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Price sensitivity analysis and factors influencing purchases of ornamental plants among local institutions

(Analisis sensitiviti harga dan faktor-faktor yang mempengaruhi pembelian tanaman hiasan dalam kalangan institusi tempatan)

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Keywords: flower, market demand, Malaysia, floral marketing, willingness to pay

Abstract

The floriculture industry is considered a high-value industry. Ornamental plants are mostly used for landscaping, interior and outdoor decoration, generally aimed at creating aesthetic value. New native and exotic flower varieties were developed to meet consumers demand, either public or institutional consumers. The objective of this article is to explore the potential of the ornamental plant industry and its sensitivity towards price changes in the market. A survey using purposive sampling was conducted among institutional users consisting of municipalities, hotels, developers, government and private premises. Institutional consumers emphasized three aspects or key factors in making decisions on the selection and purchase of plants, which should be in accordance with the specifications and requirements of a company or institution, as well as easy to maintain. When there was more than one option that meets the criteria and specifications required, then price will be the determinant factor. Local institutions generally accept and were willing to pay the proposed price for the ornamental plants studied. Sensitivity to price changes was measured descriptively and can be seen through the average minimum and maximum price that was payable, which differed for each ornamental plant. The percentage increase or decrease mirroring their acceptance occurred when the price changes. Acceptance towards the price was highest for dendrobium horn-type orchid while the lowest acceptance was for the mini plant, *Piper porphyrophyllum*. Generally, all the plants were well accepted and can potentially be used in large scale by all institutional users, although findings indicated there was a tendency of higher usage potential in airports and municipalities for interior decoration and landscape beautification.

Introduction

The National Agro-Food Policy (2011 – 2020) outlines the floriculture industry as a high-value industry with an annual growth forecast for production and exports of 6.2% and 6.7%, respectively. Floriculture products can be divided into categories of bulbs, ornamental plants, cut flowers and leaf cuttings. Ornamental plants are mostly used for landscaping, interior decoration and outdoor décor. The use of trees or ornamental plants is generally aimed at creating aesthetic value and producing a calming and soothing atmosphere. If used on a large scale, it can attract tourists from within and outside the country and create a positive impact on the country's economy (Hu and Wall 2005). Business opportunities especially for plant nurseries and landscape services can also be created.

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Demand for ornamental plants and floral products in the local market is not as intense as in other markets globally. Usage in large quantities is more geared for site decoration and landscape, as well as being widely used during state government occasions such as flower exhibitions, flower festivals and the like. Demand for flowers and ornamental plants has also increased in tandem with the implementation of national agricultural and tourism programmes such as the Malaysian Agriculture, Horticulture, and Agro-Tourism (MAHA) as well as the Floria Putrajaya Festival. Certain government policies also impacted its demand. For example, increased efforts of improving the national transportation system has resulted in the construction of the mass rapid transit (MRT) which increased the use of ornamental plants and trees.

A strong network and collaboration between private industry players and government agencies has been ongoing to boost growth of the industry, via tax and financial incentives as well as through a workable private-public partnership (Nik Rozana and Noorlidawati 2016). Competition is normal for key players in the value chain of the country's floriculture industry, especially entrepreneurs, nursery owners and exporters. Therefore, emphasis should be given to varietal development, product attributes and value-add the product's presentation in order to support current market platforms.

The Malaysian Agricultural Research and Development Institute (MARDI) has taken the initiative to develop native and exotic flower varieties to provide various types of floriculture crop products and meet consumer demand. Users of floriculture products can be divided into public and institutional users. Information on public consumption tendency towards selected ornamental plants has been carried out (Nik Rozana et al. 2016). However, neither the extent to which the use of ornamental plants among local institutions is fully known, nor on the price factors. Studies on willingness to pay has been mainly conducted for environmental protection (Forleo et al. 2018; Dorsch 2011). Focus is scarce on floral products especially within the Malaysian context. The closest study on price factors and willingness to pay for agricultural products was on organic fruits and vegetables (Nandi et al. 2017). In this regard, this study was conducted to identify the pattern of consumption and willingness to pay for selected ornamental plants among local institutional users.

Current achievement of Malaysia's floriculture industry

The national floriculture industry is valued at RM336.997 million with an export value of RM223.7 million. Total flower production is expected to grow by 6.2% per year (Department of Agriculture 2017). Competitiveness study which was carried out between Malaysia and the ASEAN countries showed that Malaysia has the comparative advantage on ornamental plants, leaf cuttings and cut flowers (Nik Rozana et al. 2016) based on its positive index value. Floriculture plants require diverse and continuous production so that they are more versatile and not monopolised by the old species, so as to ensure the sustainability of the industry's competitiveness.

Based on previous data over the last five years of the country's floriculture industry, there is great potential for the industry to grow. The area of planting is in tandem with increased production despite a slight decline in 2016 (*Table 1*).

