THE FUNCTIONS AND LATEST DEVELOPMENT OF OIL PALM SEED INDUSTRY

By
PASPI-Monitor

RESUME

The three important roles of the oil palm seed industry are the creation of superior varieties, the production of technology (embodied technology), and the preservation of oil palm germplasm. These roles are carried out by the seed industry simultaneously and continuously. Preservation of germplasm (biodiversity) through cultivation with the support of the seed industry, such as in oil palm, has not only succeeded in preserving the existing germplasm but also produced social, economic, and ecological benefits for the community across generations.

The presence of the oil palm seed industry in Indonesia has succeeded in preserving and developing 4 varieties in 1848 to 58 varieties, which were produced by 18 oil palm seed industries in Indonesia in 2020. Seed production capacity in Indonesia has also increased from around 120 million sprouts to around 250 million sprouts during the period 2000-2020.

With this current large production capacity of the oil palm seed industry, Indonesia is able to change the position of Indonesia, which was originally excess demand into excess supply. But the implementation of the moratorium on new permits for oil palm plantations, which has implications for stopping the expansion of corporate oil palm plantations in Indonesia, has caused the sale of seeds to decreased significantly.

Another interesting thing about the development of the oil palm seed industry in Indonesia is that the market structure of oil palm seeds in Indonesia tends to monopolistic competition market, where the basis of competition is not dominated by price but also non-price competition variables such as quality, promotion, networking, and payment system.
INTRODUCTION

The area of Indonesian oil palm plantations has increased from around 4.1 million hectares in 2000 to 16.3 million hectares in 2020, or an increase of about four times in the last 20 years. With this increase in area, palm oil production also increased from around 7 million tons to around 50 million tons. The performance of palm oil plantations has succeeded in bringing Indonesia to become the largest palm oil producer in the world since 2006.

With that expansion and increase in palm oil production, the community enjoys the benefits of the multifunctionality inherent in oil palm plantations, namely white function (economic benefits), gray function (social benefits), green and blue functions (environmental benefits) simultaneously and sustainably (Aldington, 1998; OECD, 2001; Huylenbroeck et al., 2007; Moon, 2012). These benefits are enjoyed not only by the Indonesian people but also by the international community (PASPI Monitor, 2021a).

Behind the revolutionary growth of oil palm plantations, the role of the oil palm seed industry is very important. The availability of seed is a determining factor in the expansion acceleration of oil palm plantations. Without sufficient seeds availability, it is impossible to increase the area of oil palm plantation significantly in Indonesia.

Assuming a density of about 150 trees per hectare, the seeds (sprouts) that have been used for Indonesian oil palm plantations to achieve this revolutionary growth are 1.8 billion sprouts. In addition to the expansion of the oil palm plantation area, seeds are also needed for replanting. Oil palm plants have a production cycle of generally 25 years, starting from immature, mature and damaged. So, to ensure the sustainability of production requires replanting around 4 percent per year.

The seed industry is not just a starting point and ensures the sustainability of oil palm plantations. Oil palm seeds or sprouts are a blueprint for multifunctionality that produces multi-benefits from oil palm plantations. The oil palm seed industry is also an important pillar of the sustainability of the multifunctionality and multi-benefits of oil palm plantations.

This paper will discuss the role and function of the seed industry in the palm oil industry. Then there will also be discussions regarding the latest development of the Indonesian oil palm seed industry in the last 20 years (2000-2020 period).

THE ROLE AND FUNCTION OF THE OIL PALM SEED INDUSTRY

Palm oil-based economic activities begin with oil palm seeds. The seed industry is a blueprint for the palm oil industry. The economic properties of oil palm plantations, such as productivity, oil yield, and ecophysiology are determined and highly dependent on seed quality. Likewise, the blueprint for palm oil quality characteristics (chemical composition) and ecophysiological properties are also determined by seeds.

