Practical Applications of Industrial Ecology and Life Cycle Approaches

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including materials by Prof Roland Clift
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Sustaining Future Ecosystem Services,
University of Bath

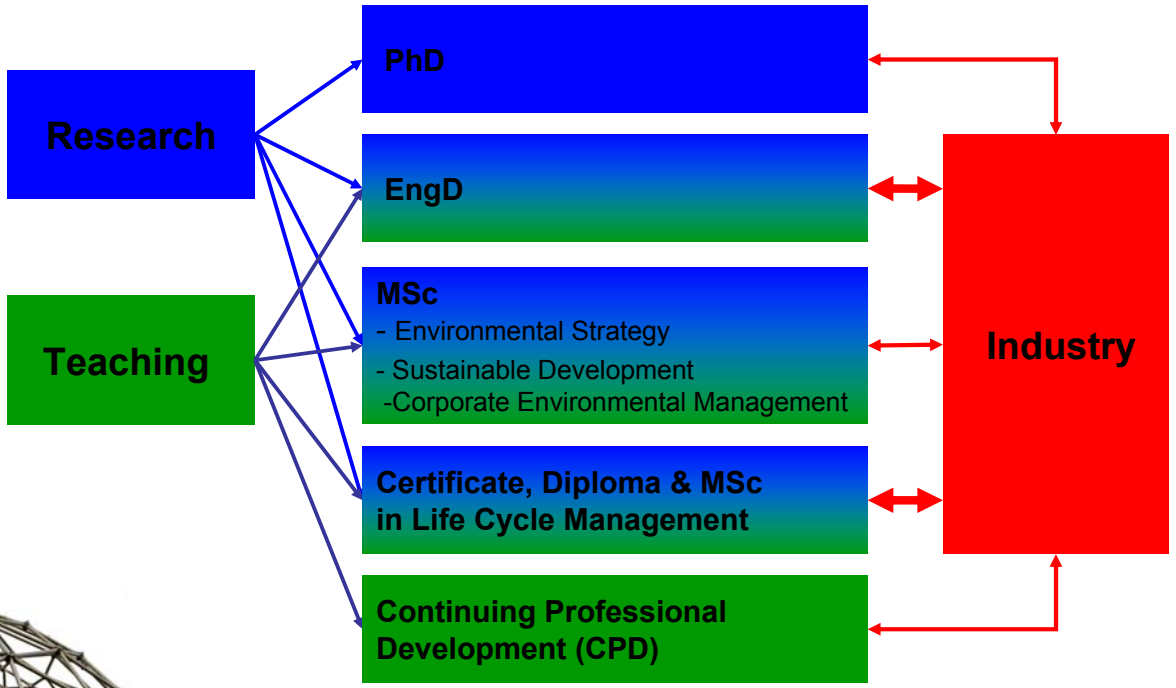
Outline

- Centre for Environmental Strategy (CES)
  University of Surrey
- Eco-Efficiency & Value Chain Analysis
  - Case Study 1:
    Sustainable Food Supply Chains, Marks and Spencer
- Industrial Ecology
  - Case Study 2:
    Decision Support for
    National Industrial Symbiosis Programme (NISP)

What is CES and What Do We Do?

- Postgraduate research and teaching centre within the School of Engineering and Physical Sciences
- Members include engineers, physicists, environmental scientists and managers, geographers, economists, sociologists, psychologists, policy analysts…..
- Multi-disciplinary research and teaching focussed on developing action-oriented, policy-relevant responses to long-term environmental and social issues
- Strong links to industry through collaborative research as well as general and tailored teaching programmes

What is CES and What Do We Do?