The Malaysian agricultural sector provides space or land to be allocated for traditional cultivation of short-term crops (eg. papaya, corn, banana, sugarcane, watermelon, paddy, herbs, vegetables), long-term crops (coconut, coffee, tea) and ornamental plants (including flowers, landscaping and nursery). In 2018, land for ornamental plants reached 4,562 ha in Peninsular Malaysia (*Table 2*). The planting area is expected to increase

Table 1. Current achievements of the floriculture industry (2010 – 2018)

	2014	2015	2016	2017	2018
Planting area (ha)	2,619	2,610	2,559	2,605	2,687
Production unit (cuttings/pot/plant)	498,967,031	510,290,217	500,084,413	509,085,932	524,650,404
Production value (RM '000)	330,975	338,485	331,716	337,687	348,011
Export (RM '000)	371,562	428,424	493,626	nd	nd
Import (RM '000)	24,739	27,898	23,875	nd	nd

nd = no data
Source: Department of Agriculture (2018)

by 3.8% per year from 2,400 ha in 2010 to 3,500 ha in 2020.

The development of new varieties through improvement, introduction and application of native and exotic species is expected to propel the country's floriculture industry. New plant species and technologies developed during the 10th Malaysia Plan will be continued as potential technologies to be commercialised during the 11th Malaysia Plan period.

Past studies on price factors and willingness to pay

Willingness to pay (WTP) denotes the maximum price that a consumer is willing to pay for a particular or a bundle of products. It plays a decisive leverage on consumer choice behaviour. The majority of studies on WTP has been notably conducted for environmental protection (Forleo et al. 2018; Dorsch 2011), although studies exploring consumers' willingness to pay across different product categories have also been done (Biswas 2016). Studies on floral products especially within the Malaysian context are scarce. The closest study on price factors and willingness to pay for agricultural products was on organic fruits and vegetables (Nandi et al. 2017), in which the contingent valuation method was applied to estimate WTP. Empirical data were drawn from a consumer survey conducted in Bangalore. A binomial logistic regression model was applied to obtain the value of WTP and determine the factors influencing it.

Table 2. Sub-category of land use for ornamental plants, Peninsular Malaysia (2018)

Sub-category	Type of land use	2018 (hectare)
Ornamental plants	Flowers and landscape	3,212.16
	Grass nursery	1,349.85
Total land use		4,562.01

Source: Department of Agriculture (2018)

Customers, regardless of individuals or institutions, assign high importance on price, relative to other attributes. Search costs and expected benefits determine price sensitivity (Shankar et al. 1999). Another researcher conducted several experiments to determine important characteristics for edible flowers sold in retail outlets. It was found that one of the deciding factors to purchase was the price factor (Kelley et al. 2001). A more recent study found that most consumers felt that in-store sales or discounts, greater flower longevity, more price ranges, and trendier arrangements would increase their purchase and use of fresh flowers (Rihn et al. 2011). Since limited studies have been conducted in the Asian context, especially with regard to plants, flowers and floral-related products, this study proposed to undertake price sensitivity analysis in Malaysia to represent the Asian setting and culture, and to discover the factors influencing purchases of selected newly developed floral varieties.

Development of native and exotic varieties by MARDI

The development of native and exotic varieties by MARDI is carried out through the Horticulture Research Centre. Throughout the 11th Malaysia Plan, the focus was on pre-planned activities namely the adoption of native and exotic species as ornamental and functional plants, mass production of plant materials, eco-friendly pest management, quality retention and post-harvest handling, as well as assessment of potential market. All of these activities support the development of new varieties of native and exotic flowers and plants in MARDI.

Native ornamental plants

These plants are rarely used as landscape plants as they have no bright flower colours and are mostly leafy. In addition, these native plants which often require shading have limited use for landscaping and outdoor decorations. In this regard, some native plant varieties have been potentially identified to be developed as miniature plants. Among them are *Scindapsus pictus*, *Piper porphyrophyllum*, *Schismatoglottis calyptrate*, *Alocasia regimula*, and *Medinilla scortechinii*.

Exotic ornamental plants

These plants originate from abroad and are introduced to this country. Typically, exotic plants have attractive morphological criteria, beautiful flowers and are very attractive. Exotic ornamental plants that have interesting morphological features, beautiful flowers and grow in habitats that are similar to the climatology of the country are adapted and introduced as ornamental plants to enhance biodiversity and provide new ideas in the design of garden landscapes. Some exotic plants have been combined to produce the multispesies technology.

Multispesies

From the perspective of landscape management, the normal practice of seasonal flowering cultivation in the nursery which is then transferred to the landscape requires careful maintenance and involves high cost structure.Thus, other approaches to improve existing plant cultivation and maintenance practices are developed through multispesies technology. Multispesies technology is developed through the incorporation of several species of plants that have different flowering periods and stages, early, mid and late flowering in a community of landscape plants. Seasonal flowers such as *Celosia* and *Gomphrena* have been identified as early flowering species while species such as *Cosmos*, *Tagetes* and *Tithonia* are late flowering plants. Through mixed seed multiplication methods, a colorful crop community for landscape use is produced which has a natural and dynamic view with minimal maintenance.

