STRATEGIES FOR INDUSTRIALIZATION AND INCREASING PRODUCTIVITY OF OIL PALM PLANTATIONS

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RESUME

Increasing productivity is a solution to maintain the existence of the national palm oil industry in the future, increase competitiveness to meet sustainable aspects, and become an answer of issues related to deforestation. The strategy to increase palm oil productivity also shows that there is an improvement of industrialization process from the factor-driven and upgrade to the capital-driven and innovation-driven.

Opportunities to increase the productivity of national oil palm plantations are still wide open, given the large gap in actual productivity with the potential. Strategies that can be used to increase productivity can be done in two ways, namely increasing partial productivity (improving technical culture according to GAP) and increasing total productivity (replanting). These two strategies can be done by adjusting certain goals, the partial productivity strategy for immature and mature oil palm plantations while the total productivity strategy for old oil palm plantations.

If the S1 and S2 strategies are carried out simultaneously (combined) and consistently, the average national palm oil productivity is expected to reach at least 6 tons of oil per hectare before 2050. With area of national oil palm plantation remains 16.3 million hectares, the palm oil production volume will reach 97.8 million hectares or double the production in 2018.
INTRODUCTION

The economic value of oil palm plantation is based on its ability to produce oil. Higher productivity will increase the economic value of the oil palm plantation. The success of the palm oil industry in the future is no longer determined by plantation area but by the oil productivity per hectare (Fairhurst and Hardter, 2003).

Increasing productivity is one of the important efforts to develop the competitiveness of oil palm plantations. Every year, the Cost of Goods Sold (COGS) of palm oil (CPO) in Indonesia continues to increase due to an increase in the minimum wage and other components of production costs. If productivity does not increase, the difference between COGS and CPO/FFB prices will be smaller and maybe the same as the selling price of CPO/FFB so that the competitiveness of palm oil will decrease.

In addition to affecting competitiveness, increasing productivity is also an important step to improve the sustainability quality of oil palm plantations (Saragih, 2017). Increased production based on higher productivity will decouple/separate palm oil from deforestation (Fairhurst and Hardter, 2003). The higher productivity of palm oil will also increase the ecological benefits due to its role as the "ecosystem lung" by absorbing more carbon dioxide from the earth’s atmosphere and producing more oxygen into the earth’s atmosphere.

Opportunities to increase the productivity of oil palm plantations are still wide open. When compared with the potential of existing varieties, the productivity of oil palm that has been achieved is still far from its potential. The potential for variety is currently around 8 tons of oil per hectare, even the potential for oil productivity produced by the newest variety has reached 8-10 tons per hectare. Meanwhile, the average productivity of national oil palm plantations in 2018 was around 3.6 tons of oil per hectare. This shows that the average national oil palm productivity is still less than 50 percent of its potential.

The wide productivity gap is an opportunity for continuous improvement and innovation both in managerial and technical culture as well as changes in oil palm plantation varieties. Therefore, this article will discuss the strategies for increasing the productivity of oil palm plantations.

THREE PHASES OF INDUSTRIALIZATION OF OIL PALM PLANTATION

From the supply side, the process of industrializing oil palm plantations from the source of growth in palm oil production. In the first phase, the source of growth in palm oil production is derived from the utilization of the abundant natural resources and unskilled human resources or the factor-driven stage (Figure 1). This initial stage is referred to as the extensification, which is the oil production obtained by expanding the area. The wider area of oil palm plantations will increase palm oil production.

This first phase is the mainstay of Indonesian oil palm plantations so far. Initially, oil palm plantations from North Sumatra and expanded to 24 other provinces in Indonesia. This shows that Indonesian oil palm plantations are the result of the factor-driven phase. However, this first phase has a limit point, namely the availability of natural resources, especially land. The land limitation is due to considerations of the balance of growth between sectors and the ecological balance.
The advanced stage of industrialization is the capital-driven stage, which uses embodied technology (capital) and semi-skill human resources. This second phase is also known as intensification. With a fixed area of oil palm plantations, palm oil production can increase due to increased productivity through improved technical culture (Good Agriculture Practices/GAP) such as increased use of fertilizers, labor and others. This second phase also has its limits. Higher productivity due to increased use of inputs implies following the law of diminishing returns (Debertin, 2013). This theory states that the use of inputs (such as fertilizer) will reach a certain limit so that the use of fertilizers will no longer increase productivity.

