Abstract

The aim of this study was to evaluate raw material inventory system applied at a plywood industry in South Sulawesi, which was PT. Panca Usaha Palopo Plywood (PT. PANPLY). For the purpose of the study, the data of raw material supply and consumption during five years (2005-2009) as well as inventory management and operation costs were collected. Data were then analyzed by using Economic Order Quantity (EOQ) approach. Results showed that the supply system of log raw material was reorder point approach. The optimum order of logs from shorea group was 706.93 m$^3$ with the cycle of 2 days or with the yearly order frequency of 133 times. Re-order must be executed when the availability of its stock became 7225.96 m$^3$. Whilst, the optimum order of mixed species group was 771.65 m$^3$ with the cycle of 2 days or with the yearly order frequency of 145 times. For this group, re-order must be executed when the availability of stock became 8609.72 m$^3$.

Key words : Plywood industry, EOQ, inventory system, PT. PANPLY, raw material supply

Introduction

The government policies relating to the forestry industry have spurred highest growth of timber industry and reached its peak in the 1990s. However, the growth of this industry has decreased in line with the decline in log production from natural forests, while the production of logs from plantation forests has not been able to replace it.

The deficit trend of wood raw material in the timber industry began to appear since 1987. Based on industry business license data, there are 1.881 unit of wood processing industries (sawmills, plymill, pulpmill) with raw material demand of 63.48 million m3/year, while the production capability of natural forests, plantations forest and small scale is about 22.8 million m3/year. This indicates the deficit of supply and demand of 40.60 million m3/year. The direct impact due to the deficit of raw materials is the decrease of wood industrial capacity, especially plywood industry from 99% in 2007 to 42% in 2005 (Ministry of Forestry, 2006).

In anticipating the sustainability of plywood industry, it necessary to have a planning system for the availability of raw material to meet the needs of the production plan. The system should consider the balance of the raw material supply and plywood production in terms of quantity and availability. In this case, an inventory system plays an important rule as a control in assuring effective and efficient planning.
Methods

**Evaluation of supply system.** Supply system was determined by deep observation on the availability of log raw materials during the last five years (2005-2009). All the collected data were then descriptively analyzed.

**Determination of Economic Supply system.** Analysis was conducted using *Economic Order Quantity* (EOQ) method. For the analysis, the data of purchase as well as of raw material ordering costs and storage costs were collected. The optimum of material payment was calculated using the following formulas:

\[
EOQ = \sqrt{\frac{2SD}{H}} \quad EOQ = \sqrt{\frac{2SD}{H}}
\]

\[
F = \frac{D}{EOQ}
\]

\[
T = \frac{EOQ}{D}
\]

\[
D = a + bX
\]

where:

- **EOQ** = the economical scale on order amount
- **D** = demand (inventory needed forecasted per year)
- **S** = One frequency order (knowing by observation)
- **H** = storage cost per unit a year
- **F** = frequency of order within a period
- **T** = time of order (year)
- **a** = constanta (average need per year)
- **b** = the amount of Y changed for one X changed
- **X** = time unit. (year)
Results and Discussion

Supply System. Results of identification showed that the log raw materials used by the industry were obtained from Maluku, Irian Jaya, Kalimantan and Sulawesi. All the raw materials were purchased by direct order and contract systems. The log raw materials consisted of the groups of shorea (mersawa, hopea and angasana) and mixed species (Kempas, merbau, Bintangur, geronggang, merawan).

Inventory System. The amount of raw materials purchased during the last 5 years (2005-2009) for shorea group was 91,219.14 m³ and that of mixed species was 82118.45 m³. The average consumption for shorea group was 90.383,99m³ and that of mixed species was 80506.69 m³ (Table 1). These results indicated that the purchase of raw materials was higher than its consumption.

