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Oil Palm Industry Economic Journal

OPIEJ

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eISSN 2948-3557

Available online http://opiej.mpob.gov.my/

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OIL PALM INDUSTRY ECONOMIC JOURNAL
Vol. 23 (2)/ SEPTEMBER 2023

Oil Palm Industry Economic Journal (OPIEJ) is published twice a year, *i.e.* March and September by the Malaysian Palm Oil Board (MPOB).

Contributions and comments should be addressed to:
Director-General MPOB,
6 Persiaran Institusi, Bandar Baru Bangi,
43000 Kajang, Selangor, Malaysia.

Oil Palm Industry Economic Journal Vol. 23 (2) September 2023 p. 49-60
DOI: https://doi.org/10.21894/opiej.2023.06

EMERGING RURALITY IN MALAYSIA: THE ADAPTATION OF FELDA MODEL

SYAHANEEM MOHAMAD ZAINALABIDIN[1]*; MARCEL DJAMA[1,2] and GÉRAUD MAGRIN[3]

ABSTRACT

The Federal Land Development Authority (FELDA) model appears in many aspects to be a successful example of a rural development program in Malaysia. FELDA eventually rehabilitated more than 115 000 families of settlers in its active years of land opening. Together with its settlers, FELDA has managed to overcome significant challenges that came along over more than sixty years of its establishment. Yet today, the model appears fragile, and its future seems insecure. Upcoming vital issues and challenges threaten the sustainability of these settlement programmes in their endeavour to realise Malaysia's rural development agenda. This article seeks to look at the emerging rurality in Malaysia and how the FELDA model is adapting to the settlers' new demographic, social, and economic conditions, especially with the changing landscape of urbanisation, out-migration of the second and third generation of settlers and socio-economic conditions in Malaysia. This article also illuminates the issues and challenges faced by FELDA and its settlers and throws some light on the programme introduced by FELDA to develop its settlers' social and economic qualities and related insights from both studies locations; FELDA Bukit Goh, Pahang and FELDA Tenggaroh, Johor. This article found that FELDA is currently facing a rural exodus where the next generation of settlers is exiting the scheme. The upward social mobility of the settlers' children, especially in education, has led to their out-migration to the urban areas in the quest to find higher-paid employment. It is suggested that the adaptation programmes introduced in the model need to be mobilised to the fullest extent. It is not impossible to make the next generation committed to the programme as the community of FELDA has the advantage of being closely related to the management.

Keywords: FELDA, land settlement, out-migration, rural development, rural exodus.

Received: 6 September 2022**; Accepted:** 28 March 2023**; Published online:** 12 May 2023.

INTRODUCTION

The Federal Land Development Authority (FELDA) was established on 1 July 1956, under the Land Development Ordinance of 1956, for the development of land and relocation of the rural poor, to eradicate poverty through oil palm and rubber cultivation. In addition to assisting the participants or the "settlers" of their settlement program, FELDA also carries out land development and agricultural projects, as well as industrial and commercial social economy projects that can generate their own income to support various development through a variety of businesses (FELDA, 2022). FELDA settlement programme established the 'complete whole' system by providing all the amenities and support to enhance the livelihood of the settlers in terms of financial, economic, educational and spiritual matters. Settlers' self-development is stressed by providing social and community development programmes

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covering all aspects of the settlers' lives. As stated by Graham *et al.* (1984), FELDA has not only opened up large tracts of land to profitable crops but also created a widespread scatter of 'urban villages' in which settlers and their families lead lives that differ markedly from the traditional ways of the village. Today, FELDA continues to play a major role by providing adequate and modern facilities on the schemes, ensuring the next generation of settlers are well educated to enhance their socio-economic and quality of life and ensuring the schemes can generate various economic activities as well as bridging the gap between urban and small urban areas.

Nevertheless, as with any other land development agency, FELDA faced various shortcomings in its initial years of establishment. Lee and Tengku (2006) stated that FELDA was not that proficient at the beginning. FELDA encountered several limitations, inadequacies and problems during its initial years of establishment. Still, with experience, FELDA came up with various specific guiding principles for its settlement programme that best suited the situation and local scene. Throughout the years as the 'manager' of the settlements, FELDA and its settlers have managed to overcome the numerous challenges that came along and successfully rehabilitated the lives of more than 112 000 families of settlers (FELDA, 2022). For the most part, settlers' post-settlement lives have been better as they have managed to pay off their resettling loans and obtained the title to their residential and agricultural land. However, some looming key issues and challenges threaten the long-term viability of these settlement programmes in their efforts to realise Malaysia's rural development agenda.

FELDA came into the scene of rural and agricultural development at about the same time as the independence of Malaysia. FELDA's objectives of allocating the land for the rural poor and improving the socio-economic well-being of the settlers were coordinated with the New Economic Policy (NEP, 1970-1990) strategies. They became one of the major agrarian reform programmes during the NEP period. FELDA programme established a "complete whole" system by providing all the amenities and support to improve the livelihood of the settlers and their families in terms of financial, economic, educational and spiritual matters. Settlers' self-development is stressed by providing social and community development programmes covering all aspects of the settlers' lives. By the end of the NEP period in 1990, FELDA initiatives had lifted over 122 000 families (equal to over one million people) out of poverty. They enabled a generation of landless Malays to become rural middle-class (Ragayah, 2014).

Malaysia effectively diversified and altered its economy from an agriculturally-based to a manufacturing- and services-based economy in the second half of the NEP period. These sectors have become the backbone of the Malaysian economy, creating many job opportunities. As Malaysia continues to grow, the agriculture sector shrunk to make way for industrialisation. Both sectors continue to contribute immensely to the economy, with manufacturing contributing 24.3% and services contributing 57.0% in 2021 (Department of Statistics, 2022). On the other hand, the agriculture sector shrunk to only 7.1%. Manufacturing and services sectors attracted job seekers established in the more developed part of Malaysia or urban areas. Vast job opportunities prompted people from the less developed states to the more progressive states and rural areas to urban areas. Due to Malaysia's developing economy, significant cultural and social changes impact rural people's decisions, especially the youth. FELDA is facing the same trend as any other rural area with the out-migration of its youth to the city.

This paper focuses on the sustainability of the FELDA model, especially with the changing landscape of urbanisation, out-migration of the second and third generation of settlers and socio-economic conditions in Malaysia and how FELDA is coping with this contradiction and use its resources to help the settlers become independent. Therefore, this paper aims to look at the emerging rurality in Malaysia and how the FELDA model is adapting to settlers' new demographic, social and economic conditions.

METHODOLOGY

This study is conducted in two FELDA schemes; Bukit Goh, Pahang and Tenggaroh, Johor. This study uses a combination or mixed method that includes both quantitative and qualitative approaches to inquire about data in the field. 323 settlers responded to the survey using a prepared questionnaire of which 125 respondents are from FELDA Bukit Goh and 198 respondents are from FELDA Tenggaroh. For the quantitative approach, descriptive analysis is used to report the results. For the qualitative approach, unstructured interviews with five respondents were conducted to aid in the exploration of specific issues concerning settlers' adaption to new demographic, social and economic conditions.

BACKGROUND OF THE STUDY LOCATION

Principally, every FELDA scheme applied a similar system: A group of settlers managed by its own

scheme's management office. However, each scheme has its own unique structures ranging from the management of a settlers' development committee, the way farms are operated, management of schemes' cooperatives, and so forth. Both of the study sites were chosen due to their own distinct features that are exclusive to that particular scheme. To begin with, Bukit Goh is a far more mature scheme than Tenggaroh, as the oil palm holding is expected to be replanted for the second time by 2022. Every settler in Bukit Goh received their land ownership title for their residential and oil palm lands. In Tenggaroh, at the time of the field visit, not all received the land ownership title. Both schemes also have a distinctive style of farm management, where all the settlers opted to self-manage the oil palm holdings while most of the settlers in Tenggaroh handed their holdings to be managed by FELDA. Therefore, the current study explores the evolvement of FELDA settlers as they experienced the changes in their socio-economic conditions and adaptations under different landscapes. Another fascinating angle to investigate is FELDA's policies and programmes that did not work well for the settlers.

RESULTS

The findings in this paper are organised around two main themes: 1) The Results of Over 60 Years of Land Settlement: What Are the Relevant Issues and Challenges?, and 2) Addressing The New Rural Context: The FELDA Model Between Adaptation and Transformation. The themes examine the issues and challenges of the FELDA model due to the emerging rurality in Malaysia and the FELDA response in adapting to the settlers' new demographic, social and economic conditions.

The Results of Over 60 Years of Land Settlement: Pertinent Issues and Challenges

For decades, settlers have been side by side with FELDA through so many ups and downs. It was, more or less, a trial-and-error effort from both parties to ensure the program's objectives were met. Tengku *et al*. (1977) said, "The settlers are the nucleus of the FELDA land development and settlement program. They become not only the reason for development but also the means of development." FELDA has aided the country's objective of eradicating poverty by improving the socioeconomic well-being of the settlers. FELDA settlement programme is a 'complete whole' system that provides all of the amenities and support to enhance the livelihood of not only the settlers but also their families. While it had tremendously changed the lives of its settlers, FELDA faced several issues that may jeopardise the sustainability of this programme, especially in this present day.

As the decades went by, each FELDA settlement's settings also changed as settlers aged and their children became adults. FELDA is facing the same trend as other rural areas with the out-migration of its youth to the city. In Malaysia, the rural population has been declining for decades, which is concerning (*Figure 1*). In 1970, the rural population accounted for about 72% of the total population and steadily declined to 38% in 2000, 29% in 2010 and 25% in 2020 (Department of Statistics, 2022). By 2030, the rural population in Malaysia is projected to decrease to 20% (The World Bank, 2021). This declining pattern has given rise to matters related to social and economic development in rural areas. This issue is also not uncommon in FELDA. In FELDA, with the out-migration of settlers' children from the settlements, FELDA is facing a shortage of young workforce to manage and work in settlers' agricultural holdings particularly working on their father's farm. It appears that settlers' children lack interest in working on their father's farm. Hence, settlers and their families currently choose to have their agricultural holdings managed by FELDA or its subsidiary company, FELDA Technoplant (FTP). When a smallholding is managed by FELDA, there are no management fees while there are incurred cost of RM12 per acre per month for the farm that is managed by FELDA Technoplant (FTP), of which FELDA subsidies RM2 per acre per month.

In some other FELDA settlements, settlers opted to manage it themselves by hiring workers, mostly foreign workers. Usage of foreign labour on FELDA settlements became inevitable as the pioneer settlers aged and the second generation was largely uninterested in engaging in agricultural work or rural life.

Previous studies by Marsitah (1991) mentioned the unemployment of the second generation in the settlements and FELDA's failure to draw the second generation to get involved in agricultural work. Second-generation issues are viewed as a major impediment because they threaten the program's sustainability. After all, second generations or these young generations are drawn to job opportunities outside the scheme and the attractiveness of the urban area. Urban areas' greater opportunities have made agriculture and rural living less appealing to younger generations (Alias, 2008). The study by Ghazali (1988) shows that there has been considerable out-migration from the schemes by the settlers' children, with few wanting to stay on and manage their parent's agriculture holdings. The majority of the settlers' children migrating out of the settlements went on to work in manufacturing and the service industry. A later study by Lee and

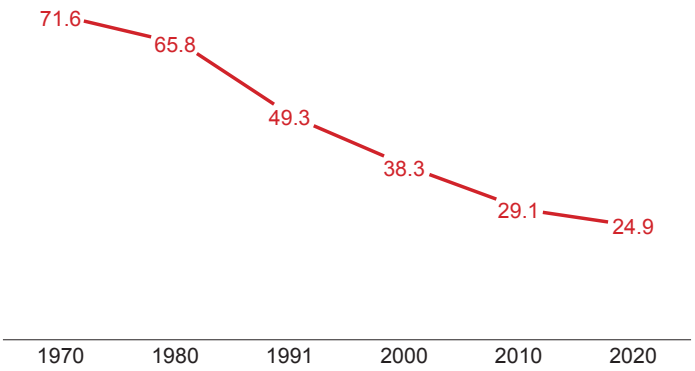

Figure 1. Percentage of the rural population in Malaysia (1970-2020).

Tengku (2006) noted that 13 061 professionals among settlers' children entailed jobs such as doctors, engineers, accountants, chemists, pilots, and other professionals. Socio-economic programs carried out in the FELDA settlements scheme had contributed to an unintended effect of generating rural-to-urban migration among the settlers' children as settlers' children became well-educated and migrated to urban areas. While thousands of settlers' children have left the schemes to find employment elsewhere, yet, there have also been others who chose to remain in the settlements.

In general, the second generation of settlers has experienced an upgrade in their socio-economic and well-being. However, most of the settlers' children or the second generation have left the settlements to seek employment outside the settlements or expand the family after marriage. The educational support they received has also massively changed their lives as they can find well-paid and professional jobs, mainly in urban areas. *Figure 2* and *3* illustrate the level of education of the second generation of settlers in FELDA Bukit Goh and FELDA Tenggaroh. In Bukit Goh and Tenggaroh, more than 40% and 55% of them have finished their secondary education, respectively. Meanwhile, more than 20% and 30% of the second generation in Bukit Goh and Tenggaroh have received tertiary education. The higher level of education gives them opportunities to work in semi-professional and professional jobs. Another reason for out-migration is that not every settler family, especially larger settler families with many children, could make ends meet on the yields of their agricultural holdings. Once divided among the children, the revenue from the agricultural holding is insignificant to support the household expenses. As a result, the second generation would seek employment, either within or outside of the settlements, and some job opportunities would lead to out-migration. Furthermore, commonly after marriage, the children would move out as it might be overcrowded to remain. *Figure 4* and *5* demonstrated the out-migration of the second generation in FELDA Bukit Goh and FELDA Tenggaroh. Both settlements show that more than 70% of the second-generation settlers have moved out from the settlement.

With the departure of the second generation of settlers searching for better-paying employment outside the settlements, the FELDA settlements scheme has been left with an ageing population of settlers. Even with higher palm oil or rubber prices, oil palm and rubber planting are not likely to persuade them to return to farming. In the FELDA settlements scheme with ageing settlers, the service of migrant labour is widely relied upon. The growing use of foreign labour (mostly Indonesian) marks the maturing stage of the settlements as their service is sought after as the original settlers aged and are not fit to do physical work, and the second generation is not interested in working in the holding or rural life. This scenario changes the way the settlers' agricultural holdings are managed. There are several options available depending on the collective decision made by the management of the FELDA scheme office. Settlers may manage the holdings themselves by hiring workers or letting FELDA or its subsidiary company, FELDA Technoplant (FTP), do so.

Settlers were responsible for working in their rubber or oil palm holding after they moved into the settlements. After the first replanting of rubber or oil palm, collective decisions are made among the settlers and the local FELDA office concerning the agriculture holding operations. Due to certain limitations for settlers to work in their holdings due to ageing and history of illnesses, letting FELDA manage settlers' holdings is made. FELDA would undoubtedly want the operations to be uniform and centralised to encourage collective work wherever necessary. However, some settlers believed that they should independently manage their holdings, especially when they had received land ownership. Through discussion between both parties, a particular decision on the management method was made that best suited the interests of the settlers.

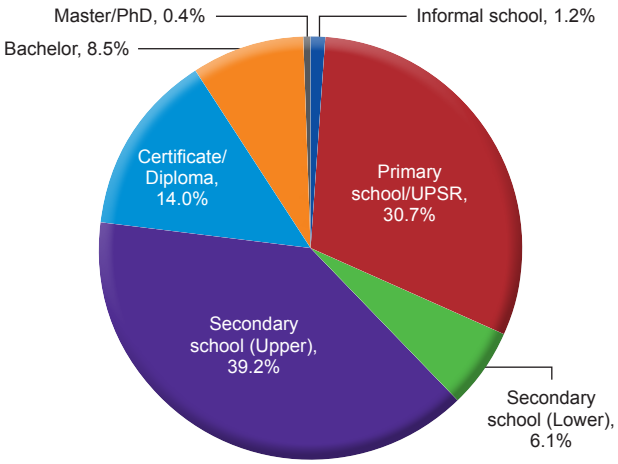

Figure 2. Level of education of FELDA second generation in FELDA Bukit Goh.

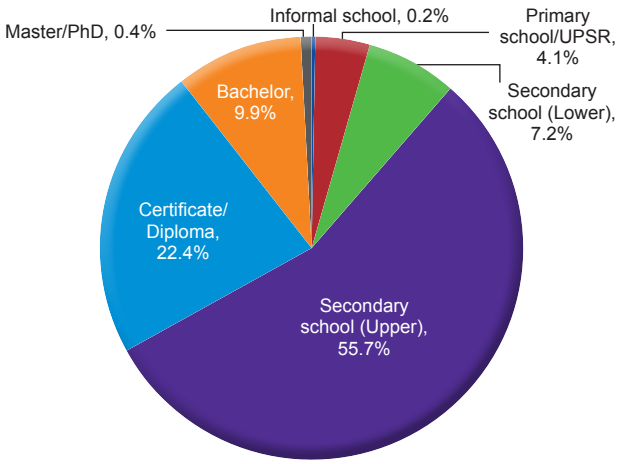

Figure 3. Level of education of FELDA second generation in FELDA Tenggaroh.

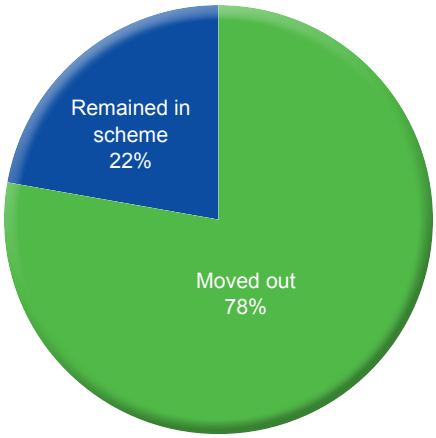

Figure 4. Out-migration of second generation settlers in FELDA Bukit Goh.

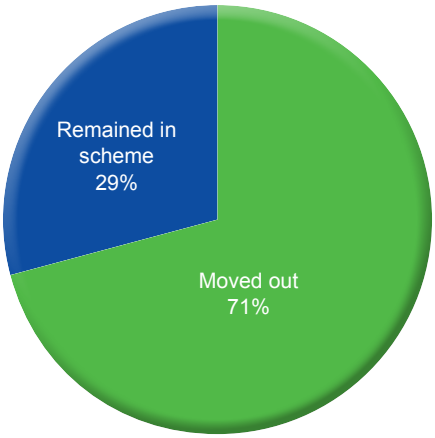

Figure 5. Out-migration of second generation settlers in FELDA Tenggaroh.

