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NTNU

Innovation and Creativity

# **Environmental Management and Corporate Social Responsibility – the challenges in a globalized world.**

Professor Annik Magerholm Fet  
Norwegian University of Science and Technology - NTNU

XII ICIEOM - Fortaleza, CE, Brasil,  
October 9 to October 11, 2006

# Outline

- Brief introduction to NTNU
- Industrial Ecology, CSR and Sustainability
- Environmental management tools from a system perspective – site, life cycle and value chain
- Exemplification by case-studies
- Sustainability challenges in the future – the tough issues and the need for systems understanding and systems engineering

# NTNU

- Established in 1910
- Technology and natural sciences
- Broad base in the classical disciplines of the humanities, medicine and the social sciences
- National responsibility for
  - technological research
  - interdisciplinary research and cooperation across disciplinary boundaries



# NTNU strategic research areas

- Energy and Environment
- Information and Communication Technology
- Marine and Maritime Technology
- Materials Technology
- Medical Technology
- Globalization



# NTNU Globalization Programme

- Established March 2004
- 140 researchers and 150 research fellows from 27 departments
- Interdisciplinary cooperation is a main goal
- Close ties with both society and industry
- Two main research areas and three cross-cutting perspectives

Cross-cutting perspectives



# Production Systems in a Globalized World

Four thematic areas with projects in:

- Global value chains
- Information technology
- Culture and knowledge
- **Environmental and Social Responsibility**



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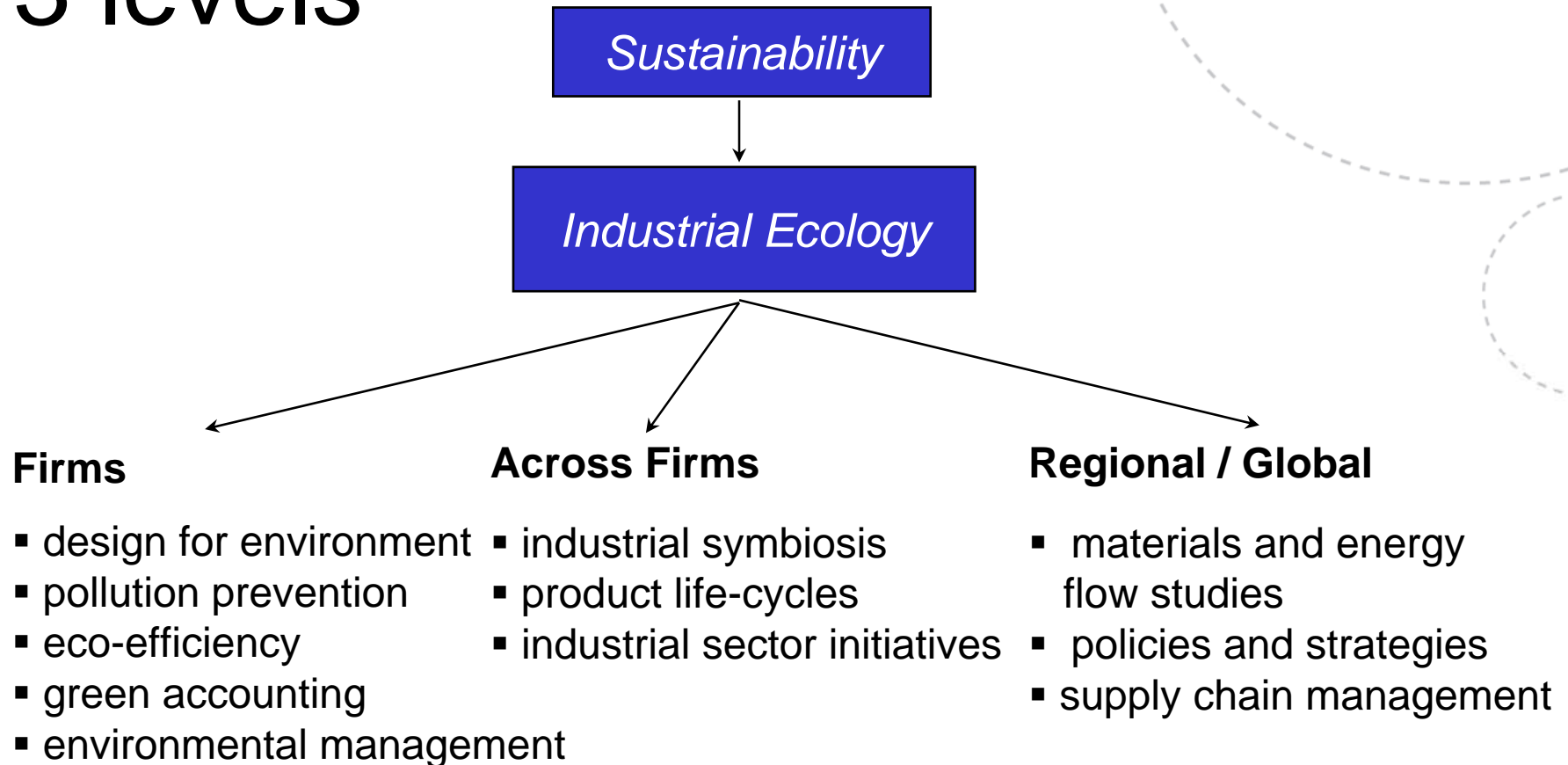
# Industrial Ecology

Industrial ecology is the study

- of the flows of materials and energy in industrial and consumer activities,
- of the effects of these flows on the environment,
- and of the influence of economic, political, regulatory, and social factors of the flow, use, and transformation of resources



# Industrial ecology operates at 3 levels



*At all levels, industrial ecology aims to provide tools and knowledge for analysis and design towards more sustainable solutions.*

# Industrial Ecology at NTNU

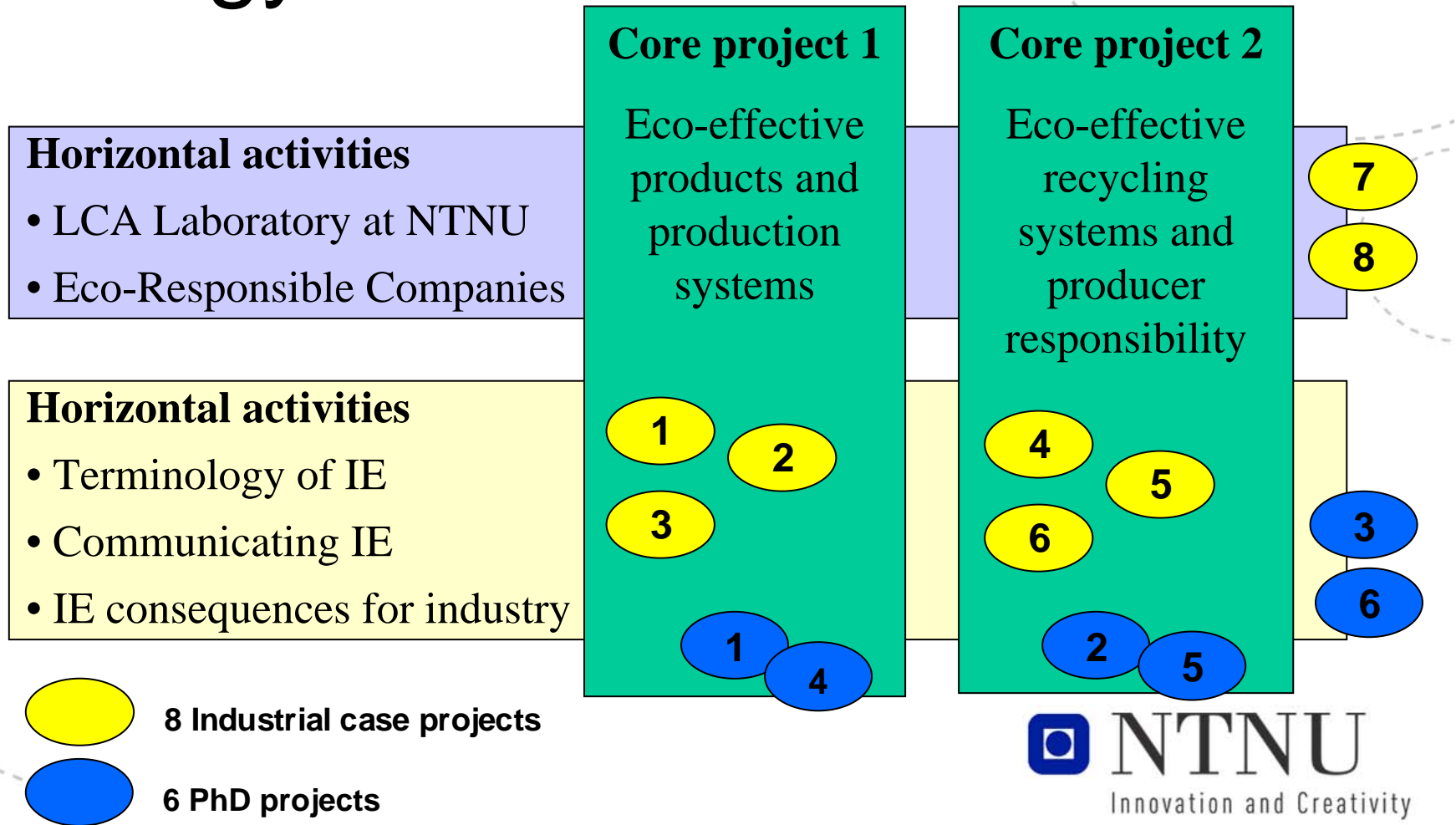
- Initiated in 1993/94, formalised 1998 - Unique
- Strong influence from Norwegian industry
- **3 focus areas:**
  - Education
  - Research
  - Information and outreach
- Strong international alliances



# Major research projects in Industrial Ecology at NTNU

- ✓ **Productivity 2005 Industrial Ecology**
  - Eco-efficiency challenge of the manufacturing industry
- ✓ **Industrial Ecology in energy intensive industry**
  - Life cycle env. performance, exergy performance and energy culture in Oil & Gas industry
- ✓ **Global Watch Industrial Ecology (Statoil)**
  - Life cycle / eco-efficiency performance indicators in cluster of Oil & Gas industry
- ✓ **Additional doctorate projects**
  - SD criteria and eco-efficiency indicators; Extended producer responsibility; Integration of wind energy; Wastes recycling; and, Corporate social responsibility performance

# Productivity 2005 Industrial Ecology



# Corporate Social Responsibility

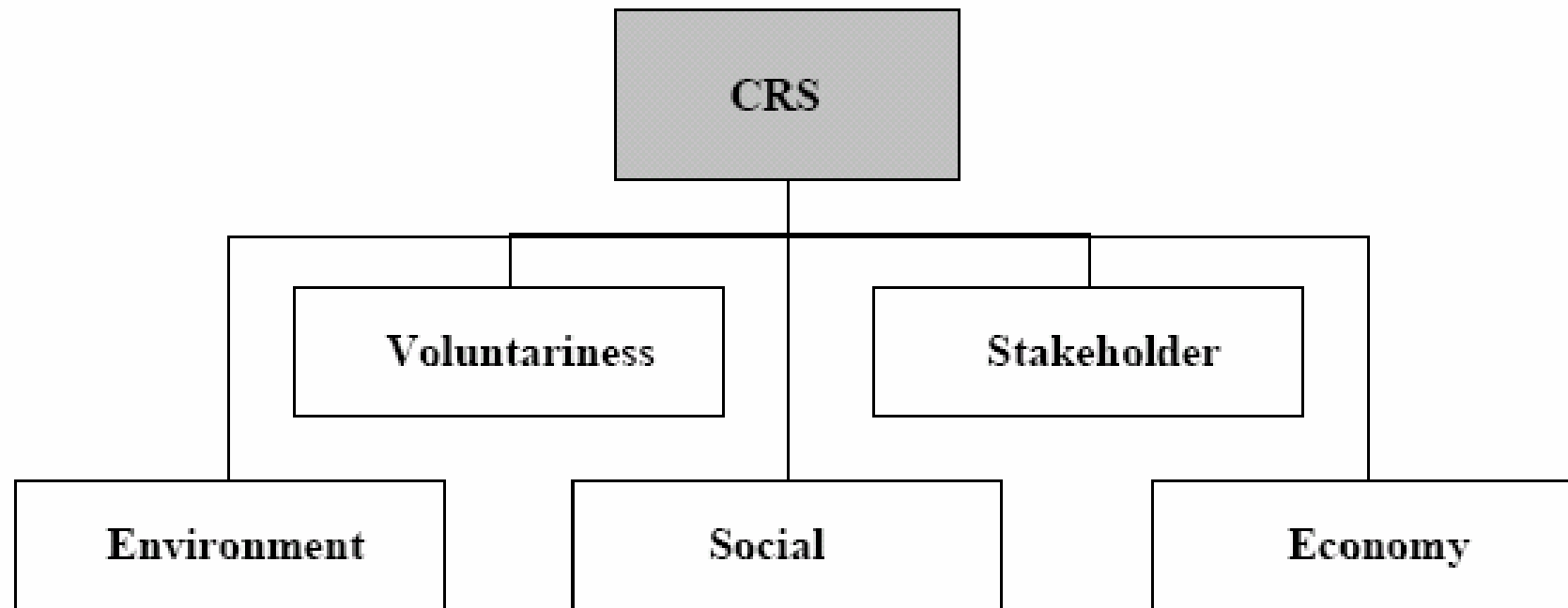
Corporate Social Responsibility (CSR) is about business and industry taking responsibilities beyond that of creating economic value