Arundina graminifolia or its local name *Arundina suria* is a new hybrid orchid variety produced by MARDI. Research and improvement studies to produce orchids that are resistant to hot weather have resulted in the development of *Arundina suria* and *Arundina mentari*. These two orchids are formed through a combination of three orchid species, *Arundina graminifolia* from Malaysia, Vietnam and India. These three orchids were chosen because of their important features such as durability, flowering frequency and their suitability for landscape gardening.

Objectives

The general objective of this study was to assess the potential of selected ornamental plants at the institutional user level in Malaysia. The specific objectives were:

1) To evaluate the features or factors that influenced institutional consumers to purchase selected ornamental plants developed by the Horticultural Research Centre of MARDI.

2) To evaluate the sensitivity to price changes among institutional consumers for selected ornamental plants.

Methodology

This study involved the collection of primary data. Eleven types of plants or species under the category of ornamental plants were selected to be the study cases. All the plants were developed and introduced by MARDI. Data were obtained through face-to-face interviews conducted on 50 representatives of selected institutions (*Table 3*) including municipalities, hotel chains, housing developers, government (eg. schools, universities) and private premises (eg. airport). Managers, horticultural officers or landscape architects representing the institutions were interviewed personally using a questionnaire form as the primary data collection instrument. Respondents were selected using a purposive sampling, as well as depending on the institution's approval and willingness to participate.

Information collected were factors preferred and considered important by the institution during selection and purchase of ornamental plants. The 'word count analysis', a qualitative form of analysis, was used to identify the key factors. According to Silverman (2007), content analysis by studying the frequency of words is the accepted method for text investigation to develop a set of categories based on the number of occurrences that falls within each category. This was done by accurately computing the word (Selltiz 1964) to ensure the reliability of the measurements and the validity of the findings. Other information collected was the level of sensitivity towards price changes. These data were analysed using descriptive analysis to get the percentage of acceptance of the proposed price as well as changes in the willingness to pay when there was a decrease or increase in its selling price.

Table 3. Category of institutional respondent

Category	Percentage (%) (n = 50)
Municipal council	36
Hotel/golf resort	16
Housing developer	4
Government office and premises	14
Private office and premises	30
TOTAL	100

Result and discussion

Ornamental tree plants purchased by institutional users

The main ornamental trees or plants purchased by institutions can be divided into six groups; shade and roadside trees, shrubs, ground cover plants, climbers and creepers, palm trees and potted plants. Institutions such as hotels and golf resorts mainly purchased turf grass. The shade trees and roadside plantings provide shade especially in parking areas, playgrounds, parks, roads and surrounding fields or open locations. The principal function is to provide shades from the sun, rain, wind as well as protection from glare and light reflected from vehicles or glass buildings. Planting of trees around residential areas is also an environmental pollution control effort, which is used to reduce the problem of increasing temperature and reducing carbon dioxide levels in the air. Planting of shrubs and ground cover plants is also carried out on the slopes or hillside to prevent soil erosion.

Average demand per year in the early 2000s for ornamental plants by institutional users is shown in the table below (*Table 4*). Overall, the highest average annual demand for ornamental plants was for flowering shrubs (222,549 trees), followed by shade and roadside trees (116,570 trees), ground covering plants, creepers and climbers (45,035), leafy shrubs (33,809) and palm trees (3,964). Although these data were obtained nearly twenty years ago, they are still useful as basic information on the

Table 4. Yearly demand (units) based on tree and plant category

Institution	Number of trees and plants						
	Shade and roadside trees	Flowering shrubs	Leafy shrubs	Ground cover, creepers and climbers	Palm trees	Total	Area (m2)
Housing developer	100	1,041	404	1,822	31	3,398	23,222
Municipal council	539	13,688	10,925	20,733	3,292	49,177	8,555
District council	84	219	167	772	8	1,250	-
Hotel	13	2,632	2,549	2,144	328	7,666	360
Recreational park	142	4,450	2,025	500	235	7,352	1,023
Golf club	255	1,300	739	314	70	2,678	65,096
PLUS	115,437	199,219	17,000	18,750	-	350,406	nd
Total	116,570	222,549	33,809	45,035	3,964	421,927	98,256

Source: Syed Abdillah & Md. Yunus (2000)
nd = no data

average annual demand, taking into account current currency value factor and the trend of rising commodity prices. The reason behind the high demand for flowering shrubs is that they are widely planted for landscape purposes and also in pots for interior and exterior decoration. On the contrary, demand for palm trees is lowest because the tree is more expensive and difficult to obtain.

