Long-Term Environmental Effects of Mega-Trucks

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Impacts of Mega-Trucks – which side weighs more?

**Positive:**
- less fuel
- less pollution
- less drivers
- less congestion
- lower costs
- competitiveness

**Neutral:**
- Impact on road surface
- Safety with appropriate technology standards
- Noise impacts

**Negative:**
- bridges, intersections
- modal shift
- more road traffic
- more emissions
- more congestion
Our approach to address the problem

**Literature review**
Impact chains and market structures from recent studies

**Market review**
Assessment of statistics and expert judgements on key parameters

**Case Studies**
Assessment of door-to-door transport chains on corridors with high combined transport volumes

**System Dynamics Model**
Model construction for analysis of global reaction patterns by key markets over time

**Geographical logistics model**
Application of NESTEAR model for assessment of modal shift effects by 2020

**Overall assessment**
Common conclusions using both models and the insights from the literature review on long-term modal split effects by Mega-Trucks in Europe
## Review of experiences and study results

<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweden</td>
<td>Increase of weight limits from 40 t (1966) to 60 t (1993), parallel increase of train lengths and rail wagon axle loads. Overall effect on modal split negligible.</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Field trials on selected relations on national territory only. Conditions: short distances with generally small haulage market. Only limited effects. Road +0.05% - 0.1%, inland waterways -0.2% to -0.3%, rail (total) -1.4% to -2.7%</td>
</tr>
<tr>
<td>UK</td>
<td>Model results (TRL08): 8 % to 18 % shift from rail with 60 t payload (bulk 5 %-10 %, deep sea containers 22 %-54 %) and 2.5 % to 5.5 % with 44 t vehicles. Domestic CT only integrated model consideration due to dynamic market.</td>
</tr>
<tr>
<td>Germany</td>
<td>Model and logistics chain forecasts (TIM07, K+P06): Huge potential for modal shifts in combined transport (up to 55 % reduction). Field tests by the federal states not yet evaluated.</td>
</tr>
</tbody>
</table>
Risks of Modal Shift by Market Segment

Shares of decisive market structures - MT 60t

- Bulk
- High value goods
- Continental unitised
- Maritime unitised

Market shares >800km
Market share <800km
Impacts of Swiss Heavy Vehicle Fee and Tonnage Increase

- 28t to 40t from 2001 on
- Temporary stop of HGV growth
- Increase in 2007
- Strong Swiss rail policy
- Impacts of regulation on weight + size limit extension in EU?
## Netherlands to Poland: typical port hinterland route

<table>
<thead>
<tr>
<th>Road quality in Poland</th>
<th>-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planned extension of Betuwe lijn to Germany</td>
<td>-</td>
</tr>
<tr>
<td>SMEs dominating Polish haulage business</td>
<td>-</td>
</tr>
<tr>
<td>Big hauliers dominating international transport</td>
<td>+</td>
</tr>
<tr>
<td>Increasing Polish wages</td>
<td>+</td>
</tr>
<tr>
<td>Goods structure: clothes and food products</td>
<td>+</td>
</tr>
<tr>
<td>Fast adaptation of Mega-Trucks in road haulage</td>
<td>±</td>
</tr>
<tr>
<td>Strong pressure on modal shifts from rail</td>
<td>±</td>
</tr>
<tr>
<td>Regulation to protect rail and local hauliers</td>
<td>?</td>
</tr>
</tbody>
</table>

### Graphs:

**Rail PL ⇆ NL**
- **other products:** 8.0%
- **potatoes, fresh fruits and vegetables:** 5.3%
- **timber, cork:** 8.5%
- **fodder and food:** 8.8%
- **iron-ore, steel and metal scrap, etc.:** 5.7%
- **iron, steel and non-iron metal:** 8.0%
- **cement, lime and building materials:** 3.5%
- **chemical products:** 5.9%

**Rail NL ⇆ PL**
- **other products:** 10.1%
- **textile raw materials:** 5.7%
- **fodder and food:** 20.5%
- **metal-products:** 3.8%
- **motorcars, vehicles machines:** 6.2%
- **chemical products:** 10.5%
- **iron, steel and non-iron metal:** 7.1%
Network Analysis – the LOGIS Model

2,000 Trans-European logistics relations

Special emphasis on new markets in New Member States

Transhipment between all modes (road, rail, ferry) possible

Productivity increase 20% to 30%
Transhipment costs 75 € -100 € to and from non-motorway road network
LOGIS Results: Demand by mode and hypothesis