*“A concept whereby companies integrate social and environmental concerns in their business operations and in their interaction with their stakeholders on a voluntary basis”*

The European Commission

# Content of CSR

(European Commission, 2001)



# Examples of ongoing CSR-projects at NTNU

- Corporate Social Responsibility (CSR) in the US and Norway (CRUSAN) – a “get acquainted” project
- C(S)R in Global Value Chains: a Conceptual and Operational Approach
- Environmental- and global supply management and CSR, proposal for the EU Framework Program 7
- Scandinavian Chapter of Net Impact

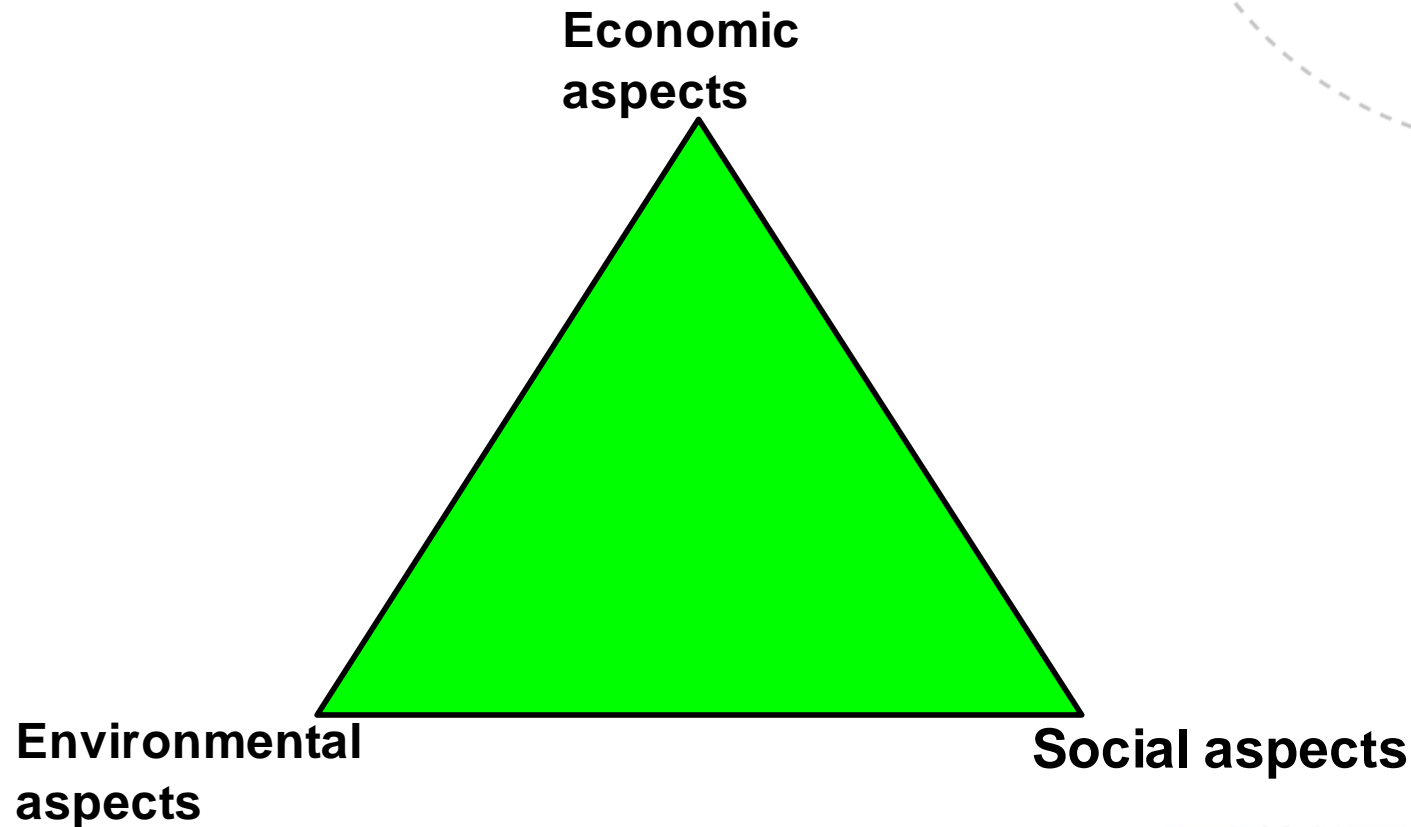


# Sustainable Development

*“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”*

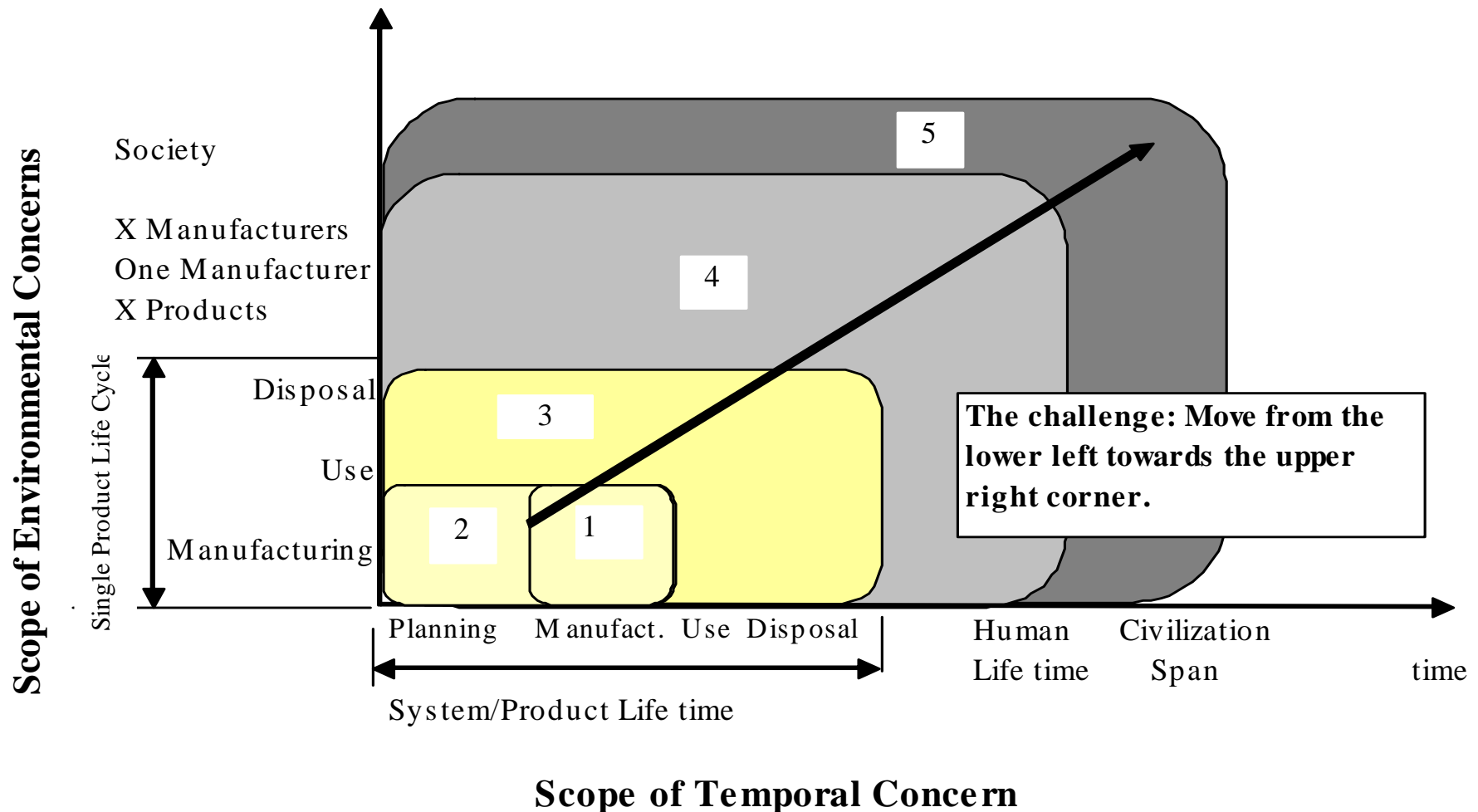
*“Our Common Future” (WCED, 1987)*

# The framework of sustainable development (SD)



# Progress toward sustainability

1. Environmental Engineering,
2. Pollution Prevention,
3. Environmental Conscious Design and Manufacturing
4. Industrial Ecology,
5. Sustainable Development.



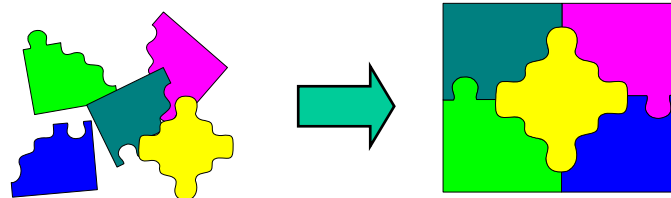
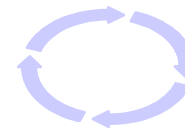
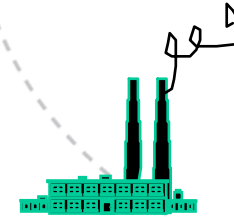
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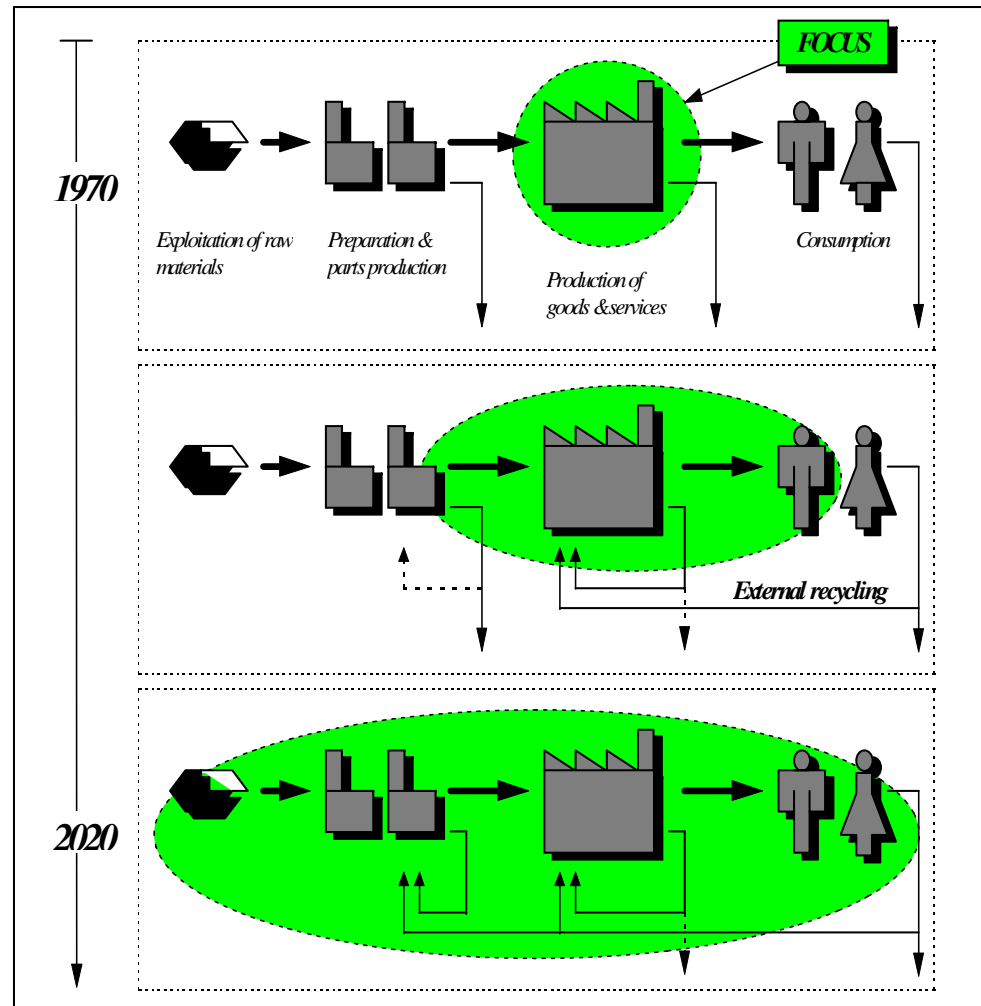
# Environmental strategies

