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## **System Innovation for Sustainability : Linking Micro-Level to Macro-Level**

**by Ayse Idil Gaziulusoy**  
**University of Auckland, New Zealand**

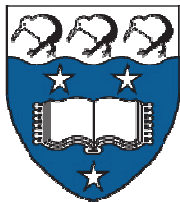
Session 8, Workshop 8.2: „New Manufacturing Technologies“  
Our Common Future, Essen, November 5th, 2010

Our Common Future, Hannover/Essen, 2-6 November 2010 ([www.ourcommonfuture.de](http://www.ourcommonfuture.de))



INTERNATIONAL CENTRE FOR  
SUSTAINABILITY ENGINEERING & RESEARCH

# System Innovation for Sustainability: Linking Micro-Level to Macro-Level



**THE UNIVERSITY  
OF AUCKLAND**

**NEW ZEALAND**

Te Whare Wānanga o Tāmaki Makaurau

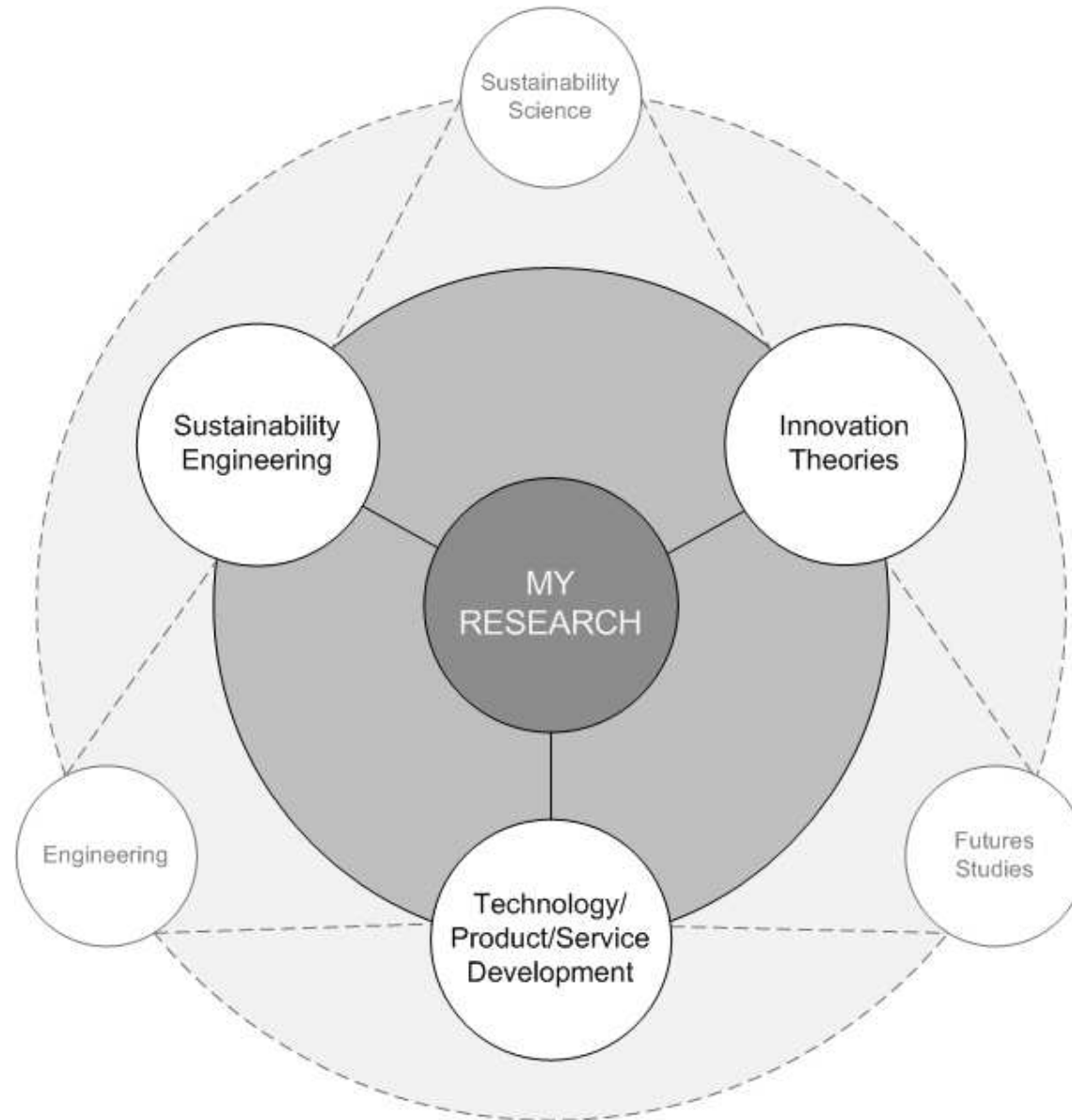
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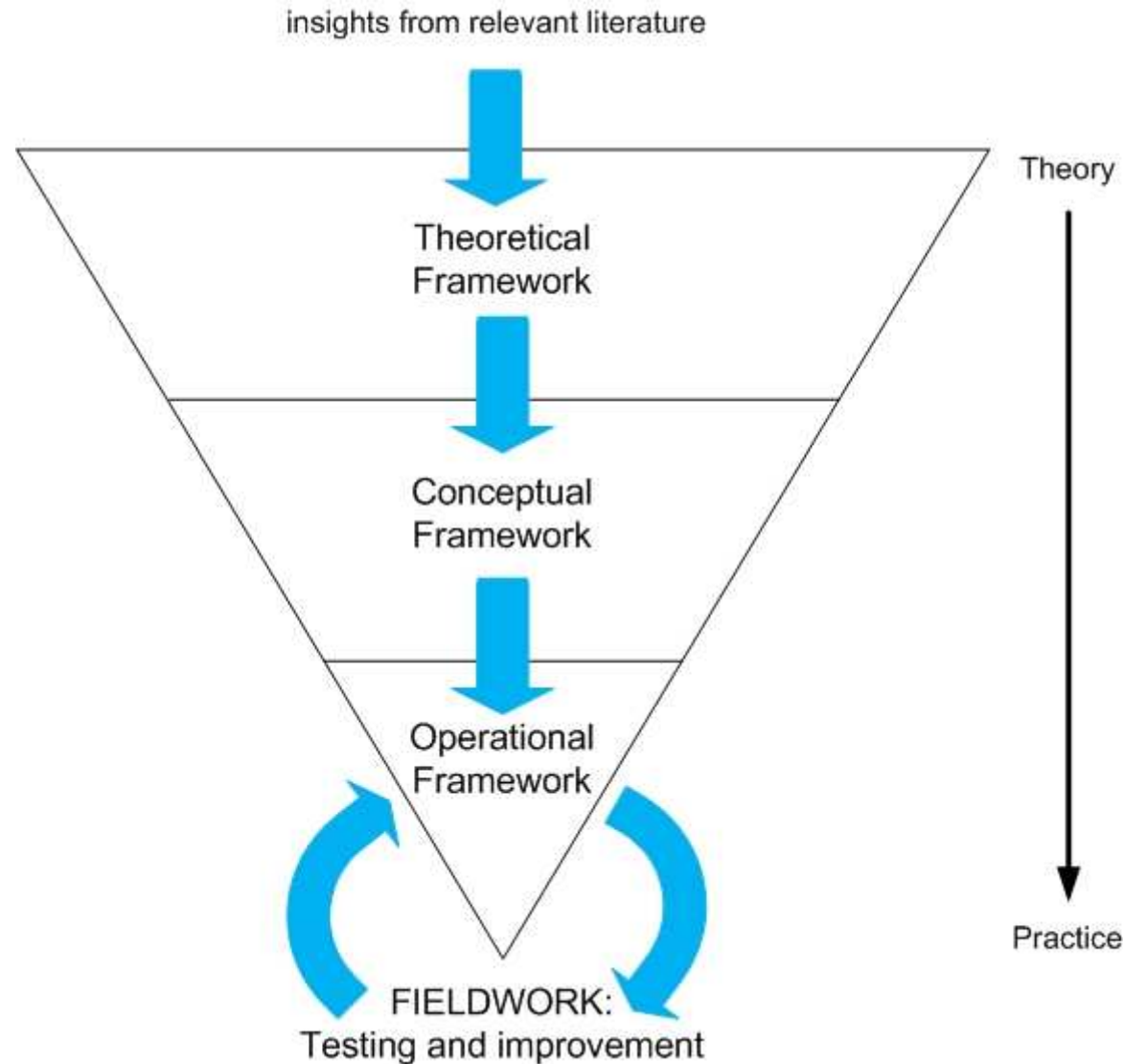
# Research Question