Billion tkm by mode and hypothesis 2020

<table>
<thead>
<tr>
<th>Hypotheses: Costs efficiency / splitting costs</th>
<th>Tkm road classic</th>
<th>Tkm Mega-Truck</th>
<th>Tkm combined transport</th>
<th>TOTAL</th>
<th>Proportion road classic</th>
<th>Proportion Mega-Truck</th>
<th>Proportion Combined</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Mega-Trucks</td>
<td>1 369</td>
<td>0</td>
<td>144</td>
<td>1 513</td>
<td>90</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>H3: -20% / 100€</td>
<td>1 247</td>
<td>187</td>
<td>75</td>
<td>1 509</td>
<td>83</td>
<td>12,4</td>
<td>4,9</td>
</tr>
<tr>
<td>H2: -20% / 75€</td>
<td>1 121</td>
<td>330</td>
<td>61</td>
<td>1 512</td>
<td>74</td>
<td>21,8</td>
<td>4,0</td>
</tr>
<tr>
<td>H5: -25% / 100€</td>
<td>1 146</td>
<td>313</td>
<td>56</td>
<td>1 514</td>
<td>76</td>
<td>20,6</td>
<td>3,7</td>
</tr>
<tr>
<td>H6: -25% / 75€</td>
<td>978</td>
<td>500</td>
<td>41</td>
<td>1 518</td>
<td>64</td>
<td>32,9</td>
<td>2,7</td>
</tr>
<tr>
<td>H4: -30% / 100€</td>
<td>1 038</td>
<td>442</td>
<td>39</td>
<td>1 519</td>
<td>68</td>
<td>29,1</td>
<td>2,6</td>
</tr>
<tr>
<td>H1: -30% / 75€</td>
<td>871</td>
<td>628</td>
<td>25</td>
<td>1 524</td>
<td>57</td>
<td>41,2</td>
<td>1,6</td>
</tr>
</tbody>
</table>
LOGIS Results for Hypothesis 3

Hypothesis 3:
- HGV cost 2020: cost 2007 + 20 %
- Mega-Truck: HGV cost – 20 %
- Transhipment: 100 € to and off motorways

Results:
- Major market penetration above 800 km in road haulage
- Smallest reduction of CT from 10% in base case to 5% under hypothesis 3
- Sensitivity test with major improvement in CT networks: Reduction CT share from 20 % (base) to 8 % (hypothesis 3)
LOGIS Results: Impact of Improved Intermodal Services

Two settings of CT network:

- Grid of service between intermodal yard + improvement of the frequency against 2005
- At least one direct relationship between each intermodal yard (constraints linked to the service is limited)

Results:

- Base case: 10% CT (var. 1) / 20% CT (var. 2)
- Hyp. 3: var. 1: 4.9 % CT  12.4 % MT
  var. 2: 7.8 &% CT  13.3 % MT
- Hyp. 1: var. 1: 1.6 % CT  41.2 % MT
  var. 2: 5.2 % CT  38.2 % MT
ISI  IIS  IML

SD-Analysis – structure of the system dynamics model

Base Rail demand by segment

Cost elasticity

Introduction of Mega-Trucks

Cost of road transport

Mode shift Rail/Road

New rail demand

New road demand

Rail efficiency

Road congestion

Transport CO₂ emissions

New road demand

Road congestion

Cost of road transport

Mode shift Rail/Road

New rail demand

New road demand

Rail efficiency

Base Rail demand by segment
SD-Analysis - CO₂ balance of central scenario

60 t Mega-Trucks, central scenario: neutral assumptions on model parameters

CO₂ emissions total rail and road haulage market

- Initial decrease of CO₂ due to efficiency gains on the road 2010-2012: - 0.8 Mt/a
- Strong increase of emissions due to mode shifts from rail until 2017 (max. + 1.7 Mt/a)
- Decrease and stabilisation at +0.2 Mt/a due to stronger growth of road haulage than rail

Overall small impact but with certain risk of contradicting climate goals.

Difference in CO₂ emissions TOT

SC 1 60t
50% 75% 95% 100%
Reduction of weight limit from 60 t to 50 t

- Central scenario: no fallback to balanced CO$_2$ emissions due to less efficiency in road haulage and thus lower market penetration.

- Probable negative effect in climate-adverse scenario (+2 Mt/a) stronger magnitude than central case (-1.5 Mt/a).

Lower attractiveness of 50 t Mega-Trucks in the huge bulk market eliminates much of road efficiency gains.

Against initial intuition climate effects of 50 t Mega-Trucks are much more expressed than with 60 t max. gross weight.
Conclusions on long-term impacts

1. Three phases of development can be observed:
   1. Road sector accepts Mega-Trucks rather quickly Ë decrease of CO\textsubscript{2}-emissions
due to efficiency gain on the road († 3 to 6 years, 0.5 Mt CO\textsubscript{2}/a).
   2. If Mega-Trucks are established in road haulage modal shift tendencies set in in
   the rail sector Ë counter-balancing of CO\textsubscript{2} reduction († 5 to 20 years, 2 Mt
   CO\textsubscript{2}/a).
   3. Under specific demand and capacity scenarios efficiency gains of Mega-Trucks
   weigh out modal shift Ë easing negative climate effect († 15 - 30 years).

2. In all scenarios negative impacts in the medium run are much stronger than initial
positive effects.

3. Reducing maximum gross weight to 50t will increase the likely adverse effects due
to less attractiveness and lower efficiency gains in the road sector.
Thank you!