Malaysian Palm Oil Supply Chain: The Role of the Oil Palm Nursery Operators

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ABSTRACT

The function of the oil palm nursery sector is to produce high quality oil palm planting materials to the growers. Therefore, to ensure the smooth operation of the whole supply chain of the Malaysian palm oil industry, this subsector should operate efficiently. Ineffective management at this point will affect directly the efficiency of the oil palm producers and indirectly the other subsectors in the oil palm chain. Hence, when some of the oil palm nursery operators are inefficient, the producers and other subsectors will be negatively affected. A study found that there is room for improvement to enable these nursery operators to become efficient. Among others, they can become efficient if they are subjected to mandatory oil palm nursery certificates of competency (OPNCC). Sufficient knowledge on how to operate their nurseries well should be provided, especially to the new operators. Elements of inefficiency among some of them could thus be solved through MPOB to ensure that they are able to produce seedlings of a high quality.

BACKGROUND

Oil palm nurseries is an upstream subsector of the Malaysian palm oil supply chain. This subsector comprised 431 operators registered in the Malaysian Palm Oil Board's (MPOB) database in 2007 (*Table 1*). Sabah recorded 106 operators, representing 24.59% of the total number of operators in Malaysia, and forming the largest number of operators in 2007. Meanwhile, Johor, Sarawak and Perak recorded 87, 67 and 57 operators respectively, cumulatively representing another 49% of the total number of oil palm nursery operators in Malaysia. The remaining states made up only 26.41% of the total number.

There are two categories of nursery operators, namely, the single stage and the double stage. The former consists of operators who plant oil palm seeds directly into big polybags (38.1 cm x 45.7 cm) [15" x 18"] and transfer the seedlings to the farm after 12 months. Meanwhile, the latter makes up a group of operators who plant the seeds in smaller polybags (15.2 cm x 22.8 cm) [6" x 9"], and then transfer the seedlings into the big polybags after three to four months.

The oil palm seedlings are ready to be sold to the oil palm growers, namely the estates and smallholders, from the age of 10 months onwards. These buyers normally purchase either directly from the oil palm nursery operators or through middlemen, which include oil palm dealers or contractors of the plantations.

The nursery operators need to provide good planting materials to the oil palm producers. As

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such, they need to practice Good Agricultural Practices (GAP) which include all management aspects, such as applying sufficient fertilizer, carrying out weed control and pest control, using a good watering system, practicing a culling procedure as well as germinated seed selection.

Like other subsectors of the oil palm industry, this subsector of nursery operators also plays a very important role in the supply chain. It is important to note that it is linked with other subsectors of the whole supply chain. Thus, the success of the supply chain depends on the efficiency of each subsector – if one is inefficient, it may affect the performance of other subsectors, and therefore the whole industry may become inefficient. It is the purpose of this study to investigate the efficiency of the oil palm nursery operators in carrying out their activities. As such, the problems, the efficiencies and the structural changes in the subsector will be dealt with in this study.

The related issues that were studied are as follows:

- is the oil palm nursery subsector operating in an efficient manner?;
- what are the structural changes that contribute to the good performance of the oil palm nursery operators?; and
- what are the other factors that cause the less efficient operation of the nurseries?

LITERATURE REVIEW

A study conducted by Mohd Arif (2002) concentrated on the economics of oil palm planting material production. He found that SITS (*Skim Insentif Tanaman Semula*) was expected to bring about new chains of development in the Malaysian palm oil industry. At the same time, SITS was also envisaged to lead to increase in demand for quality seedlings. Effective regulations are essential for the development of an effective seedling industry which is capable of producing high quality seedlings in the future.

To understand the new trends in the technology for supply chain management, it is worth reviewing the latest definitions from the literature. Kalakota and Whinston (1997) defined supply chain as 'a collection of interdependent steps that, when followed, accomplishes certain objectives such as meeting customer requirements'. A study conducted by Aitken (1999) defined supply chain as 'a network of connected and interdependent organizations mutually and co-operatively working together to control, manage and improve the flow of materials and information from supplies to end users'. Tan and Shaw (1999) described the supply chain slightly differently, namely, 'a supply chain is a network of business units and facilities that produce raw materials, transform them into intermediate goods and the final products, and deliver the products to customers through a distribution system'.

