According

to Cassens (2011), the average urban trees are about 50 cm in diameter above the ground whereby a 3 m solid log should yield 150 to 200 board of lumber. USDA Forest Services (2004), log ranging from about 30 to 76 cm in diameter on the small end is ideal for lumber production. Besides that, the sawlog which could be processed for lumber is at least 2 m long (plus 15 to 20 cm trim) with a diameter of at least 20 cm measured inside the bark on the small end of the log. As a result, the waste of urban trees that can fulfil the above criteria is mostly suitable for lumber production. Besides, the Tree Care Industry Association, Inc. (2013) states that the wood should be used at the highest possible value that is appropriate given the quality, quantity, and marketability. In addition, the wood waste of urban trees that harvested as logs can be categories into three levels of quality and its uses:

a) Higher Quality - furniture, veneer, cabinetry, flooring, and art/ novelty items.
b) Medium Quality - lumber, pallets, packaging crates, and firewood.
c) Lower Quality - mulch, compost, biomass, and pellets.

5. CONCLUSION

Every year, waste derived from urban trees was found plenty either from the pruning or removal activity for a specific reason such as due to site construction, weather, and disease. The waste was commonly a costly waste issue. Most of them is either dumped into the landfill or used as low value products like mulch and firewood.

Many valuable trees species and wood qualities of urban trees have been planted along the roads in Kuala Lumpur namely, *Samanea saman*, *Hopea odorata*, *Tabebuia rosea,* and *Peltophorum pterocarpum*. In this study identified that these trees are significant and valuable for the utilisation as an alternative for furniture material. All the trees are categorised as big trees height with 15-30 m and more than 1 m in diameter are mostly suitable for furniture lumber production.

Wood waste of urban trees is an invaluable resource. However, a lack of information on the utilisation of waste wood derived from urban trees and on available technology seems most prominent for this reason. Moreover, waste of urban trees needs to be handled in a proper way such as using them for a wood product. Utilisation the waste of urban trees not only can reduce financial burden of urban trees disposal but also can increase the sustainability living and even provides opportunities for green industry professional seeking to extract value from the waste. Furthermore, the right tree in the right place that needs to be planted not only to increases the quality of urban life but also for its waste utilisation. Trees are planted in an urban area not only to achieve the city's agenda but otherwise reused as resources in providing additional economic benefit and value. Promoting a new alternative furniture material from waste of urban trees is mostly significant due to its beauty and unique appearance of wood characteristics such as structure and colour. This study should be further discussing on the resilience characteristic of bolewood and large branches for lumber production in the near future.

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Appendix 1

***Table 5**: List of Trees Population in Seven Major Roads in Kuala Lumpur*

Name of Trees Species	Jalan Imbi	Jalan Istana	Jalan Parlimen	Jalan Tunku Abdul Halim	Jalan Syed Putra	Jalan Kuching	Jalan Ampang	Total
Samanea saman	4	143	93	84	276	227	201	1028
Hopea odorata	48	67	164	116	30	532		957
Tabebuia rosea	7			9	50	365		431
Peltophorum pterocorpum					33	252	119	404
Alstonia angustiloba						384		384
Syzgium myrtifolium		27	53	199				279
Terminalia mantaly						114	153	267
Schizolobium parahyba			17			211		228
Cinnamomum iners		175	20	10				205
Terminalia mytifolium						189		189
Diospyros buxifolia		154						154
Juniperus chinensis			134					134
Khaya senegalensis				17		84		101
Cratoxylum cochinchinense		94						94
Andira inermis					93			93
Mimusops elengi	45		25	18				88
Syzygium cumini					81			81
Agathis borneensis				77				77
Pterocarpus indicus					41		30	71
Eusideroxylon zwageri		71						71
Shorea assamica		67						67
Swietenia macrophylla			16	36				52
Pongamia pinnata					51			51
Ficus benjamina	2		12	9			22	45
Lophanthera locteseans		44						44
Delonix regia					38			38
Bucida molinetii					37			37
Variegated white							37	37
Terminalia calamansanai							36	36
Lagerstroemia floribunda				10			18	28
Syzygium grande					28			28
Hopea sangal		28						28
Morinda citrifolia					27			27
Dillenia indica		26						26
Caosalpinia ferrea							23	23
Syzygium glaucum							21	21
Cratoxylum formosum							19	19
Ravenala madagascariensis			14					14
Pometia pinnata			14					14
Bauhinia blakeana				13				13
Calistemon viminalis				8				8
Plumeria rubra	6							6
Ficus variegate	4							4
Ficus microcarpa golden	3							3
Bauhinia purpurea	1							1
TOTAL	**120**	**896**	**562**	**606**	**785**	**2358**	**679**	**6006**