FOREST SECTOR TRANSFORMATIONS

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IPST Workshop:
A 20-Year Outlook for the Forest Bioproducts Industry: Implications, Challenges, Opportunities

5-6 February, 2013
SYSTEMS MATTER EVEN MORE:

- Demographics
- Economics
- Technology Development
- Infrastructure

Interconnected systems:
- Food
- Energy
- Climate
- Poverty/Society/Health

- Water
- Minerals
- Terrestrial Ecosystems
- Biodiversity
STRUCTURAL CHANGES

• The megatrends have, during the last 15 years, resulted in a radical reduction in the life expectancy of businesses and business models

• Businesses are forced to transform themselves from fortresses to networking systems
THE FULL STORM OF STRUCTURAL CHANGE

NEW PLAYERS
China, Latin America
Subsidies:
China 33 bill. (2002-09)

RAW MATERIAL
• Increased competition/cost
• Recycling reaches limits

MARKETS
• Shift in geographical consumption
• Strong decline in certain products
• New societal demands on products

TECHNOLOGICAL CHANGE
Hardwood instead of softwood

STRUCTURAL CHANGE OF INDUSTRY

SUBSTITUTE
• ICT
• Growing substitutes (e.g. plastic)

UNSATISFACTORY
Economic performance
DELIVERED PULP WOOD COSTS IN BRAZIL ($US/ODMT)

Source: Roberts, D. CIBC, 2012; and Wood Resource Quarterly.
INDUSTRIAL WOOD DEMAND

• Strong increase in demand
• Supply options decreasing
• See details in Appendix I
DEMAND OF FOREST PRODUCTS

• Paper and paperboard: global growth rate 1.6% per year to 2025
• All growth in emerging economies: flat or decreasing demand in developed countries
• Global growth in lumber consumption: 1% per year
• Rapid growth in wood panels: 2.6% per year – emerging economies
• Dramatic increase in consumption of recovered paper.
• Substantial growth in hardwood kraft
• All other pulps: flat or declining growth
• For details, see Appendix II
INDUSTRIAL EXPANSION

- Nearly all expansion in emerging economies
- Pulp in Latin America
- Paper and Paperboard in China and Asia
- See Appendix III for detailed information
TECHNOLOGICAL CHANGE

1950s-1970s

- Northern countries had an advantage by long fibre resources; thus the industry was developed around this resource
- Wood costs were not as critically important as today

Today

- Paper making is no longer dependent on softwood pulp to boost strength
- Newsprint can be produced by 100% recovered paper
- For printing and writing papers, hardwood pulp fibres give better formation, smoothness, and coverage meaning lower grammages
- LWC (a Northern softwood flagship) is now produced in Asia using hardwood pulp
- For packaging papers, the change from open flat wires to twin-wires performs better with hardwood and recycled fibres compared to virgin softwood fibres. All modern mills follow the twin-wires concept
- Softwood pulp is needed to boost strength in thin paper grades at high speed and for wet strength, especially in older paper machines
- Production of liner still requires softwood fibres
THE DISSOLVING PULP STORY

New announcements
~4 mn tonnes, e.g.,
- Fortress (0.2)
- Mercer (0.9)
- Sun Paper (0.4)

Mercer, Sun plans on hold in 2011-12
Many projects under reconsideration

ROCE’S WORLD TOP 100 FOREST INDUSTRY COMPANIES (based on sales)

SYSTEMIC CHANGE

• Only systematic change, as opposed to incremental changes, will make it possible to keep pace in the rapidly changing world

• Creative destruction would be a sign of progress

• USA is not alone – all of the Northern Hemisphere industry is in the same situation

• The Nordic industry has started to transform, Canada is trying, but not much transformation in US is being observed, apart from closing down capacities

• Why is the transformation not happening?
OUTPUT OF THE US FOREST PRODUCTS INDUSTRY DECLINING

