LCA of long-lasting capital goods in business environment

A case study of paper machines

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Did you know…?

- more than 100.000 single parts
- use over decades
- continuous modification of machine and produced paper

Agenda

1. Project Framework
   - project partners
   - project structure

2. Research Line „Product“
   - product system „paper machine“
   - special characteristics of the product system
   - transferability of LCA results

3. Research Line „Organization“
   - challenges of LCA in business environment
   - quantification of effort and benefit
   - effort-benefit-ratio

4. Open questions and remaining challenges

University and Industry

Lehrstuhl für Unternehmenstheorie: Nachhaltige Produktion und Industrielles Controlling, RWTH Aachen

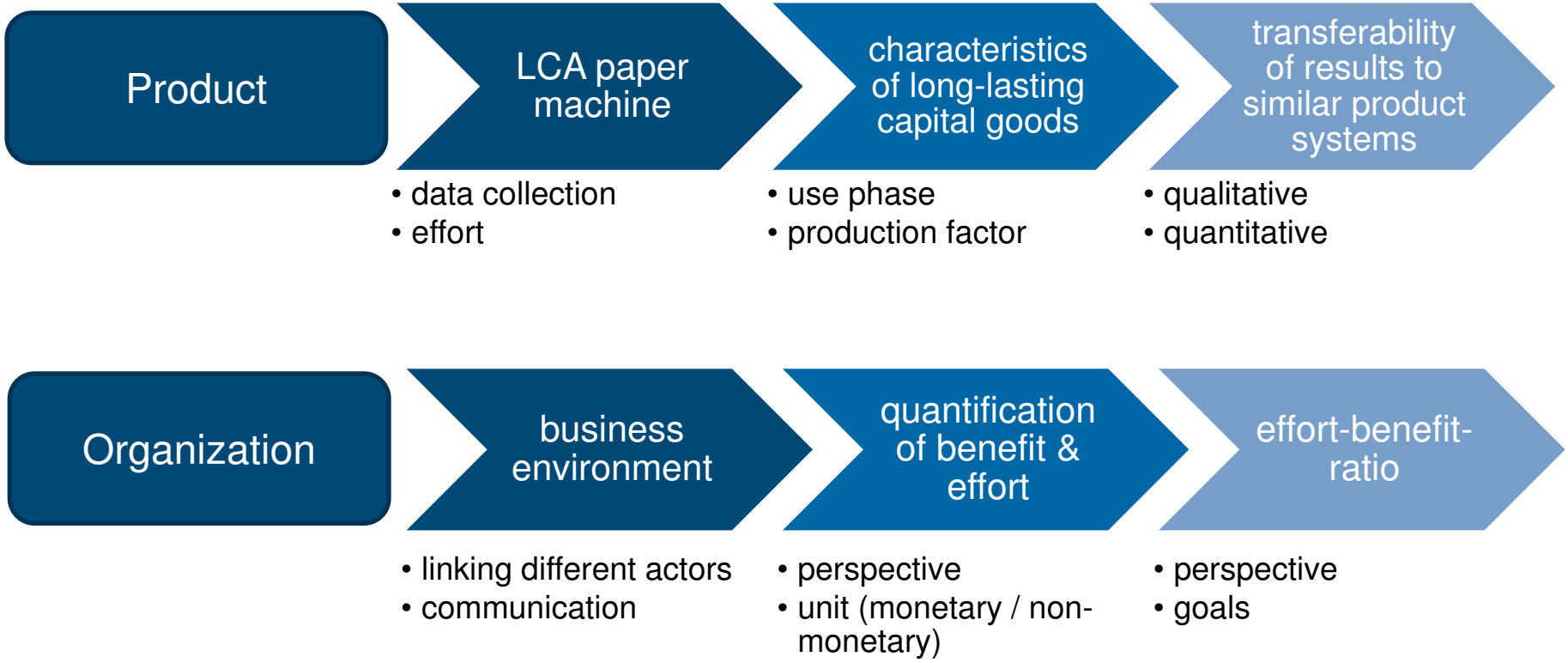
Prof. Dr. Harald Dyckhoff
Scientific staff: 10 research assistants
Research fields: LCA, eco-efficiency-analysis, data-envelopment-analysis among others

Voith Paper GmbH

Staff: 9.353, (Voith Group: 39.754)
Sales: 1,7 bn. € (09/10) (Voith Group: 5.198 bn. €)
Products: paper machines (graphic Paper, Tissue, Board), all related products & services
Headquarters: Heidenheim a.d. Brenz, Germany