This study also applies to the work done by Handfield and Nichols (1999), who in turn, emphasized the importance of raw materials and information flow so that the supply chain encompasses all activities associated with flow and transformation of goods from the raw materials stage (extraction) to the end user, as well as the associated information flows. Both materials and information flow up and down the supply chain.

METHODOLOGY

The study adopted a face-to-face interview with the oil palm nursery operators registered with MPOB. The operators were selected based on a stratified random sampling approach in which stratification was based on the states in which they were living. In each state, they were randomly selected based on computer generated numbers. Further differentiation was made between operators with oil palm nursery certificates of

TABLE 1. OIL PALM NURSERY OPERATORS BY STATE (2007)

State	Number of operators	Percentage of total
Sabah	106	24.59
Johor	87	20.19
Sarawak	67	15.55
Perak	57	13.23
Pahang	35	8.12
Selangor	21	4.87
Kedah	20	4.64
Terengganu	9	2.09
N. Sembilan	8	1.86
Melaka	7	1.62
P. Pinang	7	1.62
Kelantan	7	1.62
Total	431	100

Source: MPOB.

competency (OPNCC) and those without OPNCC. The interview was facilitated by a questionnaire and was carried out at the premises of the nurseries.

Based on the Yamane (1967) formula[1], the sample size for this study (*n*) was 82 out of a total of 431 oil palm nursery operators (*N*) in the country. This was achieved with a 90% degree of confidence (*e*).

Based on the stratification approach, the sample size of nursery operators[2] to be interviewed in each state (n_i) was calculated and their distribution is tabulated in *Table 2*. This table, however, indicates that in the study 17 more operators were interviewed than the statistically recommended number of 82.

TABLE 2. SAMPLE SIZE OF NURSERY OPERATORS BY STATE

State	Recommended sample size	Number interviewed
Sabah	20	20
Johor	16	22
Sarawak	13	15
Perak	11	12
Pahang	7	8
Selangor	4	6
Kedah	4	4
Terengganu	2	4
N. Sembilan	2	2
Melaka	1	4
P. Pinang	1	1
Kelantan	1	1
Total	82	99

RESULTS AND DISCUSSION

Some Key Features of the Oil Palm Nurseries/Operators Efficiency of Oil Palm Nursery Operators with and without Oil Palm Nursery Certificates of Competency (OPNCC)

It was found that nursery operators with OPNCC were more efficient in operating their business. This is because OPNCC holders usually follow GAP in managing their nurseries as compared to those without OPNCC, who normally do not follow the GAP as suggested by MPOB. The study found that 23 of them had OPNCC while 76 of them did not have the certificates.

Average Quantity of Oil Palm Seedlings Per Hectare

The number of oil palm seedlings produced per hectare by each operator ranged from 2500 to 50 656. This gives an average production of 16 420 seedlings and a median of 13 591 seedlings per acre, as shown in *Figure 1*.

Selling Price of Oil Palm Seedlings

The price of oil palm seedlings offered by the oil palm nursery operators ranged between RM 4 and RM 8 per seedling. The mean