How can we **link** actions (short-term) and strategic decisions (medium-term) of product development teams (**micro-level innovation**) to the massive societal transformation (long-term) that needs to take place for us to achieve sustainability (**macro-level innovation**)?

# Positioning My Research

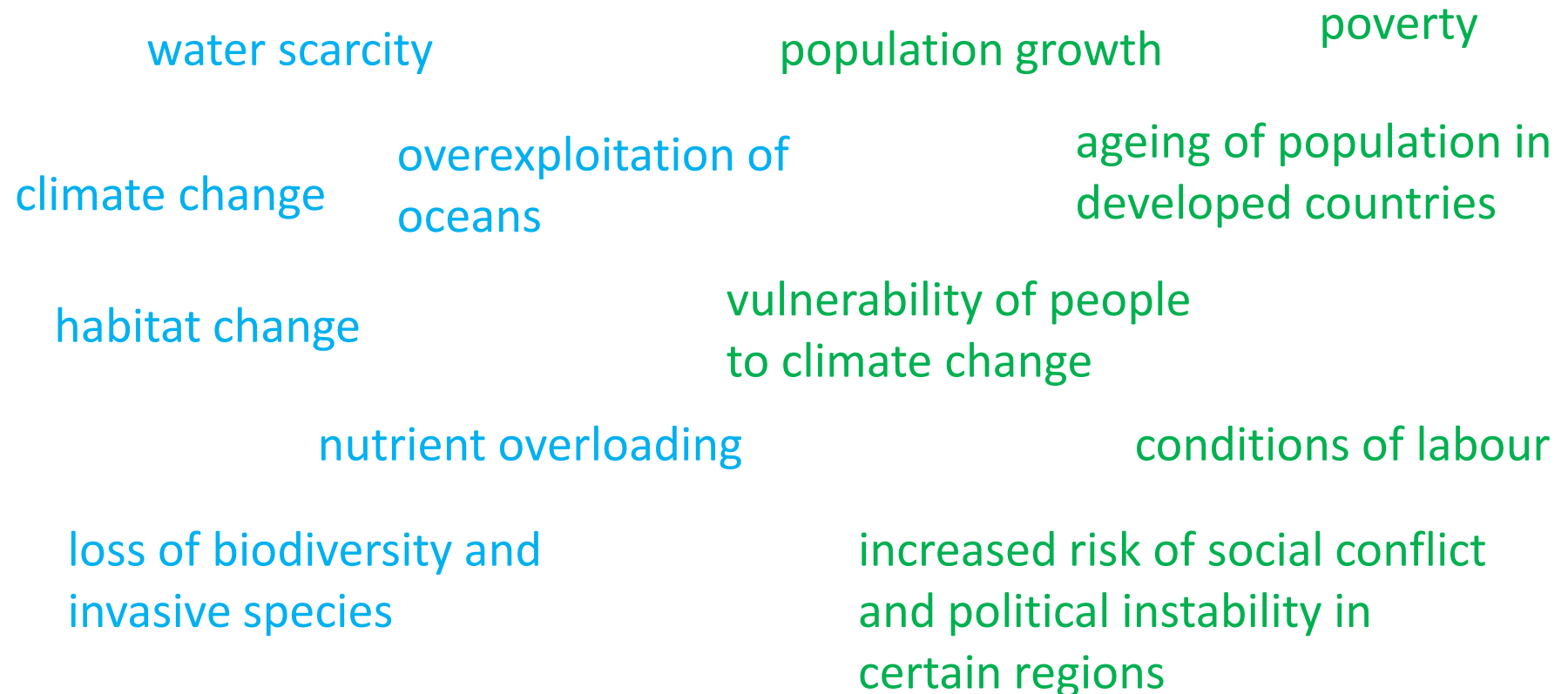