Source: Voith GmbH (2010), annual report 2009/2010

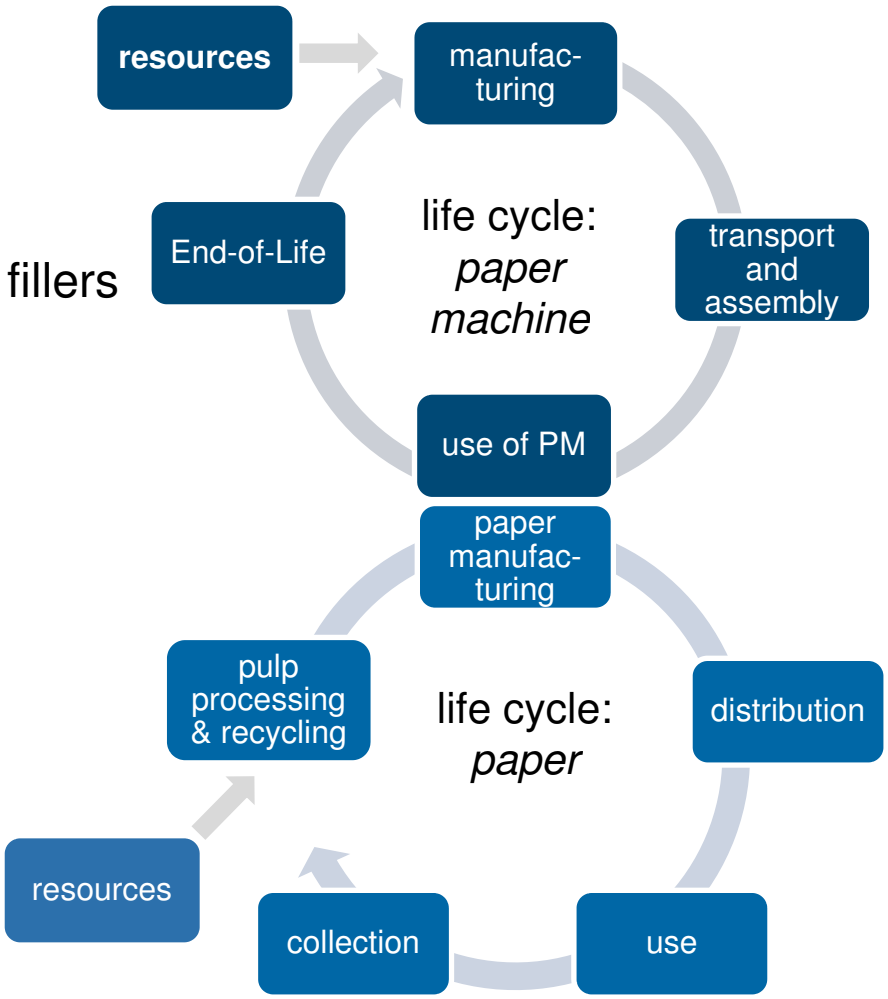
Practice related research lines

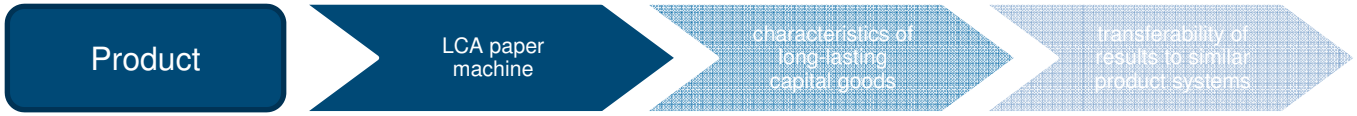


Product systems: paper machine ≠ paper

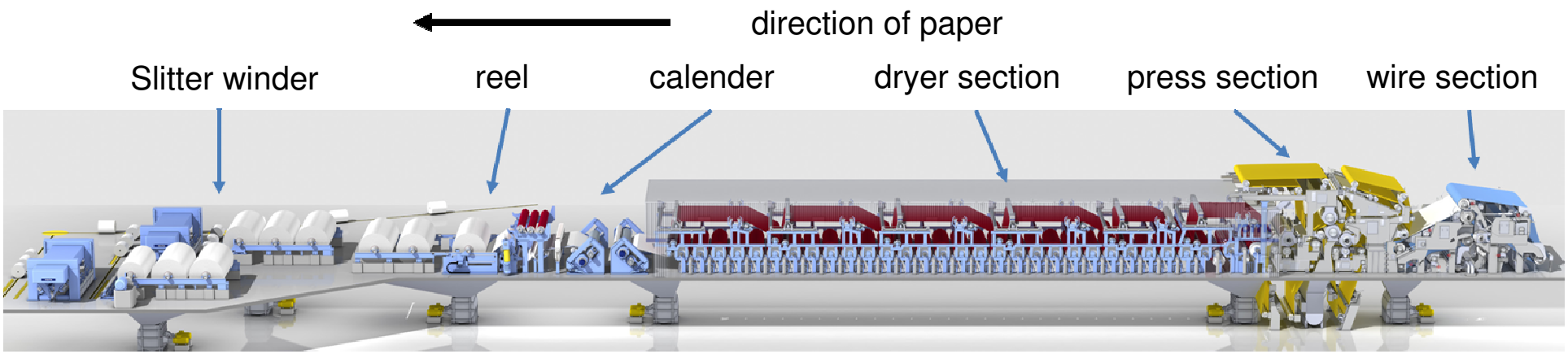
- boundary:
  - paper machine, **NOT** paper
  - no fibres, auxiliary chemicals and fillers included

- product system „Paper“ as research matter:
