Utilization Rates and Cost Factors in Timber Harvesting based on Long-Term Machine Data

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Problem

- Rising harvesting costs drive contractors to force different improvements such as improved cost effectiveness, utilization rates and fuel efficiency
- Lack of detailed data available for cost calculation of mechanized harvesting systems
- Variable quality of data needed for calculation
- Availability of main cost factors – time needed for analysing (just-in-time)
Objectives

➢ To improve and update the data used for cost calculation of forest machinery

➢ Develop and define guideline values for cost calculation in timber harvesting

➢ To give responsible persons an overview of used machinery with it’s costs factors

➢ Improve and support the decision process for investment in new forest machinery equipment
Analysis and Calculations

- Source: Enterprise resource planning system from the Austrian Federal State Machine Workshop
- Data collection period: 2004 – 2008

<table>
<thead>
<tr>
<th>Type</th>
<th>Harvester</th>
<th>Cable Yarder</th>
<th>Skidder</th>
<th>Forwarder</th>
</tr>
</thead>
<tbody>
<tr>
<td># Machines</td>
<td>12</td>
<td>28</td>
<td>19</td>
<td>18</td>
</tr>
<tr>
<td># Models</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

- Calculations and data collection based on PSH_{15}
- Filtering and preparing the data – i.e. consumer price index for cost related factors
- Combining with quantities such as fuel use and considering time limits (12 month for utilization)
Factors According to FAO-Scheme

Cost calculation is actually based on the FAO-Scheme combined/adapted with enterprise data

- Purchase costs
- Expected useful life
- Technological obsolescence
- Annual utilization
- Repair cost ratio
- Insurance and garage costs
- Interest rate

- Utilization barrier
- Depreciation
- Repair cost
- Interest
- Fuel and lubricants
Results: Scheduled Machine Hours in AUSTRIA

- Restriction by law:
  - 52 weeks/year with 40 hours/week and worker

<table>
<thead>
<tr>
<th>Maximum Working Hours</th>
<th>2,080</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vacation and employee's illness (approx.)</td>
<td>- 430</td>
</tr>
<tr>
<td>Total Scheduled Machine Hours</td>
<td>1,650</td>
</tr>
</tbody>
</table>

~1,650 h/year
Tower Yarder
1 shift

~3,300 h/year
Harvester/Forwarder
2 shifts
Results: Utilization Rates

- Tower Yarders: 1.083 hours, 66%
- Skidders: 1.151 hours, 68%
- Forwarders: 2.068 hours, 63%
- Harvesters: 2.042 hours, 62%
Results: Fuel Consumption Model

- Model based on liter/PMH$_{15}$ depending on:
  - Engine Power
  - Machine type
## Results: Additional Cost Factors

<table>
<thead>
<tr>
<th>Machine Type</th>
<th>Repair Costs [€/PMH$_{15}$]</th>
<th>Lubricants – Perc. of Fuel Costs [%]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvester</td>
<td>20.2</td>
<td>12.6</td>
</tr>
<tr>
<td>Forwarder</td>
<td>11.2</td>
<td>7.9</td>
</tr>
<tr>
<td>Skidder</td>
<td>11.4</td>
<td>7.2</td>
</tr>
<tr>
<td>Tower Yarder</td>
<td>28.0</td>
<td>12.9</td>
</tr>
</tbody>
</table>
Summary

- Average utilization ranges between 60 and 70%
- Repair costs show high variability between machine types
- Data availability and calculations could be automated using interfaces between ERPs and costing
- Identifying of detailed factors influencing repair costs of forest machines not easy to do
Outlook

- Data analysis and calculations should be done periodically - supporting the timber harvesting/discussion process
- Identifying of main factors driving harvesting costs could be done more quickly and precisely
- Results support the teaching quality in forest engineering related courses at the institute
- Further studies have to be carried out – including more detailed data collection/analysis
Thank you for your attention!