## History

- Dilution strategies
  - 1960
- Filtration strategies
  - 1970
- Recycling- and reuse strategies
  - 1980
- Precautionary strategies
  - 1990
- The holistic perspectives
  - 2000 and beyond



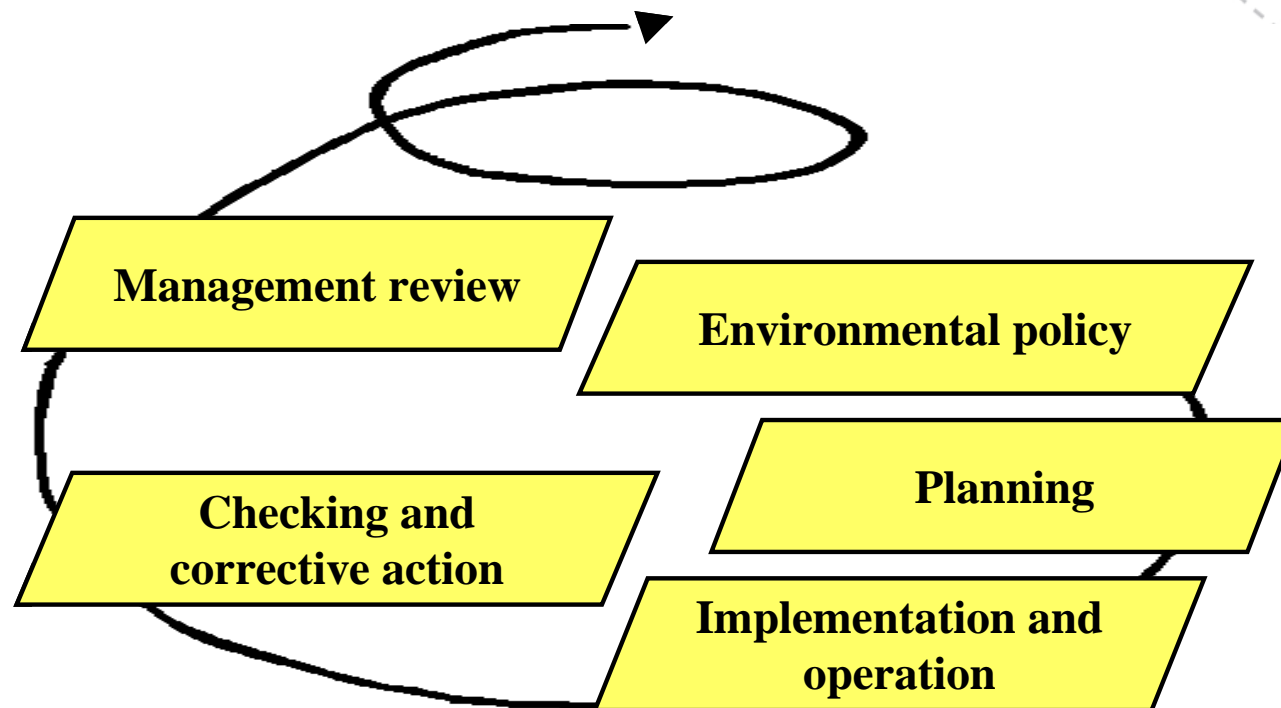
# Increased use of systems thinking



# Environmental management standards (EMS)

ISO 14001,4	Environmental management system
ISO 14020-25	Environmental labels and declaration
ISO 14031	Environmental performance evaluation
ISO 14040-48	Life cycle assessment
ISO 14060	Environmental aspects in product standards
ISO 19011	Auditing
EMAS -	Eco Management and Audit Scheme

# Continual improvement with ISO 14001

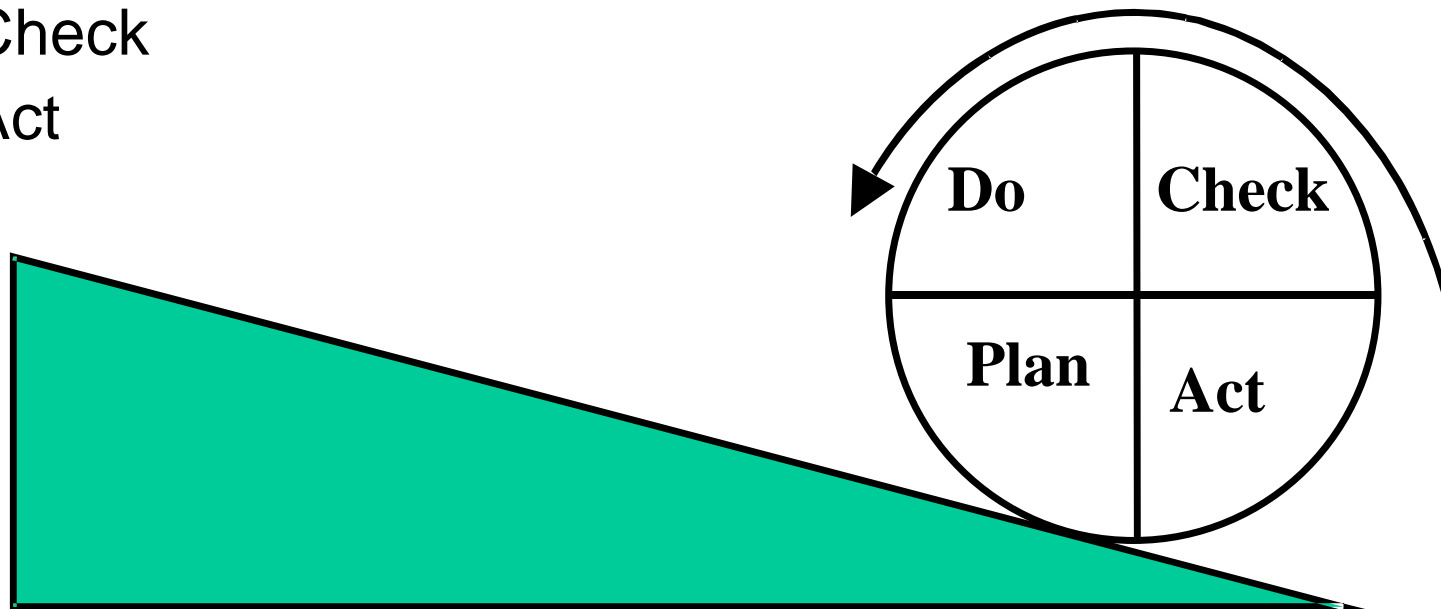




# Continual improvements using PDCA

EMS follow the Shewhart cycle:

- Plan
- Do
- Check
- Act



# How can companies navigate the different tools and standards?

LCA EPI KPI CSR THE NORDIC SWANE  
ENVIRONMENTAL MANAGEMENT ENVIRONMENTAL ACCOUNTING LCC CLEANER PRODUCTION  
ECO-EFFICIENCY ECO-DESIGN EPD  
ENVIRONMENTAL REPORTING ENVIRONMENTAL AUDITING

# Methods and tools categorized

**Cleaner Production (CP)**  
**Environmental Accounting (EAc)**

– **Process related**

**Life Cycle Assessment (LCA and LCC)**  
**Material, Energy and toxicity analyses (MET)**  
**“Material Input per Service Unit” (MIPS)**  
**Design for the Environment (DfE)**

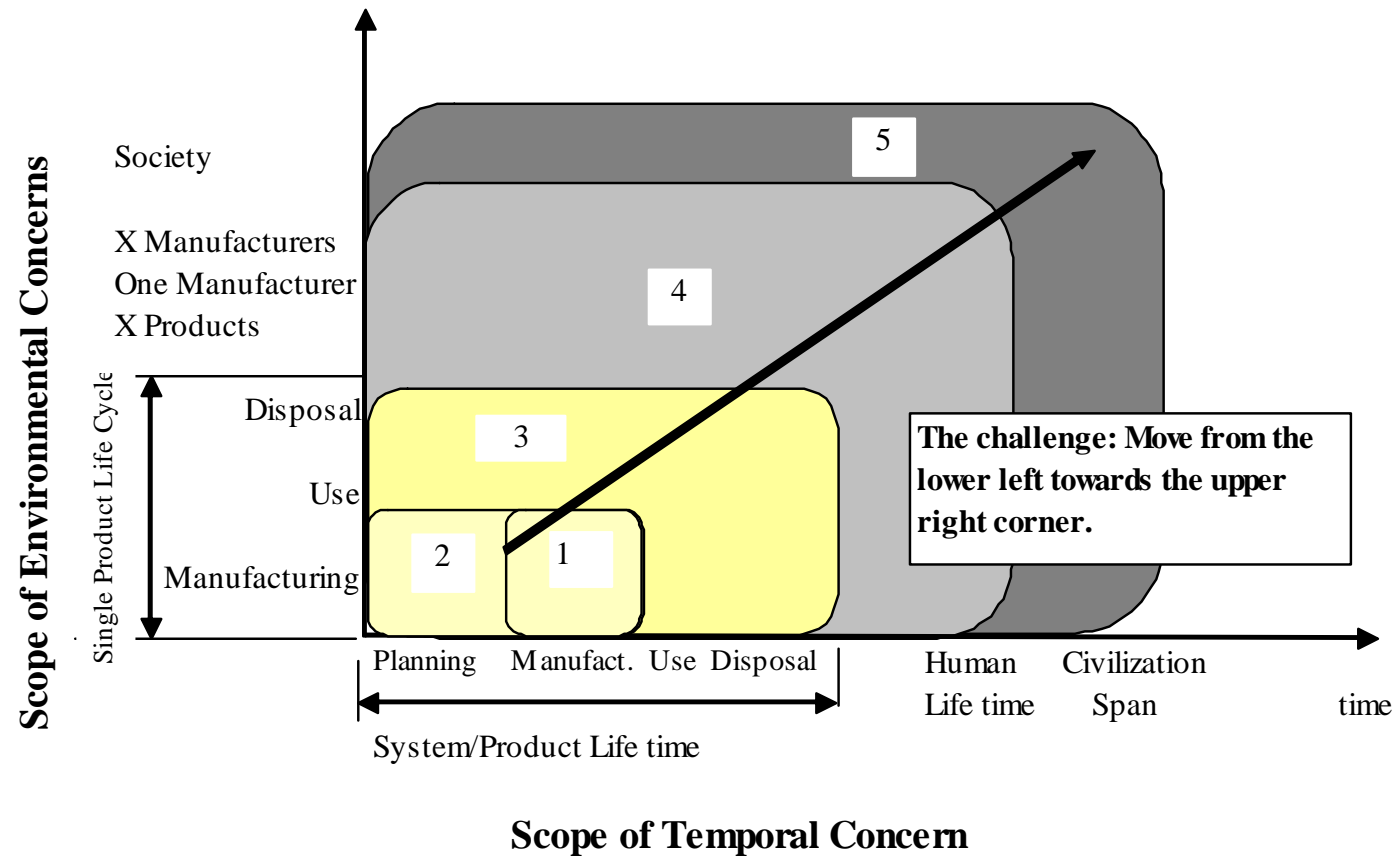
– **Product related**

**Environmental Auditing (EA)**  
**Environmental Performance Evaluation (EPE)**  
**Environmental management Systems (EMS)**