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012

<table>
<thead>
<tr>
<th>Industry</th>
<th>2000</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturing – all durable goods</td>
<td>100</td>
<td>104</td>
<td>111</td>
<td>113</td>
<td>114</td>
<td>108</td>
<td>119</td>
</tr>
<tr>
<td>Mining – oil &amp; gas</td>
<td>100</td>
<td>184</td>
<td>217</td>
<td>211</td>
<td>263</td>
<td>199</td>
<td>232</td>
</tr>
<tr>
<td>Agriculture – Farms, forestry, fishing, hunting</td>
<td>100</td>
<td>136</td>
<td>125</td>
<td>171</td>
<td>162</td>
<td>143</td>
<td>160</td>
</tr>
<tr>
<td>Wood products</td>
<td>100</td>
<td>117</td>
<td>119</td>
<td>99</td>
<td>87</td>
<td>72</td>
<td>79</td>
</tr>
<tr>
<td>Paper products</td>
<td>100</td>
<td>87</td>
<td>91</td>
<td>95</td>
<td>84</td>
<td>91</td>
<td>92</td>
</tr>
</tbody>
</table>

ROCE OF AMERICAN COMPANIES IN 100 TOP FOREST COMPANIES WORLDWIDE

CAPACITY CHANGES IN USA

• Net loss of paper and paperboard capacity 2000-2012: 13.5 MMt or ~ 15% of the total capacity
• Reduction of the number of pulp mills: ~ 25% = 15% in capacity
• Reduction of number of saw mills: ~ 18% = 25% in capacity
• Due to the capacity reductions, the American industry has made substantial money in 2011 and 2012
• How much must the capacity shrink for a sustainable economic performance?
• Is the long-term strategy just to reduce capacities?

GLOBAL GROWTH RATES FOR COMMODITY PRODUCTS TO 2025 COMPARED WITH EXISTING US INDUSTRIAL CAPACITY

<table>
<thead>
<tr>
<th></th>
<th>News -print</th>
<th>Un-coated wood containing P&amp;W</th>
<th>Coated wood containing P&amp;W</th>
<th>Un-coated wood free P&amp;W</th>
<th>Coated wood free P&amp;W</th>
<th>Hygiene</th>
<th>Liner &amp; fluting</th>
<th>Folding box board</th>
<th>Sack paper</th>
<th>Other paper and paperboard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global growth rates (average %/yr)</td>
<td>-1.4</td>
<td>-1.2</td>
<td>-0.8</td>
<td>+0.5</td>
<td>+0.6</td>
<td>+3.2</td>
<td>+2.8</td>
<td>+2.4</td>
<td>+0.8</td>
<td>+0.4</td>
</tr>
<tr>
<td>US current capacities (in million tons)</td>
<td>3.4</td>
<td>2.1</td>
<td>3.3</td>
<td>10.3</td>
<td>3.9</td>
<td>7.8</td>
<td>32.6</td>
<td>9.6</td>
<td>1.3</td>
<td>4.1</td>
</tr>
</tbody>
</table>

- Some 28 million tons will be stressed for structural change
- This corresponds to 33% or current total US capacity of paper and paperboard
- Very difficult to increase prices under negative or low growth rates (Rennel, 2010)

GLOBAL GROWTH RATES FOR PULP DEMAND (in tons) BY 2020 AND EXISTING US PULP CAPACITIES

<table>
<thead>
<tr>
<th></th>
<th>Unbleached kraft – unchanged demand 2010-2020</th>
<th>Bleached hardwood kraft – substantial increased demand</th>
<th>Bleached softwood – slightly decreased demand</th>
<th>Mechanical and semi-mechanical – unchanged demand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Market</td>
<td>Internal</td>
<td>Market</td>
<td>Internal</td>
<td>Market</td>
</tr>
<tr>
<td>US current capacities (in million tons)</td>
<td>20.9</td>
<td>---</td>
<td>13.9</td>
<td>2.0</td>
</tr>
</tbody>
</table>