The sustainable industrialization phase is the total factor productivity through the use of knowledge and creative human resources based, or otherwise known as the innovation-driven stage. Precision farming with Industry 4.0 or 5.0 applied to oil palm plantations is part of this phase. This phase is almost unlimited, as long as technological innovations continue, productivity increases will always occur.

The development of oil palm plantations (and the industry as a whole) is expected to undergo an industrialization process that moves from the factor-driven phase, upgrading to the capital-driven phase and then upgrading to the innovation-driven phase. With such an industrialization process, it is hoped that sustainable competitiveness can be achieved.

In the last 20 years (2000-2020), Indonesia's oil palm plantation area has increased from around 4.1 million hectares to 16 million hectares or increasing of almost 4 times. Meanwhile, in the same period, palm oil production increased from around 7 million tons to 49 million tons, or an increase of seven times (Ministry of Agriculture, 2020). This means that Indonesian oil palm plantations are shifting from factor-driven phase to capital-driven phase.

**PRODUCTIVITY IMPROVEMENT**

Based on Palm Oil Statistics (Ministry of Agriculture, 2020), the average productivity of national oil palm plantations in 2018 reached 3.6 tons of oil per hectare,
consisting of private plantations (3.8 tons per hectare), state-owned plantations (4 tons per hectare), and smallholder plantations (3.6 tons per hectare).

If we compared with the average productivity of current varieties developed by the Indonesian Oil Palm Research Institute (IOPRI/PPKS) (Table 1), which is 7.8 tons of oil per hectare (average of varieties 1990-2010), shows that the productivity of the national oil palm plantations is still relatively low (Figure 2).

Table 1. Development and Productivity of Oil Palm Varieties in Indonesia

<table>
<thead>
<tr>
<th>Year</th>
<th>TiTypepe</th>
<th>FFB Average (ton/ha/year)</th>
<th>yield (%)</th>
<th>CPO (ton/ha/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>DxD, DxT, TxD</td>
<td>23.1</td>
<td>18.8</td>
<td>4.3</td>
</tr>
<tr>
<td>1970</td>
<td>DxT, TxD, DxP</td>
<td>23.9</td>
<td>22.6</td>
<td>5.4</td>
</tr>
<tr>
<td>1980</td>
<td>DxP</td>
<td>27.2</td>
<td>23.5</td>
<td>6.4</td>
</tr>
<tr>
<td>1990</td>
<td>DxP</td>
<td>29.8</td>
<td>23.8</td>
<td>7.1</td>
</tr>
<tr>
<td>2000</td>
<td>DxP</td>
<td>30.6</td>
<td>25.8</td>
<td>7.9</td>
</tr>
<tr>
<td>2010</td>
<td>DxP</td>
<td>32.0</td>
<td>26.0</td>
<td>8.3</td>
</tr>
<tr>
<td>2017*</td>
<td>DxP, Klon</td>
<td>35-36</td>
<td>27.0</td>
<td>10-12</td>
</tr>
</tbody>
</table>

Source: IOPRI

The productivity gap (potential/standard productivity of variety minus realization) in smallholder plantations is 4.2 tons per hectare, private plantations is 4 tons per hectare, and state-owned plantations is 3.8 tons per hectare.

To increase oil palm productivity, there are two strategies, namely increasing partially productivity through improving technical/managerial culture in existing plantations; and increasing total factor productivity by changing varieties and technical-managerial culture or replanting (Sipayung, 2018). Both strategies can be done by adjusting certain goals. The partial productivity strategy for immature and mature oil palm plantations, while the total productivity strategy for old oil palm plantations.

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According to the estimation of the IOPRI (2021), there are about 14 percent categorized as Old and Very Old Plants and around 86 percent are immature and mature plants. With such a composition of plants, two strategies to increase productivity, both partial and total, need to be implemented simultaneously (Figure 3).