In FELDA Bukit Goh and FELDA Tenggaroh, there is a distinct setting on the way settlers' agricultural holdings are managed. In FELDA Bukit Goh, settlers independently operate their oil palm holding by hiring local contractors or independent labours. Independent labours are mostly foreign, originating from Indonesia. Local contractor companies are owned mainly by FELDA settlers and their children. However, these contractors also rely on using foreign labours to carry out the work. Local contractors and independent labourers hired by settlers only execute activities such as harvesting, weeding and fertilising activities. However, the transportation of palm oil fruits to the nearest palm oil plant is mainly handled by the FELDA Bukit Goh settlers cooperative. The cooperative will liaise with the FELDA office in terms of the record of the production of each holding and the final settlers' monthly revenue. On the other hand, settlers' oil palm holdings are managed by FELDA Technoplant in FELDA Tenggaroh. Interviews conducted with settlers in FELDA Tenggaroh revealed the motivations of the settlers to hand over their farm management to the FELDA Technoplant. Certain reasons have been reported, primarily due to old age, health problems, and lack of financial ability to maintain the farm operations. Other motivations are the children's desire to hand over the farm to the FELDA Technoplant as the children are not interested in working on their parent's farm and it is easier to leave the management of the farm under the care of the company. Nonetheless, certain settlers chose not to join the majority by cultivating their farms independently by hiring local contractors and independent workers.

Other pertinent issues include social problems, such as drug abuse among the FELDA youth, that are widely reported through the media. Although these topics were raised during the interviews with

respondents, they were not thoroughly investigated in this study. However, scientific evidence from Khor *et al*. (2015); Mohd Khairi (2017) and Hisham *et al*. (2010) studies indicate that drug abuse poses severe threats to FELDA vision as it leads to other social issues, such as criminal behaviour and health problems.

Addressing The New Rural Context: FELDA Model Between Adaptation and Transformation

As an agency that cares for its settlers' welfare and socio-economic status, the FELDA transformation plan aims to improve the quality, well-being and high income of all settlers and the new generation of FELDA through sustainable programmes. *Figure 6* depicts selected FELDA achievements and programmes implemented to ensure the model's relevance. FELDA settlers and their next-generation well-being have extensively improved compared to their former life before entering the scheme. Established programmes have helped increase settlers' incomes, and improve family health, and education. Furthermore, FELDA is now taking a more effective step in implementing the adaptation and transformation program towards the transition to a new FELDA model after more than six decades of its inception. Nevertheless, the task is much more challenging as it focuses on developing the second generation of settlers. This section presents and discusses several selected initiatives adopted by FELDA to adapt to the new rural context and settlers situation.

Education. Success in promoting the education of the second generation in the FELDA schemes or the settlers' children has increased the aspiration levels, which can often be better achieved through out-migration to higher-paid urban jobs, a situation that becomes a deep concern to the sustainability of the FELDA model. However, education is an important aspect that needs to be provided to the settlers' children to ensure they receive the same level of education as their counterparts in the urban areas. The establishment of the FELDA settlements scheme would come with educational establishments such as kindergartens and primary schools. For secondary schools, depending on the number of students, a secondary school would be established, or the students would go to school at the other nearby FELDA settlements scheme or outside localities. Selected high achiever students from FELDA schemes are also being placed in premier secondary schools in the urban areas, as FELDA established several residential hostels in Kuala Lumpur, Kuantan and Johor Bharu. In 2018, more than 400 settlers' children were placed in this program (FELDA, 2020). In addition, with the support of MARA (People's Trust Council), FELDA established the FELDA Trolak MARA Junior Science College (MRSM FELDA), which could accommodate up to 1050 students. Equips with hostel facilities, the student recruitment policy to MRSM FELDA is 80% from the children of settlers and FELDA staff, while the remaining 20% is from the public.

Significant achievements in education have been observed. In 2018, 67.3% of the 7190 settlers' children passed their UPSR (Primary School Achievement Test) examinations (FELDA, 2020), a rate slightly higher than the rural passing rate of 63.2% and almost surpassing the national passing rate of 67.4%. In the secondary school assessment, SPM (Malaysia Certificate of Education), the national average grade received by FELDA settlers' children in 2018 is 5.33, an increase of 0.01 from the previous year of 5.34 (FELDA, 2020). Out of 7571 candidates in FELDA, 90.1% managed to receive the certification. However, the national GPN recorded a better average of 4.89, a slight difference of 0.44 compared to FELDA's GPN.

Figure 6. Selected FELDA milestones and programmes (1956-2020).

Extended assistance is also being provided to settlers' children for tertiary education through loans, subsidies and scholarships. FELDA has set up *Skim Insentif Anak Peneroka* (SIAP, Settlers' Children Incentive Scheme) as an incentive and gift to SPM achievers who successfully received offers to further their studies in public or private universities. Settlers' children who successfully obtain a place in universities and pursue either a diploma in local universities, a degree in local universities or a degree in overseas universities are awarded one-off assistance of RM500, RM1000 and RM1500, respectively and between 2004 and 2018, more than 2000 settlers' children have benefited from this incentive (FELDA, 2020). Another education assistance to assist settlers' children in continuing their tertiary education is *Skim Latihan Kemahiran* FELDA (SLKF, FELDA Training Skill Scheme). This scheme aims to ease settlers' children who enrolled in the Malaysian Skill Certificate (MSC) Program Grant with up to RM5000 being paid by FELDA for the entire course and the excess study cost will be considered as an education loan.

FELDA has fulfilled its education objectives for the settlers' next generation by providing better quality and access to education for all settlers' children. A good education has leveraged the opportunity of settlers' next generation for upward social mobility. In this sense, education is a pathway out of poverty and those who have received high-quality education have fared far better than those who don't. Yet, the well-educated second generation has to seek job opportunities outside FELDA settlements to improve their social mobility. In addition, FELDA's growing population over time demands that the second generation and beyond look for income sources and not rely solely on the farm as the family is expanding. This has resulted in the unintended effect of their out-migration to urban areas when their task is to develop the existing schemes further. In this sense, FELDA developed various programmes to encourage the second generation to remain in the schemes. The following sub-section discussed further two prominent programs to encourage the second generation of settlers to own a house within the vicinity of FELDA schemes.

FELDA's new generation housing. In keeping second-generation settlers in the settlements, various training and development programme aims to equip them with the required skills that would enable them to make a head start on their own. Besides the Settler Replacement Program that provides training in plantation management to the second generation of settlers that manage their parent's farm, new-generation housing projects were built in selected FELDA settlements to respond to the second generation of settlers' needs to own a house within the vicinity of FELDA settlements. Among the objectives of new generation housing projects are: (i) to provide opportunities to FELDA second generation of settlers to remain in the settlements and help the older generation; (ii) to encourage more economic activities and development in the schemes; and (iii) to make use of any undeveloped land in the FELDA schemes efficiently and effectively. The project would be ideal for married second-generation settlers raising their own families or working nearby who prefer to remain within the settlements. The housing project built within the vicinity of FELDA settlements paves the way for nuclear family development among the second generation within the scheme (Lee and Tengku, 2006) while allowing second-generation settlers to have a house of their own and remain in the scheme.

FELDA Bukit Goh is one of the settlements involved in this project to provide affordable housing to the second generation of settlers. Two types of houses were built: 338 units of medium-low cost and 139 units of low cost (139) single-storey houses with a total housing area of 17 hectares including 4 units of shop lots. *Figure 7* depicts the dynamic relationship between Taman Bukit Goh Perdana (New Generation Housing Project) and FELDA Bukit Goh (Existing Settlement) to Kuantan, the nearest city. The housing project acts as the mitigation for the out-migration of second-generation settlers to the urban areas. Since Taman Bukit Goh Perdana was built within the vicinity of FELDA Bukit Goh, the second generation of settlers who own a house here enjoyed the privilege of staying within the vicinity of their parent's home. They also have the advantage of finding jobs and enjoying the amenities of the nearby Kuantan town, which is about 20 km away. Bukit Goh's Settlement Manager has mentioned that the housing project in Bukit Goh has enabled the second generation of settlers to have their own home. They also have the option of working on their family's oil palm holding or other settlers' holding, having a job within the scheme or being employed in the nearby town of Kuantan. Due to the demand for more housing projects for the second generation, the same project is already in the plan to be developed in Bukit Goh (Interview with the Bukit Goh's Settlement Manager, 2016).

New Generation Housing is a retort to the needs of the second generation of settlers where they can remain in the settlement and be nearby their parents while they may have jobs in the city or outside the settlements. This project is ongoing and FELDA actively develops areas within the settlements to provide housing development for the next generation. This programme, however, is

mainly focused on ensuring that the next generation of settlers own homes and property close to where they were raised. Despite this benefit, they still need to look for work, either within the settlement or elsewhere.

FELDA Sentuhan Kasih. FELDA sought to introduce a new model, namely FELDA Sentuhan Kasih, to solve housing and unemployment among second-generation settlers. It is a comprehensive model designed to address issues regarding the new generation of FELDA like out-migration to urban areas, unemployment, low income, unskilful and housing problem. This programme is consistent with FELDA's aspiration to have its second and third generation of settlers pursue agro-based business ventures to improve their socio-economic status (Lee and Tengku, 2006). This programme encompasses three core components; modern contemporary houses, modern integrated farming and modern infrastructure. The target group of this programme is the new generation of FELDA who presently are married, do not have a permanent income and could not afford to own a house (*Table 1*).

While settlers in the original FELDA model earned money from industrial crops like rubber and oil palm, participants in FELDA Sentuhan Kasih earned money from a shared 20-acre farm plot planted with high-value crops and managed by the participants' cooperative. However, Sentuhan Kasih participants are not as fortunate as the originals, who were each given a housing lot and an agricultural holding. The participants of FELDA Sentuhan Kasih are only entitled to the ownership of their house lot. At the beginning of the program, the participants of Sentuhan Kasih received a stable allowance amounting to RM1500 per month and a new house amounting to RM85 000, which was then converted to a loan. When the farming plot begins to yield, small monthly deductions are offset as repayment to FELDA for the cost of building the house and the monthly allowance.

FELDA Sentuhan Kasih is newly introduced and launched in 2014 by the then Prime Minister of Malaysia, the first Sentuhan Kasih project is in operation in FELDA Tenggaroh 3, Mersing, Johor. It is within the vicinity of one of the study locations. The operations integrated farming and infrastructure are managed by a cooperative

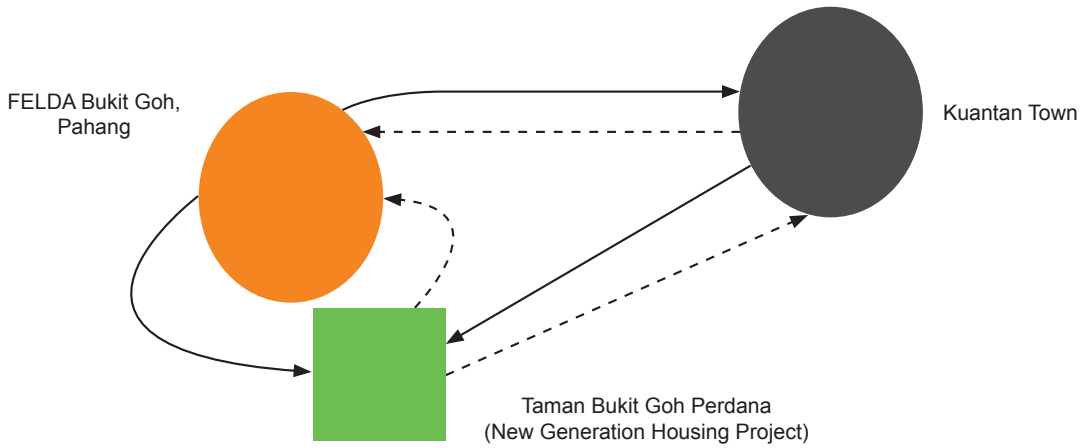

Figure 7. The dynamic relationship between Taman Bukit Goh Perdana (New Generation Housing Project) and FELDA Bukit Goh, Pahang (Existing Settlement) to Kuantan (nearest town).

TABLE 1. PARTICIPANTS' SELECTION CRITERIA TO ENTER FELDA SENTUHAN KASIH

The main conditions to be participants in FELDA Sentuhan Kasih are:
i) The applicant and spouse are citizens of Malaysia;
ii) Married;
iii) Applicant and spouse's age between 21-40 years old at the date of application;
iv) Applicant and spouse must reside and work in the schemes;
v) Household income does not exceed RM2500 per month;
vi) Applicant and spouse are not bankrupt;
vii) Non-government servant;
viii) No criminal record or involvement in any criminal case;
ix) Do not own a house; and
x) The scheme manager must support the application.

belonging to the participants and are financed through returns from this project. According to the officer in charge of the project, each of the participants in Sentuhan Kasih is a member of the cooperative with at least one member from each family. In order to ensure the project is sustainable, a cooperative is formed, comprising the management team and the participants. The cooperative's objective is to support and nurture new entrepreneurs among participants and create new industries within the communities using agricultural products or their relevant expertise. These new industries will provide more job opportunities to surrounding communities and at the same time raise the communities' income. Consequently, the future generation does not have to migrate to urban areas in order to get a job and improve their lifestyle.

For a start, the community runs many agriculture projects, such as traditional food production and farming of fruit and fish. A team of FELDA officers supervises this programme, with its main division situated in the FELDA headquarters in Kuala Lumpur. The function of the office in FELDA Sentuhan Kasih is almost similar to that in the FELDA settlements scheme. The structure of the management office includes a manager and assistant manager covering all aspects including social development, welfare and agricultural issues. Two supervisors are dedicated to conducting agricultural activities and one community officer is dedicated to handling welfare and social issues. The office acts as the 'manager' of all aspects of the programme, including the participants' welfare. As a 'manager', the office also offers advice and provides extension services to the programme's operation. Meanwhile, the Sentuhan Kasih programme participants are encouraged to be active in their community organisation or JKKP (*Jawatankuasa Perwakilan Peserta*) with the vision to empower leadership skills among the participants to become a self-reliant community in the future. This is to get the participants to participate in the programme's day-to-day administration and development. The management office highly emphasises their participation as it plans to withdraw once the participants can be independent.

However, after three years, 14 participants have left the programme or requested to leave the programme due to several reasons. Among the reasons are drug abuse and divorce (Interview with the supervisor of FELDA Sentuhan Kasih, 31st July 2017). Some interviewees have mentioned drug abuse as a problem in FELDA settlements. However, it is impossible for us to have information about its extent and level in comparison to the whole country. Even though the participants' selection to enter the Sentuhan Kasih Programme requires a drug screening test and no participant is a user, at the following random screening after the programme started, few cases were detected (Interview with the supervisor of FELDA Sentuhan Kasih, 31st July 2017). As for divorcees, one of the main conditions to be the participants is to be married. Hence, automatically, when participants have divorced, they are not eligible to be in the programme any longer. The said issues might hamper the intensification of the program. Action to solve these issues needs to be taken so that the objectives of this programme could be accomplished. *Table 2* explains further the settings of the FELDA Sentuhan Kasih programme in Tenggaroh, Johor and inside stories from an interview with the project supervisor.

This model may be perceived as an improvement of the New Generation Housing but with additional agricultural areas jointly managed by the participants as a cooperative for income. The unique feature of this project is that it is self-sustainable, which means if the cooperative could operate with a promising return on investment and generate sufficient profits, the participants could benefit from it and receive a stable amount of income. By implementing this project, not only will the new generation of FELDA enjoy the benefit, but the nearby population will also taste the spillover benefit of this project. However, like any other newly introduced programme, Sentuhan Kasih would face plentiful challenges in its pathway to success.

FELDA 2.0 initiative. Over time, FELDA retort to the needs of the settlers' next generation by introducing various programmes. FELDA is now taking a more effective step in implementing the innovation and transformation program that has been started in 2010 as a symbol of the transition to the new FELDA model after more than six decades since its inception. Apart from the New Generation Housing and FELDA Sentuhan Kasih that give settlers' next-generation opportunities to be a part of their father's legacy, FELDA had come out with FELDA 2.0 initiative (*Table 3*). It is an initiative to transform and give a new look to the 317 FELDA land schemes in the country. The new initiative is focused on creating a FELDA community that is smart and sustainable, and resilient in terms of the economy and environment.

FELDA White Paper was introduced in 2019 as a new model for managing settlers' land through land rental for a reasonable period. This model is said to resolve the demographic issues of the settlers and the absence of economies of scale. The introduction of this new model will enable the settlers' land to be consolidated and cultivated efficiently. Economies of scale can reduce operating costs and increase productivity. FELDA is determined to develop skilled and innovative new settlers to improve income through agricultural and livestock activities

TABLE 2. INSIDE STORIES OF FELDA SENTUHAN KASIH PROGRAMME IN TENGGAROH, JOHOR, 31 JULY 2017

According to the project supervisor, FELDA Sentuhan Kasih in Tenggaroh, Johor attracted more than 2000 applicants, but only 100 people were selected to participate. Among the criteria to be chosen is that the participant must be a native of FELDA Tenggaroh (second or third generation of FELDA Tenggaroh settlers) and earn less than RM3000 per month. Although 103 houses were built, only 100 participants were selected. The remaining three houses are used to create a kindergarten, and the remaining two houses are used as visitor's lodging (homestay) to generate income for the participants' cooperatives. The rental for the homestay per night is around RM250 to RM300, depending on the season. This programme received its first participant in October 2013.

FELDA Sentuhan Kasih in Tenggaroh, Johor, covers an area of 55 acres, of which 27 acres consist of an agricultural area. The participants need to be involved in agriculture activities with working hours from 7 am to 2.30 pm from Sunday to Thursday. In this programme, the participants consist of males and females (30% males and 70% females). Their spouses who are not working in the programme are also encouraged to have a job to supplement the family income. Participants are divided into groups of ten, and each group is called a block. The females are usually assigned to work in the greenhouse while the males are assigned to work that needs extra physical strength, such as planting fruit trees, farm maintenance and aquaculture farming. Apart from these activities, there are also activities such as broiler poultry farming. The block would be rotated so that each participant would receive enough exposure to various agriculture skills. Since this community runs these agriculture projects, a cooperative was set up to responsibly manage the activities and incomes. There is also off-farm and non-farm income from the production of agriculture by-products, homestay rental, shop lot rental, facilities rental (multipurpose hall and meeting rooms), and night market site rental.

