Introduction to Remanufacturing

Submitted by: Universiti Teknologi Malaysia (UTM)
Introduction to Remanufacturing

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OBJECTIVES

Enhance understanding on the scope and definition of remanufactured goods

To define and identify the remanufacturing activities in Malaysia.

Overview of remanufacturing industries, existing environment on Remanufacturing activities in Malaysia and the Asia Pacific.
REMANUFACTURING

THE CONCEPT

Remanufacturing is an industrial process whereby used/broken-down products (or components) – referred to as “cores” – are restored to useful life. Remanufacturing means that a product is reprocessed or upgraded in an industrial process (Ostlin, et al., 2009).

THE DEFINITION

REMANUFACTURING

• An industrial process that transforms end of life (EOL) product into a product with as good as new condition (Matsumoto, 2009; Seitz, 2007).

• The process of bringing a used product to like-new condition through replacing and rebuilding component parts (Haynsworth and Lyons, 1987)

• Remanufacturing is the process of restoring a non-functional, discarded, or trade-in products (cores) to like-new performance (Lund and Hauser, 2008)

• Remanufacturing is a process of bringing used products to like-new functional state with warranty to match (Ijomah, et al., 1998)
**REMANUFACTURING PRODUCT PROFILE**

- Look-like new; Same condition as brand new product OEM product
- Same technical performance with comparable brand new OEM product (could be more due to upgrading)
- Same warranty period as given to a comparable brand new OEM product
- Same expected life-span as brand new/OEM product
- Lower in Price (45%-65% of the price of comparable new OEM product)

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**REMANUFACTURING OPERATIONAL DEFINITION**

<table>
<thead>
<tr>
<th>Input Profiles</th>
<th>Process/Activities Involve</th>
<th>Output Profiles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used Products/Broken-down Products/Components [Cores]</td>
<td>Disassembled</td>
<td>Look-Like a comparable brand new product OEM product</td>
</tr>
<tr>
<td></td>
<td>Checking/Inspecting</td>
<td>At least same performance as a comparable brand new OEM product</td>
</tr>
<tr>
<td></td>
<td>Cleaning/Drying</td>
<td>Same lifespan with a comparable brand new OEM product (subject to maintenance)</td>
</tr>
<tr>
<td></td>
<td>Repairing/Rebuilt/Replacing/Repainting</td>
<td>Have warranty (could be a same period and coverage as given to comparable brand new OEM product)</td>
</tr>
<tr>
<td></td>
<td>Reassembled</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Testing</td>
<td>40%-65% lower than a price of comparable brand new OEM product</td>
</tr>
</tbody>
</table>
REMANUFACTURING vs. OTHER ACTIVITIES

- **Recycling**: Processing used material into new products.
- **Repairing**: Correction of specified faults.
- **Refurbishing**: A used product, cleaned up, tested, repackaged and made available for re-sale.
- **Reconditioning**: A used product that is cleaned up and tested extensively with possible repair, re-sale at a satisfactory working condition.
- **Remanufacturing**: Returning a used product to a least OEM original performance specification.

**REMANUFACTURING**

- **Remanufacturing**: The process of returning a used product to at least OEM original performance specification from customers’ perspective and giving the resultant product a warranty that is at least equal to that of a new manufactured equivalent.

- **Reconditioning**: The process of returning a used product to a satisfactory working condition that may be inferior to the original specification. Generally, the resultant product has a warranty that is less than that of a newly manufactured equivalent. The warranty applies to all major wearing parts.

- **Repairing**: Repairing is simply the correction of specified faults in a product. When repaired products have warranties, they are less than those of newly manufactured equivalents. Also, the warranty may not cover whole product but only the component that has been replaced.
Remanufacturing: Definition and Process (TOR 1)

Proposed Definition
Remanufacturing is an industrial process whereby used product or components are restored to at least OEM's specification, performance and warranty.

The Process

Example of Malaysian Remanufacturing Products

- Power & Distribution Transformer (Malaysia Transformer Manufacturing Sdn Bhd)
- MTU Diesel Engines (Motor Teknologi Industri Sdn Bhd)
- Hydraulic Pump, Hydraulic Motor (Hitachi Construction Machinery (M) Sdn Bhd)
Remanufacturing: Parts, Components, Whole Product

Malaysian Remanufacturing Products by Sector

Source: MITI, MIDA, FMM, internet

* number of companies

** Based on companies' claim
The Potential and Impacts of Remanufacturing in Malaysia (TOR 3)

GROWTH OF REMAN

Lewin Model
### Profile of Selected Remanufacturing: Product & Process

<table>
<thead>
<tr>
<th>Name of Company and Reman Product</th>
<th>Business Model</th>
<th>Processes</th>
<th>Product Criteria</th>
<th>Market</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Company:</strong> Motor Teknologi Industri Sdn Bhd</td>
<td><strong>Product:</strong> Highway and off highway diesel engines</td>
<td>Third Party Reman &amp; Refurbishment (Army &amp; Police trucks, cylinder head, crank shaft, cam shaft and crank case) Paid up capital RM7 million Revenue: RM9 million (2009) RM4.8 million (2010) Staff strength: 50</td>
<td>-Inspection -Disassembly -Cleaning -Repair/ replace of cores -Repainting -Testing</td>
<td><strong>Performance:</strong> as good as new product <strong>Price:</strong> 40% cheaper than brand new <strong>Expected life span:</strong> same as new <strong>Warranty:</strong> 1 year</td>
<td>Domestic &amp; International <strong>Fulfill remanufacturing product criteria</strong></td>
</tr>
</tbody>
</table>