# Conducting My Research

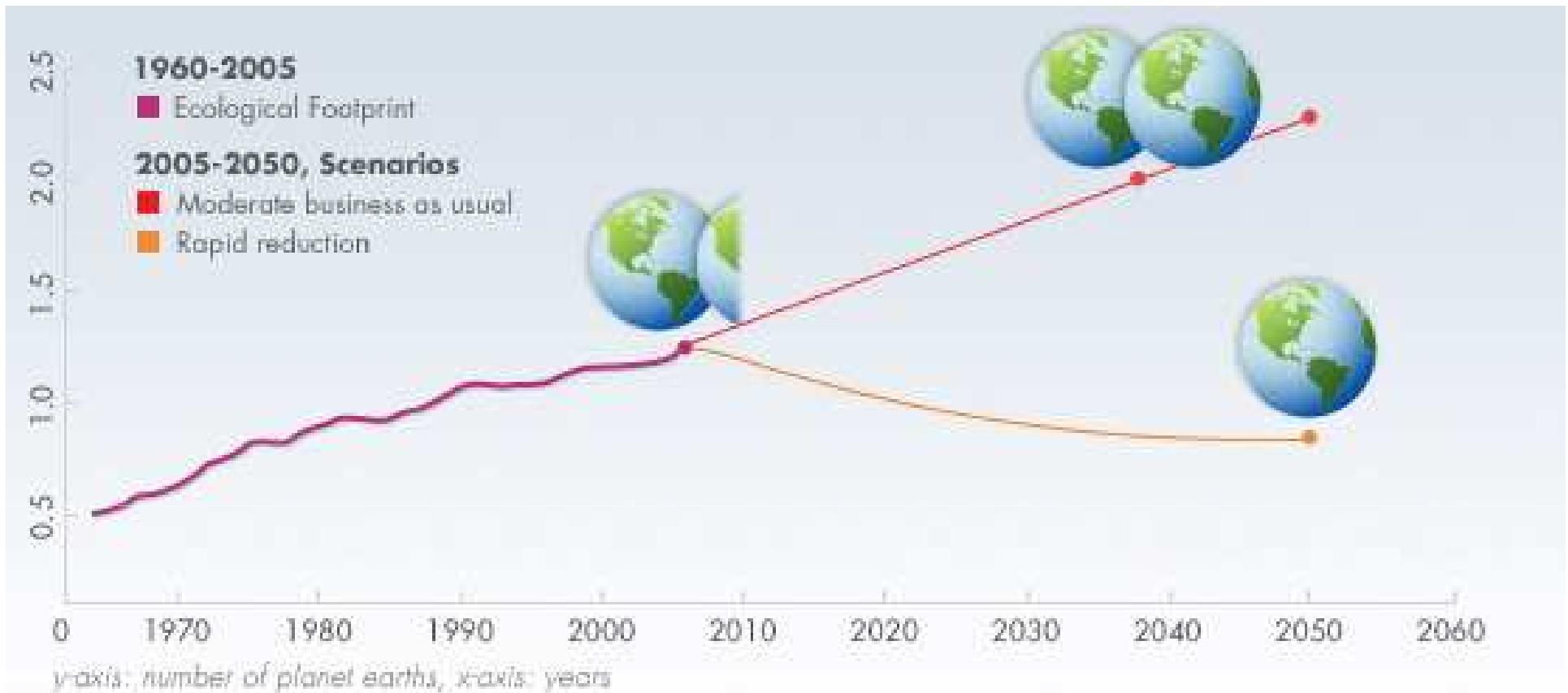


# Sustainability Risks and Industry

Major long-term ecosystem and social changes identified as relevant to the industry are:



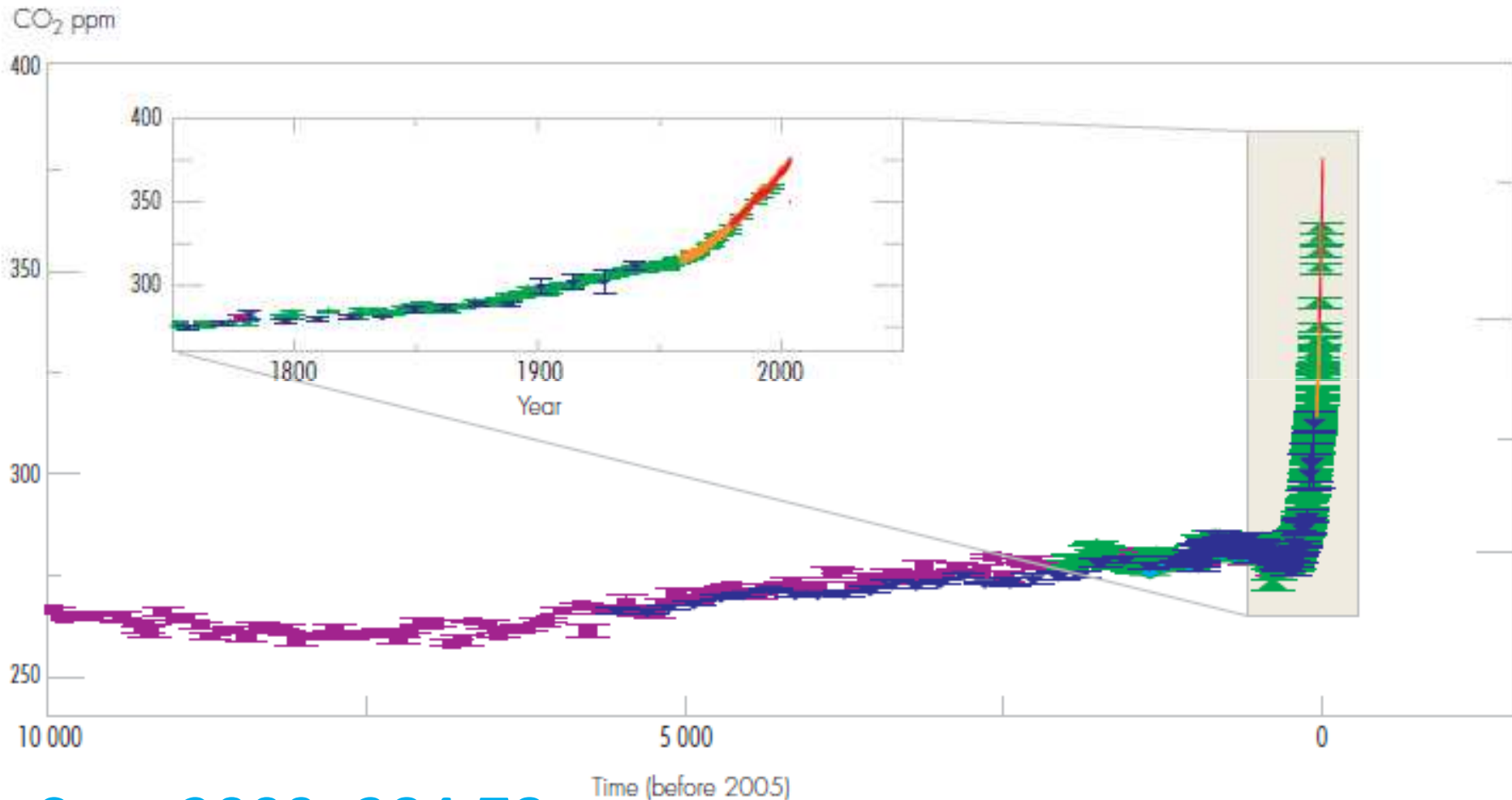
(Millenium Ecosystem Assessment, 2005; World Business Council for Sustainable Development, 2004; ILO, 2005; 2006; UN, 2007; UNDP, 2007; UNEP, 2007)



