The First International Workshop on Sustainable Consumption
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Towards Sustainable Production and Consumption Systems: Preparedness for Product Service System Concept

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Sustainable Production and Consumption Systems

- Why to have a systems approach?
- How to have a systems approach?

1st Int. Workshop on Sustainable Consumption

Sustainable Production and Consumption Systems

- Why to have a systems approach?
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1st Int. Workshop on Sustainable Consumption

Sustainable Production and Consumption

Why to have a systems approach?

EU-15: Shift to resourcing from other regions

M. Kuhndt
Wupperal Institute - Eco-Efficiency & Sustainable Enterprise Group

Sustainable Production and Consumption

Why to have a systems approach?

EU-15: Shift to resourcing from other regions

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Sustainable Production and Consumption
Why to have a systems approach?

Total resource requirements of EU-15 follow a constant trend & requirements of foreign resources increase. Why?

- **Macro Level Trends**
  - Increase in disposable household income leading increased unit of demand;
  - Trends in the households' lifestyles e.g. individualistic housing practices;
  - Shortened life-time of innovation cycles leading to frequent number of unit purchases;
  - Product chains are getting increasingly global

- **Micro Level Trends**
  - Uncoordinated design efforts with the use phase-leading to resource intensive usage patterns;
  - Increasing complexity of the products so that consumers are unable to manage the technical issues.
  - Outsourcing of resource intensive production steps

Source: Kuhndt, et al., 2003

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Sustainable Production and Consumption
Why to have a systems approach?

**Raw Materials** sourced from a variety of geographical regions

80% of raw materials for a lap-top is resourced from developing countries.

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Sustainable Production and Consumption
Why to have a systems approach?

**Life-cycle of electronic products**

- **Raw Materials extraction**
- **Component manufacturing**
- **Assembly**
- **Use**
- **Disposal**

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Sustainable Production and Consumption
Why to have a systems approach?

**Production-Consumption System**

**Actors and Factors at different Levels**

- **Producers**
- **Retailers**
- **Consumers**
- **Infrastructure Providers**
- **End of life managers**
- **Take-back systems / Remanufacturing**
- **Resource Extraction**
- **Recycling**
- **Waste Processors / Recyclers**
- **Technology Providers**
- **Environmental Consultants**
- **Marketing Organizations**
- **Consumer Organizations**
- **Contractors in other Industries** (petroleum, packaging, transportation, machinery and equipment, etc.)
- **Governmental Institutions**

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Sustainable Production and Consumption
Why to have a systems approach?

**Environmental Conditions**

- **Climate**
- **Inequality**
- **Geography**

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Sustainable Production and Consumption
Why to have a systems approach?

**Economic Conditions**

- **GDP**
- ** Interest Rates**
- **Exchange Rates**
- **Inflation Rates**
- **Growth Rates**

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Sustainable Production and Consumption
Why to have a systems approach?

**Cultural Issues**

- **Education**
- **Lifestyle**
- **Values**
- **Marketing**

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Sustainable Production and Consumption
Why to have a systems approach?

**Social Conditions**

- **Health**
- **Safety**
- **Security**
- **Happiness**
Possible Strategies for a Systems Approach at Different Levels

1. Change the framework state of affairs
   - Reviewing and adapting the economic system in order to focus more on delivery of human welfare and less on economic growth.

2. Question the nature and quantity of consumption
   - Focusing on defining needs and sustainable quantities of consumption.

3. Steer production and consumption systems towards sustainability
   - Business taking responsibility for the creation of production and consumption systems considering TBL aspects via intense interactions with consumers.

Sustainable Production and Consumption

Why to have a systems approach?

- Why to have a systems approach?
- How to have a systems approach?

Functional Thinking and Product Service Systems

Moving towards “Functional thinking”

Considering products as capital assets & consumers paying for the utilisation of the product

Practising the concept of Product Service Systems

Concept aiming to establish a network system of economic and social actors, which can be sustained with a physical infrastructure, delivering a function requested by the consumer at a lower triple bottom line impact level than the one that would be created by the assembly of discrete production chains to fulfill the same function.

Different fields of demand

Material intensity per capita per year

- 75 tonnes
- 66.8 tonnes
- 76 tonnes

Material intensity per capita per year

- others
- community
- leisure
- food
- recreation

The hidden material “rucksack”

- displacement
- emissions
- biological raw materials
- mineral raw materials

The visible material load

- earth
- erosion
- displacement
- emissions

Preparedness for PSS concept

1st Int. Workshop on Sustainable Consumption
Product Service System in Focus

Triple Bottom Line Aspects of PSS

- Social Implications
  - Encouragement of social interaction
  - Social equality
  - Preservation of cultural values
  - Support for quality of life

- Environmental Implications
  - Less resource use
  - Less waste generation

- Economic Implications
  - Local economy enhancement
  - Employment opportunities

PSS Applications - ICT Sector

Can ICT sector applications contribute delink "welfare" from "use of nature"?