For the time being, the participants receive an allowance of about RM1000 monthly after a deduction for housing loan payments. Like the settings of the original settlers, the participants would obtain the ownership title to the house after 25 years of the repayment period. However, FELDA will retract the monthly allowance once the projects under the cooperative could produce sufficient monthly income to the participants.

The supervisor also mentioned that at the beginning of the programme, a consultant was hired by FELDA to develop this area and provide training and exposure to the participants. However, the contract was not renewed due to specific issues, and the project was handed over to FELDA. When this interview was done, the FELDA site office in Sentuhan Kasih was still restructuring the organisation of works and activities that would benefit the participants to improve income. He further added that their roles in managing the participants are not permanent. The aspiration for this programme is that the participants would obtain enough skills in agriculture works and cooperative management to be independent.

TABLE 3. FELDA 2.0 INITIATIVE

The FELDA 2.0 is an initiative to transform and give a new look to the 317 FELDA land schemes in the country. The new initiative is not only focused on creating a FELDA community that was smart and sustainable but also resilient in terms of the economy and environment. FELDA 2.0 is an initiative that emphasises an 'open and communicable' strategy or approach that brings a surge in the FELDA community that suits the current technological facilities and fulfilled future aspirations.

FELDA Lurah Bilut was chosen as the pioneer for the programme due to its significance to the history of FELDA as the first settlement that was opened in 1958 for a land development programme in clusters for agriculture in the country. The valley in the Titiwangsa Range had undergone rapid development with various facilities, in fact in November last year it was recognised as the first land scheme which had become a smart town through the Bilut Digital Valley, which was a pioneer project under the FELDA 2.0 initiative.

which use new technologies such as smart farming and precision agriculture. In implementing this model, the government has agreed to allocate RM1 billion for a period of four years to implement this new idea. The development planning under FELDA White Paper will surely change the scene of the initial model. However, little is known about FELDA White Paper's direction since Malaysia's government shifted again in March 2020. With the newly changed government, the focus of the FELDA initiative for the model sustainability is hoped to favour the settlers and their generation.

DISCUSSION

FELDA has helped a generation of landless people become 'rural middle-class' smallholders, with 4 ha of oil palm or rubber smallholding and some investment holdings. Most of them who were once deprived labourers, agriculture workers or unemployed had now each possessed their own residential and agricultural land. FELDA has managed to fulfil the initial objective of its establishment, providing "land for the landless, jobs for the jobless". It is a very relevant development programme for developing rural Malaysia; a social enterprise designed to be settler-centric. FELDA carries a significant role to support Malaysia's emerging economy by providing adequate and modern facilities in the settlements, ensuring the next generation of settlers received a good education, enhancing the socio-economic and quality of life and ensuring the schemes can generate various economic activities as well as bridging the gap between urban and small urban areas.

Yet, as the economy of Malaysia transitions from an agrarian economy to a more diversified economy that concentrates more on industrialisation, upcoming vital issues and

challenges are confronting the sustainability of these settlement programmes in its endeavour to realise Malaysia's rural development agenda. FELDA is currently facing a rural exodus where the next generation of settlers is exiting the scheme. The upward social mobility of the settlers' children, especially in education, has led to their out-migration to the urban areas in the quest of finding higher-paid employment. As the next generation is not interested in agricultural work, the ageing settlers need to depend on foreign labourers to work in their rubber or oil palm holdings.

Out-migration of the next generation of settlers is a deep concern to the sustainability of the FELDA model, as it should be their task to contribute to the scheme's development. FELDA has introduced various innovative programmes to adapt to the new rural context and settlers' situation while at the same time encouraging the next generation to remain within the vicinity of the schemes. A programme such as the New Generation Housing responds to the settlers' next generation's need for housing. Still, this project only limits them to just own a house within the vicinity of the place where they grew up. Aside from that advantage, they still need to seek employment either in the settlement or outside. However, the bright side of this programme is that the next generation is attracted to remain in the schemes with the extra benefits of owning their own house at a subsidised value.

Another programme, the FELDA Sentuhan Kasih programme is deemed a new model of FELDA. However, it has different settings as the pioneer model of providing the settlers with housing lots and agriculture holdings. In the Sentuhan Kasih model, the participants would only receive the ownership of house lots after a period of 25 years of repayment. Instead of working on rubber or oil palm holdings, the participants need to work on integrated farming projects. A cooperative consisting of Sentuhan Kasih's participants was set up to manage the economic activities. The unique feature of this project is that it is self-sustainable, which means if the cooperative could operate with a promising return on investment and generate sufficient profits, the participants could benefit from it and receive a stable amount of income.

FELDA and its settlers need to face certain challenges to formulate the ideal programme to protect the sustainability of the FELDA model. The programmes introduced need to be mobilised to the fullest extent and it is not an impossible task to make the next generation committed to the programme as the community of FELDA has the advantage of being closely related to the management. Therefore, the current and future programmes should also integrate the aspirations of the next generation of settlers while supporting Malaysia's policy of supporting a more diversified rural economy.

CONCLUSION

This paper has addressed the following objectives: Looking at the emerging rurality in Malaysia and how the FELDA model adapts to settlers' new demographic, social and economic conditions.

During its more than 60 years of existence, FELDA encountered several limitations, inadequacies, and problems; however, with experience, FELDA was able to develop some specific guiding principles for its settlement programme that best suited the local context and national policies. As Malaysia's economy transformed from an agriculture-based economy to a more industrialised economy, FELDA has also evolved in keeping with the situations and policies of the country. In the past, FELDA relied on land opening to provide land-owning opportunities to the rural poor. Unfortunately, today there is no more land to be opened. FELDA must adapt by implementing a different approach, especially towards settlers' next generation, to ensure the FELDA model's continuous social and economic stability. FELDA's development programme introduced in the later years was based on evolving needs of the settlers, especially their next generation, more suited to the new demographic background of the community and its social and economic conditions.

Today, the settlers and their families have experienced upward social mobility. The next generation of settlers had the chance to receive a proper education. Well-educated settlers' next generation experience social mobility, but not by having jobs within or around the schemes. They have to move to more urbanised areas to find professional or well-paid jobs. The out-migration of settlers' next generation from the settlements led to a shortage of young workforce to manage their family agricultural holding and remain in the settlement. In this sense, the extension programme and approach introduced has to prioritise and integrate the aspirations of settlers' next generation. Despite several programmes that have been introduced, it would take some time for the programmes to be fully-fledged due to the multiple challenges that may be encountered along with their implementation before an ideal model could be finalised.

FELDA and its settlers need to face certain challenges to formulate the ideal programme to protect the sustainability of the FELDA model. The programmes introduced need to be fully mobilised. It is possible to make the next generation committed to the programme as the community of FELDA has the advantage of being closely related to the management. Therefore, the current and future programmes should also integrate the aspirations of the next generation of settlers while

supporting Malaysia's more diversified rural economy. Most importantly, the programmes must appeal to the next generation like the original FELDA model once did to their parents.

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Oil Palm Industry Economic Journal Vol. 23 (2) September 2023 p. 61-69
DOI: https://doi.org/10.21894/opiej.2023.07

WORLD PALM OIL SUPPLY FORECAST: REVIEW AND UPDATE

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ABSTRACT

Since the beginning of oil palm business in the 1960's, world palm oil production has always shown an upward trend until the year 2019. Even though there were some occasions that made palm oil production go down, such as El Nino in the year 2015-2016, it was a temporary weather anomaly. However, this article explains that a structural, not a temporary, palm oil shortage may occur in 2-3 years. This article reviews the production data in the year 2019-2022 that was published by Minchul Suh (2020), mentioned as P.F hereinafter when the growth of the world's palm oil production was stagnant. This article forecasts palm oil production in the year 2023-2025, by employing the age profiles of Malaysian and Indonesian oil palm plantations as well as the yield profile of oil palm. According to the methodology used in this article, even without any weather effects, the growth of palm oil production will be stagnant or can even decline until the year 2025.

Keywords: Indonesia, Malaysia, palm oil, replanting, supply outlook.

Received: 27 April 2023**; Accepted:** 24 August 2023**; Published online:** 8 September 2023.

INTRODUCTION

According to the data from the U.S. Department of Agriculture (USDA, 2023), world palm oil production has always shown an upward trend since its beginning in the 1960's until the year 2019. From less than 2 million tonnes in the 1960's, world palm oil production has grown rapidly to more than 70 million tonnes nowadays.

From the year 2020 however, an unexpected COVID-19 pandemic occurred and had a significant impact on the palm oil industry. For example, a severe labour shortage occurred in Malaysian palm oil industry, due to COVID-19 quarantine policy that induced border closure leading to the inability to hire foreign harvesters. This labour shortage has led to a decrease in palm oil production in Malaysia (Mei Mei Chu, 2022). According to Malaysian Palm Oil Board (MPOB, 2023), Malaysian palm oil production peaked in the year 2019 with 19 858 367 t but declined to 18 116 354 t in 2021. It recovered to 18 453 420 t in 2022, but this number is still lower than the production in 2019. Furthermore, the oil palm planted area in Malaysia declined from 5 900 157 ha in 2019 to 5 674 742 ha in 2022 or a reduction of 3.8%. These factors made the growth rate of the world's palm oil production after 2020 stagnant.

Minchul Suh (2020), hereinafter *P.F,* forecasted that in the year 2020-2025, the growth rate of the world palm oil production will be stagnant and the production can even decline, after the peak seen in 2021. The reasons for this forecast were restricted expansion of oil palm plantations, lower productivity due to old age profiles of oil palm plantations, and the upcoming replanting period in Malaysia and Indonesia. The forecasted world palm oil production using the methodology by *P.F* almost coincided with the actual data in the year 2020-2022, while individual forecast for Malaysia and Indonesia did not.

The purpose of this paper is to review the *P.F* and its assumptions. By reviewing and comparing the inferred production derived from the assumptions in *P.F* with actual data, this article aims to refine the major assumptions for a more reliable forecast. This article will attempt to offer a forecast of the world's palm oil production until the year 2025.

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METHODOLOGY

The methodology adopted in this article to infer palm oil production is basically the same as conducted in *P.F*. However, when this article infers and forecasts the palm oil production, some assumptions used in *P.F* will be changed in accordance with the actual data released.

This article and *P.F* infer the palm oil production based on the planted area, matured area and the yield profile of oil palm. In order to eliminate biases due to different source of databases from Malaysia and Indonesia, this article only uses data from the U.S. Department of Agriculture (USDA). In the USDA reports (Rahmanulloh, 2022; Wahab, 2022), we can obtain data on 'Harvested Area of Oil Palm', which is the matured area, on a yearly basis.

Assuming that the planted area of oil palm is 1000 ha in the year 2000 and becomes 1200 ha in the year 2001, it clearly indicated that there were 200 ha of newly planted oil palm area in the year 2001. Therefore, in the year 2023, we can infer that there are 200 ha of 22-year-old oil palm, which were planted in the year 2001. Based on this methodology, *P.F* inferred the age profiles of oil palm in Malaysia and Indonesia in the year 2016-2018 as *Table 1*.

After inferring the age profiles of oil palm (*Table 1)*, we can infer the oil palm Fresh Fruit Bunch (FFB) production by multiplying *Table 1* with the yield profile in *Table 2*. Using *Table 1* and *Table 2*, we can infer that in the year 2018, 3 year old oil palm trees planted in Malaysia produced around 1 440 000 t (180 000 ha × 8.0 t/ha) of FFB, assuming it was in a medium condition.

TABLE 1. AGE PROFILES OF OIL PALM IN MALAYSIA AND INDONESIA IN THE YEAR 2016-2018 ('000 HA)

Age / Yr	Malaysia			Indonesia		
	2016	2017	2018	2016	2017	2018
0	114	64	131	496	46	124
1	180	114	64	403	496	46
2	374	180	114	499	403	496
3	241	374	180	485	499	403
4	269	241	374	730	485	499
5	175	269	241	678	730	485
6	333	175	269	576	678	730
7	200	333	175	391	576	678
8	141	200	333	861	391	576
9	248	141	200	799	861	391
10	201	248	141	450	799	861
11	223	201	248	487	450	799
12	168	223	201	376	487	450
13	139	168	223	354	376	487
14	262	139	168	523	354	376
15	215	262	139	487	523	354
16	183	215	262	517	487	523
17	569	183	215	122	517	487
18	63	569	183	371	122	517
19	85	63	569	448	371	122
20	219	85	63	121	448	371
21	125	219	85	339	121	448
22	160	125	219	285	339	121
23	110	160	125	445	285	339
24	99	110	160	238	445	285
25	123	99	110	145	238	445
26	131	123	99	124	145	238
27	64	131	123	46	124	145
28	80	64	131	103	46	124
29	74	80	64	99	103	46
Planted Area	**5 568**	**5 558**	**5 609**	**11 998**	**11 945**	**11 966**
Matured Area	**4 900**	**5 200**	**5 300**	**10 600**	**11 000**	**11 300**

Note: USDA provides seasonal data for October-September. This article adopts the beginning year when using matured area (area harvested) data and adopts the ending year when using production data. The planted area of 0-2 year old (immature) oil palms is excluded from the matured area (area harvested) because immature oil palms are unable to yield palm oil.

TABLE 2. YIELD PROFILE OF OIL PALM

Age of Oil Palm	FFB Yield (t/ha/yr)		
	Low	Medium	High
0	-	-	-
1	-	-	-
2	-	-	-
3	4.6	8.0	10.5
4	8.8	12.0	15.5
5	13.1	18.0	22.0
6	17.1	22.0	26.0
7	20.4	26.0	31.0
8	21.4	27.0	32.5
9	22.4	28.0	33.5
10	22.4	28.0	32.5
11	21.4	27.0	31.0
12	19.5	25.0	31.0
13	19.5	25.0	31.0
14	19.5	25.0	31.0
15	19.5	25.0	31.0
16	18.5	23.0	28.0
17	18.5	23.0	28.0
18	18.5	23.0	28.0
19	18.5	23.0	28.0
20	18.5	23.0	28.0
21	16.0	21.0	25.5
22	16.0	21.0	25.5
23	16.0	21.0	25.5
24	16.0	21.0	25.5
25	16.0	21.0	25.5

Source: Kushairi *et. al* (2011).

P.F used the methodology above to forecast the future production of palm oil. Before forecasting, we can infer the past production of palm oil using this methodology and the assumptions. We can check whether this methodology is valid, by comparing this inferred past production with the actual past production data. After this verification, we can infer the future production of FFB and palm oil.

RESULTS AND DISCUSSION

Review of the Previous Forecast

Using the methodology stated in this article, *P.F* forecasted that the world palm production growth will be stagnant from 2019 and the production can decrease after 2021. This is shown in *Figure 1*, with the forecasted palm oil production (dashed lines) and the actual palm oil production (solid line). The forecasted period of *P.F* is shown as a red dotted box in *Figure 1*. As shown in *Figure 1*, the forecasted world palm oil production in *P.F* almost coincided with the actual data released, but the forecasted production for Malaysia and Indonesia deviated from the actual data.

In *P.F*, several assumptions were adopted in order to infer and forecast the palm oil production, which are displayed as dashed lines in *Figure 1*. Firstly, *P.F* assumed that the productivity, or the yield of oil palm FFB, of 25 year old is maintained until 29 year old. Secondly, *P.F* assumed that the oil extraction rate (OER) of palm oil is 23.0% in Malaysia and 20.0% in Indonesia. Lastly, *P.F* assumed that Malaysian FFB productivity is 85.0% of the medium condition of yield profile in *Table 2*, while Indonesia is 75.0%. With the assumptions above, the inferred palm oil production derived from methodology in *P.F* showed a high correlation, which is 99.8%, with the actual data released in the year 2001-2018.

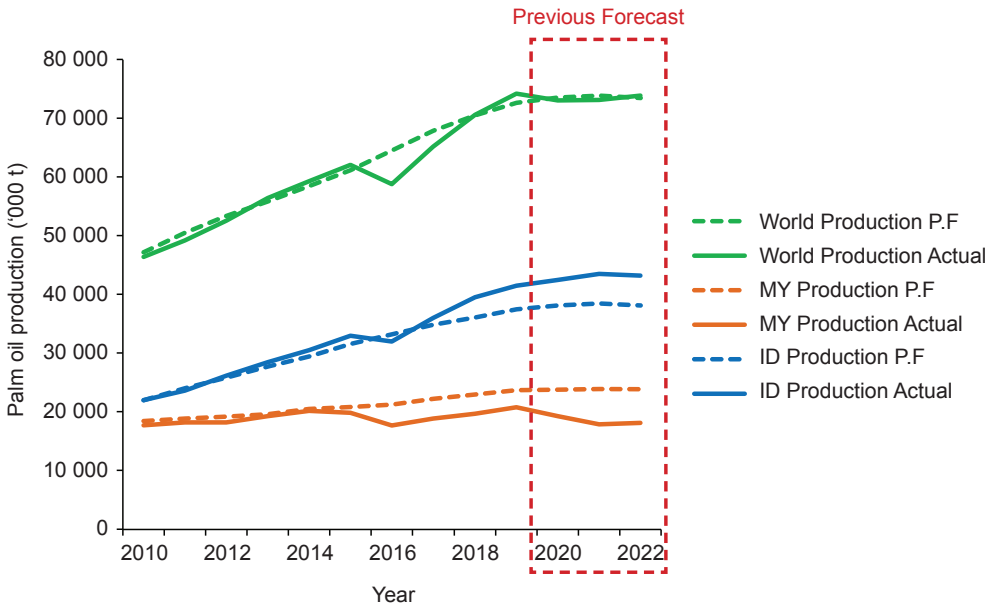

Figure 1. World, Malaysia (MY) and Indonesia (ID) forecasted production from the previous forecast and actual data.

Based on this result, or a high correlation with the actual released data, *P.F* regarded the methodology as valid and forecasted the future palm oil production. But for the forecast, some assumptions were added. The most important assumption added was that the future planted area in Malaysia and Indonesia will be the same as in the year 2020, because the governments of Malaysia (Ayisy Yusof, 2019) and Indonesia (Wiko Saputra and Ichsan Saif, 2018) were restricting the expansion of oil palm plantations at that time. Other than this assumption, *P.F* assumed that palm oil production from countries other than Malaysia and Indonesia accounts for 15.5% of world palm oil production, based on data in 2015-2019. In this methodology, weather factors such as El Nino, were excluded.

With all these assumptions and methodology, *P.F* forecasted the world palm oil production in the year 2020-2022 which almost coincided with the actual data released by USDA. However, the forecasts of palm oil production for Malaysia and Indonesia using the same methodology and assumptions in *P.F* deviated from the actual data, as shown in *Figure 1*.