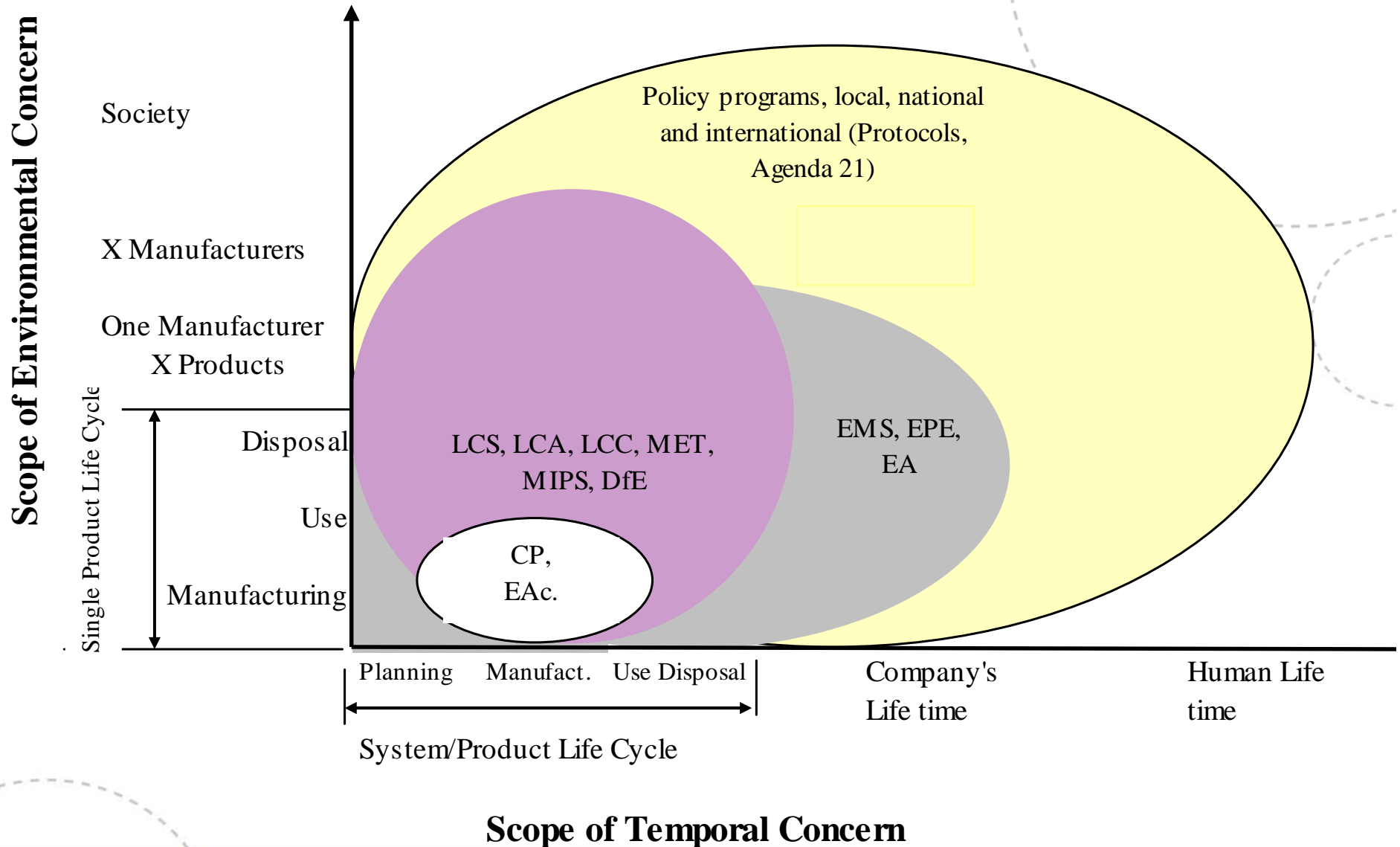
– **Management related**

# Progress toward sustainability

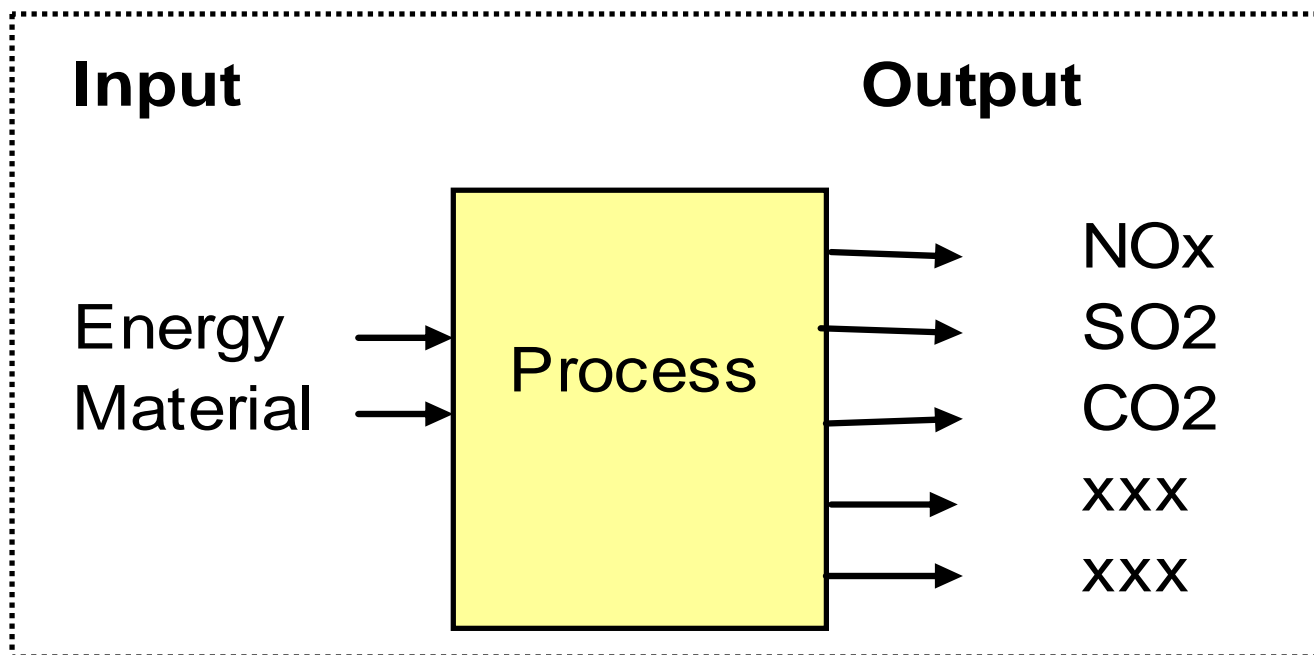
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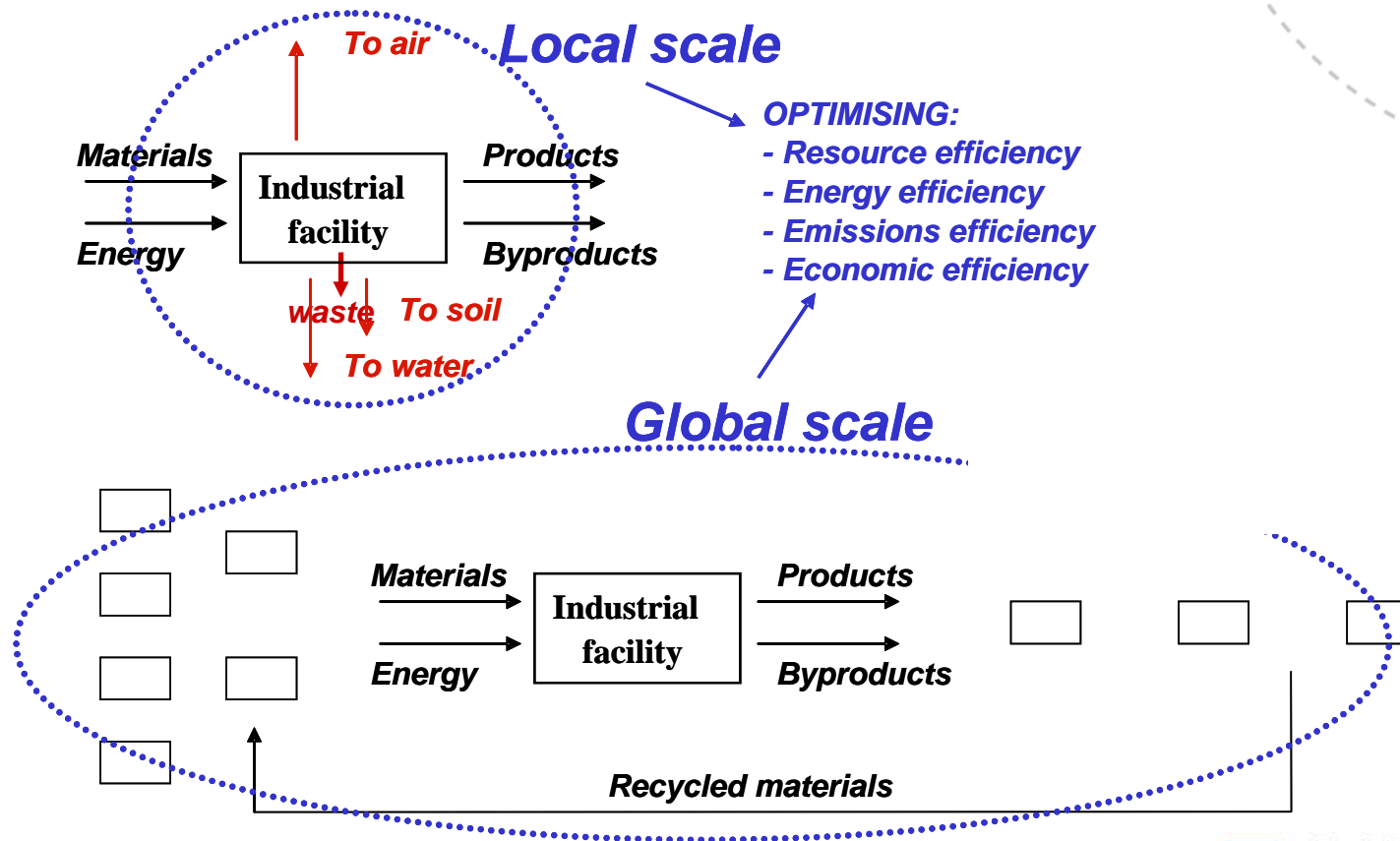
# Application of the methods & tools