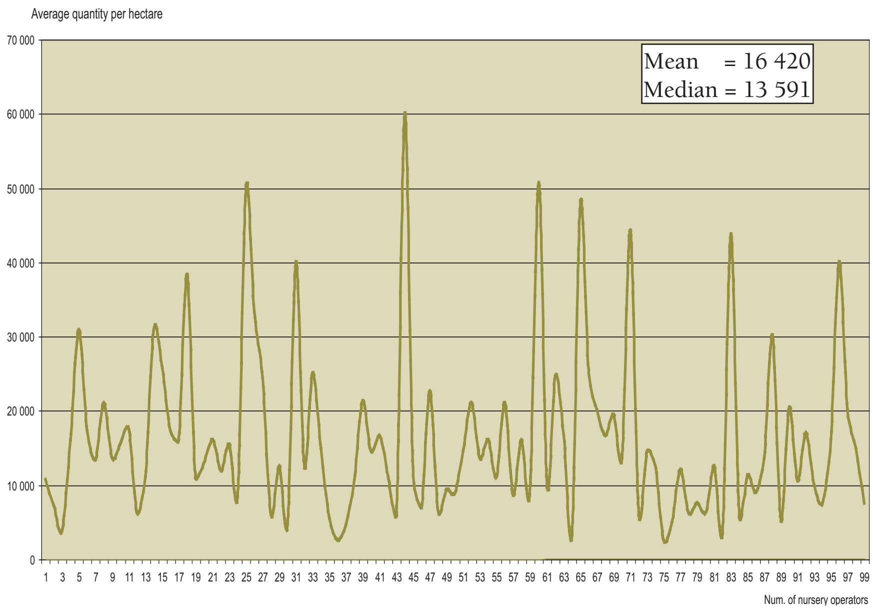

Figure 1. The mean and median numbers of oil palm seedlings produced by each operator (per hectare).

[1] Yamane (1967) formula: n = N/{1+N(1-e)[2]}, where *n* = sample size of operators to be interviewed in Malaysia, *N* = number of operators in Malaysia, and *e* = degree of confidence.

[2] Sample size of nursery operators to be interviewed in a state is $n_i = n \times (N_i/N)$, where n_i = sample size of operators in state *i*, *n* = sample size of operators to be interviewed in Malaysia, N_i = number of operators in state *i*, and *N* = total number of operators to be interviewed in Malaysia.

price of oil palm seedlings was RM 5.51 each, and the median was RM 5.50 as shown in *Figure 2*.

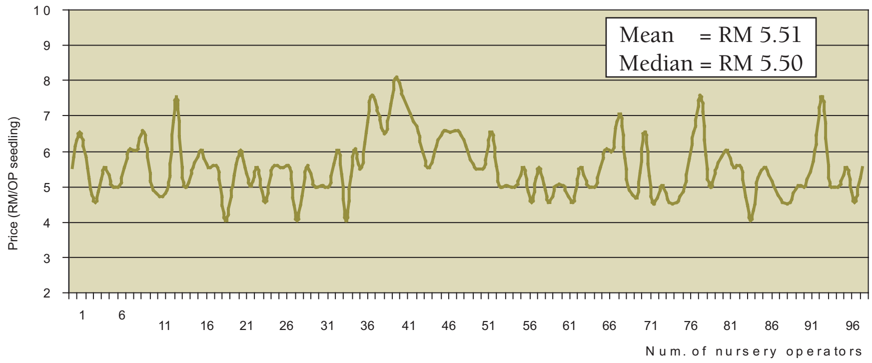

Figure 2. The mean and median prices of oil palm seedlings (RM per seedling in 2007).

Price of Germinated Oil Palm Seeds

The study shows that price of germinated oil palm seeds purchased by these operators ranged between RM 1.05 and RM 1.38 per seed. The average price was RM 1.28 per seed, and the median was RM 1.30 as shown in *Figure 3*.

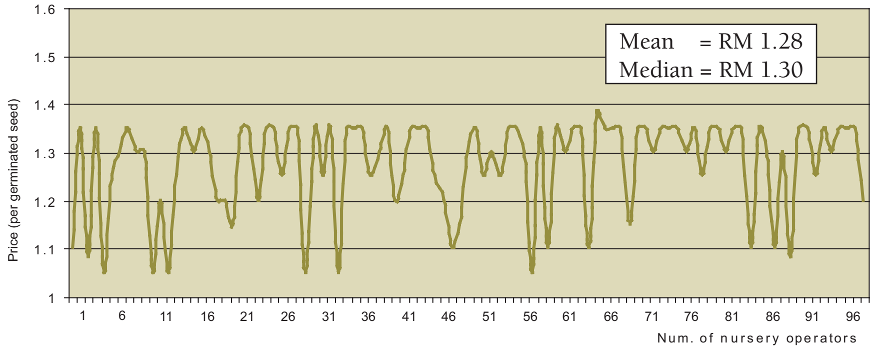

Figure 3. The mean and median prices of germinated oil palm seeds paid by each operator (RM per germinated seed in 2007).