One of the reasons why Malaysian and Indonesian forecasts deviated is because the major assumption of the forecast, that the planted area will not be changed, turned out to be wrong. According to the USDA report (Rahmanulloh, 2022), the area harvested (matured area) of oil palm in Indonesia increased from 11 750 000 ha in 2019 to 12 300 000 ha in 2021. Even though the Indonesian government announced a moratorium on expanding the oil palm plantations (Wiko Saputra and Ichsan Saif, 2018), the planted area of oil palm in Indonesia increased during this period. Other than new planting, it could also be due to less replanting than expected. Because of this unexpected expansion or less replanting of oil palm in Indonesia, the actual production of palm oil in Indonesia exceeded the forecast in *P.F*, as shown in *Figure 1*.

On the contrary, the planted area in Malaysia decreased in the year 2019-2022. According to the Malaysian Palm Oil Board data (MPOB, 2023), the planted area of oil palm in Malaysia was 5 900 157 ha in 2019, but it gradually went down to 5 675 742 ha in 2022. The Malaysian oil palm industry also experienced a severe labour shortage (Mei Mei Chu, 2022), which led to low harvesting of oil palm FFB. Because of these factors, the actual palm oil production in Malaysia was lower than the forecast in *P.F*, as shown in *Figure 1*.

However, the suggestions from *P.F* that the oil palm plantations in Malaysia and Indonesia are losing their productivity and need replanting in the near term, are still valid. According to USDA data (USDA, 2023), the productivity of palm oil (t/ha), which is calculated by dividing the palm oil production by matured area, decreased in 2019-2022. The productivity of palm oil in Malaysia was 3.9 t/ha in 2019 and fell to 3.3 t/ha in 2022. During the same period, the productivity of palm oil in Indonesia decreased from 3.7 t/ha to 3.5 t/ha, and the world's palm oil productivity decreased from 3.2 t/ha to 2.9 t/ha. This decreasing productivity indicates that the age profile of oil palm is getting older in the world, Malaysia and Indonesia thus, more plantations will need replanting in the near future in order to maintain the current palm oil production.

Updated Inferred Production

To update the findings from *P.F*, this article inferred the palm oil production by reflecting the actual planted area for 2020-2022 as shown in *Figure 2*, using the major assumptions from *P.F*.

However, this newly inferred production included another assumption *i.e.* the OER of palm oil. In *P.F.*, it was assumed that the OER of palm oil in Malaysia was 23.0%. In this newly inferred production, the OER in Malaysia was 23.0% before the year 2017 and 19.5% from the year 2017. According to the report overview of the Malaysian oil palm industry (MPOB, 2017), this OER downtrend from the year 2017 can be explained by lower quality FFB processed by the mills. On the contrary, the assumed OER of palm oil in Indonesia was 20.0% in *P.F*. After the update, the OER in Indonesia was 20.0% before 2017 and 22.0% from 2017. This upward trend can be explained by the improvement in agricultural practices or better seedlings of oil palm plantations were planted in the 2010's. With the OER assumption above, this methodology can better explain the past world, Malaysia and Indonesia data. However, as mentioned in *P.F*, OER is not a critical factor in forecasting the direction of palm oil production (whether it will increase or decrease).

Other than this, the assumption that palm oil production from countries other than Malaysia and Indonesia accounts for 15.5% of world production is changed to 16.1%, as reflected in the latest data for the year 2018-2022 published by USDA.

The inferred age profiles of oil palm in Malaysia and Indonesia, which are the back data of this inferred production are shown in *Table 3* and *Table 4*. Considering the small deviation between the newly inferred and actual data in 2010-2022 (*Figure 2)*, this newly inferred production also coincides with the actual data. The correlation between the newly inferred production and the actual production of the world palm oil in 2010-2022 is 98.9% (excluding the data for 2016 when there was El Nino).

TABLE 3. INFERRED AGE PROFILE OF OIL PALM IN MALAYSIA IN THE YEAR 2016-2022 ('000 HA)

Age	Malaysia						
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
0	114	181	173	149	99	110	160
1	180	114	181	173	149	99	110
2	374	180	114	181	173	149	99
3	241	374	180	114	181	173	149
4	269	241	374	180	114	181	173
5	175	269	241	374	180	114	181
6	333	175	269	241	374	180	114
7	200	333	175	269	241	374	180
8	141	200	333	175	269	241	374
9	248	141	200	333	175	269	241
10	201	248	141	200	333	175	269
11	223	201	248	141	200	333	175
12	168	223	201	248	141	200	333
13	139	168	223	201	248	141	200
14	262	139	168	223	201	248	141
15	215	262	139	168	223	201	248
16	183	215	262	139	168	223	201
17	569	183	215	262	139	168	223
18	63	569	183	215	262	139	168
19	85	63	569	183	215	262	139
20	219	85	63	569	183	215	262
21	125	219	85	63	569	183	215
22	160	125	219	85	63	569	183
23	110	160	125	219	85	63	569
24	99	110	160	125	219	85	63
25	123	99	110	160	125	219	85
26	131	123	99	110	160	125	219
27	64	131	123	99	110	160	125
28	80	64	131	123	99	110	160
29	74	80	64	131	123	99	110
Planted Area	**5 568**	**5 675**	**5 768**	**5 853**	**5 821**	**5 808**	**5 869**
Matured Area	**4 900**	**5 200**	**5 300**	**5 350**	**5 400**	**5 450**	**5 500**
Rate of old plantations (Age > 20)	**19.7%**	**21.4%**	**21.1%**	**20.8%**	**28.8%**	**29.6%**	**31.4%**

TABLE 4. INFERRED AGE PROFILE OF OIL PALM IN INDONESIA IN THE YEAR 2016-2022 ('000 HA)

Age	Indonesia						
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
0	496	324	495	438	238	445	285
1	403	496	324	495	438	238	445
2	499	403	496	324	495	438	238
3	485	499	403	496	324	495	438
4	730	485	499	403	496	324	495
5	678	730	485	499	403	496	324
6	576	678	730	485	499	403	496
7	391	576	678	730	485	499	403
8	861	391	576	678	730	485	499
9	799	861	391	576	678	730	485
10	450	799	861	391	576	678	730
11	487	450	799	861	391	576	678
12	376	487	450	799	861	391	576

TABLE 4. INFERRED AGE PROFILE OF OIL PALM IN INDONESIA IN THE YEAR 2016-2022 ('000 HA) (continued)

Age	Indonesia						
	2016	2017	2018	2019	2020	2021	2022
13	354	376	487	450	799	861	391
14	523	354	376	487	450	799	861
15	487	523	354	376	487	450	799
16	517	487	523	354	376	487	450
17	122	517	487	523	354	376	487
18	371	122	517	487	523	354	376
19	448	371	122	517	487	523	354
20	121	448	371	122	517	487	523
21	339	121	448	371	122	517	487
22	285	339	121	448	371	122	517
23	445	285	339	121	448	371	122
24	238	445	285	339	121	448	371
25	145	238	445	285	339	121	448
26	124	145	238	445	285	339	121
27	46	124	145	238	445	285	339
28	103	46	124	145	238	445	285
29	99	103	46	124	145	238	445
Planted Area	**11 998**	**12 223**	**12 615**	**13 007**	**13 121**	**13 421**	**13 468**
Matured Area	**10 600**	**11 000**	**11 300**	**11 750**	**11 950**	**12 300**	**12 500**
Rate of old plantations (Age > 20)	**17.2%**	**16.8%**	**19.4%**	**21.4%**	**21.0%**	**23.5%**	**25.1%**

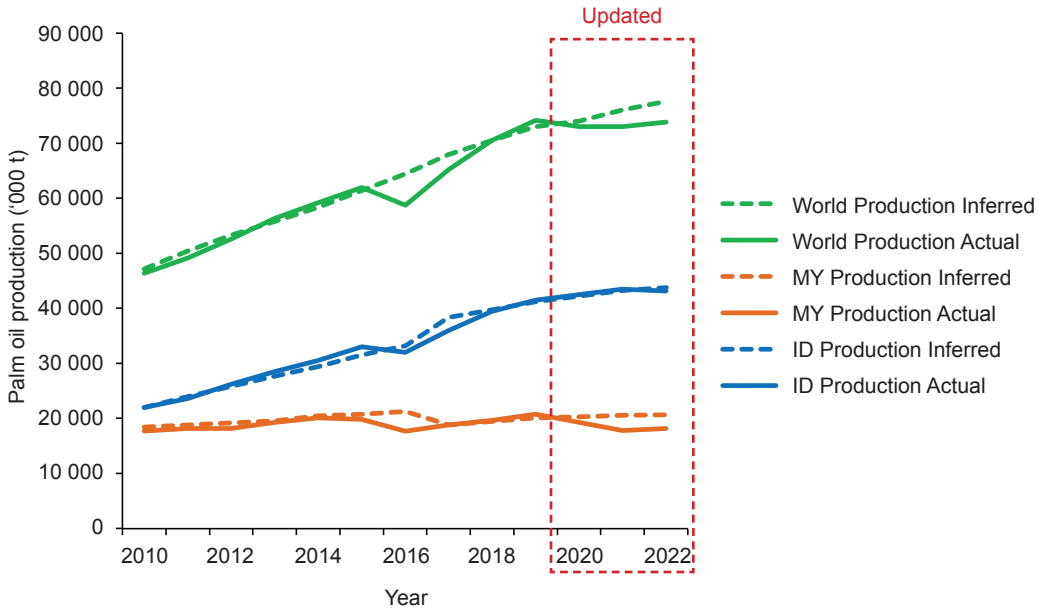

Figure 2. World, Malaysia (MY) and Indonesia (ID) newly inferred production and actual data.

Looking at the production in 2020-2022, the newly inferred production is bigger than the actual data for both the world and Malaysia. This phenomenon can be explained by the labour shortage in Malaysia because the methodology used in this article does not cover the labour factor.

The growth of palm oil production was stagnant in 2020-2022 (*Figure 2*), while the planted area and matured area both grew in this period according to USDA data. The main reason for this stagnant growth is that the number of old plantations (aged more than 20 years old) is getting higher. As the oil palm plantations are getting older, the oil yield decreases and it leads to stagnant growth of palm oil production, despite the expansion of the planted area.

Updated Forecast

In *P.F.*, after verifying the methodology with the correlation between the inferred and actual data (which was 99.8%), future palm oil production was forecasted, with a major assumption added. This major assumption was that the planted areas in Malaysia and Indonesia would not be changed. However, we cannot use this assumption anymore, as the moratorium on oil palm plantations was terminated by the Indonesian government (Bernadette, 2021) and in Malaysia, the oil palm planted area is declining. Without this assumption, it is not possible to forecast how much area will be newly planted in the future.

According to the yield profile of oil palm (*Table 2)*, oil palm trees that are younger than 3 years old cannot yield oil palm FFB. It means that the oil palm planted in the year 2023 does not contribute to the production before the year 2026 when it becomes 3 years old. Therefore, although we cannot forecast how much area will be planted in 2023-2025, we can forecast the matured area, which is older than 3 years and producing oil palm FFB until 2025. The inferred future age profile until 2025 of oil palm plantations in Malaysia and Indonesia is shown in *Table 5*.

According to *Table 5*, the matured area both in Malaysia and Indonesia will be stagnant, but the rate of old plantations will go up until the year 2025. A high rate of old plantations will lead to low productivity. Based on this information, future palm oil production can be inferred in *Figure 3*.

TABLE 5. INFERRED AGE PROFILE OF OIL PALM IN THE YEAR 2023-2025 ('000 HA)

Age	Malaysia			Indonesia		
	2023(E)	2024(E)	2025(E)	2023(E)	2024(E)	2025(E)
-	unknown	unknown	unknown	unknown	unknown	unknown
1	160	unknown	unknown	285	unknown	unknown
2	110	160	unknown	445	285	unknown
3	99	110	160	238	445	285
4	149	99	110	438	238	445
5	173	149	99	495	438	238
6	181	173	149	324	495	438
7	114	181	173	496	324	495
8	180	114	181	403	496	324
9	374	180	114	499	403	496
10	241	374	180	485	499	403
11	269	241	374	730	485	499
12	175	269	241	678	730	485
13	333	175	269	576	678	730
14	200	333	175	391	576	678
15	141	200	333	861	391	576
16	248	141	200	799	861	391
17	201	248	141	450	799	861
18	223	201	248	487	450	799
19	168	223	201	376	487	450
20	139	168	223	354	376	487
21	262	139	168	523	354	376
22	215	262	139	487	523	354
23	183	215	262	517	487	523
24	569	183	215	122	517	487
25	63	569	183	371	122	517
26	85	63	569	448	371	122
27	219	85	63	121	448	371
28	125	219	85	339	121	448
29	160	125	219	285	339	121
Planted Area	**unknown**	**unknown**	**unknown**	**unknown**	**unknown**	**unknown**
Matured Area	**5 489**	**5 439**	**5 474**	**12 293**	**12 453**	**12 399**
Rate of old plantations (Age > 20)	**34.3%**	**34.2%**	**34.8%**	**26.1%**	**26.4%**	**26.8%**

Note: (E) – Estimated.

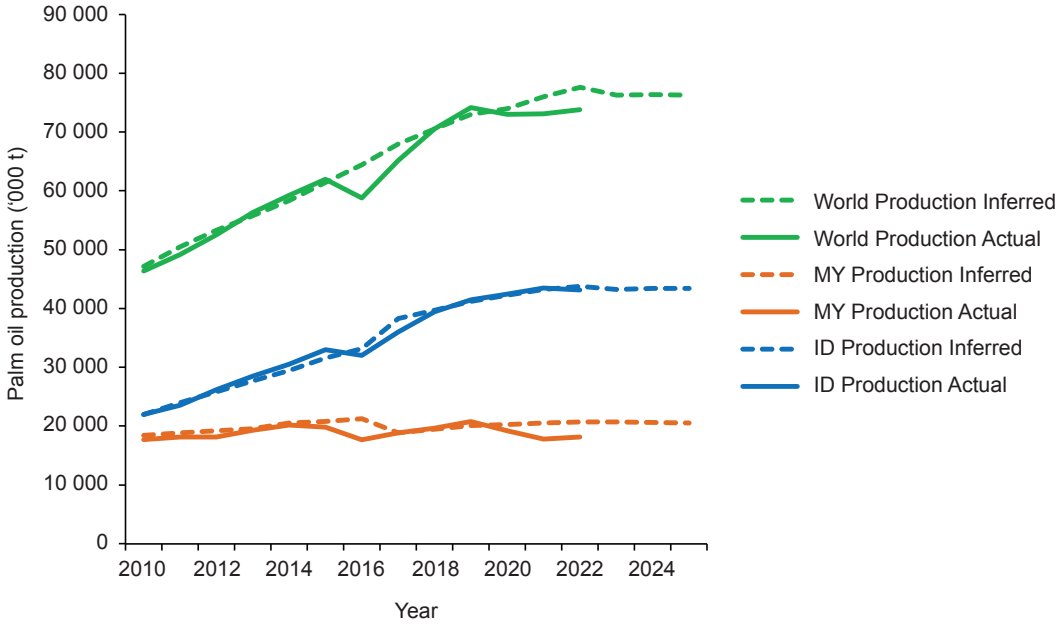

Figure 3. World, Malaysia (MY) and Indonesia (ID) newly inferred, forecasted production and actual data ('000 t).

CONCLUSION

According to the methodology and assumptions in this article, the growth rate of palm oil production will be stagnant until the year 2025. According to a report by the United Nations (UN, 2022), the world population will continue to grow to 8.5 billion by the year 2030 and per capita consumption of vegetable oil will also increase (OECD/FAO, 2022). *P.F* forecasted that these factors would cause palm oil shortage, and the market price of palm oil rose from RM2274/t in 2018-2019 to RM3824/t (average Jan-May 2023). According to this article, as the world's palm oil production in the near future cannot grow as fast as before 2019, this shortage and a bullish palm oil market can remain until 2025.

This article stated that it is not possible to predict newly planted areas in the future. However, more strict environmental regulations and voluntary efforts to conserve the environment (Philip Yap *et. al.*, 2021) can make the expansion of new oil palm plantations in Malaysia and Indonesia difficult.

The methodology used in this article adopted USDA data in order to minimise potential biases arising from various sources in Malaysia and Indonesia. However, the oil palm matured area in Malaysia for the year 2022 is 5 127 290 ha (MPOB, 2023), which is smaller than 5 500 000 ha as recorded by USDA (2023). If the data from MPOB proves to be more reliable than the data from USDA, it is possible that future production in Malaysia could be lower than what has been forecasted in this article.

Under the circumstance that this structural declining production is expected, consumption growth due to biodiesel policy or lower production due to unexpected weather factors can accelerate the palm oil shortage. We can consider using biotechnology to improve OER, which has the potential to increase palm oil production. However, it will take time for these factors to affect oil palm production growth as it takes 3 years for a newly planted oil palm to produce FFB.

The palm oil market in *P.F.* was predicted to shift from bearish to bullish within 2 to 3 years due to a decrease in production. Currently, the market has indeed become bullish. Based on the forecast in this article, this trend is expected to continue until 2025, as palm oil production remains stagnant.

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Oil Palm Industry Economic Journal Vol. 23 (2) September 2023 p. 70-81
DOI: https://doi.org/10.21894/opiej.2023.08

COMPARATIVE ANALYSIS OF OIL PALM IN-FIELD COLLECTION SYSTEMS

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ABSTRACT

The purpose of this study is to determine the most efficient system for the evacuation of oil palm fresh fruit bunches (FFB) from the oil palm tree to the mill. The study employed a quantitative method by utilising primary data, gathered by randomly selecting 500 oil palm estates in Malaysia. A descriptive analysis was conducted to identify the most used system for the in-field collections. The efficiency of each system was then measured by dividing the total output of each system by its respective operating costs involved. The study found that most oil palm plantations in Malaysia are using the conventional way of evacuating oil palms to the mill (termed as System 1). However, System 1 was found to be inefficient because it requires a higher cost of operation to produce the same amount of FFB. The study found that System 2, in which the FFB was immediately transferred to the collection bin after being removed from the oil palm tree and sent directly to the palm oil mill, is the most effective. System 2 has the highest ratio of production compared to the other systems under consideration, producing 0.0213 t of FFB on average per month for every Malaysian Ringgit (MYR) spent.

Keywords: bin system, efficiency, evacuation, productivity, oil palm.