Case Study 1:
Sustainable Food Supply Chains
Marks and Spenser

Research Engineer: Sarah Sim (2006)

Academic Supervisors: Roland Clift and Sarah Cowell

Industrial Supervisor: Mike Barry

YOUR M&S

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Centre for Environmental Strategy (CES)

Background

- Research conducted in Marks & Spencer's fresh fruit and vegetable supply chains
- Influential UK-based retailer of food (& clothing)
  - Quality and innovation
  - 100% own-branded food products
  - Control of product development & full traceability
- Motivation: sustainable supply chain management

Research Approach

- Life Cycle Assessment:
  - Principal environmental impacts & stages where they arise

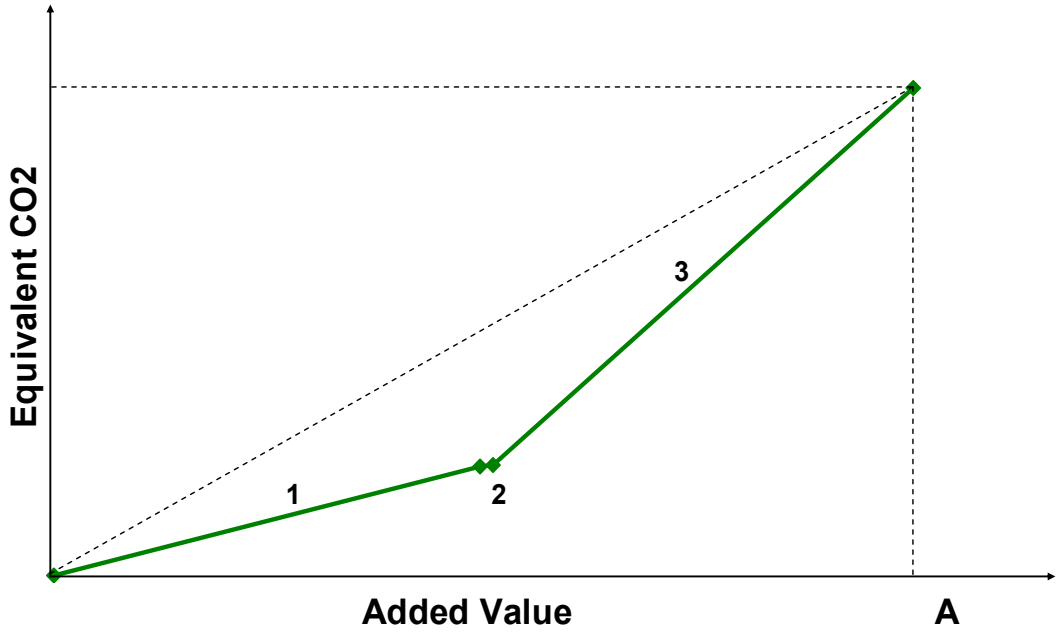
- Application of an Eco-efficiency metric:
  - compare "CO_2 equivalents"/added value for different stages along the supply chain

- Value Chain Analysis:
  - Influence exercised by each agent in the chain (governance pattern)

Example: Watercress

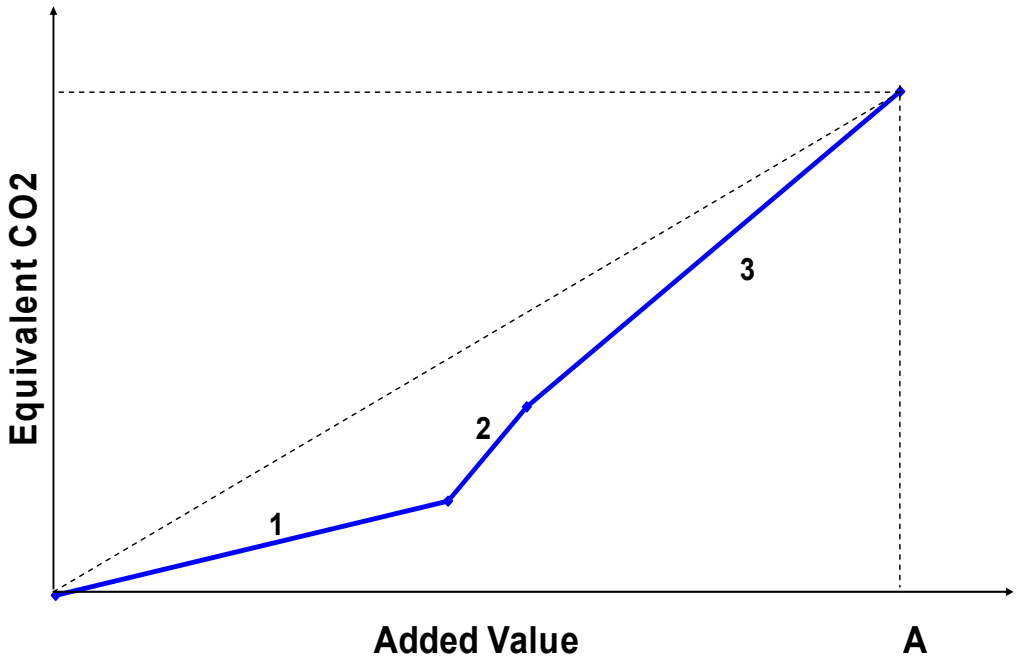
- Alternative sources compared
- System boundaries: Field to pack house
- Principal environmental impacts:
  - Global warming, abiotic depletion and acidification
  - All arise from the same supply chain activities
  - Focus on global warming as a proxy for all three
- Calculation of eco-metric: CO_2 equiv / £
  - For use in supply chain management