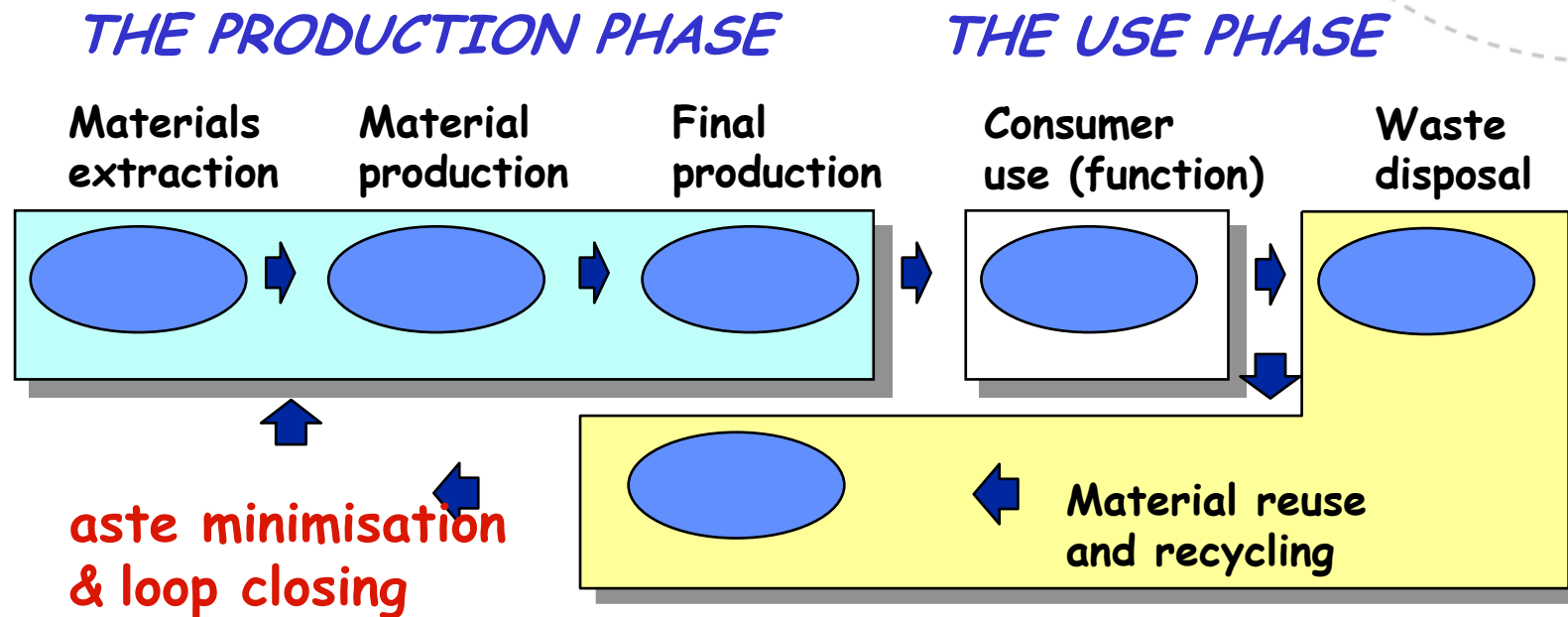
# Input – output model



# Expanding from local to global scale

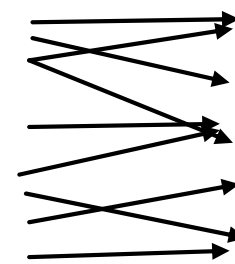
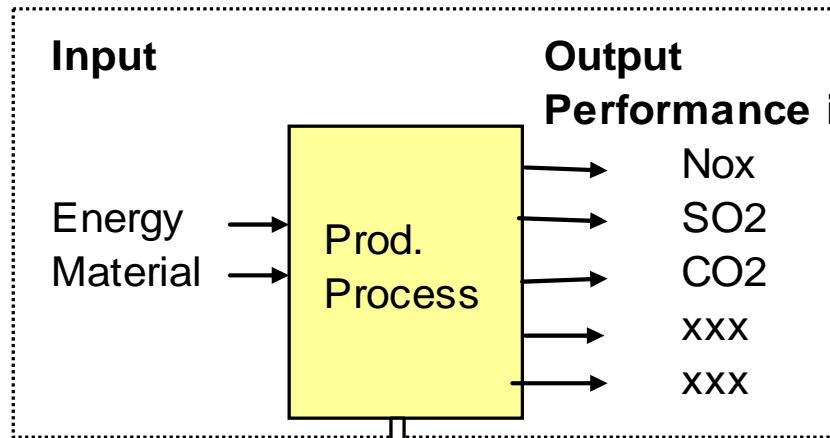


# The product life-cycle



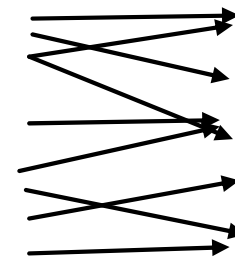
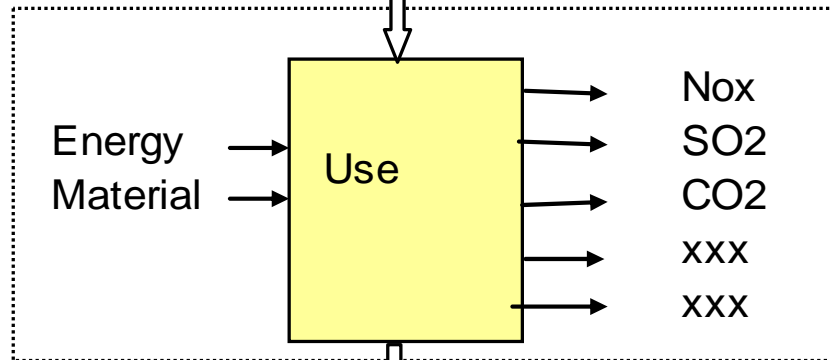
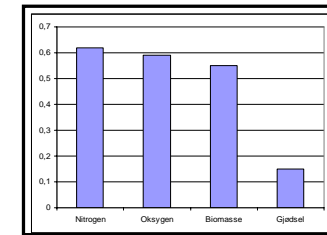
## THE PRODUCT END-OF-LIFE PHASE



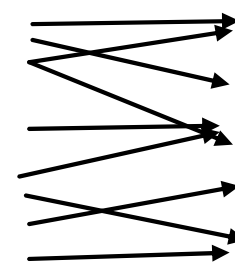
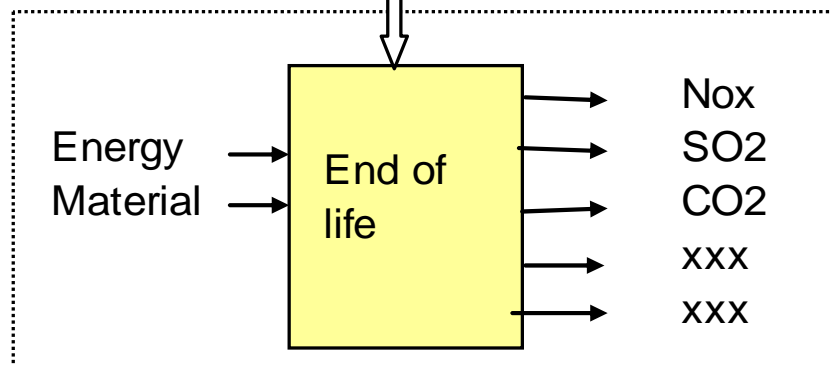
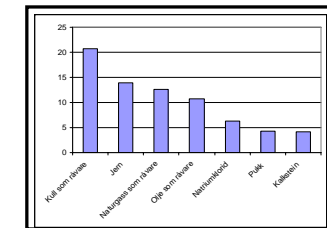


**Environmental Impact category**

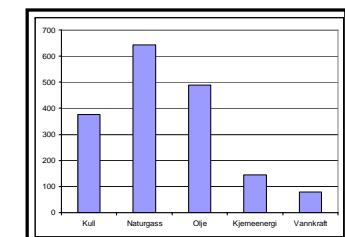
Acidification  
Eutrophication  
Global warming  
Ozon depletion  
YY



Acidification  
Eutrophication  
Global warming  
Ozon depletion  
YY



Acidification  
Eutrophication  
Global warming  
Ozon depletion  
YY



# Global Reporting Initiative (GRI) - guidelines



- the first global framework for comprehensive sustainability reporting, encompassing the "triple bottom line"
- will become the generally accepted, broadly adopted framework for communicating information about corporate performance.
- give guidance to reporters on selecting and using indicators.

**”It was the GRI reporting process that prompted our announcement last fall to increase the fuel efficiency of our SUV fleet by 25 percent by 2005.”**

**Deborah Zemke,**  
Director of Corporate Governance,  
Ford Motor Company,  
April 2001

# THE INDICATOR FRAMEWORK

**Category:** The groupings of economic, environmental and social issues

**Aspect:** The general subsets of indicators that are related to a specific category. A given category may have several aspect

**Indicator:** The specific measurements of an individual aspect that can be used to track and demonstrate performance

- Core indicators (general applicable indicators)
- Additional indicators (business specific indicators)
- Systemic indicators
- Cross-cutting indicators

# THE INDICATOR FRAMEWORK

	CATEGORY	ASPECT
ECONOMIC	Direct Economic Impacts	Customers Suppliers Employees Providers of capital Public sector
ENVIRONMENTAL	Environmental	Materials Energy Water Biodiversity Emissions, effluents, and waste Suppliers Products and services Compliance Transport Overall
SOCIAL	Labour Practices and Decent Work	Employment Labour/management relations Health and safety Training and education Diversity and opportunity
	Human Rights	Strategy and management Non-discrimination Freedom of association and collective bargaining Child labour Forced and compulsory labour Disciplinary practices Security practices Indigenous rights
	Society	Community Bribery and corruption Political contributions Competition and pricing
	Product Responsibility	Customer health and safety Products and services Advertising Respect for privacy

# For environmental issues:

Aspect	Performance Indicators
Suppliers	Performance of suppliers relative to environmental components of programs and procedures described in response to Governance Structure and Management Systems section
Products and Services	<ul style="list-style-type: none"> <li>• Significant environmental impacts of principal products and services.</li> <li>• Percentage of the weight of products sold that is reclaimable (recyclable or reusable) at the end of the products' useful life and percentage that is actually reclaimed.</li> </ul>
Compliance	Incidents of and fines for non-compliance with all applicable international declarations / conventions/treaties, and national, sub-national, regional, and local regulations associated with environmental issues. Explain in terms of countries of operation.

# For environmental issues

The listed performance indicators are addressing requirements upstream:

- Requirements to supplier performances:
  - implementation of environmental management
  - compliance with external regulations
- Requirements about product information
  - environmental impacts from products
  - recyclability of products (end-of life treatment)

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# For social issues, product responsibility:

Aspect	Performance Indicators, examples
Customer Health and Safety	<ul style="list-style-type: none"> <li>• <i>Description of policy for preserving customer health and safety <u>during use of products and services</u>, and extent to which this policy is visibly stated and applied</i></li> <li>• <i>Voluntary code compliance, product labels or awards with respect to social and/or environmental responsibility.</i></li> </ul>
Products and Services	<ul style="list-style-type: none"> <li>• <i>Description of policy, procedures/management systems, and compliance mechanisms related to product information and labeling</i></li> <li>• <i>Number and type of instances of non-compliance with regulations concerning product information and labeling.</i></li> <li>• <i>Description of policy, procedures/management systems, and compliance mechanisms related to customer satisfaction..</i></li> </ul>
Advertising/ Respect for Privacy	<ul style="list-style-type: none"> <li>• <i>Number of substantiated complaints regarding breaches of consumer privacy.</i></li> </ul>

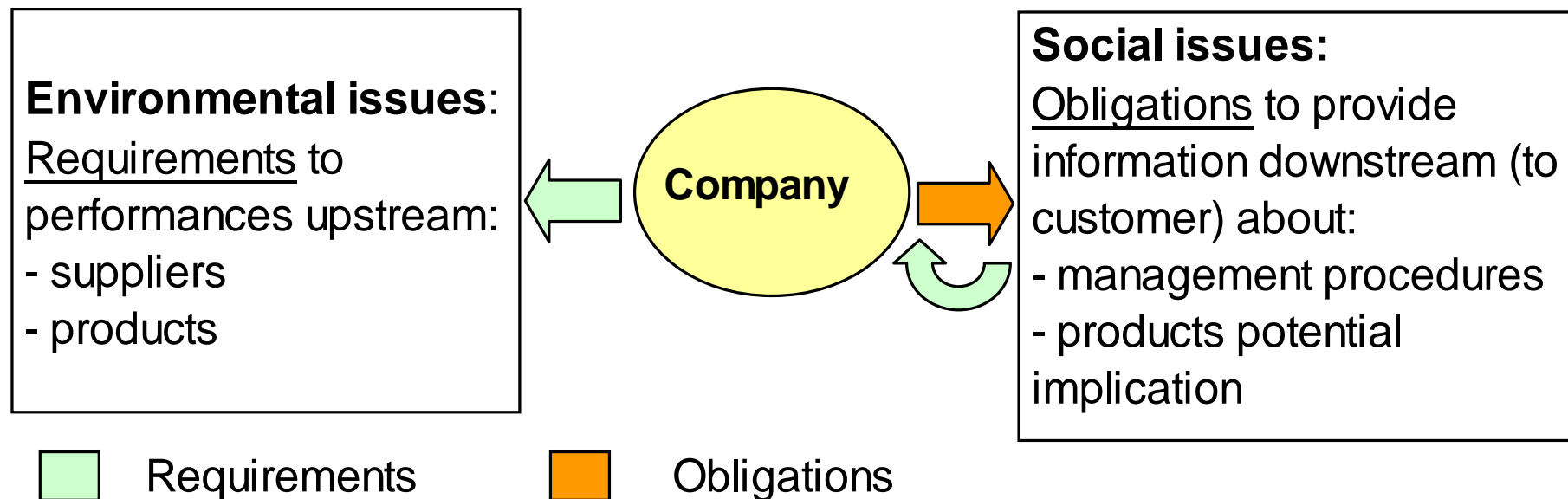
# For the products responsibility aspect under the social issue:

