The Use of Oil Palm Trunk for Commercial Product

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Outline

- Palm Oil Industry – *a highlight*
- Oil Palm Trunk – *availability & character*
- Sawit Laminated Lumber – *technology, product, challenge & prospect*
- SLL – *a solution for replanting program (esp. smallholder)*
Palm Oil Industry – a highlight

producing more oil, while using less land

10x more oil
8.5x less land

- 11.7 mio ha
- 33.5 mio ton

- Most Efficient Oil Crop
- Less in Price
- Renew- & Sustainable
- 31% of world vegetable oil prod.
- 7% of world oil crops area
India is the main CPO export destination (US$ 3.6 Billion) in 2014, followed by China (US$ 1.7 Billion) then Pakistan (US$ 1.3 Billion).

While, export to EU countries of about (US$ 2.8 Billion) in 2014.
Palm Oil Industry – summary

- Palm oil products → 1 from 10 main export products of Indonesia to the world & palm oil becomes second larger export product after coal.

- Currently, Indonesian palm oil entering new-era of oil crop industry, where this golden oil able to face the challenges and prosecution.

- Palm oil products → one of strategic product which can be used for raw material in various industries.

- World palm oil export of about US$ 34.6 Billion in 2014, where Indonesia as biggest producer shares more than 50% or about US$ 17.4 Billion in 2014.
Oil Palm Trunk – availability & characters

**Availability**

- 300,000 ha/y should be replanted (period 2015 – 2020)
- 120 trees/ha, 1.6 m³/trunk
- ~ 3 ton/trees (wet)
- MC ~ 350%

**As raw material**

- 8.5 m length → ~ 1 m³
- 120 m³/ha → 36 mio m³/y available
- Density 170 – 570 kg/m³
Oil Palm Trunk – availability & character

- Density of VB 170 – 570 (kg/m³)
  - Inner zone 170
  - Central 230
  - Peripheral 450 (n = 350)

- Density of Vascular Bundles (VB/cm²)
  - Inner zone 13.6
  - Central zone 24.2
  - Peripheral 45.4
Oil Palm Trunk – vascular bundle structure (cross section)
Oil Palm Trunk – *vascular bundle structure (longitudinal section)*

- parenchyma cells
- vessel
- fibres
Oil Palm Trunk – *distribution & variation density along the trunk*

<table>
<thead>
<tr>
<th>Trunk Height (m)</th>
<th>average density</th>
<th>central point</th>
<th>range density</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PZ</td>
<td>CZ</td>
<td>IZ</td>
</tr>
<tr>
<td>1.0</td>
<td>0.43</td>
<td>0.23</td>
<td>0.18</td>
</tr>
<tr>
<td>3.0</td>
<td>0.42</td>
<td>0.20</td>
<td>0.18</td>
</tr>
<tr>
<td>5.0</td>
<td>0.38</td>
<td>0.21</td>
<td>0.19</td>
</tr>
<tr>
<td>7.0</td>
<td>0.36</td>
<td>0.17</td>
<td>0.16</td>
</tr>
<tr>
<td>9.0</td>
<td>0.38</td>
<td>0.21</td>
<td>0.19</td>
</tr>
<tr>
<td>10.0</td>
<td>0.36</td>
<td>0.17</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Sawing Pattern
Sawing Pattern – *based on density distribution*

- **Inner zone (IZ)**: 20-25%
- **Central zone (CZ)**: 40-45%
- **Peripheral zone (PZ)**: 30-35%
Sawit Laminated Lumber – technology

Laminated

OPT

OPF

Wood veneer

Sandwiches

Woodland
Sawit Laminated Lumber – processing
Lumbering
SLL Products

Product Description:
- Single layer palmtrunk can be produced from different trunk heights & depths according to requirements purposes

Product Composition:
- Single layer palmtrunk

Product Uses:
- Core material for composite panel, blockboard, flash doors or furniture components

Product Properties:
- Palmtrunk density start from 180 kg/m³ to 550 kg/m³
- Thickness start from 5 mm to 60 mm, with up to 200mm & length up to 1200 mm
- MC less than 10% (according to requirement purposes)
SLL Products

Product Description:
- Single layer palmtrunk veneered by 2.0 mm plywood to enhance the structural strength of product. Various thickness and densities can be produced according to requirement of product purposes.
- Single palmtrunk overlay with non-decorative plywood (or decorative surface, according to requirement purposes).

Product Composition:
- 50 mm palmtrunk covered by 2.0 mm plywood and glued with PVAc.

Product Uses:
- Wall separator, table tops, furniture components
- Packaging & transport

Product Properties:
- Product density start from 200 kg/m$^3$ to 450 kg/m$^3$
- Thickness from 15 mm to 60 mm; width up to 200 mm & length up to 1200 mm
- MC less than 10% (according to requirement purposes)
Product Description:
- Blockboard SLL is constructed from different vascular bundles orientation to provide consistence stability of panel properties. The palmtrunk densities are mixed to achieve the homogeneity of blockboard properties. The products density can be designed according to requirement for LD, MD or HD.