In 2009 we overshoot the ecological capacity of the world by 40%

source: <http://www.globalfootprintnetwork.org>

# Atmospheric CO<sub>2</sub> Levels in the Last 10,000 Years



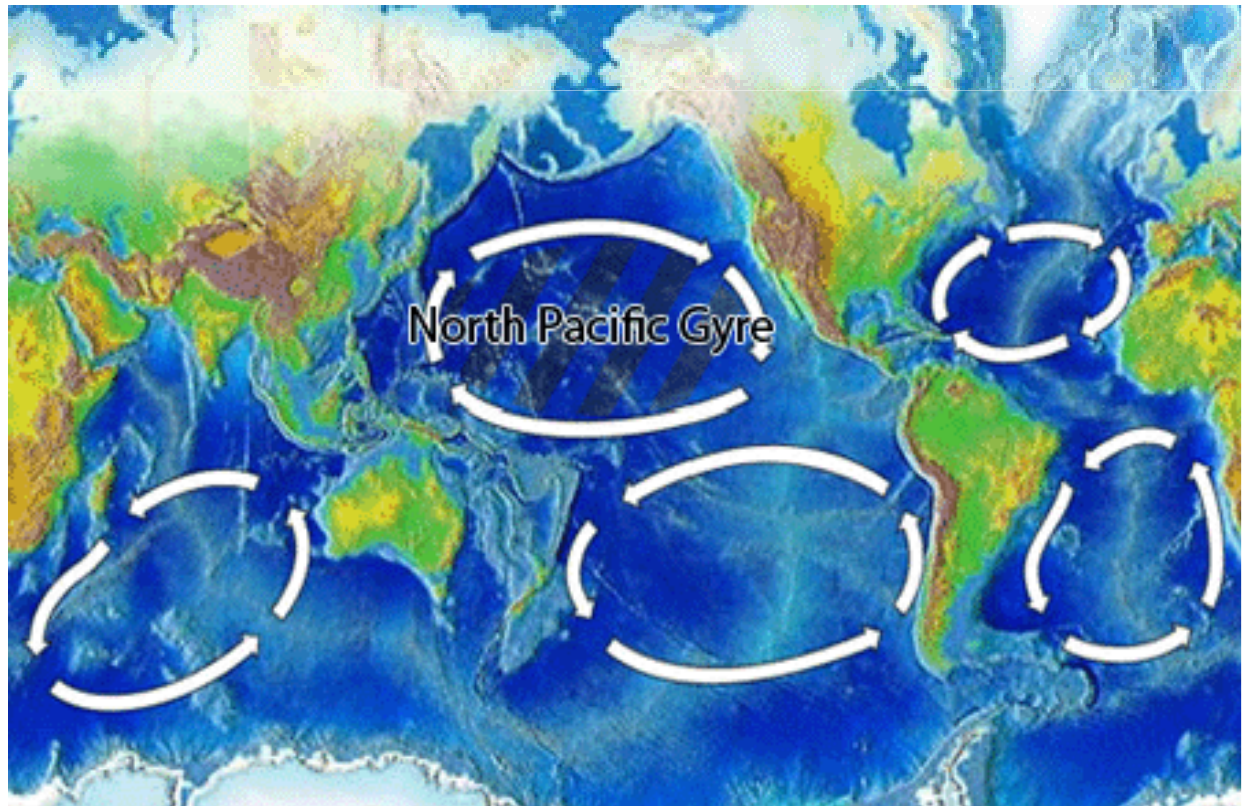
Sept 2009: 384,78 ppm  
June 2010: 392.04 ppm

source: IPCC, 2007  
<http://www.co2now.org>

# Waste

## The Great Pacific Garbage Patch

the patch extends over a very wide area, with estimates ranging from an area the size of the state of Texas to one larger than the continental United States, the exact size is unknown



# E-Waste



Informal or poorly managed processing of electronic waste in developing countries causes **serious health and pollution problems**.

Mobile phones, computer monitors, televisions, printed circuit boards, photocopiers, fluorescent lamps, etc. all have **toxic components** such as mercury, cadmium, brominated flame retardants etc.

# What is the value of a song bird?

Unlike goods bought and sold on markets, many ecosystem services do not have markets or readily observable prices. This means that the importance of biodiversity and natural processes in producing ecosystem services that people depend on is not reflected in financial markets.



O-Oh!

Something's quite wrong around here!