Future time

'welfare'

'use of nature'

Contribution of ICT e.g. e-commerce?
Product Service System Applications
MIPS as a relevant indicator to measure environmental load

\[
\begin{align*}
\text{MI} & \quad \downarrow \quad \text{Reduce Material Input} \\
\text{S} & \quad \uparrow \quad \text{Increase Service Units}
\end{align*}
\]

**Type I - Supply-chain Optimisation Level**
Decreasing the Material Intensity (MI) of a certain service unit from cradle to grave.

**Type II - Network-wide Optimisation Level**
Increasing the Service Intensity (SI) of a certain amount of material flow.

**Type III - System Optimisation Level**
Decreasing the material flow and increasing the service intensity, simultaneously.

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Non renewable natural recourses requirement of digital music distribution is more than 50% less resource intense compared to other cases.

Scenarios of Digital music distribution

[Source: Kuhndt, et al., 2003](www.digital-eu.org)
Next Steps
Implications from the PSS applications

- The dynamics of each sector is found to be different.
  - PSS applications in the food sector
    - Requirement for the involvement of a diverse range of supply chain actors & stakeholders.
    - Intangible quality aspects of food products gain importance in terms of design input.
    - A cap on the reduction of material flow is foreseen, since supply of tangible goods is always required.
  - PSS applications in the ICT sector
    - Signals for increasing consumer contribution to resource use.
    - Fast-moving applications.
  - Systems specific approach is required.

Product Service System in Focus
Triple Bottom Line Aspects of PSS

- Information
- Financial Resources (Money)
- Natural Resources
- Human Capital

Values & Beliefs

Human Resources

Tool Knowledge

Environmental Implications
  - Less resource use
  - Less waste generation
  - ... 

Economic Implications
  - Local economy enhancement
  - Employment opportunities
  - ... 

Social Implications
  - Encouragement of social interaction
  - Social equality
  - Preservation of cultural values
  - Support for quality of life
  - ...
Preparedness for PSS Concept

- Methodology
- Focus on Business Preparedness & Consumer Acceptance
- Participatory Process for Indicator Selection

1st Int. Workshop on Sustainable Consumption
Preparedness for PSS Concept

**Business Preparedness**

COMPASS Radar

- Results from the strengths and weaknesses profile

**Consumer Acceptance**

- Individual Issues
  - Needs
  - Motivation
  - Involvement
  - Attitudes
  - Self-concept
  - Income
- Social Issues
  - Cultural System
  - Communication System
- Economic Issues
  - Cost Structure
- Environmental Issues
  - Concern for the Environment

**Participative Process for Indicator Selection**

- Vision of Sustainable Consumption and Production
- Initial Categories for Business Preparedness and Consumer Acceptance
- Setting of System Boundaries
- Participative Process for Category and Aspect Enhancement
- Selection of Indicator Sets
  - Corporate Culture
  - Organisational Learning
  - Utilisation of Resources for Networking
  - Individual Issues
  - Social Issues
  - Economic Issues
  - Environmental Issues
- Review of the Indicator Sets

Initial Categories for Business Preparedness

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Preparedness for PSS Concept on different level

- Information
- Financial Resources (Money)
- Natural Resources
- Human Capital

TBL impacts

System Preparedness
Business Preparedness
Supply-chain Optimisation Level
Network-wide Optimisation Level
System Optimisation Level

Conclusions

- There is limited value in looking at the supply or demand side separately. Rather, the focus shall be on the production and consumption system.
- PSS applications, as in the case of information based e-commerce, might allow significant reductions in resource use.
- However, dynamics of each case has to be explored.
- The quantity of resource use and the impact level are intensely studied. Yet, the routes and dynamics of impact creation at the company level deserves attention.
- Preparedness of business for PSS is found to be depended on corporate culture, organisational learning and utilisation of resources for networking.
- Participative processes can be used to get a grasp of business preparedness and consumer acceptance.

Thank you for your attention!

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Further Research Areas

**Understanding of**
- organisational dynamics and aspects that would lead business to take on functional thinking and a life-cycle perspective with a consumer focus;
- the linkages and dynamics between various aspects;
- the link between aspects of business preparedness & consumer acceptance and TBL impacts of PSS applications i.e. how would the impacts change with respect to changes in aspects of preparedness?
- system preparedness beyond business and network-wide preparedness.