Percentage of Culling

The percentage of culling carried out by each oil palm nursery operator ranged from 5%-25%, while the mean or average culling was 14.76% and the median was 15% (*Figure 4*).

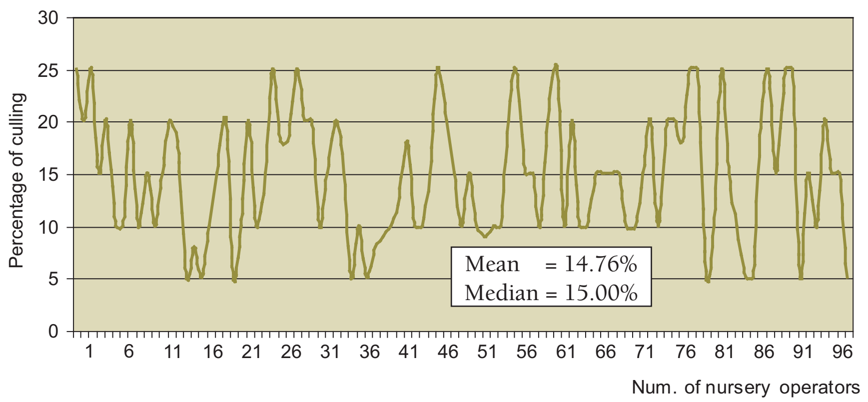

Figure 4. The mean and median percentages of culling of oil palm seedling practised by each operator.

Analysis of the Production Cost of Seedlings

Costing of the production of oil palm seedlings below 12 months old was examined based on the analysis of four major cost components, namely, cost of purchasing inputs such as geminated seeds, polybags, top soil, chemical fertilizers, weedicide and pesticide; labour cost for each activity at the oil palm nursery; cost of diesel and utility usage; and cost of culling oil palm seedlings.

This study shows an example of the cost of production of oil palm seedlings by a single nursery operator, based on his production scale of 12 000 oil palm seedlings per hectare. *Table 3* shows that the average cost of purchasing inputs for seedlings less than 12 months old was RM 3.147 per seedling or RM 37 764/ha/yr. Thus, major cost components were the costs of purchasing germinated seeds and chemical fertilizers.

Table 4 shows the costs of labour which was used for different types of activities at the nursery site. The cost of labour was RM 0.457 per oil palm seedling until age of 12 months. The total labour cost was RM 5484/ha/yr, out of which the cost of transferring the seedlings into big polybags formed the major component.

The costs of diesel and utilities (electricity and water supply) are shown in *Table 5*. The average cost of diesel was RM 0.144 per oil palm seedling or RM 1728/ha/yr. The average costs of electricity and water supply were RM 0.030 and RM 0.015 per oil palm seedling, or RM 360 and RM 180/ha/yr, respectively. Hence, the total cost of purchasing diesel and paying for other utilities was RM 2268/ha/yr.

The last cost component was the cost of culling the oil palm seedlings. For the purpose of cost calculation, an assumption of a 10% culling rate was made. *Table*

TABLE 3. COST OF PURCHASING VARIOUS INPUTS

Input	Average cost (RM/seedling)	Average cost (RM/ha/yr)
Germinated seeds	1.350	16 200
Small polybags	0.020	240
Big polybags	0.200	2 400
Top soil	0.400	4 800
Chemical fertilizers:		
i) NPK Yellow	0.570	6 840
ii) NPK Blue	0.216	2 592
Chemical weedicide	0.122	1 464
Chemical pesticides:		
i) Nurelle D 505	0.049	588
ii) Antrecol 70 WP	0.220	2 640
Total	3.147	37 764