Received: 1 August 2022**; Accepted:** 28 August 2023**; Published online:** 11 September 2023.

INTRODUCTION

The palm oil industry has contributed significantly to the Malaysian economy total export revenue for palm products in 2022 amounted to RM137.89 billion (Parveez *et al*., 2023). This had positioned the palm oil sector as the largest contributor to Malaysia's export earnings besides electrical and electronic, petroleum and chemical products. The significant role of the palm oil industry is not limited to the country, but also to the global vegetable oils market. In 2022, Malaysia was the world's second-largest palm oil producer after Indonesia, representing 23.3% of the total global palm oil production of 79.2 million tonnes (MPOB, 2023). Being the world's second-largest producer of palm oil, continuous production of palm oil is crucial in ensuring adequate supply of palm oil to the world. Hence the country needs to ensure that factors affecting production are well-observed and managed. In economic theory, factors of production are divided into four categories namely land, labour, capital and entrepreneurship. This study focuses on labour and capital as the main factors of production for Malaysian palm oil. As the palm oil industry continues to expand, there is a corresponding rise in the demand for labour within this sector. However, as oil palm plantation sector requires high physical labour, the demand for labour is hardly able to be covered by local sources which ultimately forced employers to hire foreign labour to fill this gap. In 2022, a total of 381 713 people were reported to be involved in the oil palm plantation sector in Malaysia (MPOB, 2023) in which more than 70% of the total workers were foreigners (MPOB, 2021). The high percentage of foreign workers causes the industry to be vulnerable. Any changes in policies related to foreign worker recruitment would significantly affect the labour supply in the oil palm plantation sector and disrupt the production of fresh fruit bunches (FFB), hence reducing crude palm oil (CPO) production.

The main country from which foreign workers are recruited for Malaysian oil palm plantations is Indonesia. As the oil palm plantation sector in

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Indonesia grows rapidly, the demand for labour in that sector becomes higher. This prompted Indonesia to offer a better wage rate to retain its people inside the country. Therefore, the potential for Indonesian workers to migrate to Malaysia to fulfil a career in the oil palm plantation sector is declining, hence affecting the production of Malaysian palm oil. The scarcity of labour, especially in agricultural settings, has detrimental effects on the process of harvesting and collecting FFB, resulting in millions of dollars in losses for the oil palm plantation business (Reuters, 2021). Thus, plantation owners are urged to invest in mechanisation and automation to minimise losses and improve the profitability of the companies.

In aiming to reduce the reliance on manual labour, especially foreign workers and ensure optimal levels of production, mechanisation and automation are crucial factors. However, unlike other agricultural areas, the oil palm estates' terrain has become one of the reasons hindering mechanisation and automation. Due to the topography reason, particularly on the hilly and undulating terrain, manual labour is almost preferable to machines. A good work system equipped with machines needs to be adopted to assure the best possible production of FFB, as the problem of a workforce shortage is becoming more acute. Besides reducing the dependency on manual labour, the adoption of mechanisation also helps to retain a good quality of crude palm oil as the FFB should be transported to the mill within 24 hr after harvesting (Sharif *et al*., 2017). Conventionally, after being harvested, FFB and the loose fruit were loaded into the wheelbarrow and were transported either to the roadside or to the platform for collection. From the platform, FFB were loaded manually into a lorry and ready to be sent to the mill. These conventional methods of manual handling require huge manpower and consequently increase the cost of wages (Awaludin *et al.*, 2015). The conventional loading process also causes damage to the fruits and lowers their quality. Apart from that, the chances of having more uncollected loose fruits are also higher by using this conventional work system. The lack of efficiency within the work process may result in the company's failure to attain maximum profit. Putranti *et al*. (2013) explained that the work of picking loose fruit is the most tiring activity as it takes the longest time in the FFB harvesting process. It was empirically reported that scattered fruit bunches account for up to 14% of the total fruit harvested in Papua New Guinea and about 60%-70% of scattered fruit bunches are left to rot on the ground contributing to huge losses for the palm oil industry (Adetan *et al*., 2007)

Along with technological advancement, several machines were introduced to ease the fruit collection process. Over the years these machines and the technologies have been upgraded and enhanced to handle the challenges encountered during the process. These machineries help to smooth the work process of collecting FFB from the oil palm tree to the collection point.

In maximising the performance of the work system, the process of transferring FFB to the mainline transportation has also been enhanced. Instead of leaving FFBs by the roadside or on the platform, the FFBs are directly transferred into the collection bin. Once the collection bin reaches its maximum capacity, a lorry equipped with a hook-on mechanism will attach to the bin and transport it directly to the mill (Shuib *et al.*, 2010). Despite the effectiveness of this integrated system in collecting and evacuating FFB in the estates, the costs of purchasing and maintaining the machines will always be the major cause that limits the uptake of such technologies. The cost issue may not be a major problem for established plantations, but it plays a very important role for small and mid-size plantation companies in considering the best system that can maximise their productivity. Productivity can be measured simply as the ratio of outputs to the inputs used in production. It could be measured either as land productivity, labour productivity or total factor productivity. The interest of this study was to examine the productivity of the system which focuses on how much the system can generate the output for every Malaysian Ringgit (MYR) spent to operate the system.

Various systems have been applied by the plantation for the evacuation of FFB from the oil palm trees to the palm oil mill. The three most common systems utilised for this purpose are; (1) the platform, (2) the collection bin, or (3) the combination of platform and the collection bin. Hence, a comparative analysis of the various in-field FFB collection systems, which also include the usage of the bin was conducted to determine the most efficient system that would maximise the productivity and profitability of the plantations. This study aims to identify the most extensively utilised in-field collection systems in Malaysian oil palm plantations and assess their efficiency to improve the overall process in terms of effectiveness, efficiency and sustainability in the production of Malaysian palm oil. The study's findings were expected to offer parameters for selecting the most appropriate in-field collection.

Mechanisation in Oil Palm Plantation

In discussing the work system for in-field FFB collection, it is essential to address the advancements in mechanisation and automation that have been implemented in the harvesting and evacuation process of FFB. The advancements in oil palm plantation mechanisation and automation have improved over the years to overcome the issue brought up due to the labour-intensive collection

process. However, mechanisation and automation should not be seen as a substitute but as a method of increasing productivity in the same number of workers (Shuib *et al*., 2010). The advancement in mechanisation includes developing machinery and equipment suited to local topographical conditions. The appropriate option of machines depends on various factors such as the area, the topography, management preferences and economic returns. Shuib *et al*. (2010) discussed the development of machines used in the harvesting and FFB evacuation process to the mills. The study explored various mechanisation tools such as motorised cutters for short palms, mechanical harvesters for tall palms, mechanical grabbers, compact transporters, battery-powered wheelbarrows, three-four-eight-wheeler power carts and loose fruit collectors. The functionality and productivity of each machine were discussed as new inventions were introduced throughout the times. Additionally, a new six-wheel drive with a four-wheel steering transporter was designed to increase FFB evacuation accessibility, efficiency and cost (Shuib *et al*., 2020). Compared to the mini-tractor trailer, the usage of this machine led to cost savings of RM1.03/t. The usage of FFB collector-transporter designed by the Department of Biological and Agricultural Engineering, University Putra Malaysia was also found to reduce the cost of collection and transportation by 16.6%/t FFB collected against that of mini tractor trailer with grabber (Ali and Yahya, 2001).

Aside cost factor, the type of terrain also influences the usage of machinery in the in-field FFB collection process by the plantation players (Awaludin *et al*., 2015). Despite being well-received, the usage of the mini-tractor-trailer system for example limited to flat to slight undulating terrain. On top of that, the soil conditions also affect the effectiveness of the machines. Most of the prototypes recorded poor traction on the soft ground such as coastal and peat areas (Shuib and Hitam, 2003). These limitations combined with the cost factors need to be considered for the decision making. Apart from these abovementioned factors, the element of sustainability also plays an important role in determining the types of machines or mechanisation systems for the plantation. The integration between clean solar energy and electric vehicles in farm mechanisation operations was advantageous to the people, planet, and profit. It was found that this integration could reduce carbon dioxide emissions by up to 8 kg/ha/yr from the total diesel consumption (Azwan *et al*., 2017). Apart from the automation, Lim *et al*. (2021) proposed a harvesting and evacuation route optimisation model that minimises travelling routes while maximising output collection for different plantation sites. The model is also beneficial for small and medium enterprise farmers as the model can propose multiple trip solutions for the transporter with low loading capacity. Overall, the proposed model improved the efficiency of harvesting and evacuation of the FFB with the potentiality of better time and human resource management. On the other hand, another study developed a modified towable backhoe for the FFB collection process with the aim of time-saving (Sarip *et al*., 2020). The innovative hydraulic grabber with its technical specifications of agriculture towable backhoes was designed to assist the smallholders of oil palm in speeding up the collection process.

All the above-mentioned technologies help in improving the productivity of the plantation. The Organisation for Economic Co-operation and Development (OECD) in its manual on measuring productivity interpreted productivity as a ratio of a volume measure of output to a volume measure of input use (OECD, 2001). In this study, the indicators for the inputs were the combination of labour and capital. All inputs were converted into monetary units, which, in turn, allowed for the aggregation of a variety of them into a common measure. The conversion of input into common measure is important to prove that inputs can be combined optimally to allocate scarce resources and allow firms to maximise profits subject to a cost constraint resulting in an optimal input allocation (FAO, 2017). In estimating the productivity of the system, the study considered all relevant inputs in operating the system and defined it as operational productivity. This definition is in line with the concept of productivity discussed by the Food and Agriculture Organization (FAO) of the United Nations which measures the amount produced by a target group given a set of resources and inputs (FAO, 2017).

MATERIALS AND METHOD

The study used primary data collected through mail survey which was conducted in 2021 to randomly selected estates all over Malaysia. Before the survey, a series of virtual interviews were conducted with 10 selected estate managers via various online meeting platforms. The interviews were conducted mainly to explore the work process in oil palm plantations and to have a better understanding of the existing work system applied by the plantations and the costs involved within the systems. The interview was conducted within a predetermined thematic framework related to the estates' operational activities and was recorded and transcribed to extract the relevant information such as the workflow, cost structure and challenges. The information was then used to design a set of questionnaires for distribution to the estates under the scope of study. To enhance the validity of the study by limiting the influence

of other variables, the study focused only on estates with the topography of the planted area of more than 50% flat and undulating. The screening of the estates' topography was made based on the data from internal Malaysian Palm Oil Board (MPOB) database namely the eCOST system. In 2020, there were 1494 estates in Malaysia which reported that more than 50% of their area is on flat and undulating terrain. With a margin error of 5%, following the formula from Cochran (1977), the minimum sample size needed for this study is 306 plantations.

The questionnaires were divided into three parts whereby the first part of the questionnaires consisted of the estate profile such as licence number, estate's name, reporting officer's name and position as well as their contact details. These details were important in assisting the researcher to clarify the information given when it was needed. Meanwhile, the second part of the questionnaire was about the current harvesting and in-field collection system in the plantation. Among the questions under this section included the size of the planted and harvested area, the method used for harvesting and FFB collection as well as the number of labourers involved in harvesting and in-field collection works. The third part of the questionnaires was the main highlight of this study. In this part, plantations were presented with three systems of in-field FFB collection, which were identified during the interview conducted before the survey and they were asked to choose which system had been applied in their operation. Plantation owners were required to fill up the relevant information such as the number of harvesting rounds/month, the FFB production/month and the monthly cost involved for the chosen system. This also included the cost of machinery involved in their operation.

The construction of cost-related questions was made based on the virtual interviews with 10 estates for the exploratory study as mentioned earlier. All cost-related data were based on MYR/t of FFB. The questionnaires included the operational cost of harvesting and evacuating FFB from the oil palm tree manually as well as mechanized processes, cost of loading FFB to the collection bin and the cost of transporting FFB to the mill.

The survey was first started with a pilot study with 30 randomly selected plantations nationwide. The questionnaires were enhanced according to the comments received during the pilot study. Then it was sent to 500 plantations nationwide with a topography of their planted area of more than 50% on flat and undulating terrains. The sampling for 500 estates from the 1494 plantations was made randomly regardless of plantation size using the randomiser function provided in Microsoft Excel and the pilot study's respondents were excluded from the list. The simple random sampling method allows each member of the population to have an equal chance to be chosen as part of the sample. This sampling method helps to remove bias from the selection procedure and should result in representative samples (Gravetter and Forzano, 2011).

For this study, the data obtained were analysed using Statistical Package for Social Science (SPSS) version 20. Descriptive, statistical methods were used to analyse the data as it simplifies the interpretation of the data. Descriptive analysis involves nominal scales such as percentage and frequency used to describe the profile of respondents as well as the estates that were questioned in the first and second parts of the survey. To eliminate outliers, inconsistencies and odd patterns in the data received, a data cleaning process was carried out before the analysis. Results from the study will be more accurate if the data has been standardised validated, and checked for errors and duplicates. The parameters such as mean (the average), median and mode measure the dispersion of the data were ensured to be normally distributed.

Data from the questionnaire was examined in accordance with the three methods for in-field FBB collection to determine how effective the system was.

Figure 1 shows the three systems that were established based on the interviews conducted prior to the development of questionnaires. The primary distinctions between these methods were how the plantation handled its FFB collection from the oil palm trees before it was transferred to the mill. In System 1, FFBs were gathered from beneath each palm and taken to the platform before being sent directly to the mill by mainline transportation. Multiple FFB handling and a significant amount of labour are required by this approach (Awaludin *et al*., 2015).

For System 2, the FFBs were transferred directly to the collection bin after being evacuated from the oil palm tree and then directly sent to the palm oil mill. Except for the harvesting processes, this system is entirely automated and requires less labour interaction. Meanwhile, System 3 is a combination of System 1 and System 2. The use of this system was necessitated by poor road conditions and prevented the use of machinery for direct FFB evacuation to the bin. With the use of a wheelbarrow, the FFBs were moved from the oil palm tree to a platform, where then moved a bin using machinery with scissor-lift technology.

Based on the workflow, this study predicts that System 2 will be the most effective since it involves less labour participation and eliminates multiple handling of FFB, both of which contribute to an increase in productivity and FFB quality. Most importantly it helps to partly address the low

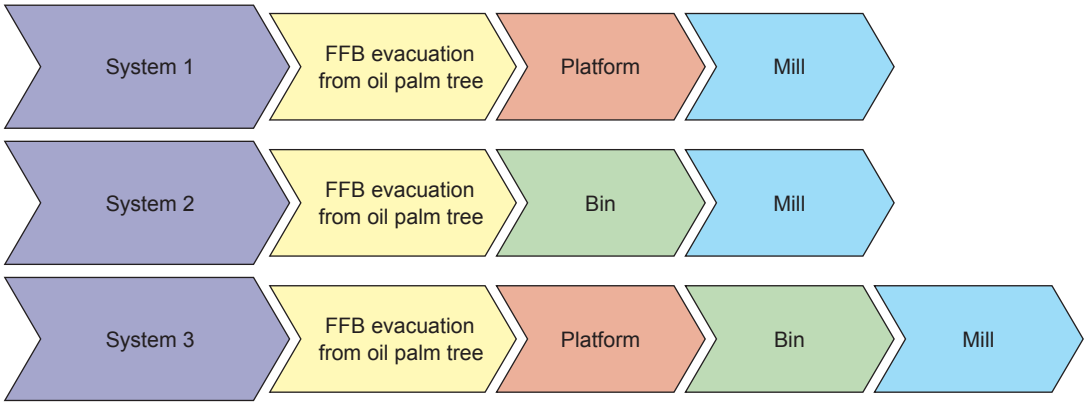

Figure 1. The in-field FFB collection systems in Malaysia.

productivity issue which is caused by the shortage in labour.

The efficiency of the system was inferred based on the productivity of each system. The term efficiency which is measured by productivity, often refers to the distribution of resources, where resources are defined as the cost of transporting FFB to the mill. When a system can produce the same amount of output with fewer inputs, it is said to be efficient (Sumanth, 1994; Tangen, 2005). Efficiency is also described as how much money is spent in relation to the minimum amount that is necessary, in theory, to produce the intended results in a system (Jackson, 2000). For this study, it was assumed that each system has similar working hours. Therefore, the time element was not considered in the computation of the system's productivity. The productivity was calculated based on a formula derived by Al-Darrab (2000) in his study on the relationships between productivity, efficiency, utilisation and quality.

The productivity [Equation (1)] is as follows:

$$\text{Productivity} = \text{Output}/\text{Input} \quad (1)$$

where, output is the number of FFB produced/month (t) and Input is the total costs involved in evacuating FFB/month (MYR).

The costs associated with FFB evacuation include wages paid to harvesters and FFB collectors; costs of fuel and maintenance costs for the machinery used; wages paid to the FFB loaders; and lastly the transportation cost to the mill/km.

In addition to the productivity analysis, the study also considers the financial decision relating to bin ownership. The estimated costs of both buying and leasing the bins were assessed using the net present value (NPV) method (Berlin and Lexa, 2006; Gordon, 1974; Ruegg and Marshall, 1990). NPV is a financial model that calculates the current value of predicted cash flows in the future. It helps determine the potential profitability of a buy *vs.* lease decision by discounting predicted future cash flows by a certain percentage rate. The analysis allows businesses to make a comparison between the cash flows of an operating lease and buying, thus, helping to make a financially informed decision. The decision either to buy or to lease the bin, cash flow with lower NPV value is advantageous as it reflects the lower cost alternative (Hah and Lee, 1993).

The Equation (2) for NPV calculation is as follows:

$$\text{NPV} = \text{Initial Investment} + \sum \text{CF}_t / (1 + i)_t \quad (2)$$

where, CF is the net cash flow at time, i is the discount rate and t is the time of the cash flow.

RESULTS AND DISCUSSION

Respondent's Profile

The sample size of 500 respondents was calculated from the population of 1494 plantations in Malaysia which have more than 50% flat and undulating terrains. The study is unable to draw a precise conclusion about the system utilised at a state level as a result of the sampling technique used. Considering this, the outcome would merely depict the overall situation of in-field FFB collection in Malaysian oil palm plantations without any further analysis on a state or regional basis. The profile of the respondents by job position is as *Table 1*. It should be highlighted that the estate managers themselves accounted for the majority of responses (60.8%), followed by the administrative officers and the account executives at 21.7%, the company's director at 8.3% and other positions at 9.2%. "Others" refers to the positions such as sustainability officers, cadet planters, mandores and supervisors.

