

Economic production of selected ornamental plants: Multispecies and *Arundina* orchid

(Ekonomi pengeluaran tanaman hiasan terpilih: Tanaman multispecies dan orkid *Arundina*)

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Abstract

Floriculture planting in Malaysia experienced a new revolution when the floriculture industry listed it as a high-value crop that can benefit the national economy in the 10th Malaysia Plan (10MP). Thus, the horticulture centre in MARDI took the initiative to introduce a few new plants called Multispecies that were suitable for landscape planting and bloomed throughout the season like *Arundina* Orchid (lasting in hot weather) compared to ornamental plants. Costing data was collected at pre-commercial plots at Kuala Lumpur and Rawang to analyse the production cost and financial analysis. In addition, several interviews were conducted with staff who handled the commercialisation and technology generators to find out issues relating to commercialisation of MARDI-produced crops at the domestic level. Financial analysis showed that multispecies and *Arundina* orchid were viable with IIR values of 59% and 98% respectively, and a payback period of 1.66 years for multispecies and 2.02 years for *Arundina* orchid. Among the commercialisation problems identified as barriers to MARDI's horticulture products included unpopularity of varieties in the local market, production issues associated with infrastructure and high production costs as well as marketing and crop copyright issues. In general, multispecies and *Arundina* orchid plants are viable and suitable as landscape plants, and have the potential to be commercialised.

Introduction

Floriculture is a type of horticulture practice which focuses on the cultivation of flowering and ornamental plants for gardens, as well as for commercial use. At present, advancement in plant biotechnology, which includes hybrid sequencing, is a key factor propelling the global floriculture market. The adoption of newer techniques has resulted in increased crop yield and development of genetically modified flowering plants.

The use of modern farm practices has also led to increased profitability for farmers engaged in floriculture. The flower industry offers a wide range of products including cut and dried flowers and leaves as well as ornamental plants. Ornamental plants are mainly used for interior and exterior decoration landscapes. The use of trees or ornamental plants is generally intended to create aesthetic and dynamic value.

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The increase in demand for flower products in the world market is expected to continue at a growth rate of 6% per annum. This rate has increased export value by 45.2% from RM283 million in 2009 to RM517 million in 2017 as reported by the Department of Agriculture (DOA), Malaysia (2018). Japan currently accounts for 25% of the total market followed by Singapore (20%), Thailand (15%), Australia (5%), the Netherlands (5%), Hong Kong (5%), Germany (5%) and the United Arab Emirates (5%). Malaysia has to compete with new world-class floriculture manufacturers leading in floricultural products trade such as Indonesia and Thailand.

The government took the initiative of listing the floriculture industry as a high value-added commodity that could boost the country's economy. Annual growth projections along the country's policy of national flower production increased from RM468 million cuts or pots by 2020, a growth of 6.2% a year. Export value of floriculture was projected to increase from RM449 million in 2010 to RM857 million by 2020, an increase of 6.7% a year according to National Agrofood Policy (2011 – 2020).

The floriculture industry in Malaysia is relatively stable with an estimated total number of cut flower farms above 1,218 ha (580 ha with orchids and 638 ha of cut flowers). The largest cut flower farm was in Pahang producing *Chrysanthemums*, while orchids were produced in Johor (DOA 2018). Based on the statistics data from

2014 to 2018 (Table 1), total production increased from 498 million in 2014 to 524 million in 2018 in line with the increase in total crop area and potential to grow. Similarly, exports increased by 36.7% from 2014 to 2017, while imports declined slightly in 2015.

The development of new native and exotic varieties was expected to give new injection to boost the floriculture industry through new species and the developed floricultural technology package to have a long-term impact on the growth pattern of the country's floriculture industry. This development was carried out by MARDI through the Horticulture Research Centre along with the 11th Malaysian Plan (2016 – 2020). The main focus was on the adaptation activities of native and exotic species as ornamental and functional plants, mass production of crops, pest management and eco-friendly diseases, quality retention and post-harvest management, and market potential evaluation.