TABLE 4. LABOUR COST FOR VARIOUS ACTIVITIES IN THE NURSERY

Activity	Average cost (RM/seedling)	Average cost (RM/ha/yr)
Filling top soil into small polybags	0.020	240
Planting seeds into small polybags	0.010	120
Transferring seedlings into big polybags	0.200	2 400
Arranging polybags in rows	0.050	600
Spraying:		
i) Weedicide	0.048	576
ii) Pesticide	0.027	324
Watering	0.036	432
Manuring	0.066	792
Total	0.457	5 484

TABLE 5. COST OF DIESEL AND UTILITIES

Item	Average cost (RM/seedling)	Average cost (RM/ha/yr)
Diesel	0.144	1 728
Utility bills:		
i) Electricity	0.030	360
ii) Water	0.015	180
Total	0.189	2 268

6 shows the cost of culling the seedlings between one and four months and between five and 12 months. The average cost for a younger seedling was around RM 0.053 each, or RM 31.80/ha/yr. The average cost of culling for a seedling aged between five and 12 months was RM 0.269 each, or RM 161.40/ha/yr. Thus, the total cost for culling was RM 193.20/ha/yr.

From these four main cost components, the total cost of producing oil palm seedlings therefore was RM 4.155 each (*Table 7*). This brings the grand total cost of oil palm seedling production to RM 45 709.20 for each hectare of oil palm nursery having 12 000 seedlings.

Elements of Inefficiencies

As mentioned above, it is important for the nursery subsector to be as efficient as other subsectors in the whole supply chain. Based on the results of the interview, it was found that there are some elements of inefficiencies in this subsector, and they are discussed below:

Spacing requirement. About 84% of the oil palm nursery operators failed to follow the right spacing required by oil palm seedlings as recommended by MPOB. They consist of those without OPNCC. Their reason was to increase the density of the oil palm seedlings in 1 ha of land. By doing so, they could sell the seedlings at a lower price as compared to those operators who followed the right spacing and had fewer seedlings per hectare.

Under such a scenario, the culling procedure could not be performed effectively if the seedlings were too close to one another. It became more difficult especially when they reached the age of eight months and above. Furthermore, the seedlings would compete for sunlight, and their leaves would become slightly longer if sunlight was insufficient compared to those receiving enough sunlight. Consequently, these seedlings could easily become stunted and take a longer time to be productive as compared to a normal palm.

TABLE 6. COST OF CULLING OIL PALMS SEEDLINGS (up to 12 months of age)

Item	Average cost (RM/seedling)	Average cost (RM/ha/yr)
Culling small oil palm seedlings (1-4 months)	0.053	31.80
Culling mature oil palm seedlings (5-12 months)	0.269	161.40
Total	0.322	193.20

TABLE 7. GRAND TOTAL COST OF PRODUCING OIL PALM SEEDLINGS (up to 12 months)

Cost item	Average cost (RM/seedling)	Average cost (RM/ha/yr)
Inputs	3.147	37 764
Labour costs	0.457	5 484
Diesel and utility bills	0.189	2 268
Culling	0.322	193.20
Total	4.155	45 709.20

Insufficient fertilizer application. Insufficient application of fertilizers can affect the quality of oil palm seedlings. The study found that about 28% of the oil palm nursery operators did not apply sufficient fertilizers. This problem arose due to the high density of seedlings in a given area, making it difficult for the nursery workers to apply fertilizers. The leaves of the seedlings became yellowish when there was a lack of fertilizer.

Non-adoption of the culling procedure. About 15% of the oil palm nursery operators did not follow the proper culling procedure. Observations made during the visits showed that some of the oil palm seedlings which were supposed to be culled were not. According to these operators, the condition of these seedlings could still improve; hence, they continued to maintain them.

Poor nursery management. About 6% of the oil palm nursery operators were found to be unable to manage their nurseries in a good condition. This was due to insufficient knowledge, especially on GAP requirements in an oil palm nursery. For example, they applied insufficient fertilizers, and they lacked knowledge on suitable pesticides to be used for different types of diseases and pests.