Apart from the job position, it is also crucial for the study to capture the size of the planted area as well as the harvested area of the plantations. *Table 2* shows the breakdown of the estates according to their size. According to the table, the respondents' planted area and harvested area distributions do not differ significantly from one another. The survey was dominated by plantations with size of under 500 ha with a percentage of 54.8% for the planted area and 59.6% for the harvested area. Plantations with sizes of between 500-999 ha represented 13.1% and 12.3% of the planted and harvested area respectively. About 26.0% and 25.0% of the plantations were reported with planted and harvested areas of 1000-3000 ha each. Only 6.2% and 3.1% of the plantation were with more than 3000 ha for planted and harvested areas respectively. The total planted area reported by survey participants was around 0.50 million hectares, which represents 8.5% of the 5.87 million hectares of the total planted area reported by MPOB in 2020 (Parveez *et al*., 2021).

A question on the harvesting method was also included in the survey. *Table 3* lists the three harvesting methods that were established in advance for the survey, either manual, a combination of manual and mechanised, or, exclusively mechanised. According to Jelani *et al*. (2008), the terms "manual method" and "mechanised method" relate to the use of chisels and sickles, and machines such as motorised cutters, respectively. It was found that most of the plantations were using manual methods for the harvesting works with a percentage of 96.9% and another 2.7% were using a combination of manual and machine. Only one plantation was fully mechanised in its harvesting process. It is conceivable that the vibration issue caused by the powered cutter is the cause of the tardy adoption of motorised cutter in the plantations. Despite the shortcomings, the productivity increases from using the powered cutter cannot be disputed. According to the field-testing findings, the motorised cutter was able to harvest between 9.5 and 12.6 t/day, compared to the manual method's productivity of between 4.2 and 6.0 t/day (Jelani *et al*., 2008). This benefit led to the development of a more suitable motorised cutter design, which addresses the vibration issue and promotes increased use of the device.

Similar to the harvesting process, the respondents were questioned about whether the evacuation process is totally manual, semi-mechanised or fully mechanised *(Table 4).* The term manual system refers to the use of a mini tractor with or without a grabber, a three or four-wheeler power cart.

It was found that more than 60% of the respondents were using machinery in evacuating FFB from the trees to the collection centre. About 16.0% of the respondents were found to be fully mechanised in the FFB evacuation process, while 53.5% were integrating machinery into the

TABLE 1. NUMBER AND PERCENTAGE OF RESPONDENTS BY JOB POSITION

Job position	Estate manager	Administrative officer/Account executive	Director of the company	Others
Number of Respondents (Percentage)	304 (60.8%)	109 (21.7%)	41 (8.3%)	46 (9.2%)

TABLE 2. RESPONSES BY SIZE OF PLANTED AND HARVESTED AREAS

	Area (ha)			
	< 500	500-999	1000-3000	>3000
Planted (Percentage)	274 (54.8%)	65 (13.1%)	130 (26.0%)	31 (6.2%)
Harvested (Percentage)	298 (59.6%)	62 (12.3%)	125 (25.0%)	15 (3.1%)

TABLE 3. HARVESTING METHOD ADOPTED BY THE RESPONDENTS

Harvesting method	Manual	Semi manual	Fully mechanised
Number of the respondents (Percentage)	485 (96.9%)	14 (2.7%)	1 (0.2%)

TABLE 4. FFB EVACUATION METHOD FROM OIL PALM TREE TO COLLECTION CENTRE APPLIED BY THE RESPONDENTS

Evacuation method	Manual	Semi manual	Fully mechanised
Frequency (Percentage)	153 (30.6%)	267 (53.5%)	80 (16.0%)

conventional work system. Only 30.6% of the respondents were still using the conventional way of evacuating FFB. The controlled variable of only flat and undulating terrain might influence the pattern of the results. According to interviews that were performed as part of exploratory research in the early stages of drafting a questionnaire, the use of machinery in carrying FFB from the oil palm is dependent on the kind of terrain and the readiness of the harvesting path. Proper terracing and detailed preparation of the harvesting path is important to ensure the accessibility of the machines used (Khalid and Shuib, 2014).

The work process of FFB evacuation is not completed without detailing the collection systems used by the estates. The discrepancies between the collection centre for FFB before it was transferred to the mill were the subject of this study's in-field collection systems. Three separate collection mechanisms were used. System 1 refers to the use of a platform only. System 2 to the use of a bin system only, and System 3 is the combination of platform and bin systems.

Table 5 shows that 79.1% of the respondents were using System 1 whereby after the FFB were evacuated from the trees, the FFB was collected at the platform and sent to the mill. This system requires more labour participation and poses a higher risk of damage to the FFB due to the multiple handlings. Only 8.7% of the respondents are using only bin systems in their operation. The bin system which is originally designed for industrial bins and waste helps to facilitate the collection of FFB. The full integration of machinery in the FFB evacuation process from the palm to the collection bin and the mill eliminates multiple handling issues (Radzi *et al*., 2020) and directly maximises the profit of the plantations. Most importantly, this system helps to reduce the participation of labour (Nadzar and Sapry, 2020; Radzi *et al*., 2020) and consequently assist in reducing the loss due to labour shortage. Apart from these two options, 12.2% of the respondents reported that their plantations were using a combination of platform and bin systems. Most of the plantations that opted for this system indicated that they are in the process of implementing full integration system for FFB in-field collection. It is also noted that the use of bin system requires proper planning in terms of the placement to facilitate and minimise the movement of the tractor transporting the FFB. Sufficient space for the tractor is needed to facilitate the work of unloading FFB into the bin. Users of System 3 indicated that they are currently meeting the aforementioned conditions. To temporarily streamline their operations, they are integrating the use of platform and bin systems.

Comparison of the In-Field FFB Collection Systems

In terms of the FFB yield/ha/month, System 1 recorded the highest yield of 1.36 t FFB as against that of 1.22 t and 1.24 t of FFB/ha for System 2 and System 3 respectively. However, comparing over these three systems, the output generated by the system needs to be analysed together with the cost element. The cost factor plays a pivotal role in determining the most efficient system. The questionnaire included questions about many cost factors, including the wage for the labour involved, the operational costs of the machinery employed, the loading cost and the transportation cost. According to the survey, the average harvester's salary was roughly RM35/t of FFB. The cost of the harvesters within the three systems under consideration does not require further examination because the majority of the respondents harvested their FFB manually.

TABLE 5. COLLECTION SYSTEMS APPLIED BY THE RESPONDENTS

Collection system	System 1 (Use of platform only)	System 2 (Use of a bin system only)	System 3 (Combination of a platform and bin system)
Number of respondents (Percentage)	396 (79.1%)	44 (8.7%)	60 (12.2%)

TABLE 6. COST COMPARISON OF THE IN-FIELD FFB COLLECTION SYSTEMS

Cost element	Average cost		
	System 1	System 2	System 3
Operational cost for manual process (RM/t)	50.78	38.50	47.18
Operational cost for machinery used (RM/t)	31.15	42.23	39.46
Loading cost (RM/t)	8.50	5.80	6.70
Transportation cost (RM/t/km)	1.80	0.76	0.77
Overall cost (RM/t)	92.23	87.29	94.11

The operational cost, whether for a manual process or a mechanised process, is another crucial cost component that would significantly alter the situation. The three system's manual processes had an average monthly cost of RM45/t of FFB. On the other hand, the average monthly operational costs for the three systems' mechanised processes were RM37/t of FFB. These expenses cover fuel as well as maintenance and repair charges. The comparison of the operational cost for manual and machinery for each system is summarised in *Table 6* together with other cost elements namely loading costs and transportation costs. The operational cost of machinery was found to be higher in System 2. This is in line with the level of usage of machinery within the respective systems. The use of the collection bin exclusively in System 2 necessitates the automation of all other job operations aside from harvesting, which helps to explain why its operating costs are higher. System 1 recorded the lowest operational cost for equipment. This system refers to the traditional method of evacuating FFB, where the majority of the work was done manually. As a result, the system does not require many machineries at a high cost.

The next important cost that needs to be examined is the loading cost. On the assumption that manual loading operations will decrease, it is known that the FFB evacuation procedure as described in System 2 helps to resolve the multiple handling problem. Given these circumstances, System 2 must have the lowest loading cost when compared to the other two systems. For these three methods, the loading cost on average was about RM7.00/t. Based on the survey, it was found that the loading cost for System 2 was at RM5.80/t FFB, 31.8% and 13.4% lower as compared to the loading cost for System 1 and System 3 respectively. The significant reduction in the cost of loading the FFB throughout the evacuation process in System 2 supports the argument of less labour participation within the said system and consequently helps to maximise the profitability of the plantations.

The other cost element is the transportation cost. This cost refers to the expenses paid for sending the FFB to the mill. The average transportation cost for these three systems was RM1.10/t of FFB/km. There was a significant difference between the transportation cost in System 1 and that of System 2 and System 3. The average transportation cost for System 1 was RM1.80/t, which was two-fold higher than the transportation cost in System 2 and System 3. This might probably due to the differences in the type of transportation used between the systems. Systems 2 and System 3 used bins, which are attached to the lorry using a hook-on device. Meanwhile, System 1 requires the plantation to use a trailer to transport the FFB to the mill. As a result, the rate varies depending on the type of vehicles used. Overall, System 2 was the most affordable system for evacuating and transporting FFB from the palm to the mill, with System 1 and System 3 coming in second and third. Compared to the operational cost of System 3, System 1 was marginally more affordable (2.0% less expensive).

On the labour involvement, *Table 7* suggests that the land-labour ratio for System 1 was 1:23, which translates into one worker can cover about 23 ha of the planted area. For System 2, the land-labour ratio was 1:30, where one worker can cover about 30 ha of the area and lastly for System 3, the land-labour ratio is 1:29, which means that one worker can cover 29 ha of the area. This finding confirmed that System 2 requires less workers than System 1 and System 3. System 2 was found to reduce labour participation by 23% as against the conventional system (System 1) which has been used by most of the plantations in Malaysia.

Efficiency of the Systems

In examining the efficiency of the pre-specified in-field FFB collection systems, the productivity of each system was calculated based on the formula described in the methodology section whereby the monthly FFB production is divided by the total cost involved in evacuating FFB from the trees to the mill per month. Based on the formula, the highest productivity was recorded by System 2 with the productivity FFB of 0.0213 t/RM which is equivalent to 21.32 kg/RM. The second most efficient system was awarded to System 1 with FFB productivity of 0.0179 t/RM (17.89 kg/RM) and the least efficient system was System 3 with FFB productivity of 0.0163 t/RM (16.32 kg/RM).

Based on the findings summarised in *Table 8*, it is also possible to conclude that System 2 could produce an average of 0.0213 t of FFB/month for every MYR used to remove FFB from the oil palm, System 3 was found to be the least efficient due to the multiple handling element which could also harm the FFB, preventing plantations from selling it for the highest possible price. Additionally, repeated handling could hinder, plantations from maximising their revenue by preventing the collection of loose fruits from being maximised. Meanwhile, System 1 can generate 0.0719 t of FFB and it is lower compared to the productivity of System 2. The multiple handling element in System 1 makes the system less efficient compared to that of System 2.

Buying *vs.* Leasing Decision for the Bin

Based on the results tabulated in *Table 6-8*, the study revealed that System 2 was found to be the most efficient system for the in-field FFB collection system in terms of the utilisation of inputs to evacuate oil palm to the oil palm mill. However, it should be noted that the element of capital

TABLE 7. LAND-LABOUR RATIO BY SYSTEMS

	System 1	System 2	System 3
Land-Labour ratio (Planted area to one worker)	23:1	30:1	29:1

TABLE 8. AVERAGE PRODUCTIVITY OF THE SYSTEMS

	System 1	System 2	System 3
Average productivity (t/RM)	0.0179	0.0213	0.0163

expenditure is not included in the determination of the most efficient system. In the survey, the respondents were also asked about the details of the collection bin which include the number of bins, the capacity, the price per unit and the ownership of the bin. Out of the 44 respondents who opted for System 2, 47.6% of them bought the bins and 52.4% contracted (leased) it out with the mainline transporter. The differences in the ownership of the bin have financial implications for the plantation as it requires huge capital investment. The results of the survey suggested that the average price for a bin with 10 t capacity was about RM16 500/unit and typically the respondents owned an average of 10 units of bins to accommodate their needs. In determining this so-called finance decision, a capital budgeting technique needs to be employed in comparing either buy or lease the bin and the best approach for evaluating this decision is to calculate the NPV of each options.

Leasing is a contractual arrangement whereby the owner (lessor) grants the lessee the right to use the asset in return for a periodic payment. Under the lease contract, the ownership of the asset remains with the lessor, but the use of the assets is available to the lessee. The lessee has to pay the agreed rental amount to the lessor periodically according to the agreement made between both parties. In the case of System 2, the bins were leased from the mainline transporter and the rental amount was included in the transportation cost to the mill. This can be seen from the differences in the transportation costs reported by the respondents in the survey. The average transportation cost of FFB (t/km) of the plantations that owned the bin was about RM0.65, lower by 27.8% as compared to that of RM0.90 for the plantations that leased the bin with the transporter.

From the above discussion, it was noted that under System 2, most of the plantations had on average 10 bins for their operation and the average price per unit of bins was RM16 500. Hence, the total cost to acquire 10 units of bins was RM165 000. To ease the calculation of the NPV, the lifespan of the bin was assumed to be 5 yr and the maintenance cost of the bin was estimated at RM100/month on average. Meanwhile, if the plantation leased the bin, the lease rental was assumed to be RM0.25/t. This was derived from the differences in the transportation cost between the plantations who owned the bin and leased the bin (RM0.90-RM0.65). *Table 9* further explains the details of the costs involved in the calculation of the NPV. In considering either buying or leasing the bins, the necessary information under System 2 was extracted to generate the NPV for each options. The calculation of NPV was only to the information under System 2 as it was found to be the most efficient system. In addition, as the cash flows were calculated on the cash outflow basis which is the expenses of the plantations, the lower number of NPV was favourable.

Based on the above information, the NPV of purchasing 10 bins was about RM28 540 and the NPV of leasing the bins was about RM11 470. Since leasing had a lower net present value of cash outflows, it was advisable for the plantation to lease the bin.

CONCLUSION

The main objectives of the study were to identify the most widely used in-field collection systems in Malaysian oil palm plantations, examine the efficiency of each system and focus on the most efficient ones. In achieving these objectives, the primary data collection with the selected plantations licensed by MPOB was conducted. The plantations were selected randomly based on the criterion of the terrain types as mentioned in the methodology section. The data collection was carried out using interviews and the distribution of questionnaires through email to gather the relevant productivity data. According to the above-mentioned results and discussion, the questionnaires were filled out primarily by estate managers, which is consistent with the survey's intention to capture as much as responses from the estate managers as operational activities were controlled by them. From the survey, it was found that the most widely used in-field FFB collection system is System 1 where the FFB were collected from beneath the oil palm trees and were brought to the platform for collection

TABLE 9. DETAILED EXPENSES AND ASSUMPTIONS BETWEEN BUYING AND LEASING

	Buy	Lease	Note (if any)
Capital expenditure for 10 bins	RM165 000	-	Based on the average price per unit of bin reported by the respondents under System 2.
Maintenance cost/yr	RM1 200	-	There is not much cost needed to maintain the bin except applying grease to prevent rust and corrosion.
Average FFB production/yr	10 800	10 800	The average FFB production reported by plantations under System 2.
Lease rental/yr	-	RM2 700	Derived based on the differences in transportation cost between the lessee and the owner of the bin which amounted to RM0.25/t in System 2.
Depreciation/yr	RM33 000	-	Straight-line method using 5 yr useful life.
Discount rate	7.5%/ yr	-	Based on the profit rate quoted by SME Bank for small business financing (SME Bank, 2021)
Term	5 yr	5 yr	-
Tax rate/yr	24%	24%	-
NPV (RM)	28 540	11 470	In the buying versus leasing decision, the NPVs of the financing cash flows for both options are calculated and compared and the lowest cost option should be selected.

and then directly sent to the mill by the mainline transportation. Based on the findings of this study, this system is still the most preferred even if it has certain disadvantages including the requirement of high labour participation and multiple handlings of FFB. However, due to these drawbacks, this system was found to be inefficient as compared to System 2. The use of bins in System 2 was able to increase the FFB production at the minimal cost of operation. Despite the advantage of the collection bin, the study did not suggest the usage of bin be combined with the use of a platform. This is because the combination of these two methods was found to increase the monthly operational cost as compared to that of System 1 and System 2. In addition to the foregoing, the study recommended that plantations lease the bins rather than buy them because it was determined to be more cost-effective. The study's conclusions gave the plantations some direction as they plan their operational business strategy. It is also significant to note that the study's findings were restricted to only plantations with flat and undulating terrains because plantations with other types of terrain are likely to have different cost structures**.**

The study would like to suggest that plantations that have more than 50% of their terrain in flat or undulating areas move forward with the integrated work system as described in System 2 of the study. This recommendation is based on the results and discussion as the aforementioned. The productivity is anticipated to rise with the proposed system. The method also reduces the number of times FFB is handled improving the calibre of the FFB gathered and ultimately enhancing the company's profitability. The fact that the full integration of the bin system into the work process was found to lessen reliance on manual labour and partially minimise the losses resulting from the labour shortage issue.

ACKNOWLEDGEMENT

The authors would like to acknowledge the assistance of other research officers of Techno-Economics Research Unit for the insight and expertise that greatly helped in the completion of this project. In addition, the authors would also like to thank all staff of the Techno-Economics Research Unit for their assistance and commitment throughout the whole process of this study.

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Oil Palm Industry Economic Journal Vol. 23 (2) September 2023 p. 82-95
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YOUTH'S MOTIVATION TOWARDS A CAREER IN MALAYSIAN OIL PALM PLANTATION

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ABSTRACT

Job creation among youth is an often debated issue in many countries, including Malaysia. Nowadays, despite the rising unemployment rate, there is a shortage of manpower in certain sectors, especially the oil palm plantation sector. It raises the question of whether or not the youth are interested in working in this sector. A comprehensive study was conducted to answer this question. Along with it, this study also surveyed youth's opinions on the factors that can motivate them to build a career in the oil palm plantation sector. A total of 724 youth in Malaysia were employed as respondents for this study and SmartPLS software was used to analyse the study data. The results found that youth still have the interest in getting involved in the oil palm plantation sector. The main motivators for their involvement are family, friends and society, followed by health and economic factors. The findings of this study are in line with the formation of the job selection theory developed in the early 1950s, in which family members play an important role in cultivating job interest. This indicates that the family plays a vital role in encouraging youth involvement in the oil palm plantations. Besides, to ensure their participation in the oil palm plantation sector, policymakers have to think of approaches to improve health and economic standards.