Native ornamental plants are rarely used as ornamental plants for landscape because they do not have bright flowers but only attractive leafy plants. Some varieties of native ornamental plants have been identified as miniature ornamental plants such as *kelampayan batik* (*Scindapsus pictus*), *sireh harimau* (*Piper porphyrophyllum*), *keladi jantan* (*Schismatoglottis calyptrate*), *keladi baldu hitam* (*Alocasia regimula*), *balung ayam* (*Celosia spicata*) and *medinilla oren* (*Medinilla scortechinii*).

Table 1. Malaysian floriculture statistical data (2014 – 2018)

	2014	2015	2016	2017	2018
Harvested area (ha)	2,619	2,610	2,559	2,605	2,687
Production (cuts/pots/plan)	498,967,031	510,290,217	500,084,413	509,085,932	524,650,404
Production value (RM 'million)	331	338	332	338	348
Export (RM 'million)	372	429	494	517	n.a
Import (RM '000)	24,739	27,898	23,875	23,700	n.a

Source: Ministry of Agriculture and Agro-Based Industry, Malaysia (2019) n.a = not available

Exotic ornamental plants are plants that come from abroad and are introduced into the country. Usually, exotic plants have beautiful and attractive flowers as well as interesting morphological criteria. Exotic ornamental plants are grown in habitats similar to the country of origin and adapted as ornamental plants, adding as new biodiversity and ideas for landscaping. Some exotic plants have been combined to produce the multispecies technology.

Multispecies technology was developed through the mixing of different plant species with different flowering periods and stages within a group of flowering plants as they flower throughout the season. Seasonal flowers such as *Celosia* and *Gomphrena* have been identified as fast flowering species while species such as *Cosmos*, *Tagetes* and *Tithonia* are slow flowering. Through the planting of multispecies seed mixing formulations, the colourful plant community looks natural, dynamic and lacks maintenance in the resulting landscape. Therefore, other approaches have been developed through multispecies technology to improve existing crop cultivation and maintenance practices.

The hybrid, *Arundina graminifolia*, locally known as Arundina suria and Arundina mentari are new variants developed by MARDI to suit the Malaysian temperature and produce heat resistant orchids which could flower often throughout the season. These two species of orchids were produced through the combination of three species of orchids from *Arundina graminifolia* originating from Malaysia, Vietnam and India. These three orchids were selected because they were durable, flowering throughout the season and ideal as a landscape crop.

This article reviewed the financial viability of these two species of flowers that were produced at the pre-commercialisation level. The viability of these flower species included the calculation of production costs, the cost of input materials such as fixed costs, variable costs and labour costs

involved. In addition, this article also described the HR issues and challenges of commercialisation of new plant varieties and penetration of MARDI into the local market.

Methodology

This study involved primary and secondary data collection. Secondary data was collected through statistical reports, journals, books and website of DOA. Primary data like costing, yield and flowering season were measured from the plot of Mutispecies under Kuala Lumpur City Hall (DBKL) with an approximate area of 100m². Meanwhile, for *Arundina* orchid plant species, data were obtained from the Arundina crop plot garden of 80 m² set up by SP Setia developers at Rawang. These data were acquired for the purpose of calculating the viability of production for these crops at the pre-commercial stage and only grown as research plots by both the developers.

In addition, interviews were also conducted with the technology plant generators at the Horticulture Research Centre (HR), entrepreneur plant nursery and floriculture, and officers at the Centre for Technology Commercialisation and Business (CB), particularly with those who had served under the Technology Commercialisation Programme (CB2) and the Production of Seeds, Crops and Livestock Programme (CB3). Respondents were interviewed either individually or in groups using a semi-structured questionnaire as a data collection instrument.