Product Composition:
- Core of this blockboard is from different height & depth of the trunk to meet the requirement of uses. Veneer or plywood can be used to cover the blockboard surfaces.

Product Uses:
- Wall separator, tabletops, flash door
- Furniture components

Product Properties:
- Product density start from 250 kg/m$^3$ to 550 kg/m$^3$
- Thickness from 15 mm to 60 mm; width up to 1200 mm & length up to 2400 mm
- MC less than 10% (according to requirement purposes)
SLL Products

Product Description:
- SB-SLL is designed to improve the strength properties of panel/board to get high quality furniture or building components therefore combination with a piece of wood resulted good performance on bending properties of the products.

Product Composition:
- This product comprises Palmtunk in combination with meranti wood to enhance the strength of panel. Surface of product can be covered using veneer or plywood for both decorative or un-decorative depends on requirements.

Product Uses:
- Furniture, building component, table tops, flash door, window

Product Properties:
- Product density from 250 kg/m$^3$ to 550 kg/m$^3$
- Thickness of this SC-LSL from 15 mm to 60 mm, width 200 to 600 mm, length up to 1200 mm.
- MC less than 10% (according to requirement purposes)
Combination PW SLL (CPW-SLL)
SLL Products

Product Description:
- Combination palmtrunk and wood at the side-parts of panel then covered with veneer / plywood for face and back sides to improve the strength properties of CPW-SLL to get high quality furniture or building components for good performance products.

Product Composition:
- Palmtrunk in combination with wood at side-parts of panel

Product Uses:
- Furniture, building component, table tops, flash door, window

Product Properties:
- Product density from 250 kg/m$^3$ to 550 kg/m$^3$
- Thickness of this SC-LSL from 15 mm to 60 mm, width 200 to 600 mm, length up to 1200 mm.
- MC less than 10% (according to requirement purposes)
SLL Products

Product Description:
- M-SLL is made from hundreds palmtrunk laminas with special design in density distribution to get good performance of panel for medium to high duty loads. This product can be used for both interior and exterior uses.

Product Composition:
- Palmtrunk laminas from different height and depth of trunk.

Product Uses:
- Wall panels (cover or separator), roof component, flash doors, chair & windows
- Structural building elements, concrete shuttering, high-grade packaging, transport
- Furniture component, built-in furniture, table tops, insulation & acoustics
- Expandable beam or lumber (acc. to requirement) & possible reinforced with metal for heavy duty load

Product Properties:
- Product density from 300 kg/m³ to 600 kg/m³ (or as required)
- Flexible in dimension (or as required)
- MC less than 10% (according to requirement purposes)

Multilayer SLL (M-SLL)
SLL Products

Product Description:
- M-SLL is made from hundreds palmtrunk laminas and covered veneer/plywood with special design in density distribution to get good performance of panel for medium to high duty loads. This product can be used for both interior and exterior uses.

Product Composition:
- Palmtrunk laminas from different height and depth of trunk.

Product Uses:
- Wall panels (cover or separator), roof component, flash doors, chair & windows
- Structural building elements, concrete shuttering, high-grade packaging, transport
- Furniture component, built-in furniture, table tops, insulation & acoustics
- Expandable beam or lumber (acc. to requirement) & possible reinforced with metal for heavy duty load

Product Properties:
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- Furniture component, built-in furniture, table tops, insulation & acoustics
- Expandable beam or lumber (acc. to requirement) & possible reinforced with metal for heavy duty load.

Product Properties:
- Product density from 300 kg/m³ to 600 kg/m³ (or as required)
- Flexible in dimension (or as required)
- MC less than 10% (according to requirement purposes)
**Product Description:**
- MB-SLL is made from hundreds palmtrunk laminas with special design in density direction and distribution to get high strength of beam for heavy duty loads.

**Product Composition:**
- Palmtrunk laminas from different height and depth of trunk (possible in combination with wood or metal)

**Product Uses:**
- Structural building elements, concrete shuttering, high-grade packaging, transport
- Expandable beam or lumber (acc. to requirement) & possible reinforced with metal for heavy duty load

**Product Properties:**
- Product density from 300 kg/m$^3$ to 600 kg/m$^3$ (or as required)
- Flexible in dimension (or as required)
- MC less than 10% (according to requirement purposes)
OPT Value – an approach

- **Calculation based on:**
  - nutrient content, price & doses of fertilizer
  - scope from immature to mature plant (25-30 tahun)

- **nutrient content \( (N_{nc}) \)**
  \[ N_{nc} = P_{cf} \times D_{cf} \times \left( \frac{NC}{100} \right) \]