Keywords: career, motivation, oil palm plantation, SmartPLS, youth.

Received: 6 January 2023**; Accepted:** 30 August 2023**; Published online:** 14 September 2023.

INTRODUCTION

The oil palm plantation sector is one of the most important sectors in Malaysia. This sector is one of the largest contributors to Gross Domestic Product (GDP) and this makes the agricultural industry the third most important industry in the Malaysian economy (DOSM, 2022). The palm oil industry is also over 100 years old and Malaysia is the world's largest producer and exporter of palm oil after Indonesia (Ahmad *et al*., 2012). Oil palm plantations are often considered primary input producers because they are a vital source of raw material for the production of palm oil and its derivatives. Palm oil is one of the most widely used vegetable oils in the world and has a wide range of applications in various industries, including food, cosmetics, pharmaceuticals, and biofuels.

In addition, the development of the world food industry has further boosted the demand for the oil and fats industry, including palm oil globally (Rashid, 2018). The satisfactory growth in the oil palm industry can bring great benefits to the country. This is because it can provide various employment opportunities at various levels in the oil palm industry ecosystem, which includes the upstream, midstream and downstream sectors (Sahbuiddin *et al*., 2021). The upstream sector involves plantation activities such as the production of germinated seeds, seedlings, fresh fruit bunches and other agricultural inputs such as fertilisers. The midstream sector consists of the processing and manufacturing sectors (crude palm oil production), and new product research; while the downstream sector consists of final processes involving other manufacturing sectors and low-

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value-added products to meet the demand for food as well as energy resources (MPOB, 2020). All three of these activities require the workforce to carry out the various tasks involved in each stage. Hence, the impact of this sector has opened more employment opportunities to the people of this country, especially the youth. However, the things youth take into account such as labour rights, fair wages, and safe working conditions are important considerations within the industry's labour dynamics. If wages and benefits in the palm oil sector are not competitive compared to other industries or urban areas, it can make these jobs less appealing to young people. Likewise, young workers may lack proper training and protective equipment, exposing them to health and safety risks. In addition, remote locations, and limited access to modern amenities like internet and telephone lines can discourage young people from getting involved in the palm oil industry. These challenges can make the work environment less attractive and more difficult for young individuals.

Therefore, the development of human capital also known as human resource development is important for the future growth of the country. Youth are an important asset in every country because they are the group needed to govern and develop the country in the future (Yunus, 2007). However, the issue of unemployment among youth is becoming more serious as many of them especially graduates cannot get a job after six months of graduation (Alkatheri and Abdullah, 2019).

Despite the unemployment, certain sectors are experiencing labour shortages, especially the agricultural sector which is difficult for the youth to fill. This causes foreign workers from countries such as Indonesia, Bangladesh and India being employed in this sector. The latest data showed that in 2022, there were 391 000 workers employed in the oil palm plantation sector. Out of the total, 74% were foreigners, mostly Indonesians (New Straits Times, 2022). However, the recruitment of foreign labour is a temporary solution to the problems faced.

The vacancies that exist in the agriculture sector, especially in the oil palm plantation sector should be filled by the unemployed (Bernama, 2020), especially the youth. However, the extent to which these young people are interested in the oil palm plantation sector is still not clear. This is because most of them are quite sceptical towards jobs classified as 3D jobs (Dirty-Dangerous-Difficult) (Mohamed *et al*., 2019). The challenge of attracting unemployed youth, who often hold reservations about jobs categorised as 3D jobs like those in the oil palm plantation sector, is a significant concern for the agriculture industry. Other than that, the lack of knowledge and skills development programs can make it difficult for young individuals to enter these roles (Saad, 2016). According to Abdullah *et al*. (2016), attraction for youth participation in the plantation sector includes improvement of the working environment, job status, facility and benefit in the plantation field. Addressing this issue requires a strategic approach that emphasises the potential benefits and opportunities within the sector while also addressing the concerns and perceptions that discourage youth from considering these opportunities.

Graduates or young people are not spared from making choices in their careers (Che Yaacob and Ramli, 2004). Proper and accurate selection of relevant jobs or occupations by graduates or job applicants is very critical as it determines their purpose as job incumbents. Moreover, job incumbents or employees who are clear with their "purposeful missions" tend to be more involved and engaged with their work (Charles and Florah, 2021). It is one of the most important processes in one's life when one begins to think of entering the working world. Locke and Schattke (2019) argued that job selection must be in line with an individual's desires and interests. A job done without interest will cause boredom and affect the quality of work done (Danckert and Eastwood, 2020).

The foundation of a career or job selection is formed by several elements. The job selection theory founded by Anne Roe and Siegelman (1964) concludes that humans tend to improve their self-efficacy to achieve a good career, and parental upbringing strongly influences their career choices and lifestyles. In fact, this theory is based on the hierarchy of needs developed by Maslow (1943), which will be discussed further in the next section. Roe's theory was later updated by Anne Roe and Siegelman (1964) and contains three components namely; i) generic background influences, ii) psychology, and iii) genetics and hierarchy of needs.

Whether individuals remain with their choices or not depends on several other theories as explained by Ginzbery (1989), namely: i) accidental theory, whereby individuals accidentally or intentionally enter the career as a result of an event, pressure, influence or by chance. b) Impulse theory, which is based on feelings or emotions towards a career seen, read, researched, or experienced by other individuals who are significant to them. c) Vocational guidance refers to career information found from vouchers, handouts or career counselors.

Therefore, the objective of this study is to identify whether there is still interest among youth and the factors that stimulate their interest in being involved in the oil palm plantation sector. Studies on these stimulating factors are important so that the objectives of policies and strategies planned for this group can be met, and this could directly attract them to be involved in the oil palm

plantation sector. The discussion continues with a theoretical explanation related to job or career selection. Then, a review of studies conducted by previous researchers in the oil palm plantation sector in Malaysia is presented. This is followed by the methodology, results and conclusion of the study. This study is based on Maslow's theory (Maslow, 1943) which emphasises the basic needs of employees as an important factor in attracting them to certain job. Youth basic needs must be met before working in the oil palm industry.

Stimulating Factors of Job Selection and Literature Review

The basic needs of employees are an important factor in attracting them to be in a job. Basic needs are needs that must be met prior to other needs (Maslow, 1943). Generally, Maslow's theory relates to human survival. Stum (2001) stated that the motivation for basic needs is the main motive for individuals choosing a job, which is based on two main parts; economic and non-economic. From an economic perspective, the motivation for basic needs means that individuals view employment in terms of the salary offered by the employer (Yuhong and Johnes 2003). Most people will mention that salary is a major factor to look at when applying for a job. This means that the higher the wage, the more individuals want the job (Brown and Medoff, 1989). In fact, according to Meyerding (2018), young people will usually immediately reject an offer if the salary offered is below expectations. Furthermore, the wage factor has a positive relationship with the involvement of rural youth in the oil palm plantation industry. The results of the study by Ayob *et al*. (2015) showed that one of the reasons why youth do not get involved in the oil palm plantation industry is because the salary is low. This minimum wage level ultimately affects unemployment among youth (Gorry, 2013). Wages and benefits need to be balanced to satisfy the wants of employees and to keep them competitive (Chiu *et al*., 2002). Abdullah *et al*. (2016) argued that the unfavourable monthly salaries in the oil palm plantation sector have caused difficulties among the employees in applying for loans and obtaining facilities offered by banking institutions. This is because salary is an important element in approving a financial loan in addition to several other factors. As jobs in this sector are more challenging and categorised under the 3D sector, the salary offered needs to reflect the job's difficulty and hazards (Kamaruddin *et al*., 2018).

In addition, job selection also depends on job prospects. This is related to the future of the job such as promotion opportunities, salary increments, and so on. According to Meyerding (2018), the perception of the future is the most important feature in choosing a job in the agricultural field. Ko and Jun (2015) empirically demonstrated that a high salary is an important factor that motivates university students to enter the public sector. Students also choose to work in the public sector because of the higher social benefits compared to the private sector (Molnár and Kapitány, 2014). This situation is different in the agricultural sector. Malaysians think that the agricultural industry is an industry that pays low wages and does not provide a bright future. Meanwhile, basic needs from a non-economic perspective are seen in terms of environmental health as well as security and safety (Greenhalgh and Rosenblatt, 1984). Involvement in oil palm plantations is an agricultural activity that is largely outdoor activity. According to a study conducted by Hofmann *et al*. (2009), the health of those working in the agricultural sector will be affected due to exposure to sunlight and the physical strength needed.

Environmental factors have their own definition, which is everything that is around us (Arthur and Lawrence, 1984). It relates to the job suitability factor, in which this factor is very important to one's job selection (Savickas and Porfeli, 2011). This is because, the workplace environment is a factor that is often beyond the control of individuals such as floods and natural disasters; and it affects economic and career conditions. Thus, it is very important that the job seekers identify suitability as a critical factor before venturing into a job (Hofmann *et al*., 2009). Similarly, the issue of occupational safety is an important aspect especially in high-risk work. Safety issues are accidents that workers are aware of as well as those they are not aware of. Tripathi *et al.* (2019) stated that job security is the most important factor in career choice for youth. This situation clearly illustrates that youth desire jobs that are of the lowest risk.

Next, family members also play a role in influencing or determining a youth's career choices. Raychaudhuri and Jana (2016) stated that family background could be influential in career decision-making. Meanwhile, a study by Mukembo *et al*. (2014) found that parents are the most influential career guides for youth. This means parents have greater influence over their children.

All the factors discussed are important factors influencing job selection among job seekers. Therefore, to encourage the specific involvement of young people, these factors need to be given attention and priority in formulating employment-related policies. Fostering interest in working in the agricultural sector, especially oil palm, is also important.

A study about Malaysian youth working in the oil palm plantation sector was conducted by Kamaruddin *et al.* (2018). The study discovered that job satisfaction among Malaysian youth is influenced positively by economic profitability

offered, government or employer's policy and social facilities provided by employer; and negatively influenced by working environment factor and perception of social job status toward this occupation. However, their study did not take into account the role of family, peers, society and health in influencing youth interest in the oil palm plantation sector. According to Mukembo *et al.* (2014) parents play a role in cultivating interest and guiding their children's career choices. Meanwhile, health is the primary consideration for young people when choosing a career (Tripathi *et al.*, 2019).

Hence, this study investigates the economic factor, job prospects, health factor, environmental factors, safety factor and family factor that might influence youth involvement in career in oil palm plantation. *Figure 1* presents the research model of factors of involvement in the oil palm industry.

We proposed the following hypothesis for this study:

Hypothesis 1: The economic factor is positively related to youth interest in the oil palm plantation sector.

Hypothesis 2: The health factor is positively related to youth interest in the oil palm plantation sector.

Hypothesis 3: The environment factor is positively related to youth interest in the oil palm plantation sector.

Hypothesis 4: The safety factor is positively related to youth interest in the oil palm plantation sector.

Hypothesis 5: The family factor is positively related to youth interest in the oil palm plantation sector.

METHODOLOGY

This study was conducted in Peninsular Malaysia involving five zones; northern, central, southern, and eastern zones; as well as Sabah and Sarawak representing East Malaysia. Sample selection was done by strata sampling. Determination of the minimum sample size according to Krejcie and Morgan (1970) where the population size is 14 990 900 people (DOSM, 2021), the chi-square value is 3.841, the population proportion (Confident interval) is 0.5 (95%), and estimation error is 0.05. Hence, the minimum sample size is 385. Meanwhile, the minimum sample for the northern is 76, central is 100, southern is 67, and eastern zones is 86. A total of 739 respondents were involved in this study. Of these, only 724 respondents could be used. This figure is determined based on the justification that the number is considered sufficient (Memon *et al.*, 2020) to represent the population by zone (*Table 1*).

Study Instrument

This study used a questionnaire as its research instrument. The questionnaire of this study contains three main parts; demographics, stimulating factors of involvement in the oil palm industry, and readiness proxied by youth interest in the oil palm plantation sector. The demographics of the respondents consisted of gender, age, race, status, occupation, education level, place of residence, and involvement in the oil palm sector.

Methods of Analysis

The study used Statistical Package for the Social Sciences (SPSS) software for descriptive statistical tests covering frequency, mean, percentage and standard deviation. Meanwhile, the analysis of the

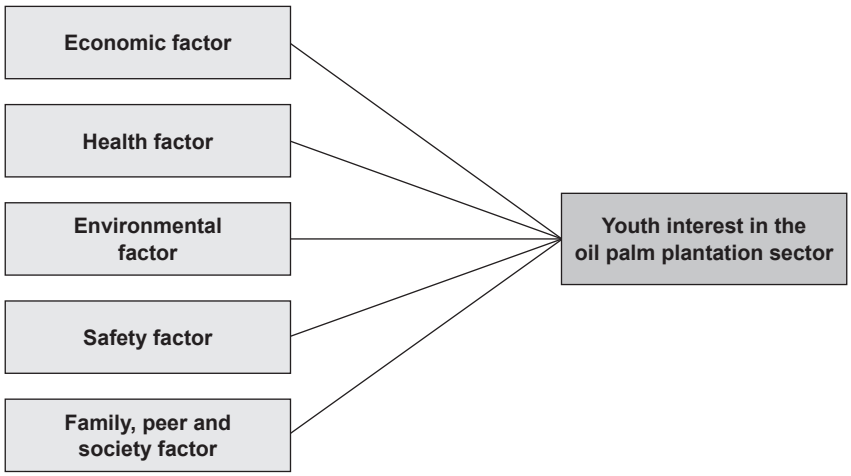

Figure 1. Research model.

TABLE 1. THE ZONES OF POPULATION

Zone	State	Population	Minimum sample	Actual no. of respondents
Northern	Kedah, Pulau Pinang and Perak	2 946 700	76	144
Central	Selangor and Federal Territory	3 897 300	100	144
Southern	Negeri Sembilan, Melaka and Johor	2 607 300	67	144
East Coast	Kelantan, Terengganu and Pahang	2 175 600	56	144
Eastern	Sarawak and Sabah	3 364 000	86	163
		14990900	**385**	**739**

relationship between independent variables and dependent variables was done using the SmartPLS software, which uses the partial least squares path modelling method. SmartPLS was used because it does not require any assumptions on the shape of the normal distribution. SmartPLS contains two parts: Measurement model and structural model. Measurement models consist of internal consistency, convergent validity and discriminative validity. Meanwhile, the structural model involves R square, variance inflation factor (VIF), predictive relevance (Q^2), effect size f^2 and path coefficient test.

The study employs Cronbach's Alpha Coefficient to track the internal consistency of the scale. CA is used to measure the accuracy of the items created by the study instrument. The lower the degree of error for an instrument, the higher the reliability of the instrument. CA values ranging from 0.00-0.49 are weak, 0.50-0.69 are moderate, and 0.70-1.00 are strong (Hair *et al.*, 2006; 2012).

Meanwhile, convergent validity based on outer loading (factor loading), composite reliability (CR), average variance extracted (AVE). Each item should have a value of at least 0.50 (Hair *et al.*, 2006). If an item is below 0.50, the item will be deleted. However, if there is one item loading 0.50 can be accepted if other items with high loading can explain 50% (0.50) of the AVE (Tan and Ooi, 2018). CR is used to determine the consistency between items through the same test. The CR value is located between the interval between 0 and 1; in which the higher the value, the higher the reliability. Constructs with CR values of above 0.6 and 0.7 are acceptable, while those with values of above 0.8 and 0.9 are good (Hair *et al.*, 2006; 2012). The AVE test aims to determine the percentage of variance in describing the latent/construct. The AVE value should be more than 0.50; meaning that on average 50% of the latent variable is explained by the item's variance. However, according to Malhotra and Dash (2011), if the AVE value does not meet the threshold value of 0.50, the model measurement test can rely on CR alone because the value is more accurate than CA and AVE. The Discriminant Validity Test aims to measure the extent to which the measurements of each construct differ from the other constructs. Each construct/latent must have a higher value than the correlation matrix.

Next, the structural model contains the R square test as well as the variance inflation factor (VIF), predictive relevance (Q^2), effect size f^2 and coefficient tests. R square aims to assess the variance of independent variables to explain the independent variables. VIF, on the other hand, aims to detect multicollinearity. Finally, the coefficient test is done to assess the level of impact of the variable. Predictive relevance (Q^2) is a measure of the model's predictive relevance. Q^2 is greater than 0 implies that the model has predictive relevance, whereas Q^2 is less than 0 implies that the model has lacks predictive relevance (Chin and Gopal 1995). The f^2 value is to determine the effect size such as 0.02, 0.13, and 0.26, which represent small, medium, and large effects, respectively (Cohen, 1988). The coefficient value analysed simultaneously T statistics, and significant level for assessing relationships between constructs and assessing the strength of the relationships between the exogenous and endogenous variables.

RESULTS AND DISCUSSION

Based on *Table 2*, the findings of the study were obtained from 724 respondents, *i.e.*, 311 males and 413 females. Of the 724 respondents, 40.2% aged 21-25 years, 24.0% aged 26-30 years, 18.0% aged 31-35 years, and 17.0% aged 18-20 years. The majority of respondents were Malays (75.5%) followed by Chinese (10.6%), other races (9.7%) and Indian respondents (3.2%).

Meanwhile, 69.6% of respondents were single, 29.3% were married, and 1.1% were widows or divorcees. Majority of the respondents were employed (41%). This is followed by students (22.4%). 22% of respondents were unemployed and 14.6 % were self-employed. Most respondents' level of education was diploma and above. Based on *Table 2*, it was found that 38.8% were rural respondents, 35.2% were urban respondents, and

26% were suburban respondents. Finally, most respondents had never been involved in the oil palm industry. A total of 77.1% of respondents had not been involved in the oil palm industry, while 22.9% had been involved in the palm oil industry.

