THE ROLE OF LOCAL INSTITUTIONS IN FACILITATING INNOVATION SYSTEMS IN PERIPHERAL REGIONS IN OLD INDUSTRIALIZED NATIONS

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Cali Nuur
Our research project

- To analyse the dynamics of natural resource based economies/industries (NRBE/I) in light of:
  - The resource curse/Dutch disease paradigm
  - Global demand for natural resources
  - The new scramble for resources ?(Climate change mitigation)
This paper aims at:

• Discussing regional innovation systems in the context of peripheral regions in an old industrialised nation (Sweden)

• Give insights into how a paper and pulp plant was transformed into a biorefinery and in the extension become a lead firm for an innovation system

• Discuss the role of institutions as facilitators of the innovation process
MoDo Domsjö plant (1990-1998)—dying in the chimney fire?

photo: Domsjö Fabriker
Chemical pulp mill closures since 2000, globally (Capacity)

Total 9.5 million tons

Source: Pöyry
Chemical pulp mill start-ups since 2000, global capacity

Total 18 million tons
*) 2009-2010 includes decided projects, delays may occur.

Source: Pöyry
Basic pulping process

Wood handling → Cooking plant → Washing stage → Bleaching stages → washing

Black liquor

Evaporation plant

Cooking chemicals treatment → Chemical recovery system

Chemical recovery system

hemicellulose → lignin

lignin

fermentation

ethanol

pulp

lignosulfonate
Biorefinery - innovation system?

*Case*: The return of the Jedi!

- From bulky business, away from commodity trap, to biorefinery innovation system
  From pulp for declining paper markets to textiles, construction materials; chemicals & biofuels in growing sustainable markets
- Innovation system - New constellations of chemical and wood fiber producers and technology suppliers have arisen after new owners taking over a former sulfite pulp mill.
- Local institutions fundamental (R&D networks; local cluster organization; local energy company)
Production activities at Domsjö Fabriker
1995-2010 and planned expansion

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<tbody>
<tr>
<td>Dissolving cellulose (viscose)</td>
<td>10,000</td>
<td>150,000</td>
<td>178,000</td>
<td>230,000</td>
<td>255,000</td>
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<tr>
<td>Pulp</td>
<td>200,000</td>
<td>30,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Pulp</td>
<td>10,000</td>
<td>10,000</td>
<td>12,000</td>
<td>15,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Ethanol</td>
<td>-</td>
<td>-</td>
<td>25,000</td>
<td>80,000</td>
<td>60-120,000</td>
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<tr>
<td>Lignosulfonate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>80,000</td>
<td>60-120,000</td>
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<td>Biogas &amp; resins</td>
<td>-</td>
<td>8,000 &amp; 5,000 tons/year</td>
<td>8,000 &amp; 5,000 tons/year</td>
<td>10,000 &amp; 7,000 tons/year</td>
<td>11,000 &amp; 7,000 tons/year</td>
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<tr>
<td>Biomethanol (or DME)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>150,000 (100,000)</td>
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| Turnover                                | 60-70 MEUR | 100 MEUR | 120 MEUR | 200 MEUR | 400 MEUR?
The biorefinery cluster

Övik Energi
Processum
Domsjö Fiber
Domsjö Fabriker
Future Domsjö BioFuel Plant 2012-2013
Domsjö Specialties
Etek
Holmen
Eurocon
MoRe Research
SEKAB
AGA
Akzo Nobel
DomInnova
Future Domsjö BioFuel Plant 2012-2013
### Agents, networks and institutions in the biorefinery innovation system

<table>
<thead>
<tr>
<th>Agents</th>
<th>Networks</th>
<th>Institutions</th>
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<tbody>
<tr>
<td>Domsjö Fabriker</td>
<td>Processum</td>
<td>Beyond Oil Project (local stakeholders with sustainable aims – to become completely independent of fossil products such as oil/gas)</td>
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<tr>
<td>Övik Energi</td>
<td>BioFuel Region</td>
<td>Incentives for more use of bioenergy instead of fossil inputs/outputs as gas and oil - in recent decades (national policy since 1980-90s) and EU policy since 2000s</td>
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**Akzo Nobel, Sekab, Holmen, M-real, Eurocon, Metso, Sveaskog, Umeå Energi, Skellefteå Kraft, AGA, SCA**

**MoRe Research**

**Umeå University, Mid Sweden University, SLU**
<table>
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<tr>
<th>Knowledge Formation</th>
<th>Entrepreneurial experimentation</th>
<th>Resource mobilization</th>
<th>Legitimation</th>
<th>Market formation</th>
<th>Externality (cluster development)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New patents for viscose and cellulose products &amp; biochemical products</td>
<td>DomInnova; Domsjö Specialties Övik Energi</td>
<td>130 million EUR in Domsjö Fabriker projects (new equipment for new biorefinery products and production capacity expansion at Domsjö Fabriker) during 2004-2010</td>
<td>Vinnova funding</td>
<td>New applications and markets for viscose, dissolving cellulose and LS in Asia</td>
<td>Processum/integration of Domsjö Fabriker, Akzo Nobel, Övik Energi, etc with common infrastructure and resource interdependencies</td>
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<td>25-30 recruited engineers in chemistry, material engineering in product development/research projects in the 2000s.</td>
<td>Co-partnership with Chemrec/Total to install first industrial synthetic gas plant for 2nd generation of biofuels (DME/methanol) in the world</td>
<td>120 MEUR in new biopower plant, etc</td>
<td>Beyond Oil Project</td>
<td>Bioenergy products (resins, biogas) as input to Övik Energi new energy mix.</td>
<td>Beyond Oil BioFuel Region</td>
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<td>Process technology education programmes with Umeå university</td>
<td>New financial owners (private consortium) taking over Domsjö Fabriker from MoDo supported by local stakeholders (trade union, local municipality bodies)</td>
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<td>New platform chemicals developed by DomInnova</td>
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<td>“Old owners MoDo sold a pulp &amp; paper mill but new owners bought a biorefinery”, CEO, Domsjö Fabriker</td>
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Conclusions

1. Innovation systems (clusters) not only question for core regions – local institutions may be crucial in peripheral regions where critical mass for positive externalities (education/research/innovation processes/clustering) are lacking or when rapid change is needed to survive.

2. From declining commodities to biorefining (mitigating climate change).

3. Local institutions important as incentive for the action framework with local stakeholders involved – good Triple-Helix collaboration shaping the innovation system.
Industrial resource flows at the Domsjö site
Components in the transformation of Biomass Industry in general and Forest Industry in particular in the near future...

Wood streams hot like oil feedstocks were in the beginning of 1900’s

Wood Feedstocks are today a strategic resource!

INNOVATIONS – INNOVATIONS - INNOVATIONS

New owners    New young engineers    New types of M&A:s
Thanks

• Questions?

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The pulp biorefinery – some possible products from wood compounds

Energy

- Ethanol
- DME
- FT-diesel
- Biooil
- Heat
- Electricity
- Solid fuel (pellets)
- Lignin
- Biogas

Chemicals & Materials

- Carbon fiber
- Phenols
- Binders
- Dispergents
- Activated carbon
- Fibers
- Derivates
- Nanocellulose
- Plastics/barriers
- Hydrogels (xylan)
- Furfural (Nylon)
- Bioactive compounds
- Fatty acids, antioxidants

Cellulose

- Bark
- Forest residues

Lignin

- Black liquor (lignin)

Hemicellulose

- Extractives

Cellulose

- Nanocellulose