**Development of**
- tools for companies to evaluate TBL aspects of PSS applications;
- tools for action and communication such as learning systems for consumers to enhance consumer acceptance.

Sustainable Production and Consumption

**Definitions - Initial Views**
- **The Oslo Symposium and Ministerial Roundtable, February 1995**
  [Sustainable production and consumption is] use of goods and services that respond to basic human needs and bring a better quality of life, while minimizing the use of natural resources, toxic materials and emissions of wastes and pollutants over the life cycle, so as not to jeopardise the needs of future generations.
Sustainable Production and Consumption
Definitions - Stand of the UNEP and UNCSD

- **UNEP, DTIE, 1999**
  Sustainable consumption is not about consuming less, it is about consuming differently, consuming efficiently and having an improved quality of life. It also means sharing between the richer and poorer.

- **UNCSD, 1999**
  Sustainable consumption includes meeting the needs of the future generations for goods and services that are economically, socially and environmentally sustainable.

Sustainable Production and Consumption
Definitions - Business View

- **WBCSD, May 1995**
  Sustainable production and consumption involves business, government and communities, and households contributing to environmental quality through the efficient production and use of natural resources, the minimization of wastes, and the optimisation of products and services. The WBCSD recognises the need for business to take a leadership role in promoting sustainable patterns of production and consumption that meet societal needs within ecological limits. Business can best work towards these goals through responsible environmental management, enhanced competitiveness and profitable operations.

Sustainable Production and Consumption
Definition - Wuppertal Institute

A vision for achievement of equal quality of life through provision of goods and services, which satisfy human needs without depleting absolute amount of natural resources and increasing waste outputs.

Product Service System Applications
MIPS as a relevant indicator to measure environmental load

<table>
<thead>
<tr>
<th>Type of PSS Application</th>
<th>Examples of strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Chain Optimisation Level</td>
<td>Decreasing the Material Intensity (MI) of a service unit from cradle to grave.</td>
</tr>
<tr>
<td>Network-wide Optimisation Level</td>
<td>Increasing the Service Intensity (SI) of a certain amount of material flow.</td>
</tr>
<tr>
<td>System Optimisation Level</td>
<td>Decreasing the material flow and increasing the service intensity.</td>
</tr>
</tbody>
</table>

- Selection of low impact materials
- Reduction of materials along the life-cycle of the product
- Optimisation of supply chain techniques
- Efficient distribution system
- Optimise use phase
- Optimise end-of-life system
- Life extension via modular design
- Multi-functionality as product meets several needs
- Use intensity via collective usage of one product
- Service substitution; substitution of services by less resource intense means
- Integrated systems: integration of products and services into a system to meet functional performance
- Production on demand: supply of pre-determined demand
- Network as platform solutions: systems management via involvement of experts
**SAFE**

*Sustainability Assessment For Enterprises*

A tool for sustainable development of organisations

- An analytical instrument which aims at helping enterprises to improve their competitiveness and to tackle the difficult task of manufacturing in a resource conservative manner.
- SAFE advances the development of ideas and strategies that help organisation to reach these goals.

@ [http://www.wupperinst.org/safe/](http://www.wupperinst.org/safe/)

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**PSS Applications - ICT Sector**

*E-commerce Services*

<table>
<thead>
<tr>
<th>Different Phases &amp; Actors</th>
<th>Degree of electronic support</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Communication</td>
<td>Communication: online</td>
</tr>
<tr>
<td></td>
<td>Delivery: offline</td>
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<tr>
<td></td>
<td>Payment: offline</td>
</tr>
<tr>
<td>(2) delivery</td>
<td></td>
</tr>
<tr>
<td>(3) payment</td>
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</tbody>
</table>

Buyer  Seller

<table>
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<th>Options for product based Ecommerce</th>
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<tbody>
<tr>
<td>Option 1: online</td>
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<tr>
<td>Option 2: online</td>
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<tr>
<td>Option 3: offline</td>
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<td>Option 4: offline</td>
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<td>Option 5: online</td>
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<tr>
<td>Option 6: online</td>
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<tr>
<td>Option 7: online</td>
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</tbody>
</table>
Product Service System Applications

MIPS as a relevant indicator to measure environmental load

Ecological rucksack (ER) value

Type I
Type II
Type III

Service Units

PSS Applications - E-commerce Services

Information-based E-commerce’s less resource intensive...

Natural Resources Requirement

Source: Kuhndt, et al., 2003