**Source:** Interview

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</thead>
<tbody>
<tr>
<td><strong>Company:</strong> Malaysia Transformer Manufacturing SdnBhd</td>
<td><strong>Product:</strong> Power and Distribution Transformer</td>
<td>Mixed (80% OEM &amp; 20% Reman) Paid up capital RM40 million, authorized capital is RM150 million Revenue: RM190 million (2010) RM222 million (2011) Staff strength of 337 people</td>
<td>-Inspection -Disassembly -Cleaning/Drying -Repair/ replace of cores -Repainting -Testing ** also do upgrading based on current technology (if needed) generally labour intensive</td>
<td><strong>Performance:</strong> as good as new product <strong>Price:</strong> 60% cheaper than brand new <strong>Expected life span:</strong> 15-25 years as compare to 25 years for brand new product <strong>Warranty:</strong> 18 months (same as brand new)</td>
<td>Domestic: mainly for TNB International: Europe, China, Korea, India. <strong>Fulfill remanufacturing product criteria</strong> <strong>cannot repair the casing of others brand due to IPR issue except their own brand</strong></td>
</tr>
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</table>
| Company: Hitachi Construction Machinery (M) Sdn Bhd. | OEM Remanufacturing company | -Inspection  
-Disassembly  
-Cleaning  
-Replacement of cores  
-Reassembly  
-Testing | -Performance: as good as new product (same as OEM specification)  
-Price: 40-60% cheaper than brand new  
-Life span: Same as brand new  
-Warranty: Same as brand new | Domestic & International (Europe) | Stiff competition with other OEM brand such as Komatsu (Japan), Caterpillar (US), Soosan (Korea) and Li Gong (China)  
**Fulfill remanufacturing product criteria**  
**Implement credit note for the core exchange** |
| Product: Hydraulic pumps and motors | paid up capital RM26 million | | | | |
| | Revenue: RM243 million (2010)  
RM255 million (2011) | | | | |
| | Staff: 207 all over Malaysia and Singapore | | | | |

Source: Interview

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**China**

- Has commissioned a remanufacturing project: engine, transmission, steering gear, starter and generator.

- Remanufacturing is listed in the National Long and Medium Term Program of Science Technology Development Planning as a key technology in manufacturing field.

- The government promotes the development of remanufacturing industry by facilitating the establishment of production system and consumption system.

- Manufacturing joint venture between Guangxi Yuchai Machinery Company Limited (GYMCL) and Caterpillar (China) Investment Co., Ltd → Yuchai Remanufacturing Services (Suzhou) Co., Ltd.

- Held 49%-51% by Caterpillar China and GYMCL, incorporated in April 2010 in Suzhou, Jiangsu Province to provide remanufacturing services for and relate to GYMCL’s diesel engines and components.
**SINGAPORE**

- In May 2011, Caterpillar announced the opening of new remanufacturing facilities in Singapore.
- Served as the regional source for remanufactured major components for large off-highway trucks and other mining equipment, including engines, transmissions, final drives and torque converters.
- In less than a year, Caterpillar has remanufactured more than two million pounds of end-of-life iron, using between 85 and 90 percent less energy than if those same components had been made new.
- In May 2012, Singapore established the Advanced Remanufacturing & Technology Centre (ARTC).
- By mid quarter of 2012, Singapore announces the presence of Boeing, Roll-Royce, Siemens Industry Software, ABB, FUCHS Lubricants and Carl Zeiss

**INDONESIA**

- Komatsu Reman Indonesia
- Established in January 18, 2007, serves as the Components Remanufacturing Plant as well as Global Reman Products Supplier of Komatsu as the leading of construction and mining machinery.
- 99.875 % owned by Komatsu Indonesia and 0.125 % owned by Komatsu Under Carriage Indonesia.
- Remanufacturing of Complete engine, Power line components, Piston pumps and motor
## Selected Practitioner’s on Remanufacturing Worldwide

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</tr>
</thead>
<tbody>
<tr>
<td>United States International Trade Commission (USITC)</td>
<td>Comprises of parts that have been obtained from the disassembly of used goods; and have been processed, cleaned, inspected, and tested to the extent necessary to ensure they have been restored to original working condition or better; and for which the remanufacturer has issued a warranty.</td>
</tr>
<tr>
<td>Cummins (Korea)</td>
<td>Engine core processing with component remanufacturing for use in local rebuild (e.g., typically blocks, cranks, cams, rods, and miscellaneous parts)</td>
</tr>
<tr>
<td>Yuchai (China)</td>
<td>Remanufacturing engineering is to develop a process to return used core to new condition. Some engineering specification should be changed on remanufacturing print. Validation will only be necessary to be applied to those changed specification.</td>
</tr>
<tr>
<td>Solar Turbinis (US)</td>
<td>The process of returning to end of life to its original condition, same as new condition or better manufacturing environment in accordance to engineering specification, performance validation testing, manufacturing quality systems and OEM’s warranty.</td>
</tr>
<tr>
<td>Komatsu (Japan)</td>
<td>Quality and performance guaranteed to be the same level as those for new components, lower cost for remanufacturing components, reduced idle time for machines through sufficient inventory.</td>
</tr>
<tr>
<td>Shin-Etsu Denso (Japan)</td>
<td>Disassembled, cleaned, replaced, tested, and mostly warranted</td>
</tr>
</tbody>
</table>

### Recommendation: Potential Remanufactured Products

Conclusions

- Relatively slow growth industry in Malaysia
- Eco-system
- Product Criteria & Possible Potential Areas
- Government Roles