Most institutions buy ornamental plants and trees for landscaping replacement (88%), interior decoration (72%), interior decoration replacement (50%), new planting area (50%) and breeding at new nurseries (48%). Further information on the purpose of purchase by each category of institutions is detailed in *Table 5*. The purchase was usually done through four methods ie. open quotation, closed quotation, rental or purchase. Individual purchases were made when the amount needed was in small quantities.

The majority of respondents representing their respective institutions expressed their interest in buying and using trees, flowers and ornamental plants. The level of importance (*Figure 1*) was asked in the form of closed question (very important, 50%; important, 44%). Among the main reasons given were for the purpose of aesthetic value and the beautification of a building or site location. Most government premises also agreed that ornamental plants industry still have the potential to grow as they have the attractive characteristics which are important for the tourism sector that can generate economic resources for the country. Furthermore, institutions located in urban areas generally have warmer environment compared to rural areas. In this regard, the microclimatic condition of an area can be changed by planting trees and ornamental plants in large quantities, which can also be a form of environmental pollution control.

The importance of the use of ornamental plants was in line with the planning of an institution. The increase in purchases has been planned earlier in their 5-year planning by 42% of institutional

Table 5. Purpose of purchase for trees and ornamental plants

Reasons of purchase	Institutional users (%) (n = 50)				
	Housing developer	Municipal council	Hotel	Government premises	Private premises
Planting and landscaping replacement	50	100	100	50	60
Interior decoration	–	26	100	–	20
Interior décor replacement	–	26	100	–	20
Exterior décor and new planting area	100	74	25	20	20
Breeding at new nurseries	-	26	-	20	26

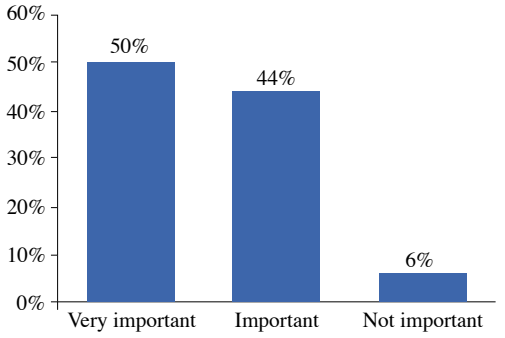

Figure 1. The importance of using floriculture products and ornamental plants among institutional users (n = 50)

users. Among the factors contributing to the increase in purchases were the increase in housing projects, the construction of new hotels and resort outlets, expansion and upgrading of landscapes in district and municipal councils and increasing use of flowers and ornamental plants in conjunction with agricultural programmes or tourism activities and other various celebrations or exhibitions. Meanwhile, 26% of the involved institutions will maintain purchases of all floriculture and ornamental plants. The balance, 16% of institutional users decided to reduce their future purchases. This was closely tied to the decision of the company to establish its own nursery as one of the strategies to diversify its internal resources and reduced overall operating costs and expenses (*Figure 2*).

Factors influencing institutional demand for selected ornamental plants

Although there were some specific characteristics that encourage the selection and tendency towards any ornamental plants, basically the institution's purchase was based on several important factors in making decisions. Respondents were asked to list the factors they prioritised during the selection and purchase of ornamental plants made by the institutions they represent. The collected written material was analysed via word cloud analysis whereby it is a visual form of word frequency. The more frequent one word or term appears in the analysed text, the larger the word will appear in the generated image (Siti Uzairiah 2017). The three highest factors were selected to be discussed further to emphasise on its importance. Local institutions make selection and purchase floral and ornamental plants based on the following three main factors:

a) Maintenance

The first factor was closely related to the cost of maintenance that can be allocated by an institution. Features such as resistance and high resilience against diseases and pests are characteristics that were given priority as they minimise costs and care. For premises that use interior decorations certain leafy plants were preferred because of the need for moderate water and did not require full sunlight. Examples of plants chosen by private premises

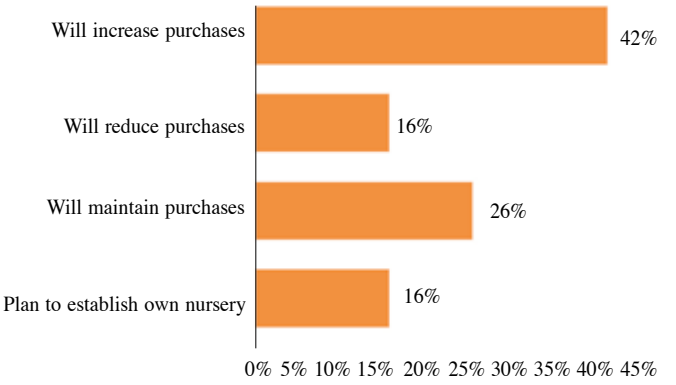

Figure 2. Future management plan on floriculture-related purchases

such as shopping complexes and hotel interiors are shown in *Figure 3*.

b) Suitability
The purchase of an ornamental plant is based on specific requirements. The plant size, height, variety or type of ornamental plant, building specifications and specific locations are clearly stated. All has to be suitable with the institution's requirements. Examples of plant selection and specifications given for airport premises are shown in *Figure 4*.

c) Price
Price is the main factor when making the final decision on the purchase of an ornamental plant. When there are more than one option that meets the criteria and specifications required, then price will be the determinant of the choice made.