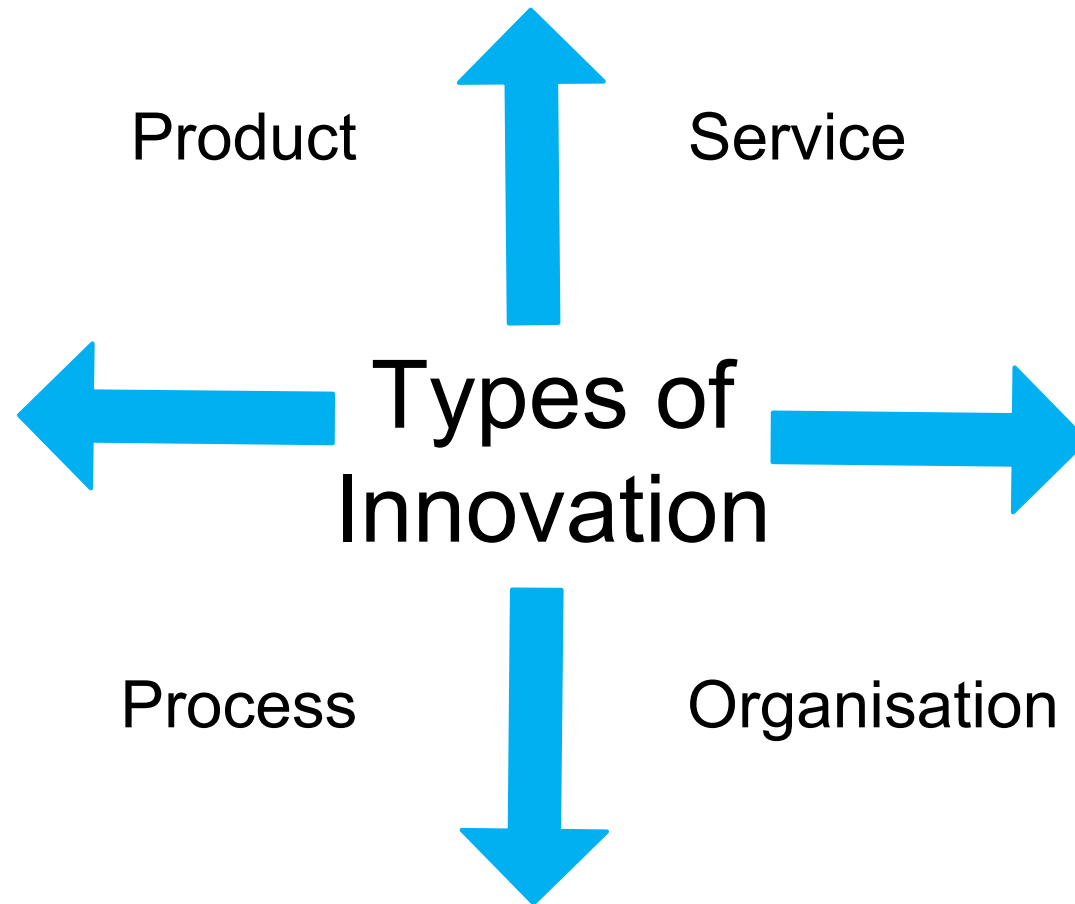
# Sustainability Risks and Industry

Sustainability risks both pose **threats** to and provide **opportunities** for businesses;

Businesses likely to evolve and avoid decline are those **adaptable to the changes** through rejuvenating entrepreneurship, experimentation, learning and strategic innovation;

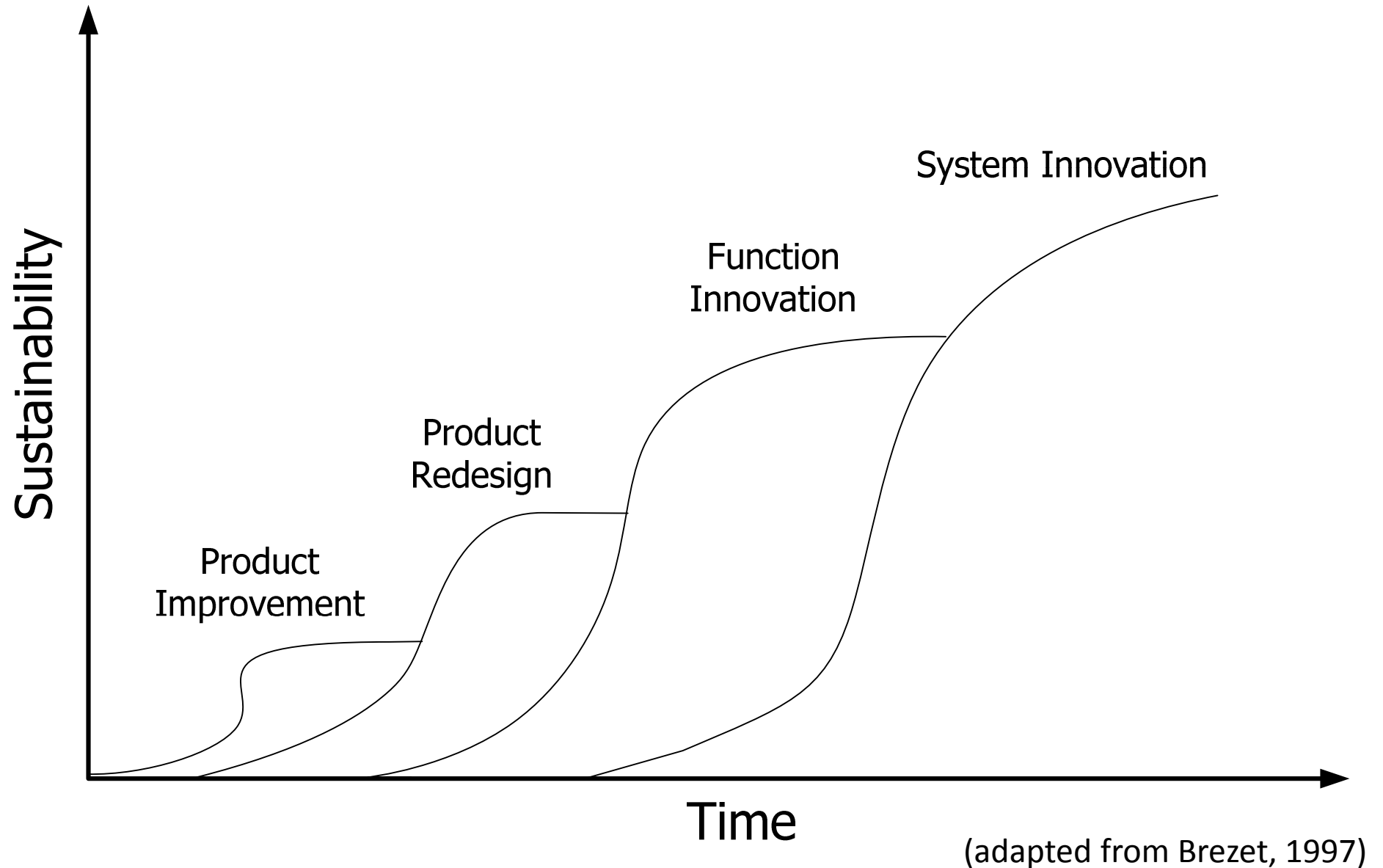
Naturally, those companies which are aware of the required change and underlying dynamics have the advantage of **creating, improving** and **orienting their core competencies** towards sustainable practices.