Table 1. The summary of raw material consumption (2005 – 2009)

<table>
<thead>
<tr>
<th>Year</th>
<th>Shorea Group</th>
<th>Mixed species Group</th>
<th>Total (m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>73.682,15</td>
<td>56.186,69</td>
<td>129.868,21</td>
</tr>
<tr>
<td>2006</td>
<td>91.538,83</td>
<td>78.589,06</td>
<td>170.127,89</td>
</tr>
<tr>
<td>2007</td>
<td>95.083,40</td>
<td>77.595,60</td>
<td>172.679,00</td>
</tr>
<tr>
<td>2008</td>
<td>114.224,85</td>
<td>83.687,68</td>
<td>197.912,53</td>
</tr>
<tr>
<td>2009</td>
<td>77.390,70</td>
<td>106.474,43</td>
<td>183.865,13</td>
</tr>
</tbody>
</table>

Table 1 show that the raw material consumption of the industry generally increased every year. Shorea group and mixed species group, however, showed declined consumption in 2009 and 2007, respectively. The higher consumption of shorea groups because they had higher market demand and they were easily obtained.

Analysis on the needs of raw materials using least square method showed that the amount of raw materials needed by the industry in a given period can be predicted. Results demonstrated that the raw materials needed for the next year would be 94196.24 m³ for shorea group and 112,234.99 m³ for mixed species group. On the other hand, the data of raw material ordering costs and storage costs are as shown in Table 2 and 3, respectively.

Table 2. The summary of raw materials ordering costs

<table>
<thead>
<tr>
<th>No.</th>
<th>Types of costs</th>
<th>Costs (Rp/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Woods</td>
<td>600.000</td>
</tr>
<tr>
<td>2.</td>
<td>Ordering preparation</td>
<td>30.000</td>
</tr>
<tr>
<td>3.</td>
<td>Raw materials income</td>
<td>40.000</td>
</tr>
<tr>
<td>4.</td>
<td>Material inspection</td>
<td>20.000</td>
</tr>
<tr>
<td>5.</td>
<td>Transaction process</td>
<td>5.000</td>
</tr>
</tbody>
</table>
### Analysis Results

Analysis Results demonstrated that the optimum order of shorea groups was $706.93 \text{ m}^3$ and 2 days cycle or order frequency 133 times a year. Re-order must be executed when the stock available were $7225.96 \text{ m}^3$. Optimum order of mixed species was $771.65 \text{ m}^3$ and 2 days cycle or frequency 145 times a year. Re-order must be executed when the stock available were $8609.72 \text{ m}^3$. Previous study showed that optimum unit numbers for each order on the shorea groups (1996-2005) was $694 \text{ m}^3$ and 4 days cycle or frequency 82 times a year. Optimum unit of mixed species was $529 \text{ m}^3$ and 4 days cycle or frequency 65 timer a year. Based on the data, after 5 years an increase in the number and frequency of optimal ordering for the shorea and mixed species (Makkarennu et al. 2006). The higher optimum value obtained in the current study was due to the increasing the availability of raw materials, both in quality and quantity, and their increased market demand.

### Conclusions

The raw material inventory system applied at PT. Panca Usaha Palopo Plywood (PT. PANPLY) as a plywood industry was direct order and contract systems. The optimum order of logs from shorea group was $706.93 \text{ m}^3$ with the cycle of 2 days or with the yearly order frequency of 133 times. Re-order must be executed when the availability of its stock became $7225.96 \text{ m}^3$. Whilst, the optimum order of mixed species group was $771.65 \text{ m}^3$ with the cycle of 2 days or with the yearly order frequency of 145 times. For this group, re-order must be executed when the availability of stock became $8609.72 \text{ m}^3$.

### References


Ministry of Forestry. 2007. Indonesian Forestry. Indonesian Forestry Centre. Jakarta


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**Table 3. The summary of storage costs for each unit**

<table>
<thead>
<tr>
<th>No.</th>
<th>Types of Storage Costs</th>
<th>Costs (Rp/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Inventory tax</td>
<td>180.000</td>
</tr>
<tr>
<td>2.</td>
<td>Insurance inventory</td>
<td>15.000</td>
</tr>
<tr>
<td>3.</td>
<td>Stock transfer</td>
<td>5.000</td>
</tr>
<tr>
<td>4.</td>
<td>Inventory shrinkage</td>
<td>60.000</td>
</tr>
<tr>
<td>5.</td>
<td>Maintenance supplies</td>
<td>2.000</td>
</tr>
</tbody>
</table>