The listed performance indicators are addressing obligations downstream (obligations relative the customers):

- Obligations concerning open information about
  - self-imposed procedures and codes of conduct,
  - internal systems to follow up such
  - openness about complaints and breaches of good practices
- Obligations concerning openness about product information on
  - potential health aspects from products
  - eco-labeling and implemented systems for providing such on own products

# From a company perspective:

- Requirements upstream
- Obligations downstream



# Outline

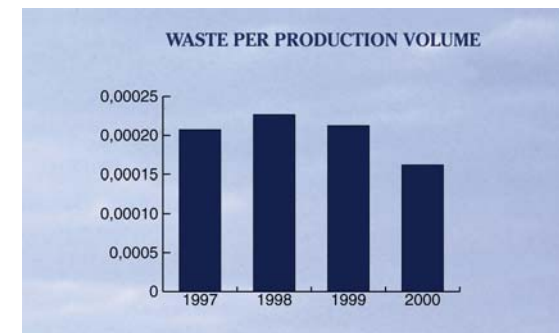
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# Case-examples: from site-focus to global focus in furniture production systems

- Site focus; introduction to environmental accounting systems, cleaner production and EMS
- Local and regional focus; cooperation with neighboring companies and local municipality
- Value chain focus; requirements from customers, LCA on case models, development of environmental product declarations and eco-efficiency indicators
- Future focus on continuous improvement; integrated management systems and environmentally conscious design, showing social responsibility

# Site focus; environmental accounting systems and CP

- Input-output analysis
- Yearly accounting systems for the company
- Performance indicators and reporting systems
- Indicators on purchase, resource usage, energy usage and waste



# Local and regional focus:

Challenge to develop indicators that communicate the environmental performance among different stakeholders with a common interest in a region:

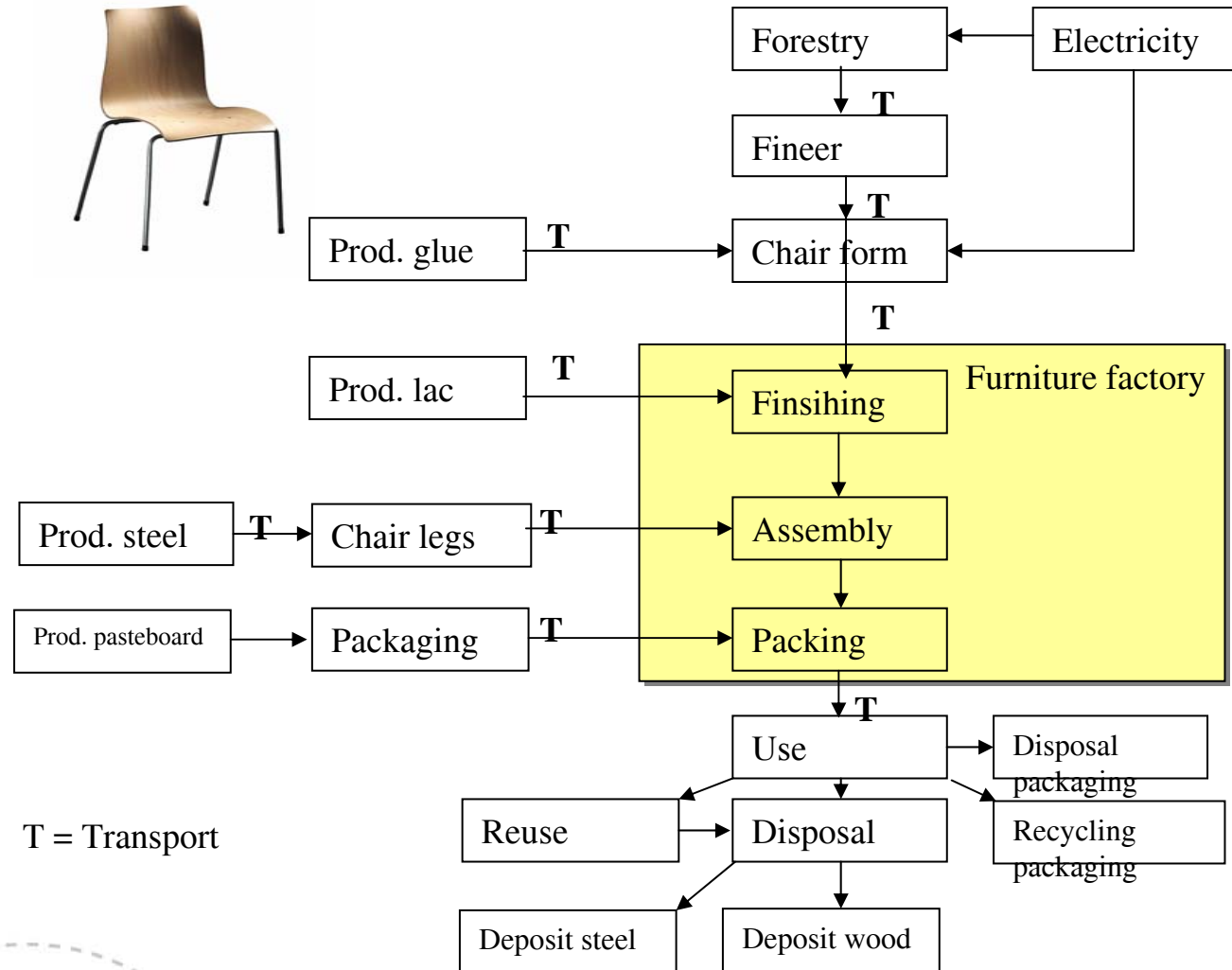
Environmental performance indicators (EPI) for companies measuring e.g.:

- Energy usage
- Emission to air
- Discharge to water bodies
- Waste

Environmental condition indicators (ECI) for the municipality and the regional governmental level measure:

- energy supply
- air quality,
- water bodies quality and
- use of land areas for waste disposal (includes discharges from landfill areas)

# Value chain focus: LCA and environmental product declarations





# Environmental Product Declarations – single products and product series

### Miljøvaredeklarasjon (MVD) type III.

**Bris Stabilestol, i tre ulike utgaver.**  
Holland Møbler AS, Norge

Figur 1: Bris stabilestol

Informasjon om produsent:  
Holland Møbler AS, Norge  
Kontaktperson: Magnar Skjellum.  
Telefon: 7027900  
E-post: [Magnar.Skjellum@holland.no](mailto:Magnar.Skjellum@holland.no)  
Organisasjonens nummer: 943 511 128

Informasjon om produktene:  
Deler av livsløp: Hele livsløpet  
Årstall for studiene: 2002  
Datagrunnlag: Generelle råvaredata 1990-2001  
Rechnisposittilke data 2001  
Funksjonell enhet: En siteløsning for konferanse i 20 år.  
Antatt levetid: 20 år  
Produksjonssted: Holland Møbler AS, Norge  
Antatt markedsområde: Norden

NEPD nr:  
Godkjent, dato: 16/12 2002  
Gyldig til, dato: 31/12 2003

Deklarasjonen er utarbeidet av:  
Institutt for industriell økonomi og teknologiledelse, NTNU.

**OBS: Dette er et foreløpig forslag til MVD for ulike utgaver av et møbel. Datagrunnlaget er ikke verifiserbart**

Erklæring fra verifiseringsorgan:

**MVD**

I henhold til ISO 14040-43 og 14025 TR

		Bøkefinner	Stål	Skumplast	Tekstil	Annet	Totalt
Bris, finert	Andel av total (%)	52,0	47,5	0	0	0,5	100
	Masse (kg/FE)	2,30	2,1	0	0	0,02	4,42
Bris, finert med hull	Andel av total (%)	48,5	51,0	0	0	0,5	100
	Masse (kg/FE)	2,0	2,1	0	0	0,02	4,12
Bris, overstoppet	Andel av total (%)	49,6	45,3	1,1	3,6	0,4	100
	Masse (kg/FE)	2,3	2,1	0,05	0,173	0,02	4,62

\*Under "annet" inngår ulike stoffer som har gått under cut-off. Eksempler på slike er muttere, gumminotter o.l.

### UTSLIPP OG MILJØPÅVIRKNINGER

#### Miljøpåvirkninger

Enhet	Avfall	Overgjødsling	Fotooksidanter	Nedbryting av ozon	Forsuring	Drivhuseffekt
	kg/FE	kg O <sub>2</sub> -ekv/FE	kg POCP-ekv/FE	kg ODP/FE	kg SO <sub>2</sub> -ekv/FE	kg CO <sub>2</sub> -ekv/FE
Bris, finert	6,90	5,89*10 <sup>-3</sup>	0,164	7,48*10 <sup>-7</sup>	0,0658	30,06
Bris, finert med hull	6,73	5,92*10 <sup>-3</sup>	0,153	7,68*10 <sup>-7</sup>	0,0651	26,85
Bris, overstoppet	7,07	6,14*10 <sup>-3</sup>	0,150	8,89*10 <sup>-7</sup>	0,0646	26,73

Figur 4: Avfall fordelt på livsløpsfaser

Figur 5: Overgjødsling fordelt på livsløpsfaser

Figur 6: Fotooksidanter fordelt på livsløpsfaser

Figur 7: Nedbryting av ozon fordelt på livsløpsfaser

Figur 8: Forsuring fordelt på livsløpsfaser

Figur 9: Drivhuseffekt fordelt på livsløpsfaser

#### Utslipp av helseskadelige stoffer

Enhet	Bris, finert	Bris, finert med hull	Bris, finert, overstoppet
PAH mg/FE	0,187	0,210	0,188
Dioksiner mg/FE	0,104	0,104	0,107

### Miljøvaredeklarasjon (MVD) type III.

**MIO-IV**  
HOV+DOKKA A/S, Norge

Figur 1: MIO-IV

Informasjon om produsent:  
HOV+DOKKA A/S, Norge  
Kontaktperson: Marianne Eidehaugen.  
Telefon: 23 24 23 44  
E-post: [Marianne.Eidehaugen@hovdokka.no](mailto:Marianne.Eidehaugen@hovdokka.no)  
Organisasjonens nummer: 943 920 020

Informasjon om produktene:  
Deler av livsløp: Hele livsløpet  
Årstall for studiene: 2002  
Datagrunnlag: Generelle råvaredata 1990-2001  
Rechnisposittilke data 2001  
Funksjonell enhet: En siteløsning for konferanse i 20 år.  
Antatt levetid: 20 år  
Produksjonssted: HOV+DOKKA A/S, Norge  
Antatt markedsområde: Norden

NEPD nr:  
Godkjent, dato: 16/12 2002  
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# How to use the EPD to improve the product?

**Environmental Declaration ISO/DIS 14025 Type III**

**HÅG H04 Credo 4400**



**EPD**  
 Næringslivet Stillebe for Miljødeklarasjoner  
**NEPD nr. 35N**  
 Godkjent av Stillebe sine Verifikasjonskontor:  
*Bjørn Rønne*  
 Gyldig til: 31.12.2016

Deklarasjonen er utarbeidet av: Stillebe Deklarasjonskontor, Desember 2014.

Informasjon om produsent: HÅG ASA, Norge.