Watercress from the UK

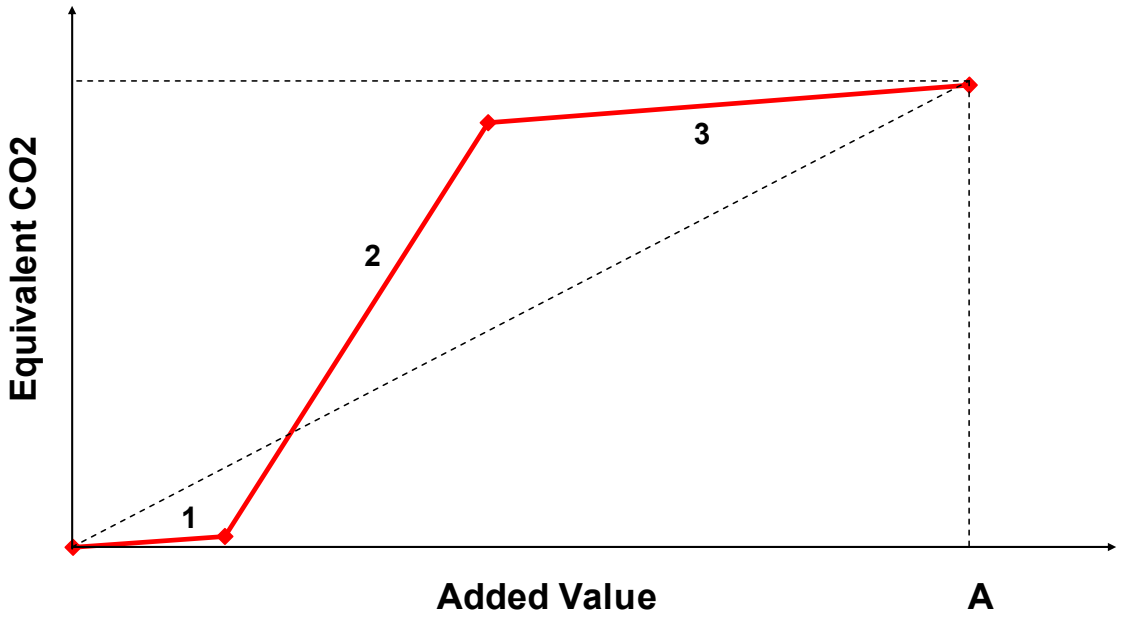


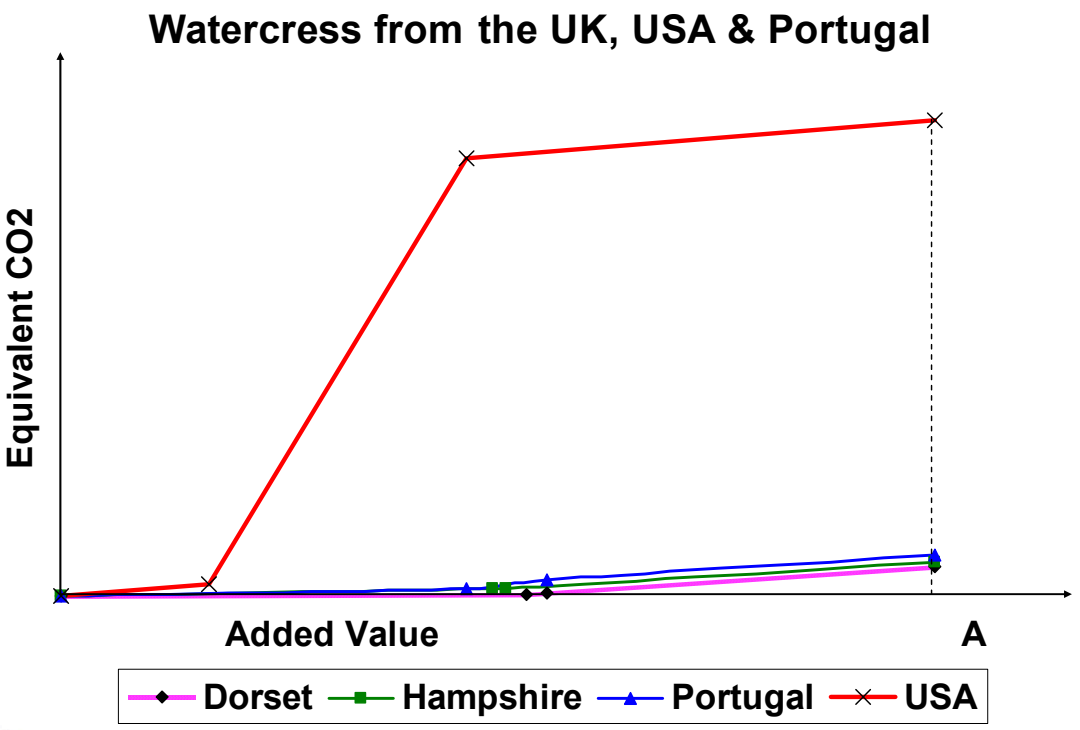
1 = Growing, harvest and vacuum chill
2 = Road transport from farms to pack house
3 = Grading packing and storage

Watercress from Portugal



Watercress from the US




Watercress from the UK, USA & Portugal
Equivalent CO2
Added Value
A
Dorset
Hampshire
Portugal
USA

Eco-efficiency: interpretation

- Uneven distribution of eco-metric along the chain
- Processing activities have high CO_2 equiv/£ & should be targeted for improvement