Cost analysis

Cost analysis is an estimate of income based on the data obtained (*Table 2*). Production costs was divided into two, namely, fixed and variable costs. Fixed cost is the development cost used to set up the business to buy or develop facilities such as building, machineries and vehicles that are involved in business, while the variable cost is the quantity and value of inputs that is always used and changes depending on the production scales. Most of the common

Table 2. Production cost analysis

Analysis	Formula
Gross income	Yield x Farm price
Net income	Gross income - Total cost of production
Total production cost	Variable costs + fixed costs + other costs
Return on investment per ringgit (gross)	Gross income/Total production cost
Return on investment per ringgit (net)	Net income/Total production cost
Break-even point	Total production costs (RM)/Total production (kg) (to get production cost per kg)

inputs used are soil, fertilizer, seed and equipment. Cost analysis showed the estimated income earned based on the data obtained during the study of gross and net income, cost of production, gross and net return and profit margins.

Financial analysis

Cash flow was constructed to capture the viability of the project for a period of 5 years. It generated the net present value (NPV), internal rate of return (IRR), the cost benefit ratio (BCR), gain on investment, break-even period and the average annual profit (Table 3).

Results and discussion

Production cost

Production costs consists of fixed and variable costs. Development costs are fixed costs known as capital to start a project. These costs include infrastructure facilities such as irrigation systems, roads, stores, farm machinery, vehicles, farm equipment, plant preparation and seedlings. Variable cost is the value and quantity of inputs that changed depending on the production scale including labour costs, input costs and other costs.

For multispecies plants, assuming a planted area of 0.8 ha, up to 3,000 trays can be fixed with a capacity of 8,850 plants at a time. The initial cost was estimated to be around RM71,247.8 for a period of one year or three seasons of cycle, with a sale price of RM25/tray and the production cost for one tray was RM22.60. This meant that the profit cost was RM2.40 per container.

Based on the NPV, IRR and BCR values as indicators in the consolidated cash flow, a discount rate of 0.25% was obtained. The BCR indicated a project's profitability and a ratio above 1 indicated that investment is profitable. The NPV for 5 years was RM23,720.75 (Table 4). This meant that the stream of cash inflow discounted at the cost of capital, minus the initial cost of the project. The positive NPV analysis value showed that project was profitable and sustainable. The payback period (PP) is the capital repayment period funded for the year of project start and the project's return period was 1.66 years for multispecies plants. The project is more profitable and sustainable if the payback period is shorter.

Table 4 also shows the total cost and list of input planting materials for one season for *Arundina* orchid. It can accommodate up to 3,000 pots at a time by assuming 0.8 ha of planted area. The sale price is based on the pot, which is RM20 and initial costs needed was RM45.018 and harvested in 8 months for one season. Production cost for one pot of *Arundina* Orchid was RM14.29 which meant that profit cost was RM5.71 per pot if the sale price was RM20. Indicator values such as NPV, IRR and cost interest ratio in the cash flow statement discounted at 10%. The BCR is an indicator of a project's profitability and a ratio above 1 indicated that investment was profitable. The value of NPV for the next 5 years mean revenue of RM38,569.66 for future was discounted at the cost of capital, minus the initial cost of the project. The NPV analysis values were positive

Table 3. Financial analysis

Analysis	Description
NPV	Evaluates the level of project viability by dividing the value of money over time. Viable projects had a positive NPV value and higher compared to other projects. Negative NPV values indicated that the project is at a disadvantage and cannot generate sufficient financial flow to repay the investment.
IRR	Evaluates the project's viability by dividing the value of money over time. High IRR values indicated that they were more viable than projects with lower IRR values.
Break-even point	The time taken to recover the capital investment that has incurred. The shorter the time it takes to recover the capital, the better the project would be.
BCR	Obtained by dividing the total revenue in projects with a total expenditure. BCR value shows the rate of return per RM invested. Should the BCR exceeds 1, then the project will be profitable.

Table 4. Cost of production of Multispecies and *Arundina* Orchids (0.8 ha)

Indicators	Multispecies	<i>Arundina</i> orchid
Average development costs (RM)	23,620.00	14,508.00
Average input costs (RM)	41,235.00	38,833.00
Average labour costs (RM)	3,000.00	3,000.00
Average of other costs (RM)	3,392.80	2,144.00
Total costs (RM)	71,247.80	45,018.00
Average yield (trays/pots)	3,000.00	3,000.00
Average farm price (RM)	25.00	20.00
Average gross margin (RM)	30,765.00	21,167.00
Average net income/year (RM)	13,752.30	14,982.00
Average production cost (RM/tray/pot)	22.6	14.29
Financial analysis		
NPV@10%	RM23,720.75	RM38,569.66
IRR	59%	98%
BCR@10%	1.24	1.42
PP	1.66	2.02

meaning that this project was profitable and sustainable, given the higher returns than the initial investment. The PP for the capital repayment period funded in the year of project start and the project return was 2.02 years for *Arundina* orchid plants.