  - Dias et al. (2007)
  - Finnveden/Ekvall (1998)
  - Gaudreault et al. (2010)
  - Umweltbundesamt (2000)



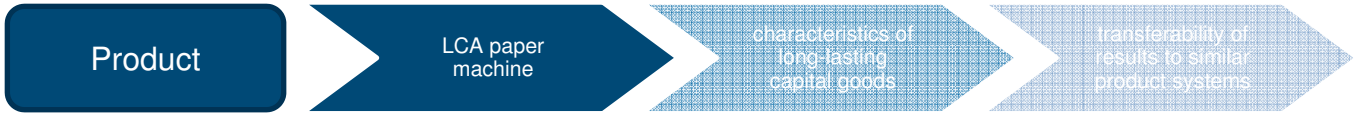


The product system „Paper machine“



Source: Voith Paper

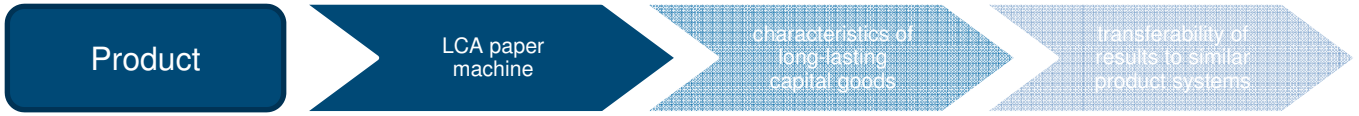
- graphic paper machines
  - up to several 100 m long
  - up to 12 m broad
  - up to several 100.000 t of paper per year