- Airfreight impacts are grossly disproportionate to economic value added
- Accumulated environmental impact is markedly higher for watercress sourced globally
- European sourcing should be maximised for eco-efficiency

More Typical Value Chain: Mobile Phones: First Use vs Re-use

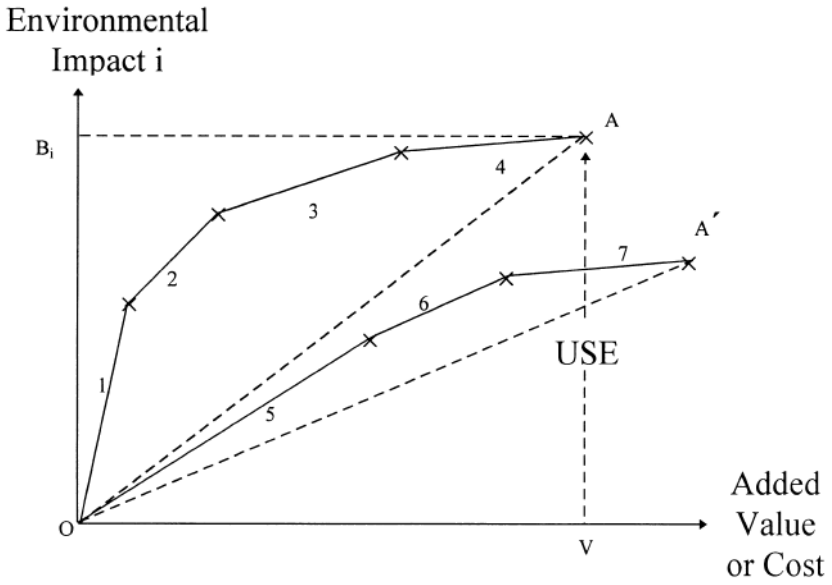


Fig. 4. Primary manufacture and re-use: 1 = Resource extraction; 2 = Processing and refining; 3 = Forming; 4 = Assembly; 5 = Collection; 6 = Dismantling; 7 = Re-assembly.