- Brazil – increasing capacity of BEK of 18 MMt; export increase 6 MMt in 2020
- Russia – increasing NBSK of 2 MMt by 2016
- US – pulp capacities will also depend on the structural changes taking place in paper and paper board (see earlier slide)

CONSUMPTION OF PAPER AND PAPERBOARD IN USA (in MMt/yr)

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012; and FAOSTAT (historical); and USFPM/GFPM (projections).
PULP PRODUCTION AND CONSUMPTION IN USA (in MMt/yr)

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012; and FAO (historical) and USFPM/GFPM (projections)
LUMBER CONSUMPTION AND PRODUCTION IN USA (in MM$^3$/yr)

Sources:
1. FAOSTAT(Historical),
2. USFPM/GFPM (Projections)

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012; and FAO (historical) and USFPM/GFPM (projections)
US CONSUMPTION AND PRODUCTION OF WOOD PANELS (in MM$^3$/yr)

Sources:
1. FAOSTAT (Historical),
2. USFPM/GFPM (Projections)

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012; and FAO (historical) and USFPM/GFPM (projections)
CONCLUSIONS FROM THE SCENARIOS

• USA has to become a major net exporter by 2030

• Export volumes
  Paper and paperboard: 10 MMt
  Wood pulp: 20 MMt
  Lumber: 7 MM3
  Fibre: 5 MM3

• Will the US be able to compete on the export markets?

• The increased export is not a guarantee for increased financial performance
THREE CRITICAL EXAMPLES – FOREST SECTOR STAKEHOLDERS

Market adaptation
Increased innovation
Alternative use of fibers and byproducts
Utilized environmental advantages
Increased productivity
Cost cutting
Competence development
Acquisition/mergers

Source: Opticom International Research AB, 16 September 2009
http://www.papernet.se/iuware_files/user/papernet.se/pdf/framtidsstudie.pdf
MATURE INDUSTRY

- Strong homogeneity in views about structures and strategies in the industry
- Increased investments in bulk and large-scale production
- Incremental within existing technology, products and markets
- Value destruction instead of value creation
- Productivity and cost-efficiency driven
WHY IS IT SO?

- Conservative and risk-adverse owners, boards, and financial analysts
- Decrease of ‘vertigo’ – uneasiness with changing dynamics of business landscape and best path forward
- Manufacturing ‘holiness’ – the idea of manufacturing being the central economic activity and all else is somehow subordinate
- The value chain of manufactured goods consumed today – the process of manufacturing and assembly constitute a small value of the process
- The value is in efficient functions, design, style, precision, quality, etc.
- Lack of champions for change
- Lack of partnerships outside the sector
AVOID THE ‘KODAK MOMENT’

• The company laid out a timeline already in 1979 of Kodak’s digital transition
• Kodak developed, together with Apple, a digital camera in the early 1990s
• “Maximize what you can earn out of a traditional business”
• Financial analysts argued “…preserve and extend the old technology, Kodak should not squander investors’ money on digital nonsense…”
• The transformation “would destroy margins and values”
• The transformation failed to breakdown the structural, cultural, and strategic obstacles inside the company
• We need, every day, to ask the question: What is the ‘Kodak moment’? How can we avoid it?
# Example of Megatrends – Forest Products Opportunities

<table>
<thead>
<tr>
<th>Megatrends</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population growth</td>
<td>More people – more housing, ageing housing stocks, more ageing people → building components, construction</td>
</tr>
<tr>
<td>Energy scarcity/climate change/emissions</td>
<td>Smart construction with wood</td>
</tr>
<tr>
<td>Growing middle class</td>
<td>Increased demand on hygiene products</td>
</tr>
<tr>
<td>Ageing population</td>
<td>Increased demand on health products</td>
</tr>
<tr>
<td>Increased food demand and changed eating habits</td>
<td>Increased demand on food components, and environmental and smart packaging</td>
</tr>
<tr>
<td>Climate change/cotton</td>
<td>Increased demand on cloth and industrial textiles</td>
</tr>
<tr>
<td>Energy/climate</td>
<td>Bio composite products</td>
</tr>
<tr>
<td>Declining availability of critical minerals</td>
<td>Bio products and bio composites</td>
</tr>
</tbody>
</table>
THE NEW INTEGRATED FOREST INDUSTRY