In general, there are at least three main roles or functions of the hatchery industry in the palm oil economy, namely: (1) the creation of superior varieties through the process of collecting superior features from oil palm germplasm; (2) the production of biological technology (embodied technology) in the form of seeds/sprouts to enlarge and share the multi-benefits of oil palm; and (3) the preservation of germplasm and varieties to preserve the functions and benefits of oil palm multifunctional multi-generationally (Sipayung, 2012 and 2018).

First, the Creation of Superior Varieties. The process of creating superior oil palm varieties through selection and breeding has a long history. Oil palm is a tropical plant whose habitat is on the West African Coast, from the Angola Region to the Liberia Region.

Oil palm plantations were first recognized in Indonesia after the Dutch Colonial Government led by Dr. D.T. Pryce brought four oil palm seeds consisting of two seeds from Bourbon-Mauritius and two other seeds from Amsterdam (Dura species) to be used as plants for the Bogor Botanical Gardens collection in 1848. These plants are the first oil palm parent trees in Indonesia. These oil palm seeds in the Bogor Botanical Gardens are then spread into ornamental
plants in Java, Sulawesi, Kalimantan, Nusa Tenggara, Maluku, and Sumatra, especially in Deli tobacco plantations (Pamin, 1998; Sipayung, 2012).

According to the Indonesian Oil Palm Research Institute (2017), the descendants of Dura seeds from the Bogor Botanical Gardens were then planted as ornamental plants in tobacco plantations in Deli, North Sumatra. The seeds are then spread to commercial plantations or research institutions, both in Indonesia and Malaysia. So, the descendants of this line came to be known as Dura Deli.

The Dura Deli has undergone separate selections in Indonesia (such as Mopoli, Bangun Bandar, Bah Lias, Marihat Baris, Tanjung Morawa, Tinjowan, Dolok Sinumbah, Aek Pancur, RISPA, and Bah Jambi. Selections were also made in Malaysia (such as: Kuala Lumpur, Serdang Avenue, Ulu Remis, Chemara, Banting, MARDI, and Elmina). The selection was also carried out in Costa Rica, Papua New Guinea, and Colombia. One of the interesting descendants of Dura Deli is the Dura Dumpy, which was planted in 1940 in Elmina and was re-introduced to Indonesia in 1958 at Aek Pancur.

The long history of genetic selection activities until now has produced parent trees for various official seed sources appointed by the Indonesian government. By being selected as the parent tree in various seed sources, the conservation of oil palm, which was introduced in 1848, is still being carried out and has becomes the germplasm source for assembling oil palm varieties in North Sumatra, Riau, South Sumatra, West Kalimantan, and West Java.

Thus, the first four grains/varieties planted in the Bogor Botanical Gardens in 1848 have developed into 58 varieties of oil palm plants in Indonesia by 2020. The number of varieties will continue to increase in the future considering that breeding programs (selection, crossing) are still ongoing.

**Second, The Production of Seed Technology (Embodied Technology).** The seedling process is the process of assembling a blueprint for oil palm through collecting the economic (superior) characteristics of oil palm elders into commercial seeds that will be planted on commercial oil palm plantations.

Oil palm seeds are not just ordinary capital goods, but also technology (embodied technology), namely biological solar energy harvesting technology and biochemical technology to produce vegetable oil, biomaterials/biomass, and by-products, as well as ecophysiological technology to act as “lungs” of the ecosystem. From an economic perspective, the role of the oil palm seed industry that produces new varieties is to create new benefits for the palm oil industry as a whole. The activities of the seed industry produce oil palm seeds with increasing oil productivity.

From 1940 to 2017, the Indonesian seed industry has succeeded in developing oil palm seeds that increase the potential for oil productivity (Figure 1). The potential productivity of oil from seeds that were produced in 1940 was still around 2.2 tons per hectare, increasing to 6.4 tons of oil per hectare in 1980 and continuing to increase to around 10.5 tons of oil per hectare in 2017.