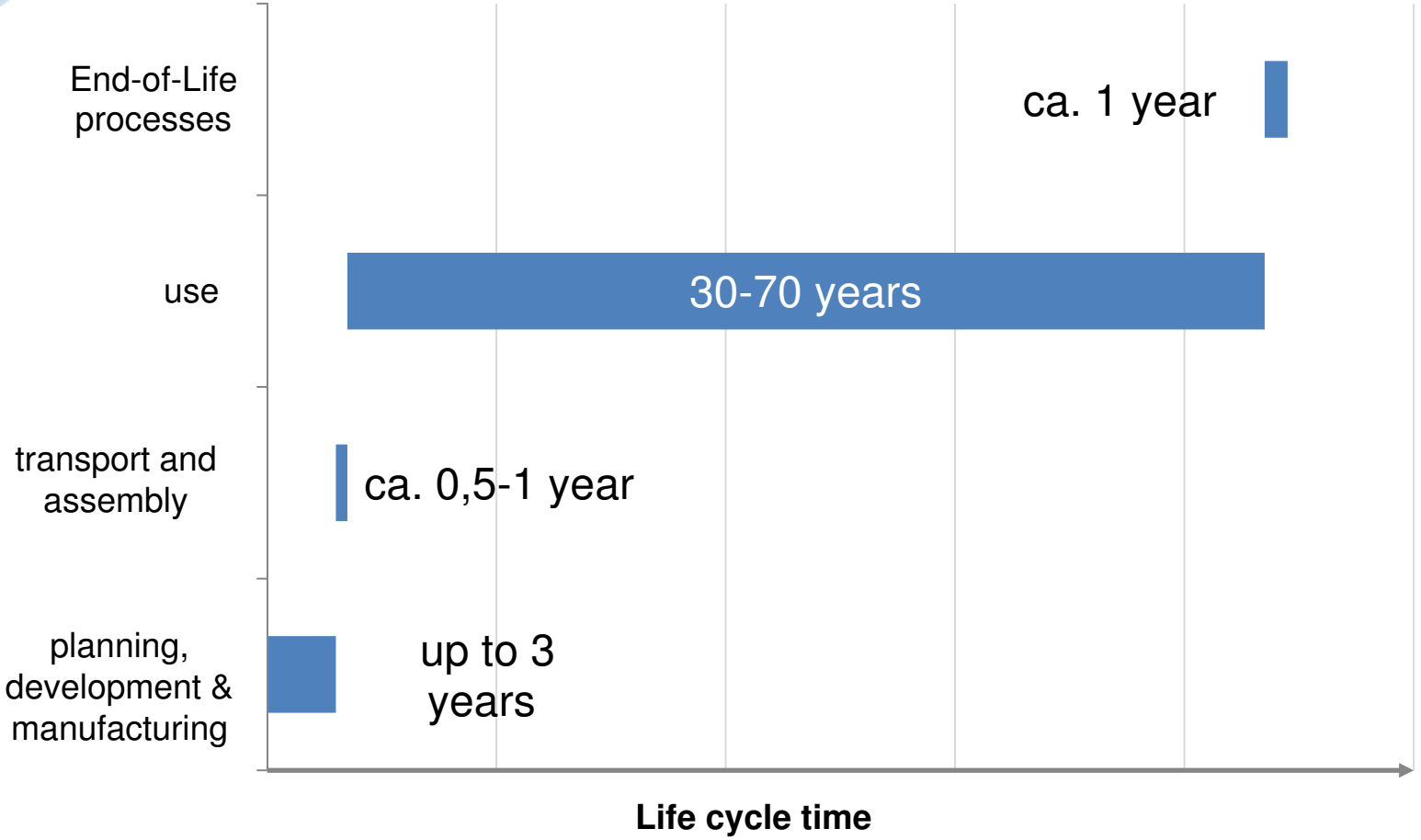
The product system „Paper machine“

- Paper machine as a long-lasting capital good
  - factor of production (Potentialfaktor) for the product paper
  - ➢ embedding in studies of related product systems

- reduction of effort and complexity
  - methodology for data collection
  - definition of detail and quality of the data
  - crosslinking of IT-Systems
  - early expulsion of irrelevant processes and life cycle stages
  - Screening / Streamlined-LCA



Special characteristics of the product system



Product → LCA paper machine → characteristics of long-lasting capital goods → transferability of results to similar product systems

Special characteristics of the product system

- remarkably high relevance of the use phase
  - high demand of electricity and thermal energy
  - modelling of energy supply processes
  - with CHP: allocation / system expansion

- Uncertainty
  - real specifications of the product system vary
  - scenarios, models
  - huge parts of the life cycle in distant future

Transferability of LCA results

- different paper machines for different paper grades
  - principle of technology and process identical
  - technical realization different
  - grade of conformity

- Which insights and results are transferable?
  - qualitative aspects (dominance of use phase)
  - approach and methodological characteristics
  - less transferable: quantitative results

Research line: Organization

- linking different actors
- communication

- perspective
- unit (monetary / non-monetary)