**Traditional Forest Products**
- Lumber
- Wood panels
- Pulp
- Paper
- Paperboard

**Advanced Forest Products**
- Wood products → construction products
- Newsprint and P&W → media products
- Paperboard → packaging products
- Tissue → hygiene, health
- Pulp → NCC, composites, specialty pulp
- Textiles

**Bioenergy**
- Pellets
- CHP
- Green coal (torification)
- Green electricity
- First generation biofuels

**Technical Breakthroughs**
- Advanced biofuels
- Biochemicals
- Food, cosmetics and medicine ingredients

# US BIOENERGY

<table>
<thead>
<tr>
<th>Source of Renewable Energy</th>
<th>2012 (Quads)</th>
<th>2040 (Quads)</th>
<th>Annual Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dedicated Biomass Plants</td>
<td>0.14</td>
<td>0.33</td>
<td>3.11%</td>
</tr>
<tr>
<td>Biogenic Municipal Waste**</td>
<td>0.06</td>
<td>0.07</td>
<td>0.55%</td>
</tr>
<tr>
<td>Cofiring Biomass*</td>
<td>0.02</td>
<td>0.55</td>
<td>12.57%</td>
</tr>
<tr>
<td><strong>Biomass Renewable Power</strong></td>
<td>0.08</td>
<td>0.62</td>
<td>7.59%</td>
</tr>
<tr>
<td>Conventional Hydroelectric</td>
<td>2.73</td>
<td>2.90</td>
<td>0.22%</td>
</tr>
<tr>
<td>Geothermal</td>
<td>0.16</td>
<td>0.55</td>
<td>4.51%</td>
</tr>
<tr>
<td>Solar Thermal</td>
<td>0.01</td>
<td>0.03</td>
<td>4.00%</td>
</tr>
<tr>
<td>Solar Photovoltaic</td>
<td>0.02</td>
<td>0.55</td>
<td>12.57%</td>
</tr>
<tr>
<td>Wind</td>
<td>1.33</td>
<td>2.46</td>
<td>2.22%</td>
</tr>
<tr>
<td><strong>Non Biomass Renewable Power</strong></td>
<td>4.25</td>
<td>6.49</td>
<td>1.52%</td>
</tr>
</tbody>
</table>

* Represents biomass that is fired with coal to produce electricity

** Includes biogenic municipal waste, landfill gas, and municipal sewage and sludge. Incremental growth is assumed to be landfill gas facilities.

Source: Hoagland, K. Biomass Magazine, 6 Dec 2012

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**Billion gallons**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
<td>35</td>
</tr>
</tbody>
</table>

3D PRINTING – TECHNICAL REVOLUTION?


Source: Jeff Kowalski, 3D Printing basics explained, Autodesk, 4 Jan, 2013.
GRAPHENE APPLICATIONS

THE TRANSFORMATION PROCESS

Source: Sten Nilsson, April 2011
Thank you for your attention!

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APPENDIX I
INDUSTRIAL WOOD DEMAND INCREASE TO 2030 IS SIZEABLE

<table>
<thead>
<tr>
<th>Product Area</th>
<th>RWE Increase 2010-2030^A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulp &amp; Paper ^B</td>
<td>150 million m^3 sub</td>
</tr>
<tr>
<td>Sawnwood ^C</td>
<td>250 million m^3 sub</td>
</tr>
<tr>
<td>Wood-based panels</td>
<td>400 million m^3 sub</td>
</tr>
<tr>
<td>TOTAL (gross)</td>
<td>800 million m^3 sub</td>
</tr>
<tr>
<td>TOTAL (net) ^D</td>
<td>700 million m^3 sub</td>
</tr>
</tbody>
</table>