Kontaktpersoner:  
 Frank Mag. Sørviq  
 Telefon: 22567660  
 E-post: [frank.mag@hag.no](mailto:frank.mag@hag.no)

Wibe Bergsjøen  
 Telefon: 2267200  
 E-post: [wibe@hag.no](mailto:wibe@hag.no)

Organisasjonsnummer: NO-22002129  
 EMAS ISO 14001 reg.no: NO-5-000005

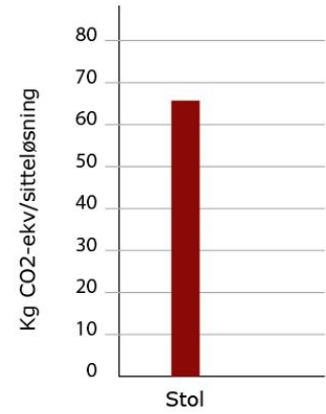
**Sentrale miljøindikatorer** (se tabell for detaljer)

Utslipp av CO <sub>2</sub>	70,3	kg CO <sub>2</sub> -ekv
Totalt utslipp av CO <sub>2</sub>	126,4	kg
Avfall	18,1	kg
Avfall med høyeste prioritet	0,046	kg
Drivhuseffekt	0,44	kg SO <sub>2</sub> -ekv

**Informasjon om produktet**  
 Anvendelsesområde: Stillebe deklarasjoner: fra utvinnning til ferdig produsert sitteløsning, inkludert brukstid.  
 Produktets livsløp: Sitteløsning, produsert og vedlikeholdt i 15 år.  
 Årsall for analyse: 2009/2014  
 Dataopprulling: Produktperioder fra 2002 og 2003. Materialer fra 1994 – 2001.  
 Annet innhold: 15 kg  
 Produkt generert: HÅG ASA, Kåres, Norge  
 Annet markedsnavn: Hågg

**Tabell 1: Produktens miljø- og miljøindikatorer for sitteløsning**

Indikator	Enhet	Verdi	Utslipp	Utslipp	Utslipp	Utslipp	Utslipp
			(kg)	(kg)	(kg)	(kg)	(kg)
Avfall	kg	18,1	18,1	18,1	18,1	18,1	18,1
Avfall med høyeste prioritet	kg	0,046	0,046	0,046	0,046	0,046	0,046
Fotokjemisk reaksjon	kg C <sub>2</sub> H <sub>2</sub> -- ekv	0,036	0,036	0,036	0,036	0,036	0,036
Nedbryting av ozon	kg CFC11 -- ekv	0,000	0,000	0,000	0,000	0,000	0,000
Forsuring	kg SO <sub>2</sub> -- ekv	0,44	0,44	0,44	0,44	0,44	0,44
Drivhuseffekt	kg CO <sub>2</sub> -- ekv	70,3	70,3	70,3	70,3	70,3	70,3

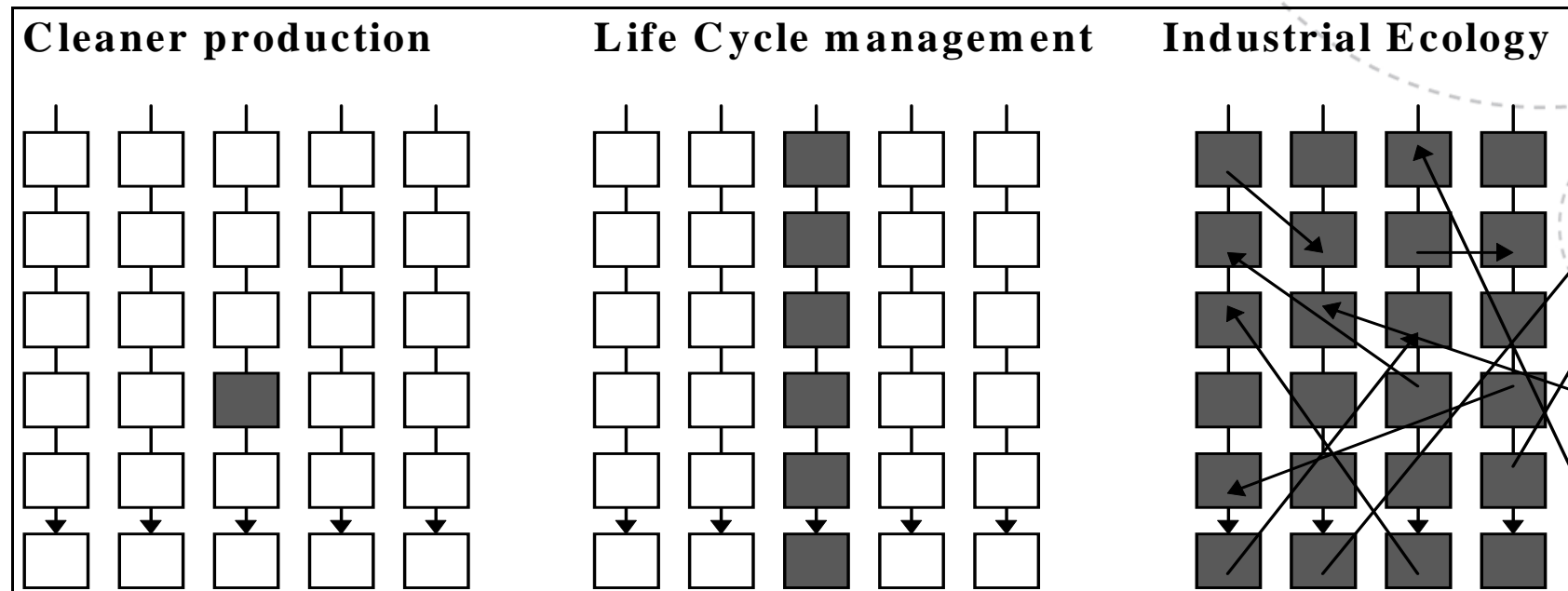


1 Avfall kg	avfall/sitteløsning	18,1
2 Overtgjødning	kg P042 -- ekv/sitteløsning	0,046
3 Fotokjemisk reaksjon	kg C <sub>2</sub> H <sub>2</sub> -- ekv/sitteløsning	0,036
4 Nedbryting av ozon	kg CFC11 -- ekv/sitteløsning	0,000
5 Forsuring	kg SO <sub>2</sub> -- ekv/sitteløsning	0,44
6 Drivhuseffekt	kg CO <sub>2</sub> -- ekv/sitteløsning	70,3

# Outline

- Brief introduction to NTNU
- Industrial Ecology, CSR and Sustainability
- Environmental management tools from a system perspective – site, life cycle and value chain
- Exemplification by case-studies
- Sustainability challenges in the future – the tough issues and the need for systems understanding and systems engineering

# Different systems approach



**MICRO**



**MACRO**

# Research project: CSR in Global Value Chains: a Conceptual and Operational Approach

Project goals:

- undertake a critical examination of current CSR business and regulatory/self-regulatory practices, with a particular focus on distributed industrial organisation in global value chains.
- develop practice-oriented recommendations, mechanisms and tools aimed at improving current CSR performance, reporting and verification systems and regulation.

# Project model

Core Projects:

A firm  
perspective on  
CSR

A regulative  
perspective  
on CSR

A system  
perspective  
and  
operative  
models for  
CSR in value  
chains

Cross-cutting projects:

1. CSR and business-NGO relations (PhD) (NSM)

2. Corporate and product/service CSR reporting (PhD) (NTNU)

3. Measurement of values and risk related to social and environmental issues

# Styles of managing CSR

- Defensive (pain alleviation)
- Traditional (cost-benefit)
- Strategic - shifted business focus into a new direction.
- Learning, innovation and risk management

*Zadek (2001)*

# Corporate Social Responsibility

**Governance  
Leadership**

**Economic impact  
Ethics  
Integrity**

**Pollution/waste  
Energy/resources  
Product safety**

**Environment  
Sustainability**

**Employees**

**Health/safety  
Competence  
Diversity**

**Civil society**

**Market**

**Business conduct  
Corruption  
Reputation**

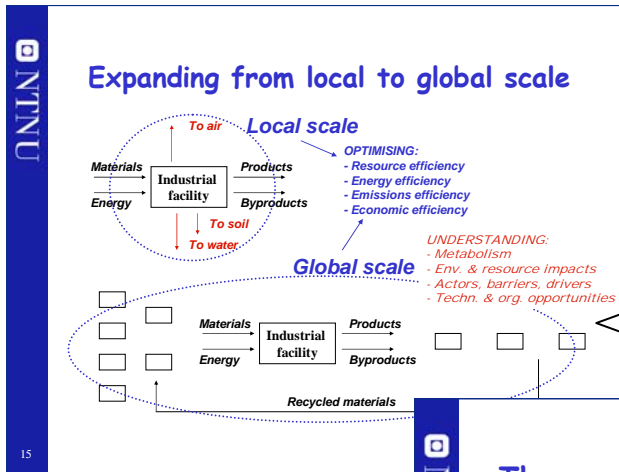
**Human rights  
Local community  
Transparency**

**Authorities**

**Compliance with law  
Business and politics  
Partnerships**



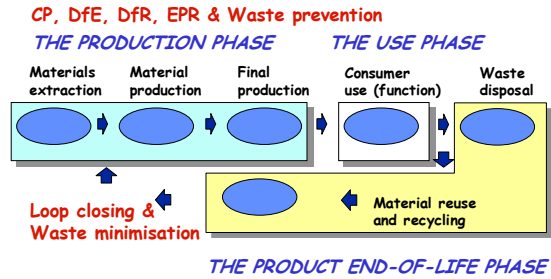
# Change of focus: "site" → "value chain"



CP, EAc, MFA



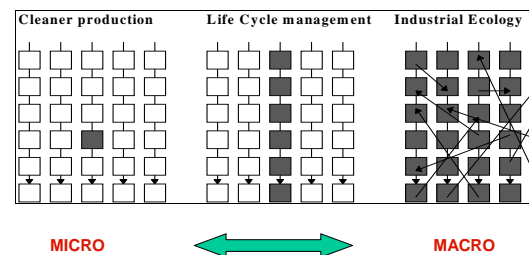
## The product life-cycle



LCA, DFE, EPD

**CSR-strategies**

## Different systems approach



EMS, EA, EPE, EPI, CSR

# The future of CSR

Who are the most important stakeholders for a company?

How can companies best manage the challenges towards sustainable development?

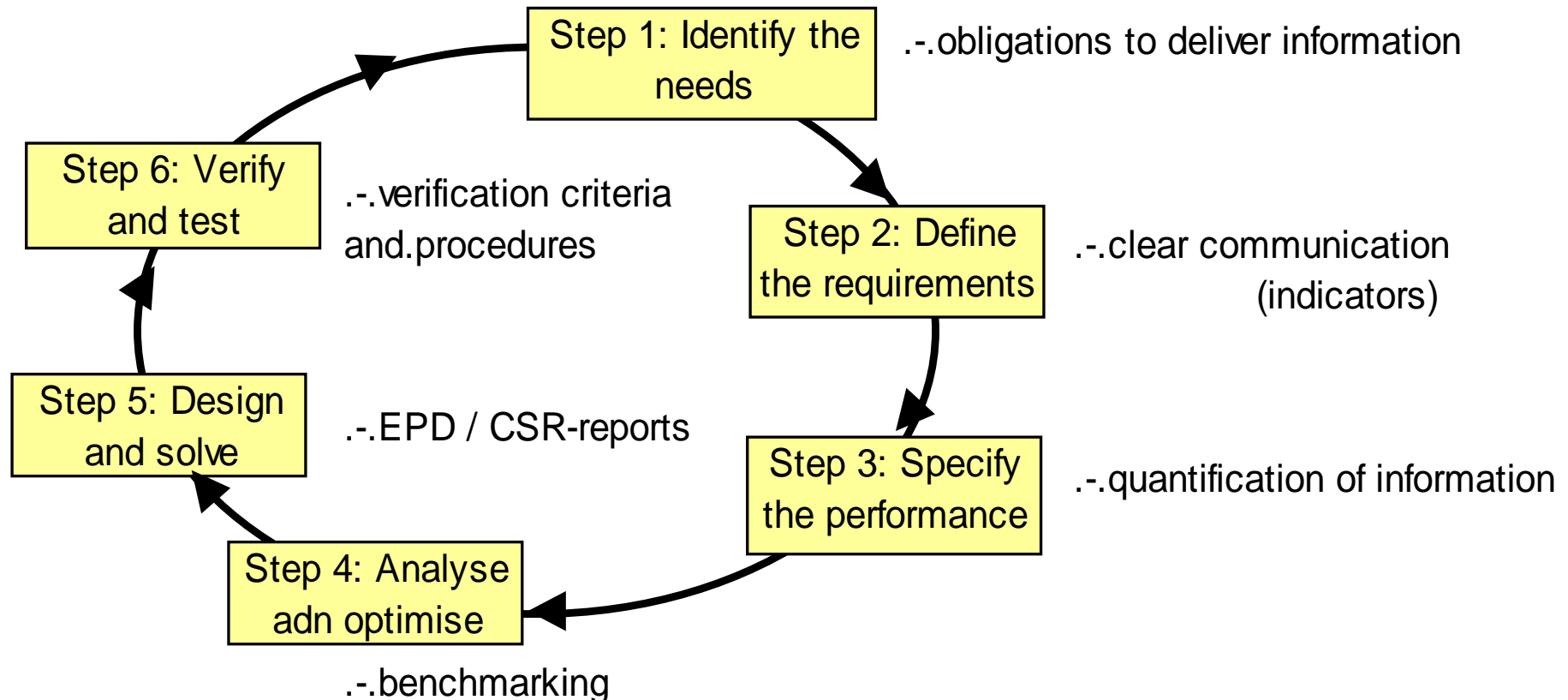
What is the role of systems understanding?