Issues and problems in commercialisation

Floricultural industry in Malaysia is well established since a long time ago but relatively slow moving and not emphasised comprehensively. There are many issues and challenges faced by the floriculture industry

players in Malaysia, especially technology generators.

Based on the interviews, quantitative analysis was performed on why plant varieties developed by MARDI through HR Centre were less successful in terms of technology transfer and commercialisation. The issues and challenges faced by the technology generators and commercialisation were categorised into production, marketing and copyright (Intellectual Property) as shown in *Table 5*.

Table 5. Issues and challenges faced by the technology generators and commercialisation

Aspect	Issues and challenges	Related quotes
Production	Infrastructure and environment stability	Issues related to infrastructure problems were more than for water problems (Respondent no. 3). Insufficient staff and less production, poor infrastructure with frequent flood problems making it difficult for production process. The suitable land has already been sold to others (Respondent no. 4). As a producer, our current problem was in the fields where there is no water source, no rainwater pool. The second problem was operating in lowland areas. So this infra should be fixed so that land can be used well as usual (Respondent no. 5).
	Production costs	In terms of sales and demand, there were no problems. Only recently our prices had increased from RM2.00 to RM3.00. The input costs have all gone up so we revised the sales price but it was often the case that a sudden change causes customers, especially the regular ones to become noisy and frustrated (Respondent no. 1). When the cost of input increased, we revised the price but our customers were angry at the increased price. So now we maintained the old price but the quantity decreased (Respondent no. 2).
	Premium crop production	When people came to buy the plants, they enquired about the latest types of orchids at the sales centre as it was reported in the newspaper that MARDI had launched a new variety of orchid. However, they were dissapointed as there was no production (Respondent no. 4).
Marketing strategy	Types of flowers (potted flower plants)	Most of the international buyers e.g. from Europe and Germany, favoured potted flowers because they lived in apartments and put small plants near the windows (Respondent no. 7).
	Interesting hybrid flowers	Consumers preferred a beautiful hybrid flower to unattractive clones (Respondent no 7).
Copyright (Intellectual Property)	Awareness of the Plant Variety Protection (PVP)	Malaysia was just about to introduce the PVP, however, awareness was less (Respondent no. 6).
	Refined the effectiveness of PVP	Industry disagreed with the PVP, and did not support it. It could be beneficial to industry, but has to be enforced and applied properly (Respondent no. 6).

Source: Field survey (2019)

Production

Production was the major issue that needed to be emphasised and addressed in discussions with technology generators. Among the issues faced by technology generators and commercialisation were infrastructure and environmental stability, increased production costs and crop production. The problems that related to environmental stability and infrastructure was that the plotting area was always hit by floods. Small plotting areas cannot support mass production and irrigation system problems. The plot areas provided inadequate and limited capacity for large-scale production. Infrastructure and small number of skilled staff/workers limited the number of seedlings. This resulted in inadequate production of seedlings to meet high market demands. In some plot areas, an additional issue was insufficient water resources. This problem will cause a decline in production if no action was taken. The high cost of inputs will lead to high selling price and demand will be less as consumers will look for more options to other substitute ornamental plants.

Marketing issues

Understanding the consumer needs is the main important element in business which includes consumer's preferences. In general, consumers tend to find products that are easy to find, attractive, reasonably priced and easy to maintain. Potted flowers were the most popular among local consumers for interior and home decorations, followed by cut flowers purchased as gifts (Nik Rozana et al. 2016). There were many factors that consumers considered before purchasing flowers such as colour, variety and price (Nik Rozana et al. 2017). Consumers preference should be emphasised in marketing strategies in developing the local floriculture industry.