Clift R and Wright L. (2000). Relationships Between Environmental Impacts and Added Value Along the Supply Chain. *Technological Forecasting and Social Change*, 65 (3) 281-295

Case Study 2:
Decision Support Tools for Industrial Symbiosis
National Industrial Symbiosis Programme (NISP)

Project 1: Multiple Criteria Decision Support for Industrial Symbiosis Development

Research Engineer: David Cobbledick (2007 ongoing)

Academic Supervisors: Lauren Basson and Roland Clift

Industrial Supervisor: Anil Kainth and David-Huw Owen, NISP Central Office

Project 2: Incorporating Industrial Symbiosis into Regional Resource Planning

Research Engineer: Paul Jensen (2008 ongoing)

Academic Supervisors: Lauren Basson, Emma Hellawell and Matthew Leach

Industrial Supervisor: Malcolm Bailey, NISP Yorkshire and Humber; a
David-Huw Owen, NISP Central Office

NISP™ NATIONAL INDUSTRIAL SYMBIOSIS PROGRAMME

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Industrial Ecosystems

- "The network of all industrial processes as they may interact with each other and live off each other, not only in the economic sense but also in the sense of direct use of each other's material and energy wastes" (Ausubel, 1992)
- Existing systems: focus on recycling and reuse of materials and energy → *industrial symbiosis*
- UK National Industrial Symbiosis Programme: (www.nisp.org.uk)

  "brings together companies from all business sectors with the aim of improving cross industry resource efficiency by exchanging materials, energy and water and sharing assets, logistics and expertise."
- Industrial ecosystems by design → *eco-industrial parks*
  Many examples in Far East especially China and South Korea

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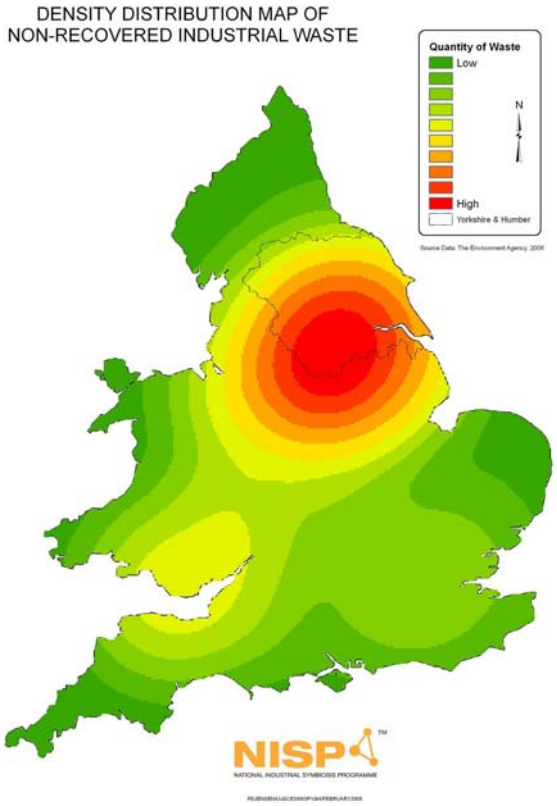
NATIONAL INDUSTRIAL SYMBIOSIS PROGRAMME

Mapping Potential Resource Assets



Data Source: The Environment Agency, 2006

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Some Concluding Remarks

- Practical Application of Life Cycle Approaches
  - Economic and Social Value Chain Analysis
  - Importance of Life Cycle Management

- Practical Application of Industrial Ecology
  - Changing Mindsets – Realising Opportunities
  - Importance of whole systems analysis delivered through comprehensive, but practical and accessible (life cycle based) decision support tools