# Mapping CSR onto PDCA for continuous improvement

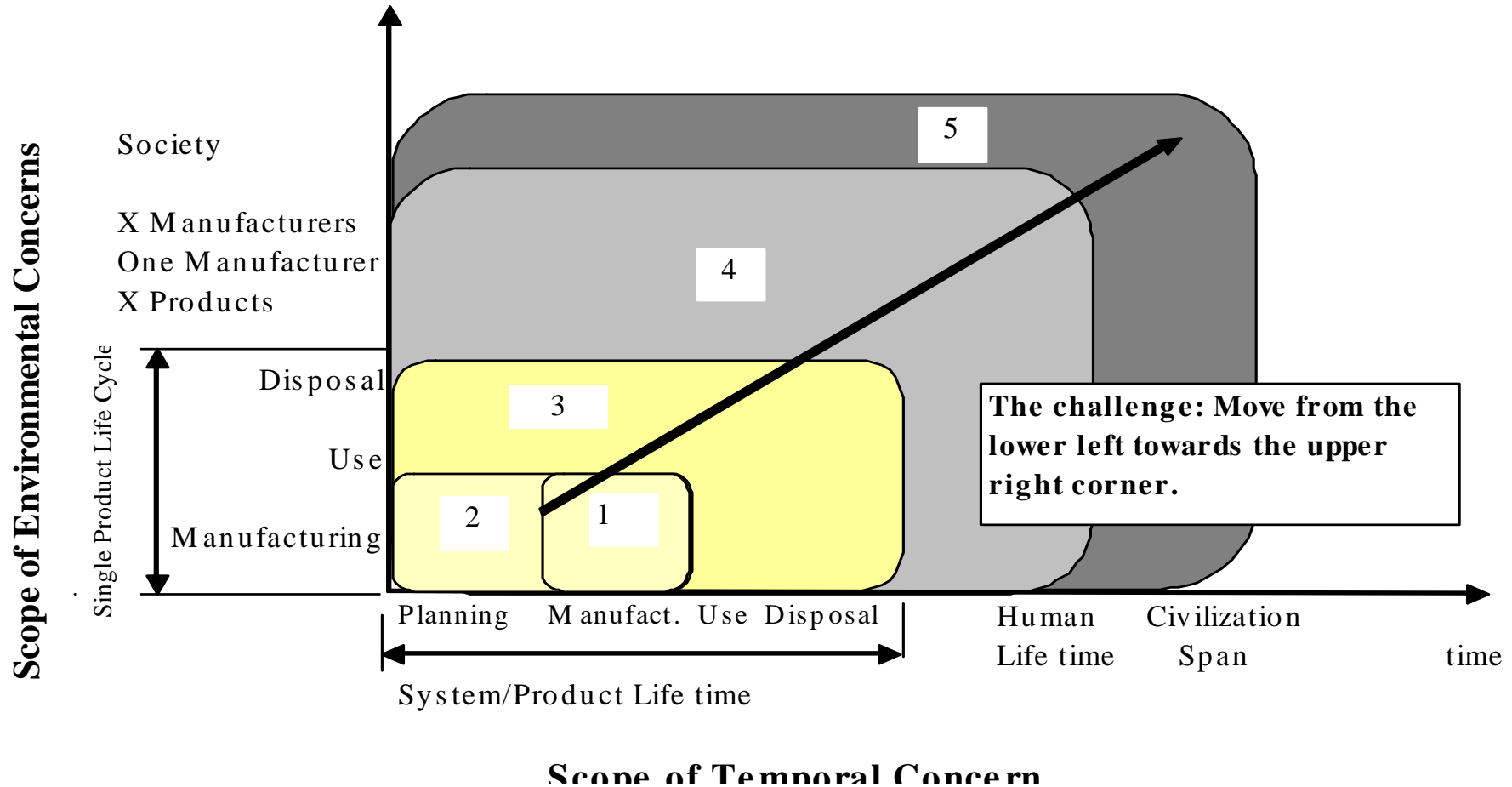


# Systems Engineering as CSR-management

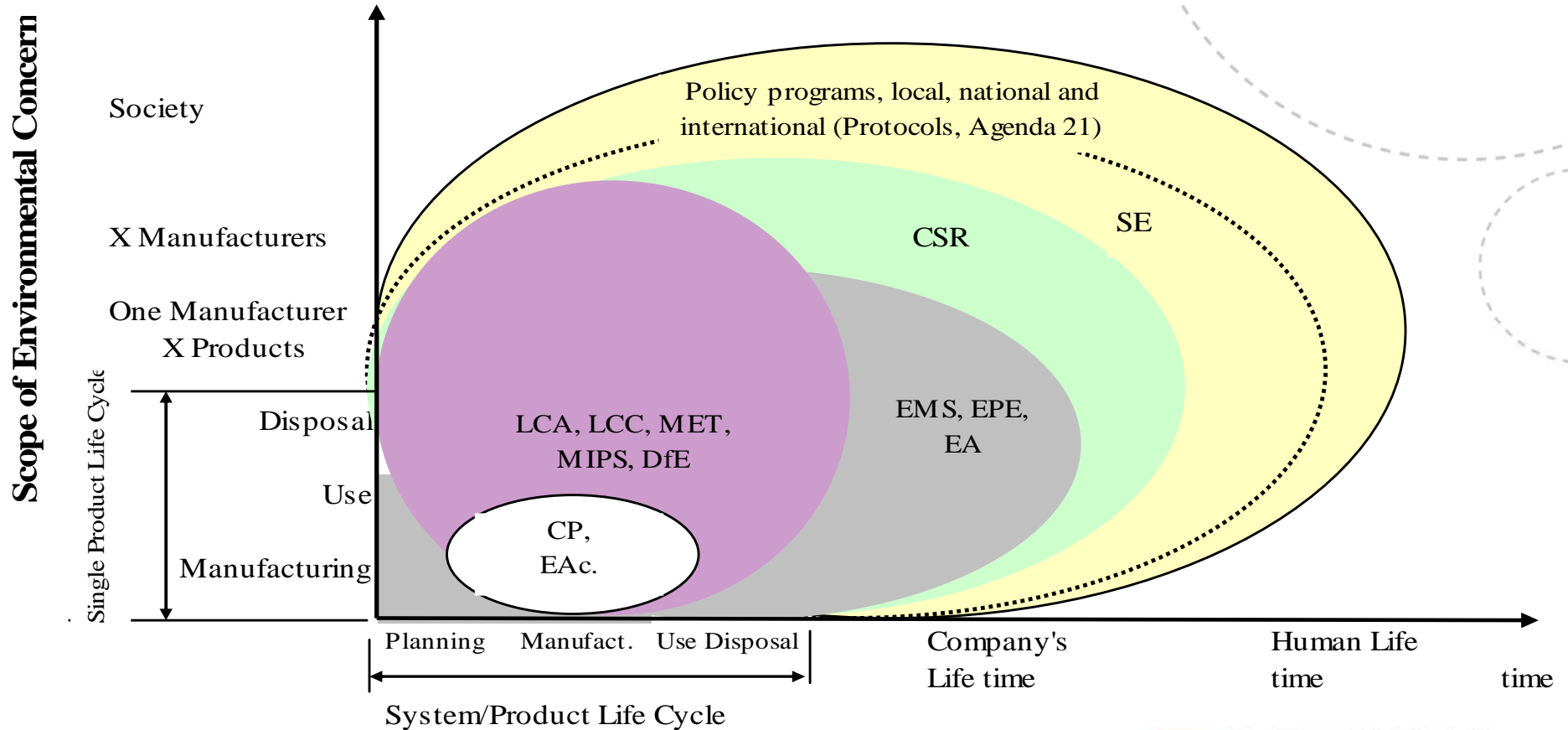


# Progress toward sustainability

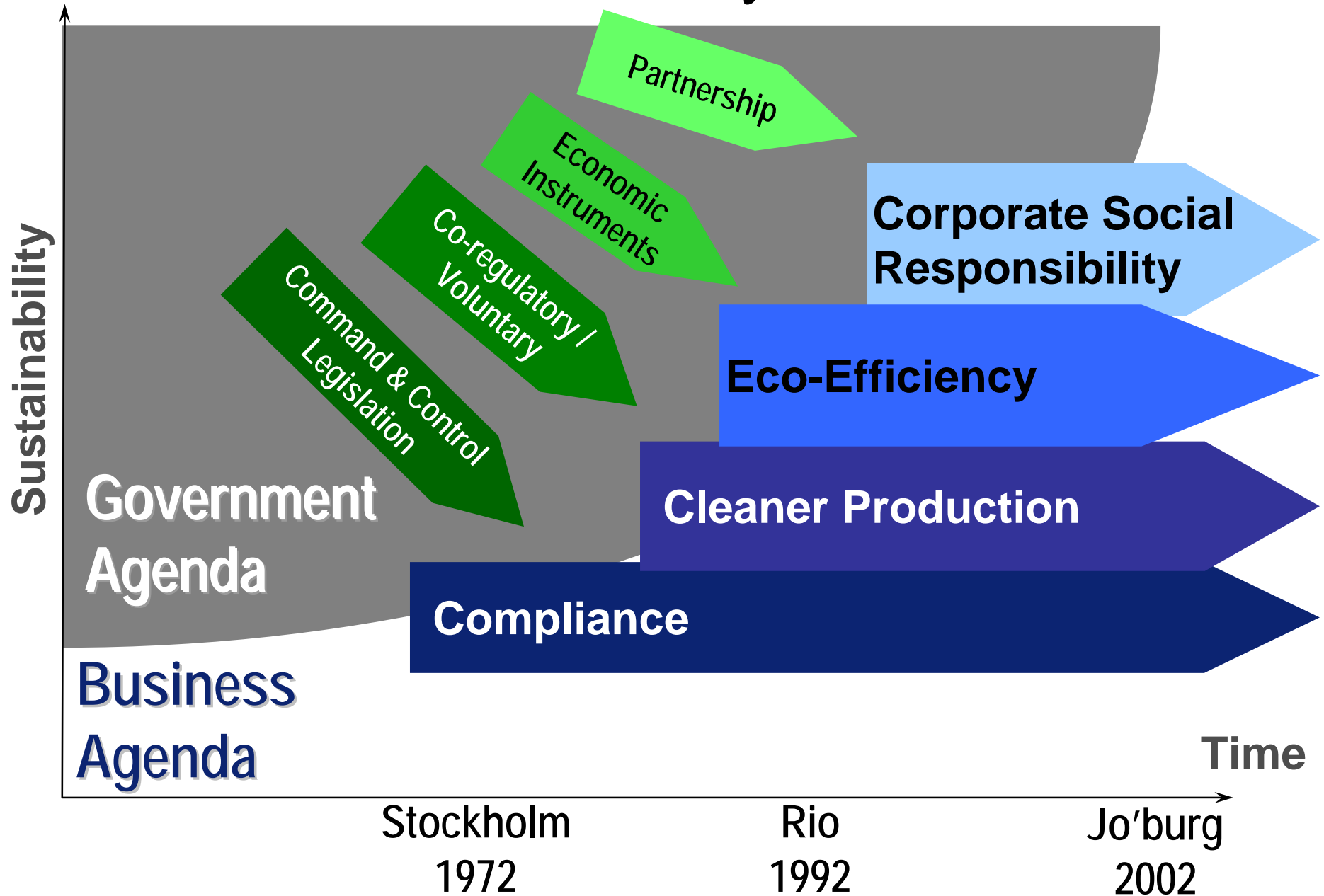
1. Environmental Engineering,
2. Pollution Prevention,
3. Environmental Conscious Design and Manufacturing
4. Industrial Ecology,
5. Sustainable Development.



# CSR-management and SE



# Global trends - summary



Thank you for your attention  
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