- **OPT Value \( (N_{OPT}) \)**
  \[ N_{OPT} = N_{ncl} + N_{nc2} + N_{nc3} + ... + dst \]
  \[ = \sum_{1}^{x-1} N_{ncx} \]

- **OPT Value from replanting \( (N_{RT}) \)**

\[
\sum N_{RT} = (N_{OPT})_{TBM} + (N_{OPT})_{TM}
\]

\[
= \left( \sum_{1}^{x-1} N_{ncx} \right)_{TBM} + \left( \sum_{1}^{x-1} N_{ncx} \right)_{TM}
\]

- \( N_{nc} \) : nilai kandungan hara
- \( P_{cf} \) : harga pupuk komersial
- \( D_{cf} \) : dosis pupuk komersial
- \( NC \) : kandungan hara
- \( N_{ncx} \) : nilai kandungan hara \( x, x = 1, 2, 3, ... dst \)
- \( N_{OPT} \) : nilai batang sawit
- \( TBM \) : tanaman belum menghasilkan
- \( TM \) : tanaman menghasilkan
- \( N_{RT} \) : nilai batang sawit hasil peremajaan
## Pemupukan TBM di Lahan Mineral

<table>
<thead>
<tr>
<th>Jenis Pupuk</th>
<th>Harga per kg (Rp)</th>
<th>Kandungan Hara</th>
<th>Dosis a (kg/pohon)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urea</td>
<td>3.900</td>
<td>N</td>
<td>7,4</td>
</tr>
<tr>
<td>RP</td>
<td>1.050</td>
<td>P</td>
<td>0,25b</td>
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<tr>
<td>TSP</td>
<td>3.650</td>
<td>P</td>
<td>4,6</td>
</tr>
<tr>
<td>MOP</td>
<td>5.000</td>
<td>K</td>
<td>6,25</td>
</tr>
<tr>
<td>Dolomite</td>
<td>450</td>
<td>Mg</td>
<td>8</td>
</tr>
<tr>
<td>HGF-Borate</td>
<td>10.100</td>
<td>B</td>
<td>0,25</td>
</tr>
<tr>
<td>CuSO4</td>
<td>31.000</td>
<td>Cu</td>
<td>0,5</td>
</tr>
<tr>
<td>Kaptan</td>
<td>100</td>
<td>Ca</td>
<td>0,5</td>
</tr>
</tbody>
</table>

## Pemupukan TM di Lahan Mineral

<table>
<thead>
<tr>
<th>Umur Tanaman</th>
<th>Dosis (kg/pohon/tahun)a</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Urea (N)</td>
</tr>
<tr>
<td>4-8</td>
<td>2,00</td>
</tr>
<tr>
<td>9-13</td>
<td>2,75</td>
</tr>
<tr>
<td>14-20</td>
<td>2,50</td>
</tr>
<tr>
<td>21-25</td>
<td>1,75</td>
</tr>
</tbody>
</table>

*Sumber: PPKS  baplikasi di lubang tanam

## Analisis Unsur Hara Batanga

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Satuan</th>
<th>Nilai</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>0,17</td>
</tr>
<tr>
<td>P</td>
<td>%</td>
<td>0,03</td>
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<tr>
<td>K</td>
<td>%</td>
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<tr>
<td>Ca</td>
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<tr>
<td>Mg</td>
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<td>0,02</td>
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<tr>
<td>Cu</td>
<td>ppm</td>
<td>0,44</td>
</tr>
<tr>
<td>B</td>
<td>ppm</td>
<td>2,50</td>
</tr>
</tbody>
</table>

## OPT Value – an approach

**OPT value from replanting:**
Rp. 206.621,- per trunk*

* under investigation
OPT Utilization – a solution for replanting

- **Wood substitution**
- **Reduce dependency to wood forest**
- **Reduce forest degradation**
- **Reduce carbon emission**

- 1 ha → 120 trees (after 25-30 y)
- Palmtrunk Volume 1.67 m$^3$ → 1 m$^3$ for SLL Products
- 1 m$^3$ trunk → Rp. 108.500

Diagram:
- Palmtrunks from Oil Palm Plantation
- Replanted Area
- SLL Mill
- Rp. 13 Million
- Replanting practices
Sheme – *business model*

- SLL Mill
- Wood-Working Company
  - Parts of equipment from WWC
- SLL Mill
  - Palm Oil Mill
  - Power from POM via Methane Capture or Biomass Plant
- SLL Mill

Scenarios
SLL Products – *prospect for commercial products*

**Product Uses:**

- Core material for panels, blockboard, composite boards
- Wall panels (cover or separator), roof component, flash doors, chair & windows
- Structural building elements, concrete shuttering, high-grade packaging, transport
- Furniture component, built-in furniture, table tops
- Insulation & Acoustics
- Expandable beam or lumber (acc. to requirement) & possible reinforced with metal for heavy duty load.

*Patend Pending*
Thank You
For Your Attention

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