There are specific and important features or characteristics of ornamental plants developed by MARDI. For the purpose of this study, five types of native ornamental plants are produced in miniature forms that are intended to be adapted inside buildings. Respondents were shown actual plants as well as pictures of them. Some of the mini plants attempt to absorb toxic gases such as *Scindapsus*, *Piper* and *Schismatoglottis*. Another two of the plants were orchid

Figure 3. Examples of potted plants use as interior decoration in shopping complexes and international hotels.

species known to be shade loving plants. Exposure to too much sunlight will be harmful. However, *Arundina suria* and *Arundina mentari* are developed as the type of orchids that are resistant to hot weather and are able to flower without any shades.

Multispesies technology is developed through ecological landscape approaches in MARDI through the incorporation of several species of plants that have different flowering periods and stages such as early, mid and late flowering in a community of landscape plants. Seasonal flowers such as

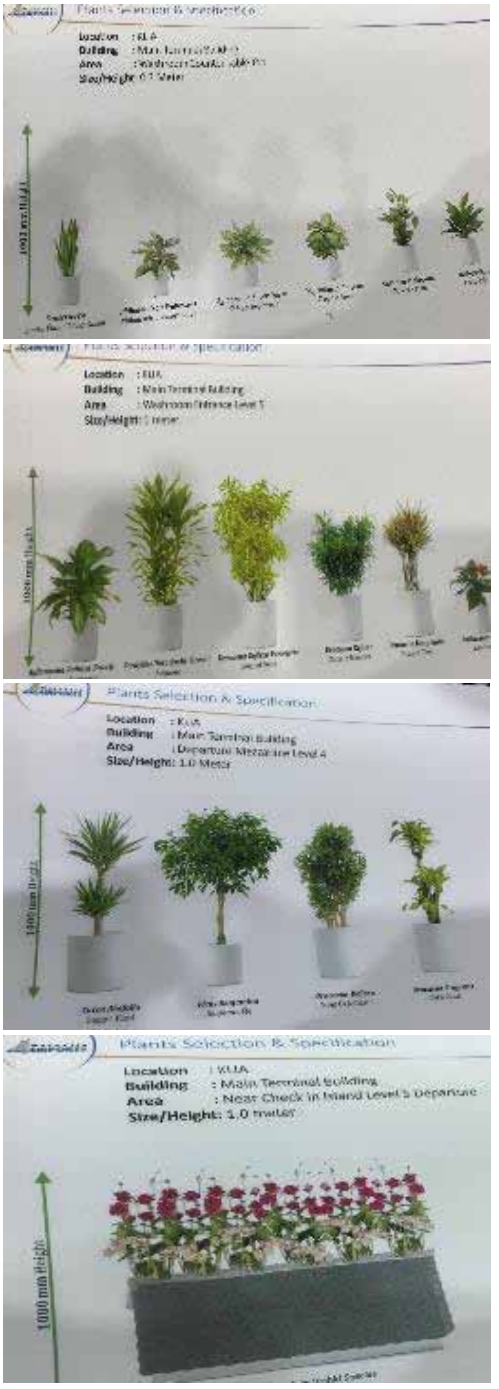

Figure 4. Examples of plant selection and specification of ornamental plants set by airport premises

Celosia and *Gomphrena* have been identified as early flowering species while species such as *Cosmos*, *Tagetes* and *Tithonia* are late flowering plants. Through the formulation of mixed seed multiplication methods, multispesies technology is produced as an alternative to single-species plants. Four of these exotic plants were selected for the purpose of this study. The majority of institutional consumers (89.9%) stated that they tend to select multispesies as a component of garden landscaping (Nik Rozana et al. 2017).

Sensitivity towards price changes

Assessment on the price that local institutions are willing to pay varies according to the types of plant. *Table 6* summarizes the acceptance of each price level among institutional users for each type of plant. Decreasing and increasing prices are set at 20% and below, based on Maxwell et al. (2013) which uses a structured focus group in measuring price equity according to user perceptions.

Scindapsus pictus – A type of climbing plant originating from tropical regions. Minimum water needed. Its attractive and interesting leaves make it suitable to be used as an indoor hanging plant. At the marketing level, the selling price offered for mini *Scindapsus pictus* was RM7.50. A total of 78% of respondents expressed their willingness to pay at that price. When the price was increased to RM8.50, and displaying the ability of this plant to absorb toxic gases, the percentage of willingness to pay decreased slightly to 70%. On the other hand, when the price was lowered to RM6.50, acceptance increased to 80% (respondents who agreed to buy at that price).