Backlog of oil palm seedlings. Due to poor business planning, around 10% of the oil palm nursery operators faced a problem of a backlog of oil palm seedlings, *i.e.* they were unable to sell their seedlings after 12 months. This gave rise to problems for both parties – the seller and buyer. For the seller, it increased the cost of production because of the need for holding the oil palm seedlings, and therefore reduced his profit. Selling price for seedlings above 20 months was lower compared to those between 10 and 14 months. At the same time, the operator could not have new oil palm seedlings because the nursery was still occupied by the unsold seedlings. Sometimes the roots of the old seedlings extended outside the polybags. Any attempt to move the seedling would then damage the roots and retard the growth of the seedling.

The Changing Structures in Oil Palm Nursery Operation

Some of the oil palm nursery operators had changed the way they managed their nurseries. For economic advantage, they probably moved into new techniques which were less expensive to reduce their cost of producing oil palm seedlings and to increase their incomes. This and other changing structures of operations will increase their efficiency in terms of managing their oil palm nurseries. The study noted some of the changes. First was the use of the sumisansui irrigation system for watering the oil palm seedlings. About 4% of the interviewed operators preferred to use sumisansui rather than overhead sprinklers. This was because sumisansui could be easily managed and was also portable compared to overhead sprinklers.

To reduce the cost of pesticides, operators attempted to introduce their own technology in their nurseries. For example, a technology called the 'Sonic System' was introduced which produced a wavelength similar to the sound of birds to scare off pests, such as the grasshopper, from the oil palm seedlings. There were also some operators who engaged contractors to manage the seedlings in their oil palm nurseries. The fee for such services was based on an agreement made by both parties.

RECOMMENDATIONS TO INCREASE THE EFFICIENCY OF OIL PALM NURSERY OPERATORS

The importance of efficiencies in the supply chain was stressed in this study, and the operators were found to be quite inefficient in certain activities. Hence, a few recommendations are proposed in order to increase their efficiency and productivity. They are:

Mandatory OPNCC

The OPNCC should be made mandatory for all oil palm nursery operators. This is because those with OPNCC have to adopt GAP in managing their nurseries. Currently, many operators do not have OPNCC because they perceive that adopting GAP can result in lower profits. Based on a spacing of 91.4 cm x 91.4 cm x 91.4 cm (3 ft x 3 ft x 3 ft), they can only have around 5000 oil palm seedlings per acre or 13 000 seedlings per hectare. Operators without OPNCC and who do not adopt the recommended spacing can have around 49 420 oil palm seedlings per hectare. As a result, they can sell the seedlings at a lower price as compared to those with OPNCC, and so maintain high profits. However, OPNCC should be made mandatory for all operators so that they operate on the same level playing field. This was a request made by some operators with OPNCC.

It was noted that eight of the oil palm nursery operators with OPNCC had discontinued and withdrawn their OPNCC certificates. This was because they claimed that there had been a decline in their profit margin as a result of the fewer seedlings they produced. They felt that OPNCC did not provide them any benefit in terms of profit generated. Therefore, it is strongly suggested that OPNCC should be imposed on all oil palm nursery operators in Malaysia. This is because it was found that through OPNCC the quality of seedlings and the efficiency of the oil palm nursery operators could be further improved.

Provide Knowledge to the Oil Palm Nursery Operators

Lack of knowledge was noticed in some of the oil palm nursery operators, especially in managing their nurseries. It is suggested that some form of posters with basic information on manuring, control of pests and culling procedure be provided to the operators. These will be a quick reference especially to their workers. Upgrading the knowledge of the nursery operators will benefit not only them but also the oil palm producers who purchase the oil palm seedlings. For example, correct use of fertilizer in the seedlings is essential for subsequent high yield.

CONCLUSION

There is room for improvement in the oil palm nursery subsector of the Malaysian palm oil supply chain. Good practices by the nursery operators will help to produce good seedlings, which later will produce high yields of fresh fruit bunches. Consequently, it will benefit all the other subsectors in the supply chain. It is important to ensure that all oil palm nursery operators are capable of producing high quality planting materials. In this respect, MPOB can assist this subsector to improve its productivity, thus reducing elements of inefficiency.

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