A) Increase according to Pöyry scenario in KSLA presentation  
B) Virgin pulp based demand increase  
C) Softwood & hardwood sawnwood including demand recovery 2020  
D) Including utilization of sawnwood residues in pulp and panels

<table>
<thead>
<tr>
<th>Region</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>Wood/biomass deficit 100-150 million m³/yr</td>
</tr>
<tr>
<td>RUSSIA</td>
<td>Same harvest level as today, or lower</td>
</tr>
<tr>
<td>JAPAN</td>
<td>Wood deficit: 50-60 million m³/yr</td>
</tr>
<tr>
<td>CHINA</td>
<td>Wood deficit: 150-200 million m³/yr</td>
</tr>
<tr>
<td>OCEANIA</td>
<td>+ 40 million m³/yr of industrial wood</td>
</tr>
<tr>
<td>SE ASIA</td>
<td>Deficit. 20 million m³/yr lower harvest</td>
</tr>
<tr>
<td>INDIA</td>
<td>Wood deficit: 20-30 million m³/yr</td>
</tr>
<tr>
<td>AFRICA</td>
<td>Wood deficit: 35 million m³/yr</td>
</tr>
<tr>
<td>LATIN AMERICA</td>
<td>+ 190 million m³/yr of industrial wood; domestically consumed</td>
</tr>
<tr>
<td>U.S.A</td>
<td>???</td>
</tr>
<tr>
<td>CANADA</td>
<td>Reduced harvest by 50-70 million m³/yr of industrial wood</td>
</tr>
</tbody>
</table>
## DEMAND OF WOOD FOR ENERGY

(Whiteman, A., 2011 – in billion m³ RWE)

<table>
<thead>
<tr>
<th></th>
<th>2020</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Heat &amp; Power</strong> (primary solid biomass)</td>
<td>3.0</td>
<td>3.25</td>
</tr>
<tr>
<td><strong>Traditional solid biomass</strong></td>
<td>5.3</td>
<td>5.0</td>
</tr>
<tr>
<td><strong>Coal replacement</strong></td>
<td>1.5</td>
<td>2.95</td>
</tr>
<tr>
<td><strong>Biofuels</strong></td>
<td>0.9-1.25</td>
<td>1.25-1.75</td>
</tr>
</tbody>
</table>
APPENDIX II
CONTINUED CONSUMPTION GROWTH IN PAPER AND PAPERBOARD

Global demand for paper and paperboard 1990-2010, outlook to 2025

Million tons

600
500
400
300
200
100
0

1990
1995
2000
2005
2010
2015
2020
2025

540 million ton 2030
496 million ton
387 million ton

1.6%/a

Other
Latin America
Rest of Asia
China
Eastern Europe
Japan
Western Europe
North America

Emerging markets
CAGR 3.2%/a
Mature markets
CAGR -0.6%/a

CONTINUED GROWTH IN SAWNWOOD DEMAND, MAIILY SOFTWOOD

Source: Wintzell, J., Poyry, 2011, and FAO.
RAPID GROWTH IN WOOD-BASED PANELS DEMAND – SW SUBSTITUTE

Wood-based panels demand by region, 1970 – 2010, scenario 2030

Source: Wintzell, J., Poyry, 2011, and FAO.
FUTURE FIBRE SUPPLY MAINLY FROM “URBAN FORESTS”

Source: Wintzell, J., Poyry, 2011, and FAO.
APPENDIX III
## LATIN AMERICAN MARKET PULP EXPANSION - CURRENT CAPACITY 15 m/ton