**Figure 3.** Strategy for Increasing Productivity of Oil Palm Plantations through Technical Culture Improvement (S1) and Replanting (S2)

**First,** the Partial Productivity Improvement Strategy (S1) to increasing the productivity of existing oil palm plantation (immature and mature) which covers an area of about 86 percent or 13 million hectares. This can be done by increasing fertilization, improving the technical culture of the plantation (best practices) according to GAP, and improving process technology in Palm Oil Mills.

Increasing the productivity of oil palm plantations is still very wide open through improving the technical culture (Daemeter, 2013, 2015; Winroct International, 2017) and improving the management of oil palm plantation (Rist et al., 2010; INOBU, 2016; Nurfatriani et al 2019; Bakthary et al., 2021). This strategy is expected to increase the productivity of the existing mature plantation from the current average productivity (for example from 3.6 tons of oil per hectare) to the potential productivity of existing varieties (for example, 6 tons of oil per hectare) or shifting the S0 curve to S1. Through the implementation of this strategy, it has the potential to produce an additional 15 million tons of palm oil in Indonesia.

**Second,** the Strategy for Increasing Total Productivity (S2) through replanting, namely replacement of old oil palm plants by using superior (high-yielding) varieties of oil palm seeds. Based on IOPRI (2021) data, the area of old and very old oil palm plantations reaches about 2.1 million hectares, consisting of smallholder plantations of 929.5 thousand hectares, state-owned plantations of 207.7 thousand hectares and private plantations of 1.06 million hectares.

The S2 strategy includes replanting activities by planting superior varieties and guaranteed quality and also accompanied by the latest improvements/innovations of technical culture and processing technology in Palm Oil Mills. Precision Farming applications as well as Industry 4.0 and even Industry 5.0 are part of this strategy which will shift the curve from S0 or S1 to S2.

Every year there are old plantations that need to be replanted. To achieve the ideal composition of national oil palm plantations, regular replanting is required every year, which is about 4 percent of the total area. For corporations such as state-owned and private plantations, replanting activities are generally well scheduled every year. Meanwhile, in smallholder plantations, the initiative for replanting can be carried out on their initiative and also with the support of
the Indonesian Government through the Peremajaan Sawit Rakyat (PSR) program.

If the S2 strategy is applied consistently, it will increase the productivity of national oil palm plantations which reaches 8 tons of oil per hectare. This is not something impossible. Several experiences of oil palm plantation companies, both BUMN (PTPN) and private companies have achieved this.

Experience of PT. Perkebunan Nusantara-IV (Harahap, 2012) in the 2002-2011 period with an area of around 139 thousand hectares of oil palm plantations, where their management made improvements to technical culture and the use of high-yielding (superior) varieties that has implications for achieving an average productivity increase of 4.4 tons oil per hectare to 6.7 tons of oil per hectare in that period. This means that some of PTPN IV's plantations have reached a productivity level of more than 7 tons of oil per hectare.

Opportunities to increase productivity through improved varieties, technical culture, and management of oil palm plantations are still wide open (Sipanyung, 2012, 2018; Nuryartono, et al., 2016; Woitieza et al, 2017; Herdiansyah et al., 2020). Even replanting activities are not just a strategy to increase productivity but have broader implications namely the development of a new economy (PASPI, 2018).

If the combination of the S1 and S2 strategies can be carried out consistently, then the Indonesian oil palm productivity is expected to reach at least 6 tons of oil per hectare by 2050. So the national oil palm plantation area remains 16.3 million hectares, palm oil production will reach 97.8 million hectares or double the production in 2018. This shows that the implementation of the two strategies is source of sustainable growth both economically, socially, and ecologically (PASPI, 2017; Saragih, 2017; Wulansari et al., 2021).

CONCLUSION

There are three phases of industrialization of oil palm plantations (supply side), namely shifting from factor-driven to capital-driven phase and then upgrade to innovation-driven phase. If the factor-driven and capital-driven phases have limitations, the innovation-driven phase has unlimited/indefinite as long as innovation continues, productivity won’t have leveling-off or decrease.

Related to the industrialization of oil palm plantations, productivity improvement can be done in two ways, namely by partial productivity and total productivity. Both of these methods can be done simultaneously and will bring palm oil plantations more sustainable and decoupling from the issue of deforestation as well as increasing the competitiveness of the palm oil industry.

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