- perspective
- goals

Challenges in business environment

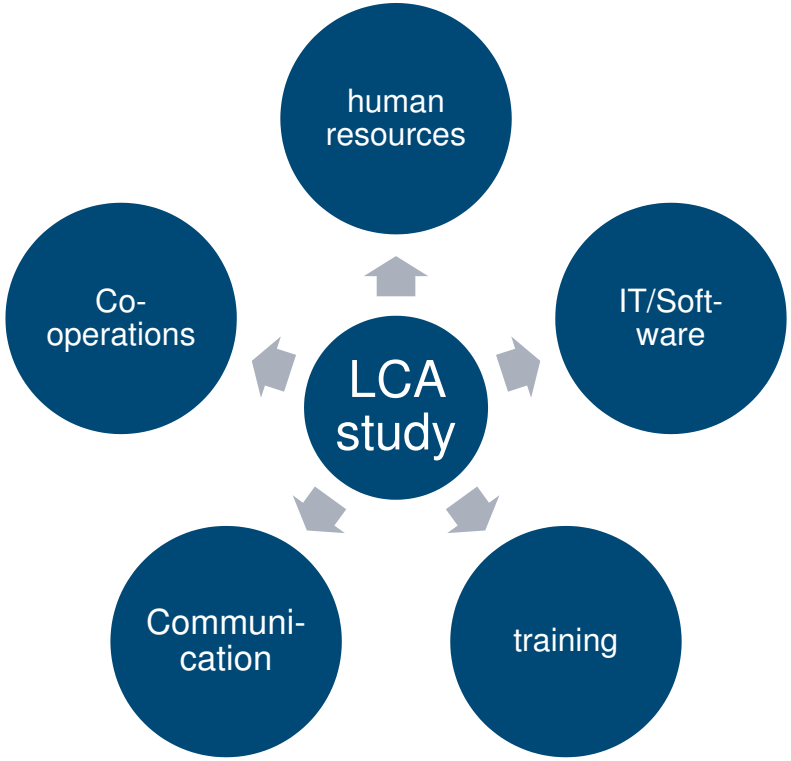
- Framework
  - corporate strategy
  - purpose of LCA study
  - definition of the product system (system boundaries)

- Internal communication
  - knowledge management
    - data collection
    - know-how regarding product and methodology
  - interdisciplinary understanding and interpretation of results

- External Communication
  - product systems cross-link organizations
  - data collection from from suppliers and customers
  - communication of LCA-results

Quantification: effort

- Determining factors
  - initial conditions
  - goals & expectations
  - data availability



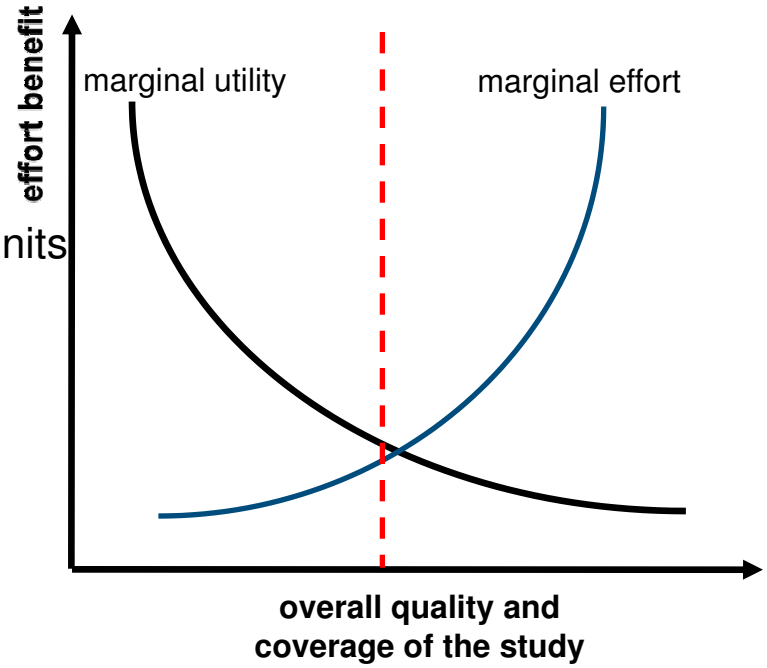
- Measurability
  - monetary
    - Costs
  - non-monetary
    - loss of focus on core business
    - …

Quantification: benefit

- Determining factors
  - quality and credibility
  - scope of impact categories
  - flexibility of calculation models
  - relevance of the product system
  - illustration of results
  - willingness for further use of the results
- Measurability
  - monetary ???
    - increase in sales?
  - non-monetary
    - reputation

Effort-benefit-ratio

- Challenges
  - definition of required / desired quality and coverage
  - comparison of effort and benefit in different units (monetary / non-monetary)
  - weighting of determining factors



Open questions and remaining challenges

- What are the environmental impacts of the product system paper machine?
- What are special characteristics of the product system and how are results transferable to similar systems?
- What are specific challenges in the execution of LCAs in business environment?
- How can effort and benefit of LCA studies be quantified and what is an adequate effort-benefit-ratio?

Literature

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Voith GmbH (2010): annual report 2009/2010, www.voith.de

Thank you for your Attention !
Questions?

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