TABLE 2. DEMOGRAPHIC OF RESPONDENTS

Information	Frequency	%
Gender:		
Male	311	43.0
Female	413	57.0
Age:		
18 -20 years old	129	17.8
21 -25 years old	291	40.2
26 -30 years old	174	24.0
31 -35 years old	130	18.0
Race:		
Malay	554	76.5
Chinese	77	10.6
Indian	23	3.2
Others	70	9.7
Marital status:		
Single	504	69.6
Married	212	29.3
Divorced/Widowed	8	1.1
Occupation:		
Student	162	22.4
Employed	297	41.0
Self-employed	106	14.6
Not employed	159	22.0
Education level:		
Never went to school	9	1.2
Informal education	20	2.8
Primary school	13	1.8
Secondary school	274	37.8
Diploma	225	31.1
Degree/Masters/PhD	183	25.3
Residence:		
Urban	255	35.2
Suburban	188	26.0
Rural	281	38.8
Involvement in oil palm industry:		
Yes	166	22.9
No	558	77.1

Mean Analysis

From *Table 3*, the mean analysis of the Economic factor items showed mean values between 3.3494 and 4.0884. The highest mean value item is "Employees choose to work in sectors that provide social protection benefits (EPF, SOCSO and pensions). The lowest item is "working in the modern sector is better than the traditional sector" with a score of 3.3494. This phenomenon is attributable to the job's future such as promotion opportunities, salary increments, and so on.

The mean values under Health factor indicate that all the items are important. The item with the highest mean value is "requiring physical strength" (4.154) and the item with lowest mean is "detrimental to health" (2.895). The Environmental factors include the aspects of cleanliness, living space, easy access (entry and exit), green surrounding, quiet, internet access and telephone lines. Respondents stated that the palm oil industry felt peaceful and secure with green surrounding with a mean of around 3.8660, while the lowest mean is 2.7182. However, access to the internet is unsatisfactory in oil palm plantation areas due to the relatively remote location and it may be one of the barriers to the readiness of youth to get involved in oil palm plantations.

The oil palm industry is not immune to security issues. This issue is also a deciding factor for youth and teenagers wanting to get involved in the oil palm industry. The analysis found that the "respondents stated that the oil palm industry is vulnerable to animal disturbances and poisonous insects". This item has the highest mean of 3.9144. Meanwhile, the item with the lowest mean value is "providing safety clothing" with a mean value of 3.3715. Job security is the most important factor in career choices for youth. This situation clearly illustrates that they want a job that has the lowest risk.

Then, the interest of being involved in the oil palm industry that has the highest mean value was "teenagers/youth are currently not interested in working in the oil palm plantation sector". The lowest mean value comes from the item of "interest in working full-time in the oil palm plantation sector" (*Table 4*).

Analysis of Measurement Model

The outer loading test found that three out of six items were dropped from the Economic factor. Four items from the Health factor were also dropped from six items. One item from the Environmental factor was also dropped. For Safety factors, four items were dropped from the study's further model. For Family, peer and society factors, no items were dropped from the study's further model (*Table 5*). Meanwhile, two out of five items such as interest in working full-time in the oil palm plantation sector were dropped (*Table 5*).

After the deletion of items with a loading of less than 0.40, model measurement analysis was performed to determine the validity of the model. *Table 5* shows the CA, CR and AVE tests for all variables. The CA test results show that all the variables are strong, *i.e.* ≥ 0.70 (Hair *et al*., 2006; 2012). For the CR results, all variables are at an acceptable level, ranging from 0.712-0.941. Meanwhile for the AVE test, the economic and environmental factors scored less than 0.50. However, this model is still acceptable as the CR values exceeded 0.70.

TABLE 3. INVOLVEMENT FACTORS IN OIL PALM INDUSTRY

Factor/Item	Mean	Standard deviation
Economic factor:		
1. Working in modern sectors is better than the traditional sectors.	3.349	1.127
2. Workers choose jobs based on current trends.	3.764	1.035
3. Workers choose jobs based on the salary being offered.	4.065	0.987
4. The salary offered by the traditional sector is low.	3.449	1.063
5. Workers choose to work in sectors that provide social safety benefits (EPF, SOCSO, pension).	4.088	0.980
6. Workers choose to work in sectors that offer employee housing scheme.	3.894	1.011
Health factor:		
1. Detrimental to health.	2.895	1.053
2. Exposed to sunlight.	3.702	1.013
3. Requires physical strength.	4.154	0.884
4. Tiring.	3.874	0.962
5. Employer provides insurance coverage.	3.379	1.013
6. Employer bears the medical cost.	3.406	1.024
Environmental factor:		
1. Clean work environment.	2.750	0.960
2. Near to residence.	2.937	1.075
3. Easily accessible (entry/exit).	3.104	1.045
4. Has various amenities (toilets, prayer room, others).	2.961	1.045
5. Peaceful with the greeneries .	3.866	0.928
6. Quiet.	3.691	0.996
7. Has internet access.	2.718	1.092
8. Has telephone lines.	3.037	1.073
Safety factor:		
1. High risk of accident.	3.550	1.017
2. Provides safety clothing.	3.372	1.034
3. Provides emergency equipment (first aid).	3.430	1.062
4. Susceptible to intruders.	3.503	0.994
5. Susceptible to animal disturbances and poisonous insects.	3.914	0.962
6. Protected by plantation security guards.	3.276	1.030
Family, peer and society factor:		
1. Family supports working in oil palm plantations.	2.957	1.034
2. Family knows the career development potential in the oil palm industry.	3.068	1.037
3. Family is always sensitive to the development of the oil palm industry.	2.931	1.040
4. Peers support to work in the oil palm industry.	2.884	0.998
5. Peers are also interested in working in oil palm plantations.	2.803	1.026
6. My friends and I often discuss the development of the oil palm industry.	2.599	1.091
7. Have taken subjects related to the agricultural sector.	2.747	1.165
8. Teachers disclose the job opportunities in the agricultural sector.	2.979	1.122
9. Teachers support my choice to work in the oil palm industry.	2.852	1.049
10. Teachers often discuss the development of the oil palm industry.	2.750	1.089
11. Teachers are alert about news related to the oil palm industry and the agricultural sector.	2.873	1.060
12. Teachers are knowledgeable about the oil palm industry.	2.953	1.088

TABLE 4. INTERESTED TO BE INVOLVED IN PALM OIL INDUSTRY

Item	Mean	Standard deviation
Interested to work full time in the oil palm plantation sector.	2.658	1.069
Interested to work part-time in the oil palm plantation sector.	2.831	1.117
Interested to continue the family's legacy of working in the oil palm plantation sector.	3.026	1.142
The youth nowadays are not interested in working in the palm oil plantation sector.	3.439	1.153
Working in the palm oil plantation sector is not as good as working in other modern sectors.	2.890	1.151

TABLE 5. RELIABILITY AND VALIDITY RESULTS (SMARTPLS)

Factor/Item	Outer loading	Cronbach's alpha (CA)	Composite reliability (CR)	Average variance extracted (AVE)
Economic factor:		0.671	0.712	0.467
1. Working in modern sectors is better than the traditional sectors.	x			
2. Workers choose jobs based on current trend.	x			
3. Workers choose jobs based on salary being offered.	x			
4. The salary offered by the traditional sector is low.	0.427			
5. Workers choose to work in sectors that provide social safety benefits (EPF, SOCSO, pension).	0.765			
6. Workers choose to work in sectors that offer employee housing scheme.	0.795			
Health factor:		0.878	0.888	0.801
1. Detrimental to health.	x			
2. Exposed to sunlight.	x			
3. Requires physical strength.	x			
4. Tiring.	x			
5. Employer provides insurance coverage.	0.794			
6. Employer bears the medical cost.	0.986			
Environmental Factor:		0.789	0.793	0.359
1. Clean work environment.	0.607			
2. Near to residence.	0.566			
3. Easily accessible (entry/exit).	0.692			
4. Has various amenities (toilets, prayer room, others).	x			
5. Peaceful with the greeneries.	0.408			
6. Quiet.	0.558			
7. Has internet access.	0.631			
8. Has telephone lines.	0.686			
Safety factor:		0.737	0.745	0.596
1. High risk of accident.	x			
2. Provides safety clothing.	x			
3. Provides emergency equipment (first aid).	0.845			
4. Susceptible to intruders.	x			
5. Susceptible to animal disturbances and poisonous insects.	x			
6. Protected by plantation security guards.	0.691			
Family, peer and society factor:		0.942	0.941	0.572
1. Family supports working in oil palm plantations.	0.895			
2. Family knows the career development potential in the oil palm industry.	0.708			
3. Family is always sensitive to the development of the oil palm industry.	0.631			
4. Peers support to work in the oil palm industry.	0.678			
5. Peers are also interested in working in oil palm plantations.	0.783			
6. My friends and I often discuss the development of the oil palm industry.	0.731			
7. Have taken subjects related to the agricultural sector.	0.857			
8. Teachers disclose the job opportunities in the agricultural sector.	0.803			
9. Teachers support my choice to work in the oil palm industry.	0.826			
10. Teachers often discuss the development of the oil palm industry.	0.671			
11. Teachers are alert about news related to the oil palm industry and the agricultural sector.	0.660			
12. Teachers are knowledgeable about the oil palm industry.	0.779			
Interested to be involved in palm oil industry:		0.839	0.842	0.641
1. Interested to work full time in the oil palm plantation sector.	0.879			
2. Interested to work part-time in the oil palm plantation sector.	0.771			
3. Interested to continue the family's legacy of working in the oil palm plantation sector.	0.744			
4. The youth nowadays are not interested in working in the palm oil plantation sector.	x			
5. Working in the palm oil plantation sector is not as good as working in other modern sectors.	x			

x = items deleted from SmartPLS

Discriminant Validity

There are two Discriminant Validity methods, namely Fornell and Lacker Criteria (1981), and Heterotraite-monotraite correlation ratio (HTMT) (Henseler *et al.*, 2015). The Fornell and Larcker Criteria (1981) show that each variable value exceeds the correlation matrix value (*Table 6*). This signifies that there is no correlation between economic factors with other factors. The result of the HTMT correlation ratio is that there is no significant correlation between variables. This is evidenced by the variables' correlation matrix value of less than 0.90. This indicates that there is no cross-loading between the variable items (*Table 7*).

Common Method Bias

As the data were gathered by questionnaires, common method bias (CMB) may be a potential concern. Using Harman's single-factor method and a marker variable assessment technique to assess CMB (Lindell and Whitney, 2001). The unrotated principal components factor analysis (omitted for brevity) indicates that there is 25.460% of the total variance in Harman's single-factor test (less than 50%) indicating that no single factor loaded on all measures, which suggests there is no CMB (Podsakoff *et al.*, 2003). In addition, we use SmartPLS3.0 to test Common Method Bias with Random Dependent Variable, the respective variables' VIFs are significantly less than 3.3, which is found to have no impact on our model, again suggesting that there is no CMB (Rönkkö and Ylitalo, 2011). Based on the results from these two methods, confirmed that CMB does not exist in our study (*Table 8*).

Assessing the Structural Model

The relationship between one dependent variable and several independent variables can be assessed through bootstrapping analysis technique. It can also tell how well independent variables can predict the dependent variables. The results of R Square show that 43.6% of the independent variables can explain the dependent variable (*Table 9*).

TABLE 6. FORNELL-LARCKER CRITERION RESULTS

	(1)	(2)	(3)	(4)	(5)	(6)
Economy (1)	0.683					
Family, peer and society (2)	0.207	**0.756**				
Safety (3)	0.324	0.522	**0.772**			
Health (4)	0.293	0.262	0.663	**0.895**		
Youth interest in the oil palm plantation sector (5)	0.249	0.643	0.374	0.260	**0.800**	
Environment (6)	0.318	0.549	0.674	0.416	0.413	0.599

TABLE 7. HETEROTRAIT-MONOTRAIT RATIO (HTMT) RESULTS

	(1)	(2)	(3)	(4)	(5)	(6)
Economy (1)						
Family, peer and society (2)	0.220					
Safety (3)	0.347	0.522				
Health (4)	0.294	0.263	0.682			
Youth interest in the oil palm plantation sector (5)	0.260	0.640	0.375	0.264		
Environment (6)	0.360	0.536	0.683	0.428	0.415	

TABLE 8: COLLINEARITY STATISTICS (VIF)

Construct	Random
Economy	1.115
Family, peer and society	1.817
Safety	1.477
Health	1.861
Youth interest in the oil palm plantation sector	1.535
Environment	1.583

The VIF results show that the value of each independent variable is less than 10. This indicates that there is no multicollinearity problem in this model (Gujarati and Porter, 2009).

A predictive relevance (Q^2) value above 0 indicates that the model has predictive relevance (Hair *et al.*, 2012). The predictive relevance (Q^2) value of the youth interest in the oil palm plantation sector is 0.247 (larger than 0), suggesting that economy, family, safety, health and environment have a predictive ability over youth interest in the oil palm plantation sector. The result of f^2 indicated that economy (f^2=0.016), family (f^2=0.420), safety (f^2=0.004), health (f^2=0.010) and environment (f^2=0.004) have small, large, small, small and small effects on youth interest in oil palm plantation sector, respectively (*Table 9*).

The results of the relationships between independent variables and dependent variables show that there are three significant relationships that motivate youth interest in the oil palm plantation sector. The first relationship is the relationship between family, peers and society, and the interest of youth in the oil palm plantation sector, whereby this relationship has the highest coefficient value (0.656). It shows that family, peers and society have a great influence on the interest of youth in the oil palm plantation sector. This is because their family members and friends give their support to the youth's intention to work in oil palm plantations. Apart from that, their friends are also interested in working in oil palm plantations. In addition, their teachers also disclose and support job opportunities in the agricultural sector.

The second relationship is the relationship whereby health influences youth's interest in the oil palm plantation sector. Although the palm oil sector has a high risk of accidents, this sector provides safety clothing. In addition, the sector also provides first aid equipment. Moreover, although the sector is highly vulnerable to animal disturbances and poisonous insects, there are plantation security guards protecting the workers.

The third relationship is where economic factor has an influence on youth's interest in the oil palm plantation sector. This is because the respondents choose to work in sectors that provide social protection benefits (EPF, SOCSO, pensions). This situation becomes the motivation of basic needs from an economic point of view; meaning that individuals view employment in terms of the salary offered by the employer. According to Heathfield (2013) salary is the amount of money or fixed compensation paid to an employee by an employer in return for work done. Salaries become an important attraction for individuals in choosing a job (Abdo, 2016).

However, the environment and safety did not attract young individuals to the oil palm plantation sector significantly. The perception of jobs in the oil palm plantation sector as low-skilled or manual labour might deter youth who are looking for more intellectually stimulating or innovative career paths. Safety measures, while important, might not be the primary factor influencing their decisions if they are more focused on career growth and development opportunities. Meanwhile, the work in the oil palm plantation sector is often physically demanding and involves outdoor activities. Near to residence and easily accessible might not align with the preferences of many youths, regardless of how close or accessible the workplace is. While internet access and phone lines are essential for communication and information exchange, they

TABLE 9. PATH COEFFICIENTS RESULTS

Relationship	Original sample (co-efficient value)	Standard deviation	T statistics	*P*-values	Variance inflation factor (VIF)	F-square
Relationship between economy and youth interest in oil palm plantation sector	0.101	0.040	2.536**	**0.012**	1.157	0.016
Relationship between family, peers and society, and youth interest in oil palm plantation sector	0.605	0.043	14.024*	**0.000**	1.545	0.420
Relationship between safety and youth interest in oil palm plantation sector	-0.086	0.087	0.981	**0.327**	2.928	0.004
Relationship between health and youth interest in oil palm plantation sector	0.102	0.059	1.745***	**0.082**	1.841	0.010
Relationship between environment and youth interest in oil palm plantation sector	0.064	0.065	0.988	**0.324**	2.068	0.004
R Square		**0.436**				
R Square Adjusted		**0.432**				
Q Square		**0.247**				

Note: Significant level: *=0.010, **=0.050, ***=0.100

might not directly relate to the core tasks involved in plantation work. As a result, these amenities might not significantly impact the appeal of the sector to the youth.

CONCLUSION

Individuals will usually be involved in a job motivated by the basic needs of themselves and their families, where the wants, food, clothing, shelter and others are categorised as economic factors. Then, they will be motivated by safety, health and environmental factors. This study was conducted to identify with certainty the real motivations that influence the interest of youth to have a career in the oil palm plantation sector.

This study showed that family, peers and society are the most important factors that motivate youth to be involved in the oil palm plantation sector. Other major factors are health and economic factors.

As there is motivation among the youth to get involved in the oil palm plantation sector, the initiatives undertaken by the government to open more employment opportunities for the youth and continue to develop the oil palm plantation sector are the right actions. The findings of this study can provide an important impact to policy makers and stakeholders such as the Malaysian Palm Oil Board (MPOB) to jointly formulate better strategies to attract the targeted group and further increase their involvement in the oil palm plantation sector. For example, planning and promotion of employment opportunities in the plantation sector should be done more actively in rural areas than in urban areas. The importance of the oil palm plantation sector in generating the national economy needs to be publicised to attract youth participation in this sector.

Consistent with the findings of this study, relevant parties are also advised to provide adequate exposure and early education to youth about the importance and benefits of working in the oil palm plantation sector. Early exposure can reduce the stigma of the oil palm plantation sector. This sector is often compared to the modern sectors, and the oil palm plantation sector is perceived to be an inferior sector suitable for foreign labour. This stigma should be brushed aside as the oil palm plantation sector has great development potential. The development of oil palm plantations could be spurred through the involvement of more local labour. For a continuous development of the nation's oil palm industry, the youth, who are the country's assets should not be wasted.

Creating a program to educate youth and parents about the potential of the palm oil agriculture industry can be a valuable initiative. The palm oil industry is important in many economies, and raising awareness about its opportunities and challenges can help individuals make informed decisions about their future endeavours. Building on the findings that family greatly impacts youth career decisions, we recommend developing tailored sessions within the program that specifically address parents. These sessions can emphasise the diverse opportunities, benefits, and sustainable practices within the palm oil agriculture industry. By fostering understanding and support among parents, we can empower them to provide informed guidance to their children as they consider potential career paths. By engaging youth and parents in an educational program about the potential of the palm oil agriculture industry, participants can gain a holistic understanding of its benefits and challenges. Empowering individuals with knowledge can help them make informed decisions, contribute positively to the industry's development, and promote sustainable practices for a more responsible future.

The study also found that youth are more interested in jobs that offer social protection benefits such as EPF, SOCSO and pensions. Policies need to be refined to improve employment benefits over time. The plantation sector is generally a physical occupation and involves outdoor activities. Thus, the offer of employment benefits must be commensurate with the risks that they have to face. Offering appropriate employment benefits will be a motivation for them to serve in the oil palm plantation sector.

An effective approach to increase youth involvement in the oil palm plantation sector can resolve various important issues in the country. First, increased youth involvement can improve the country's economic potential with the opening of new oil palm plantations; which consequently can increase the country's export revenue. Second, it can curb the issue of unemployment among youth and reduce dependence on labour from abroad. This will have a positive impact not only on economic issues but also the country's social issues.

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