Copyright (Plant Variety Protection)

Plant Variety Protection (PVP) is also known as plant rights. It is a form of intellectual property that gives the technology generators an exclusive right to protect their inventions from being exploited by irresponsible parties. This particular right enables the holder to prevent other parties from producing new varieties of plants that have been protected under it. However, in Malaysia, knowledge of PVP protection is still new and poorly implemented at the producers level. In addition, the issue of crop exploitation has been around for a long time and the implementation of PVP has been seen to be less effective.

Summary and suggestions

The native and exotic plants developed by MARDI have the potential to be developed for landscape instead of using only ornamental plants. Financial analysis showed that the production cost for *Arundina* orchid and multispecies plants were low with high returns. Values of viability measurements such as NPV, IIR and BCR showed positive indicators and ensured profitability in the short term.

Focus should be given to some of the issues identified such as production, marketing and copyright pattern for new varieties of flowers. Production issues such as land, high cost of inputs, labour and logistics were the main obstacles to mass production. Marketing was also one of the main issues when the crop produced did not meet consumer's preferences and demand in Malaysia.

The results of this study could be used as a guide for the horticulture centre's research to develop more exotic varieties or new technologies that can enhance the competitiveness of Malaysian domestic flowers and ornamental plants in the global market. The findings of this study are expected to assist in formulating stronger strategies, approaches or policies to facilitate marketing and export market channels, thus preserving the country's floriculture industry.

Based on the findings obtained from the information and analysed data, the following suggestions can be made:

- Information on the issues and problems that were encountered in commercialisation should be given more attention to improve commercialisation mechanisms in terms of procedures and the floriculture product market.
- The information of sales margin or profit margin can be used as a reference especially for new entrepreneurs who are interested in starting a business in the floriculture industry.

Abstrak

Tanaman florikultur di Malaysia telah mengalami revolusi baharu apabila Rancangan Malaysia ke-10 (RMKe-10) menyenaraikan industri florikultur sebagai tanaman bernilai tinggi yang boleh menguntungkan ekonomi negara. Pusat Penyelidikan Hortikultur MARDI mengambil inisiatif dengan memperkenalkan beberapa tanaman baharu yang sesuai untuk dijadikan tanaman landskap berbanding dengan tanaman hiasan iaitu tanaman multispesis yang berbunga sepanjang musim dan orkid *Arundina* yang tahan cuaca panas. Data kos tanaman diambil di plot tanaman secara prakomersial di Kuala Lumpur dan Rawang untuk membuat pengiraan analisis kos pengeluaran dan analisis kewangan. Selain itu, beberapa temu bual dengan pengkomersial dan penjana teknologi dilakukan bagi mengetahui isu dan masalah berkaitan pengkomersialan tanaman keluaran MARDI di peringkat tempatan. Analisis kewangan menunjukkan tanaman multispesies dan orkid *Arundina* adalah berdaya maju dengan nilai IIR 59% dan 98% masing-masing dan tempoh pulang modal sebanyak 1.66 tahun bagi tanaman multispesis dan 2.02 tahun bagi orkid *Arundina*. Beberapa masalah pengkomersialan dikenal pasti menjadi halangan untuk produk hortikultur keluaran MARDI seperti gagal mendapat tempat di pasaran tempatan. Antaranya masalah pengeluaran yang dikaitkan dengan infrastruktur dan kos pengeluaran yang tinggi serta masalah pemasaran dan hak cipta tanaman. Secara amnya, tanaman multispesis dan orkid *Arundina* berdaya maju dan berpotensi untuk dikomersialkan serta sesuai untuk dijadikan sebagai tanaman landskap.

References

- Department of Agriculture (DOA) (2018). *Direktori Florikultur Malaysia*. Jabatan Pertanian Malaysia
- National Agrofood Policy (2011 – 2020). *Dasar Agromakanan Negara*. Kementerian Pertanian dan Industri Asas Tani (MOA), Malaysia
- 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. MARDI, Serdang
- 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-bunga*. Laporan Kajian Sosioekonomi. MARDI, Serdang