Piper porphyrophyllum – A type of climbing plants originating in the tropics. The leaves are attractive. In addition to being suitable as a mini ornamental plant, it is also suitable to be presented as potted plants. The proposed selling price for this mini plant was RM12.50. The acceptance

Table 6. Institutional users' acceptance for three price levels for selected plants (n = 50)

Type of plant	Proposed price (RM)	Sensitivity towards price changes		Preferred features	Probable usage plan
		Maximum price (RM)	Minimum price (RM)		
Scindapsus pictus	7.50	8.50	6.50	Can absorb toxic gas, easy to maintain	Interior decoration
Piper porphyrophyllum	12.50	15.00	10.00	Can absorb toxic gas, easy to maintain	Interior decoration
Schismatoglottis calyptrate	11.50	13.00	10.00	Leaf shape, easy to maintain	Exterior decoration
Medinilla scortechinii	15.00	17.00	13.00	Flowering native, easy to maintain	Interior decoration
Alocasia regimula	15.00	17.00	13.00	Leaf texture, can absorb toxic gas	Interior decoration
Celosia spicata	9.00	11.00	7.00	Flower color, flower shape	Landscaping and exterior decoration
Salvia	9.00	11.00	7.00	Flower shape, flower colour	Landscaping plant
New annual mix	17.50	20.00	15.00	Flower and leaf mixture	Landscaping plant
New perennial mix	17.50	20.00	15.00	Flower and leaf mixture	Landscaping plant
Dendrobium horn-type	22.50	25.00	20.00	Flower shape, flower colour	Interior decoration
Arundina Suria	9.00	11.00	7.00	Sun-loving, flowering species	Landscaping plant

Note: The value in parentheses refers to the percentage of acceptance due to changes in price

towards the price was the lowest among respondents at only 52%. However, when the selling price was lowered to RM10 per mini pot and explanation was given on its ability to absorb toxic gases indoors, the acceptance from respondents increased to 60%.

Schismatoglottis calyptrate – This is a charming species of the genus *Schismatoglottis* which is much favoured by gardeners. It has greenish white flowers and found primarily in tropical parts of Southeast Asia. It is suitable for planting in a humid and well-drained area. Usually these ornamental plants are planted in shades or semi-shade areas, but MARDI features this plant in the form of 'miniature' to be used for interior decoration purposes. The suggested price was RM11.50, of which 66% of respondents expressed their agreement to pay at this price. A price drop of RM10 increased 6% of acceptance, while a price increase to RM13 decreased acceptance by 4%.

Medinilla scortechinii – This native plant has interesting orange flowers. It can be grown as a small shrub or a potted plant. It presents itself as a very tropical-looking exotic plant. The leaves are very fragile and may be slightly damaged during transportation, however it does not hurt the plant. The proposed selling price for this plant was RM15 and 62% of respondents agreed to pay at this price. A RM2 price drop further increased the willingness to pay to 70%. The increase in price of RM2 decreased the percentage of willingness to pay to 60%.

Alocasia regimula – The selling price offered for this plant was RM15 in the form of miniature pots, of which 70% of respondents expressed their agreement to pay at this price. This plant is suitable as an interior decorative plant which is able to absorb toxic gases. The leaves and textures are also attractive and velvety-like with silver-white veins. Accordingly, when the proposed price increased to RM17, the acceptance remains the same at 70% of all institutional users. A high increase in acceptance of up to 80% was achieved when the price falls to RM13.

Celosia spicata – The selling price offered for *Celosia* was RM9/polybag. About 70% of respondents expressed their willingness to buy at this price. This plant locally known as 'balung ayam' is suitable as ornamental plant in open landscapes. If the price was lowered to RM7, 74% accepted the price. A RM2 price increase at RM11/polybag dropped the willingness to pay down to 58%.

Salvia – The selling price of RM9/polybag was recommended for salvia plants that are suitable as ornamental plants in open landscapes. About 66% agreed to buy at that price. About 72% agreed to buy if the price dropped to RM7/polybag. At RM11/polybag, only 64% of respondents agreed with the price.

New annual mix – The proposed selling price for this new annual mix was RM17.50 per container, of which 66% of respondents expressed their agreement to pay at this price. An increase in price to RM20 resulted in a slight decrease to 64% of institutional consumers willing to pay for the ornamental plants. This plant has a complete life cycle in one season, so it needs to be replaced every year. This is recognised by institutions that manage and maintain landscapes. Most of the institutions provide sufficient annual provisions for those purposes, so they are willing to use multispesies technology to replace single-species plants as a component of the landscape.

New perennial mix – The selling price offered for another multispecies technology output, the new perennial mix was similar to the annual mix at RM17.50 per container, of which 78% of the respondents agreed to purchase at this price. In contrast to the annual mix, the perennial mix does not need to be replaced frequently. This is because this type of floral mix has a life span of more than three years. About 82% of respondents were willing to pay a minimum price of RM15 for this multispesies plant. Maximum price up to RM20 was accepted by 70% of the respondents.