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>Capacity (thou tons)</th>
<th>Startup Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eldorado</td>
<td>Três Lagoas, MS, Brazil</td>
<td>1,500</td>
<td>2012/Q4</td>
</tr>
<tr>
<td>Montes del Plata</td>
<td>Punta Pereira, Uruguaya</td>
<td>1,300</td>
<td>2013/Q2</td>
</tr>
<tr>
<td>(Arauco &amp; Stora)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suzano</td>
<td>Maranhão, Brazil</td>
<td>1,500</td>
<td>2013/Q4</td>
</tr>
<tr>
<td>Fibria</td>
<td>Três Lagoas II, MS, Brazil</td>
<td>1,500</td>
<td>2014/Q3</td>
</tr>
<tr>
<td>CMPC</td>
<td>Guaíba II, RS, Brazil</td>
<td>1,500</td>
<td>2015/Q1</td>
</tr>
<tr>
<td>Suzano</td>
<td>Piauí, Brazil</td>
<td>1,500</td>
<td>2016/Q2</td>
</tr>
<tr>
<td>Veracel II</td>
<td>Eunápolis, BA, Brazil</td>
<td>1,500</td>
<td>n/a</td>
</tr>
<tr>
<td>(Fibria &amp; Stora)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Klin</td>
<td>Paraná, Brazil</td>
<td>1,400</td>
<td>n/a</td>
</tr>
<tr>
<td>Celfibra</td>
<td>Belo Oriente, MG, Brazil</td>
<td>800</td>
<td>n/a</td>
</tr>
<tr>
<td>Suzano</td>
<td>Maranhão or Piauí, Brazil</td>
<td>1,500</td>
<td>n/a</td>
</tr>
<tr>
<td>Fibria</td>
<td>Barra do Riacho, ES, Brazil</td>
<td>1,500</td>
<td>n/a</td>
</tr>
<tr>
<td>BRAXCEL</td>
<td>Peixe, TO, Brazil</td>
<td>1,500</td>
<td>2018/Q4</td>
</tr>
<tr>
<td>LWARCEL</td>
<td>Lençois Paulista, Brazil</td>
<td>900</td>
<td>2016</td>
</tr>
</tbody>
</table>

**TOTAL**                                                            ~18,000

Source: Roberts, D. CIBC, 2012; and Pulp and Paper Products Council (PPPC) and FPM Research.

Russia: Expansion of NBASK by 2 million tons [Bratsk (currently) and Lesosibirsk (2016)]
CHINESE PRINTING AND WRITING PAPER CAPACITY EXPANSIONS (m/tons)

APPENDIX IV
US WOOD FUEL FEEDSTOCK PRODUCTION BY REGION AND SOURCE (in MM³/yr)

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012; and FAO (historical) and USFPM/GFPM (projections)
ANNUAL TIMBER HARVEST VOLUMES IN USA (in MM³/yr)

Source: Peter J. Ince, USFS, Forest Products Lab and Prakash Nepal, Louisiana State University, 2012; and FAO (historical) and USFPM/GFPM (projections)
APPENDIX V
## INNOVATION MODES IN OECD COUNTRIES BASED ON FACTOR ANALYSIS

<table>
<thead>
<tr>
<th>Industry Description</th>
<th>Technology Innovation</th>
<th>Market Innovation</th>
<th>Process Modernization</th>
<th>Wider Innovation</th>
<th>Network Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood pulp, paper, publishing</td>
<td>-0.14</td>
<td>-0.13</td>
<td>+0.23</td>
<td>-0.02</td>
<td>-0.24</td>
</tr>
<tr>
<td>2 842 firms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Machinery, electrical, communication,</td>
<td>+0.39</td>
<td>+0.22</td>
<td>-0.07</td>
<td>-0.13</td>
<td>+0.14</td>
</tr>
<tr>
<td>industrial equipment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 930 firms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Petroleum, chemicals, rubber, plastic</td>
<td>+0.21</td>
<td>+0.12</td>
<td>-0.07</td>
<td>-0.07</td>
<td>+0.15</td>
</tr>
<tr>
<td>3 756 firms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motor vehicles, transport equipment</td>
<td>+0.26</td>
<td>-0.06</td>
<td>+0.05</td>
<td>-0.09</td>
<td>+0.25</td>
</tr>
<tr>
<td>1 476 firms</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

+ averages indicate specialization in the innovation mode
- averages indicate less relevance for firms in the innovation mode