Systems engineering for sustainable growth through creation of an eco-industrial park

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Research topic

• Applying a systems engineering framework to the creation of an eco-industrial park
  – Case community – Verdal, Norway
  – Application of the collaboration framework – historical perspective
  – Progress toward sustainable development
Research activities

- Develop a questionnaire that takes the pulse of the current economic situation and local networks; also included some extra questions related to sustainability
- Questionnaire was validated by interviews with 16 respondents
- 23 CEOs participated in facilitated brainstorming session to define a Vision for Verdal for 2025
- Tour of the municipality and countless hours being told the history
- Attendance at town hall meeting regarding emission levels from new Calc-burning oven
- Website for Innherred Vekst documents projects funded nationally
- Local and regional newspapers covered the events; access to a clippings archive
- 3 studies of the Verdal phenomenon by NTNU students
Story of Verdal

• Plant closing threatened 900+ jobs in 1998
• Swift action by management averted crisis
• Verdal has been receiving national funds since 2002; the allocation ends 2007
• Money combined with local mentors has yielded impressive growth in new start-ups
• Investment in recycling and reclamation companies
• Leaders looking ahead to ensure future prosperity and growth of the municipality and the region
AS IS – TO BE
The eco-park inspiration
Multi-disciplinary mapping

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Eco-Industrial Parks</th>
<th>Systems Engineering</th>
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</thead>
<tbody>
<tr>
<td>Logistics</td>
<td>Movement of goods and materials</td>
<td>Whole life planning</td>
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<tr>
<td>Production</td>
<td>Minimize waste; recycle</td>
<td>Modularity; reuse</td>
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<tr>
<td>Economics</td>
<td>Natural capitalism</td>
<td>Sustainable operations</td>
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<tr>
<td>Organization</td>
<td>Networks; network identity</td>
<td>Multidisciplinary project teams</td>
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<td>Knowledge management</td>
<td>Collaboration</td>
<td>Communication</td>
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<tr>
<td>Industrial Ecology</td>
<td>Do no harm; symbiosis</td>
<td>Environmental concerns</td>
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<td>Systems Dynamics</td>
<td>Understand interactions</td>
<td>Process analysis tool</td>
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<tr>
<td>Soft systems methods</td>
<td>Stakeholder alignment</td>
<td>Requirements elicitation</td>
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</tbody>
</table>
Framework for collaboration

• An advantage for understanding, analyzing and recommending future directions
  – iFACE
    • Identify stakeholders
    • Frame the problem
    • Alternatives
    • Choose
    • Evaluate
Verdal and iFACE – i

i – identify stakeholders

To address the initial crisis, management involved all impacted employees; created special training and educational opportunities; created IndPro – first incubator in Norway – to provide mentoring and good advice; sought funding from the municipality and succeeded in establishing Verdal as a “CHANGE” community, eligible for special funding to support new projects.

See the next chart for a view of the Verdal Industrial Park stakeholders

www.ntnu.no
VIP stakeholders

- Industry Leaders
- Government Education
- Natural Resources
- Future generations
- Employees
- Neighbors
- Tourists
- Citizens

Verdal Industrial Park

www.ntnu.no
Verdal and iFACE – F

F – frame the problem

Rather than see the lost jobs as a problem that belonged to the employees, or the community alone, Aker Verdal management saw this as a joint challenge; they provided funding through IndPro and gave over the former administration building to house the new incubator.

Today, the community is looking for ways to increase the interactions between the firms – especially reuse of by-products; distance heating.
Verdal and iFACE – A

A – generate alternatives

Many alternatives were available; putting the employees on welfare as unemployed workers, to providing education, funding assistance for entrepreneurial ventures. Other measures were considered as ways to help mitigate the overall impact of the lost jobs – creation of an industrial cluster to replace the former disjointed relationships. Attention is turning to creating a materials flow profile of the park – bringing in experts from the university to conduct MFA and other analyses.
Verdal and ÌFACE – C

C – choose a course of action

Within months of the announcement that the jobs would be lost (1999), IndPro had been established, and the positive actions described earlier were underway. Application for national funding took more time, but that appeared in 2002 (which is not a long time in political decision-making cycles)

Today, leadership is looking to improve the ecological footprint of the industrial park while inviting new firms that can reuse, reclaim or remanufacture using existing byproducts
Verdal and iFACE – E

E – evaluate

Each action was accompanied by continuous scrutiny and progress assessment – this has resulted in a rich archival record.

Permission to observe the process from NTNU graduate students (geography department) resulted in independent assessments of the activities.

This case study is expected to yield results that support future decision-making – thus continuing the cycle!
Individual firm evaluation

<table>
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<th>Application</th>
<th>Integration</th>
<th>Leadership</th>
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<tr>
<td>Application</td>
<td>Application</td>
<td>Integration</td>
</tr>
<tr>
<td>Awareness</td>
<td>Application</td>
<td>Application</td>
</tr>
</tbody>
</table>

x-axis, social; y-axis eco
Case Study – Verdal, Norway


0 % 10 % 20 % 30 % 40 % 50 % 60 % 70 % 80 % 90 % 100 %

Lead
Integrate
Apply
Aware
Conclusions

• The definition of each sustainable community belongs to the people who live in the place – provided they observe basic tenets of equity and stewardship
• Collaboration framework has been found useful
• Eco-industrial park not a quick solution – demands new information and analysis not part of every day thinking