Dendrobium horn-type – The selling price offered for this variety of orchid was RM22.50. The acceptance of this price was highest for dendrobium orchids where 82% of respondents stated their agreement to pay at that price. This kind of orchid is suitable as decorative plants with a 20 to 30% shade and the flowers can last up to 3 weeks. The maximum price was RM25 (70%) while the minimum price RM20 (80%).

Arundina suria – These orchid seedlings are usually sold around RM7 to RM10 per polybag. The proposed selling price for the newly launched *Arundina suria* was RM9 in a 5-inch polybag and 72% of respondents expressed their willingness to pay at this price. This sun-loving orchid was launched in early December of 2018. Apart from being sold in polybags, the orchids are also sold in 16-inch size pots which can cost between RM80 to RM100 per pot.

Summary and conclusion

The potential of selected native and exotic plants developed by MARDI has been evaluated among institutional users consisting of municipalities, hotels, schools and universities, airports, government and private premises. Institutional consumers emphasised three aspects or key factors in making decisions on the selection and purchase of plants for landscaping or interior decorations on their premises. The ornamental plants should be in accordance with the specifications and requirements

of a company or institution, as well as easy to maintain. When there is more than one option that meets the criteria and specifications required, then price will be the determinant factor of the plant choice and then only the purchase will be made.

Local institutions generally accept and are willing to pay a suggested price for the ornamental plants studied. Sensitivity to price changes is measured descriptively and can be seen through the average minimum price and the maximum price that is payable, which differs for each ornamental plant studied. The percentage increase or decrease mirroring their acceptance occurred when the price changed. Acceptance towards the price was highest for the dendrobium horn-type orchid while the lowest acceptance was for the mini plant, *Piper porphyrophyllum*. Generally, ornamental plants developed by MARDI are well accepted and can potentially be used in large scale by all institutional users, although based on the findings of this study, there was a high tendency of usage potential in airports and municipalities for interior decoration and landscape beautification.

Recommendations

Information from this study can be used by horticultural research officers to develop exotic ornamental plant varieties or new related technology to meet the characteristics of floral and ornamental plants that are often preferred by different institutions. Accepted level of the pricing threshold and their willingness to pay is useful to assist in planning promotional and marketing strategies especially when dealing with potential companies or individuals during pre-commercialisation and commercialisation stages. Sensitivity to price changes can be identified through changes in the percentage of their acceptance level. Pricing can be made based on the minimum and maximum price gap afforded by the institution.

Based on the requirement aspects and building design, miniature plants and dendrobium horn-type orchids were well accepted and meet the specifications for use at the airport especially intended to be placed on counter tops and specific areas at the main terminal. Additionally, institutions such as hotels also showed huge interest, showing potential to be part of their built-in interior design, which was not limited to mini-plants but also accepted as potted plants. It should be noted that institutional users find it important to have a face-to-face discussion to identify specifications and requirements, prior to determining the best plant that matches their budget allocation and building structure.

Multispesies clearly have the potential to replace seasonal or single-species plants as landscape elements to be managed by municipalities. Expansion agent services should be used to raise awareness of institutional users on crop species developed from time to time. The price information on willingness to pay for each crop in the scope of this study can be used as a reference for making sales and pricing decisions.

References

Biswas, A. (2016). A Study of consumers' willingness to pay for green products, *Journal of Advanced Management Science* 4 (3): 211 – 215

Department of Agriculture, Malaysia (DOA) (2018). *Booklet Statistik Tanaman (Subsektor Tanaman Makanan) 2017*

Department of Agriculture, Malaysia (DOA) (2017). *Direktori Florikultur Malaysia*

Dorsch, M.(2011). The Willingness to pay for environmental protection: Are developing economies different?. Proceedings of the German Development Economics Conference, Berlin, Research Committee Development Economics

Forleo, M.B., Romagnoli, L. and Palmieri, N. (2018). Environmental values and willingness to pay for a protected area: a segmentation of Italian university students. *International Journal of Sustainable Development and World Ecology* 26 (1): 45 – 56

Hu, W. and Wall, G. (2005) Environmental management, environmental image and the competitive tourist attraction, *Journal of Sustainable Tourism* 13 (6): 617 – 635

Kelley. K.M., Behe, B.K., Biernbaum, J.A. and Poff, K.L. (2001). Consumer preference for edible-flower color, container size, and Price. *HortScience* 36 (4): 801 – 804

Maxwell, S., Mayer, V.F., Avila, M.G. and Diller, H. (2013). Reactions to a price increase: What makes it seem fair. *Global Journal of Management and Business Research Marketing* 13 (3): 1 – 9