![Figure 1. Breeding Performance (Productivity) in Oil Palm Plants in 1940-2017 Period (Source: PPKS, 2017; Asmono, 2021).](image-url)
Increasing the potential for oil production from these new superior varieties and the implementation of Good Agriculture Practices (GAP) will add new benefits in the form of economic and ecological benefits. The economic benefits in question are the added value of the productivity of palm oil, biomaterials, and by-products from oil palm plantations resulting from the use of more superior varieties of seeds and the economic value of the final product of the palm oil industry.

The ecological benefits in question are mainly from harvesting solar energy, increasing carbon dioxide absorption, and oxygen production (Henson, 1999). The increasing productivity of FFB per hectare due to the use of new superior varieties will also increase the absorption of carbon dioxide absorbed by oil palm plants from the air/earth’s atmosphere and increase oxygen production from oil palm plantations.

Thus, the role of the seed industry, which always produces new innovations in the form of new superior seeds, will save land use in the production of palm oil. In addition, the innovation of superior seeds also enlarges the harvesting of the multifunctional benefits of oil palm plantations and shares the multi-benefits of palm oil throughout the community.

**Third, Preservation of Germplasm and Cross-Generational Multifunctionality.** In addition to the blueprint formation process, the oil palm seed industry is also a mechanism for preserving germplasm along with its inherent economic and ecological functions across generations. It is conceivable, if oil palm in the Bogor Botanical Gardens in 1848 was only left as a collection of germplasm (in-situ conservation), then the oil palm plant is threatened with extinction and its economic and ecological benefits will never be enjoyed by today’s society. Therefore, the role of the seed industry as an actor in the preservation of oil palm germplasm is very important.

The development of the oil palm seed industry in Indonesia can’t be separated from the history of the Indonesia Palm Oil Research Institute (IOPRI/PPKS). IOPRI has a long history, the beginning of its formation in 1916 was named Algemene Proefstation der Algemeene Vereniging van Rubber Planters ter Oosikust van Sumatra (APA-AVROS), then (after being taken over by the government) became the Research Institute of The Sumatra Planters Association (RISPA) in 1957, then changed to BPPM (Balai Penelitian Perkebunan Medan) in 1968, then changed to the Pusat Penelitian Perkebunan in 1987.

Besides RISPA in the early 1960s, the government also developed a Sumatran Crops Research Center (specifically for oil palm nurseries) in Pematang Siantar/Marihah (Simalungun). In 1968, the research center was changed to Marihat Research Station (MRS). In addition, the government also built a Coconut Research Center in Deli Serdang. Then in 1993, RISPA, PPM, and the Coconut Research Center merged and changed their names to the Indonesia Palm Oil Research Institute (IOPRI/PPKS) to this day.

Besides IOPRI (PPKS), the seed industries also increasing. From the beginning, it was only IOPRI/PPKS, then increased to 3 companies in 1990, became to 11 companies in 2010 and increased to 18 companies in 2020. Each of these oil palm seed companies (breeders) maintains germplasm as the parent tree of various oil palms. Having a variety of breeding programs to collect superior economic and ecological properties so that they can produce germinated seeds. The increasing number of varieties produced from the oil palm seed industry has reached 58 varieties by 2020. This proves that the preservation of germplasm is going well.

The way to preserve germplasm with cultivation, such as in oil palm, is also empirical evidence that has succeeded in preserving from four varieties to more than 58 varieties of oil. This phenomenon like this is not found in other ways of preserving germplasm/biodiversity, such as In Situ and Ex Situ.

**THE DEVELOPMENT OF THE OIL PALM SEED INDUSTRY**

Before 2000, there was an excess demand for domestic oil palm seeds that were needed for expansion and replanting of oil palm plantations. This shortage of
domestic seed production has encouraged the import of oil palm seeds from Papua New Guinea, Malaysia, and Costa Rica (Liwang et al., 2012). The share of imported oil palm seeds in Indonesia reached around 27 percent in 1997 and has continued to fluctuate with a downward trend. Seed imports have not been carried out since 2010.