Ministry of Agriculture and Agro-based Industry, Malaysia (MOA) (2014). *Perangkaan Agromakanan*

Ministry of Agriculture and Agro-based Industry, Malaysia (MOA) (2011). *Dasar Agromakanan Negara 2011 – 2020*

Nandi, R., Bokelmann, W., Gowdru, N. and Dias, G. (2017). Factors influencing consumers' willingness to pay for organic fruits and vegetables: Empirical evidence from a consumer survey in India. *Journal of Food Products Marketing* 23 (4): 430 – 451

Nik Rozana N.M., Mohd Fairuz, O., Noorlidawati, A.H., and Suntharalingam, C. (2016). *Kajian Industri Florikultur Malaysia: Analisis Kelebihan Daya Saing dan Kecenderungan Pengguna Tempatan*. Laporan Kajian Sosioekonomi. Serdang: MARDI

Nik Rozana, N.M. and Noorlidawati, A.H. (2016). Malaysian floriculture industry development Policy, *FFTC Agricultural Policy Platform*. Retrieved on 7 September, 2019 from http://ap.fftc.agnet.org/ap_db.php?id=679

Nik Rozana, N.M., Noorlidawati, A.H., Mohd Fairuz, O., Mohd Tarmizi, H., Wan Rozita, W.E., Rosniza, K., Farah Zaidat, M.N. and Mohamed Hafeifi, B. (2017). *Kajian penilaian potensi pasaran dan rantaian nilai pengeluaran florikultur di kalangan pengusaha nurseri bunga-bungaan*. Laporan Kajian Sosioekonomi. Serdang: MARDI

Rihn, A.L., Yue, C., Behe, B. and Hall, C. (2011). Generations X and Y attitudes toward fresh flowers as gifts: Implications for the floral industry. *HortScience* 46 (5): 736 – 743

Selltiz, C. (1964). *Research Methods in Social Relations*. New York: Holt, Rinehart and Winston

Shankar, V., Rangaswamy, A. and Pusateri, M. (1999). The online medium and customer price sensitivity. eBusiness Research Working Paper, 04-1999 University Park, PA

Silverman, D. (2007). *Interpreting qualitative data*. 3rd ed. London: Sage Publications Ltd.

Siti Uzairiah, M.T. (2017). *Kajian kualitatif dan analisis temu bual*. Kuala Lumpur: Aras Publisher

Syed Abdillah, S.A. dan Md. Yunus, J. (2000). *Permintaan untuk pokok hiasan di kalangan pengguna institusi di Lembah Klang*. Institut Penyelidikan dan Kemajuan Pertanian Malaysia, Serdang: MARDI

Abstrak
Industri florikultur adalah salah satu industri bernilai tinggi. Tanaman hiasan kebanyakannya digunakan untuk tujuan seni taman, hiasan dalaman dan luaran, umumnya bertujuan menghasilkan nilai estetika di persekitaran. Varieti asli dan eksotik baru telah dibangunkan bagi memenuhi permintaan pengguna, sama ada pengguna awam atau pengguna institusi. Objektif artikel ini adalah untuk menentukan potensi industri tanaman hiasan dan sensitivitinya terhadap perubahan harga di pasaran. Survei menggunakan pensampelan tertuju telah dijalankan dalam kalangan pengguna institusi yang terdiri daripada majlis perbandaran, rangkaian hotel, serta premis kerajaan dan swasta. Pengguna institusi menekankan tiga aspek atau faktor utama dalam membuat keputusan pemilihan dan pembelian tanaman untuk digunakan sebagai tanaman hiasan, landskap atau hiasan dalaman di premis masing-masing. Tanaman hiasan tersebut perlulah mengikut spesifikasi dan keperluan khusus sesebuah syarikat atau institusi dan mudah dijaga. Apabila terdapat lebih daripada satu pilihan tanaman yang menepati kriteria dan spesifikasi yang diperlukan, harga akan menjadi penentu. Pengguna institusi umumnya menerima dan sanggup membayar harga yang dicadangkan untuk tanaman hiasan yang dikaji. Sensitiviti terhadap perubahan harga diukur secara deskriptif dan dapat dilihat menerusi purata harga minimum dan harga maksimum yang sanggup dibayar, yang mana ia berbeza bagi setiap tanaman hiasan yang dikaji. Peratus peningkatan dan penurunan terhadap penerimaan berlaku apabila harga berubah. Penerimaan terhadap harga adalah tertinggi untuk orkid *Dendrobium horn-type* manakala penerimaan terendah adalah untuk tanaman hiasan mini *Piper porphyrophyllum*. Umumnya, tanaman hiasan yang dibangunkan dapat diterima dengan baik dan berpotensi digunakan oleh semua institusi, namun berdasarkan dapatan kajian terdapat kecenderungan yang menjurus kepada penggunaan di lapangan terbang dan majlis perbandaran untuk tujuan hiasan dalaman dan hiasan landskap.