On the other hand, the shortage of domestic oil palm seeds also provides incentives for domestic industries to enter the oil palm seed industry so that the number of producers and the capacity of the domestic oil palm seed industry increase significantly. In the period 2000-2020, the number, capacity, and volume of the production of the oil palm seed industry have grown rapidly. The number of oil palm seed producers in 2000 was still around 3 companies (breeders) and then increased to 11 companies in 2010 and to 18 companies in 2020.

Seed production capacity has also increased from only about 120 million seeds in 2000 to 250 million seeds in 2020. Likewise, seed varieties produced from only about 10 varieties (DxP) in the early 2000s increased to 58 varieties (DxP) in 2020.

The increase in the number of producers and the capacity of the oil palm seed industry is relatively fast and creating an excess supply of domestic seeds (Liwang et al., 2012). In addition, the moratorium policy on new permits for oil palm plantations has implications for stopping the expansion of corporate oil palm plantations in Indonesia and causing decreasing sales of seeds (sprouts) in the period 2012-2020 (Figure 2).

![Figure 2. Sales Volume of Oil Palm Seed from the National Oil Palm Seed Industry for the Period of 2012-2020 (Asmono, 2021).](image1)

The sales volume of the domestic oil palm seed industry reached around 161.5 million sprouts in 2012 and then decreased to 95 million sprouts in 2015 and continued to decline to the lowest volume of 56.4 million sprouts in 2019. However, the sales volume of oil palm seeds increased again to about 87 million sprouts in 2020.

![Figure 3. Market Share of Oil Palm Seed Producers in Indonesia in 2020 (Asmono, 2021)](image2)

- Pusat Penelitian Kelapa Sawit (36%)
- PT Binasawit Makmur (13%)
- PT Tunggal Yunus Estate (11%)
- PT Socfin Indonesia (9%)
- PT PP London Sumatera Tbk (6%)
- PT Panca Surya Garden (5%)
- PT Dami Mas Sejahtera (5%)
- Others (15%)
In addition to the dynamics of selling sprouts, the competition in the oil palm seed industry is getting tougher. There were only three oil palm seed producers in Indonesia in the 2000s, namely IOPRI/PPKS, Lonsum, and Socfin. IOPRI's share reached around 50 percent. The entry of new breeders into the oil palm seed industry caused the share of IOPRI in the domestic oil palm seed market to decline because some of the market shares were taken by new breeders.

In 2020, IOPRI's market share has decreased to 36 percent (Figure 3). Then followed by Bina Sawit Makmur, Tunghal Yunus Estate and Socfin. One of the variables that influence changes in sales volume or market share of the Indonesian oil palm seed industry is consumer satisfaction (Liwang et al., 2011). The structure of the oil palm seed market in Indonesia tends to a monopolistic competition market structure, where the basis of competition is not dominated by price but also non-price competition variables such as quality, promotion, networking, and payment systems.

CONCLUSION

The three important roles of the oil palm seed industry are the creation of superior varieties, the production of technology (embodied technology), and the preservation of oil palm germplasm. These roles are carried out by the seed industry simultaneously and continuously.

The presence of the oil palm seed industry in Indonesia has succeeded in preserving and developing 4 varieties in 1848 to 58 varieties, which were produced by 18 oil palm seed industries in Indonesia in 2020. Seed production capacity in Indonesia has also increased from around 120 million sprouts to around 250 million sprouts during the 2000-2020 period.

Preservation of germplasm (biodiversity) through cultivation with the support of the seed industry, such as oil palm, has not only succeeded in preserving the existing germplasm but also produced social, economic, and ecological benefits for the community across generations.

REFERENCES


@PASPI2021