# Mainstream Innovation Theory

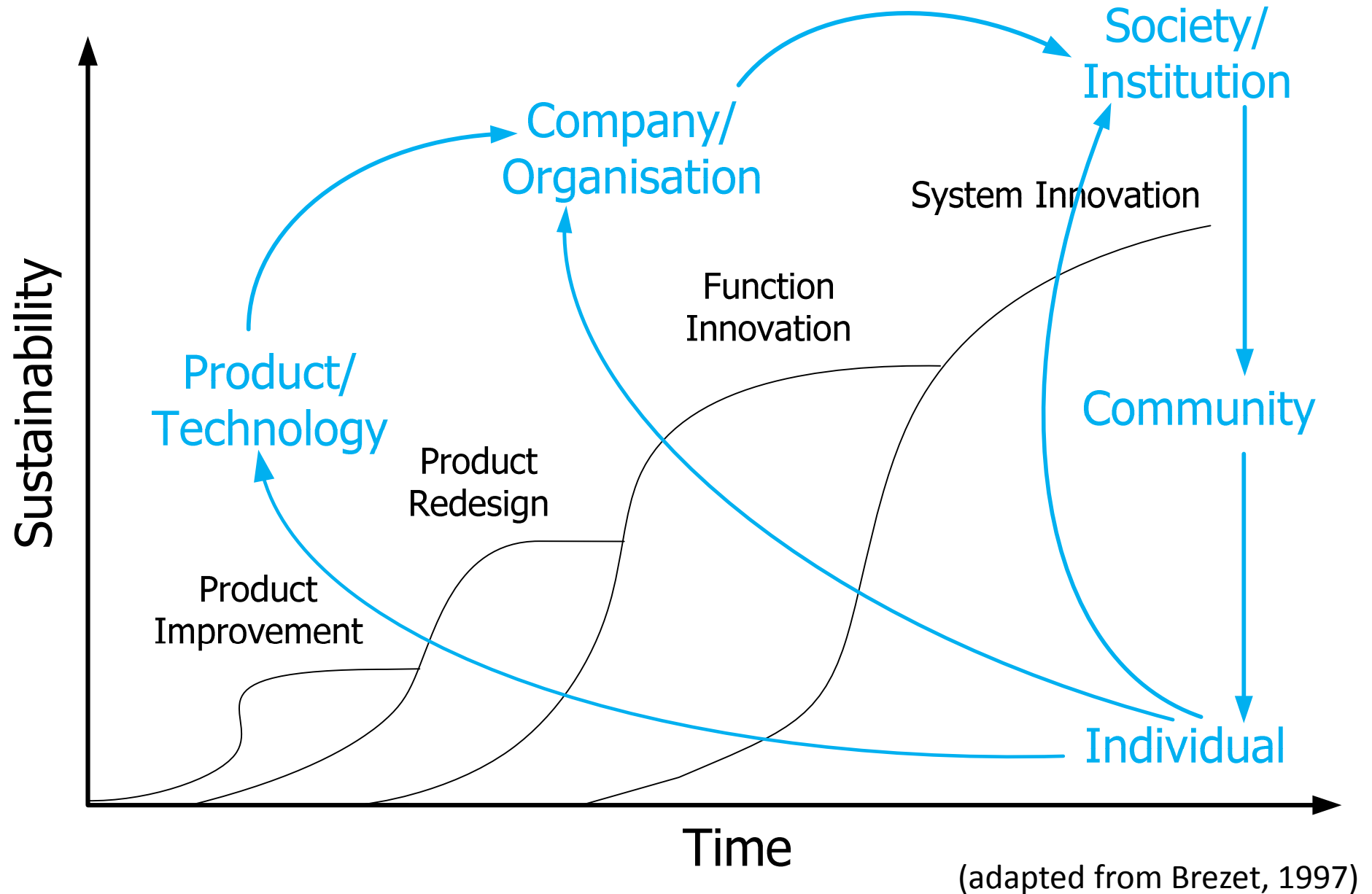


Hunter, 2008

# Levels of Innovation for Sustainability



# Levels of Innovation for Sustainability



## Characteristics of System Innovation for Sustainability:

**1. Systemic**

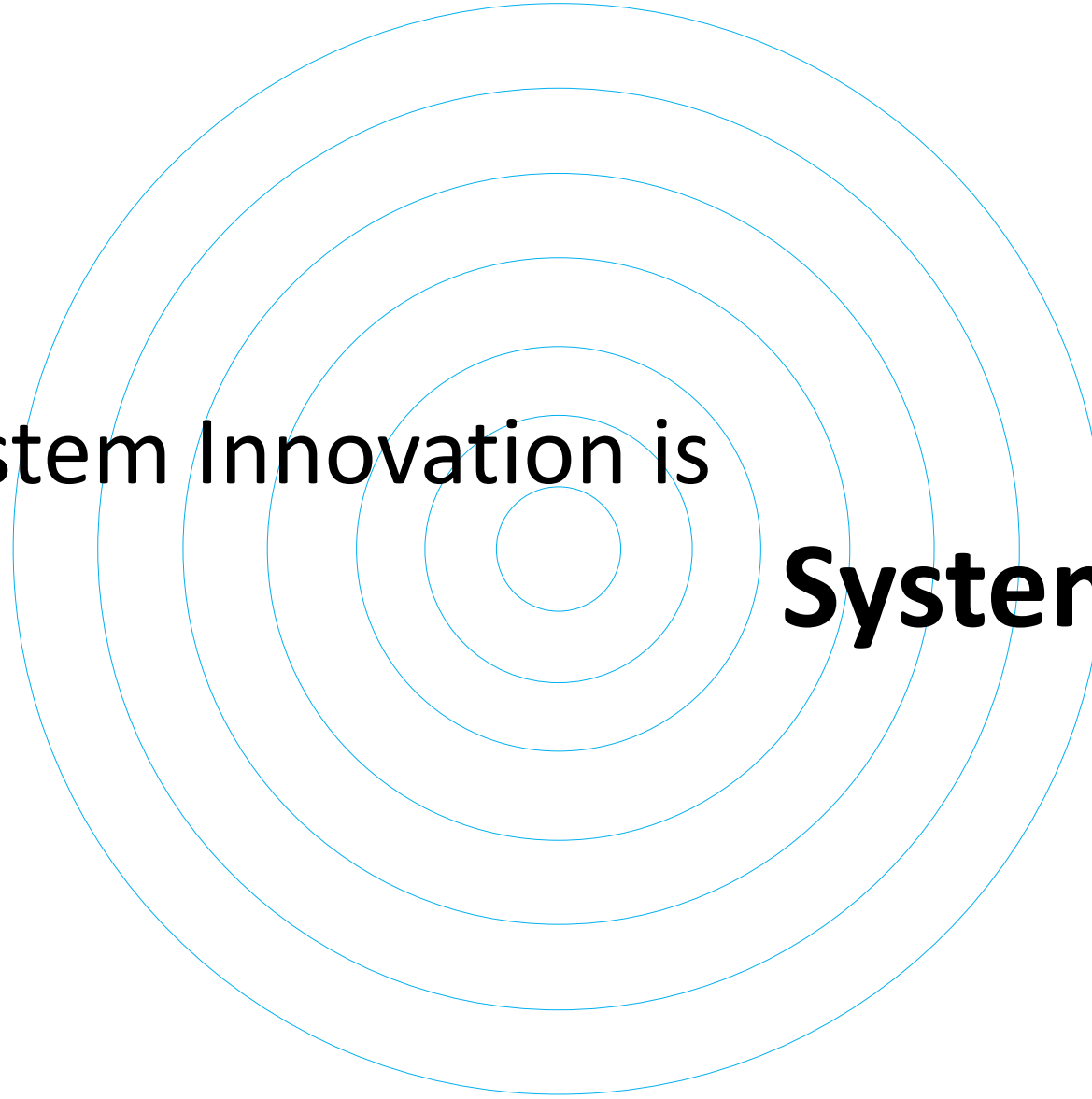
**2. Co-evolutionary**

**3. Radical**

1.

System Innovation is

**Systemic**



“System”

is the entire socio-technical system



Toyota Prius

To diffuse individual modes of mobility we need more roads



# More Roads for More Cars?

Increased **land use**

Increased **traffic**

Loss of **biodiversity**

Increased **stress levels**

Increased **accidents**

Increased **material demand**

Increased  
**individualism**

Increased **obesity**

Etc.



# Example: Systemic Intervention for Urban Mobility



Product-service systems  
for public transport



# Technological Innovations



**Organisational Innovations**

**Technological Innovations**



**Social/Cultural Innovations**

**Organisational Innovations**

**Technological Innovations**



**Institutional Innovations**

**Social/Cultural Innovations**

**Organisational Innovations**

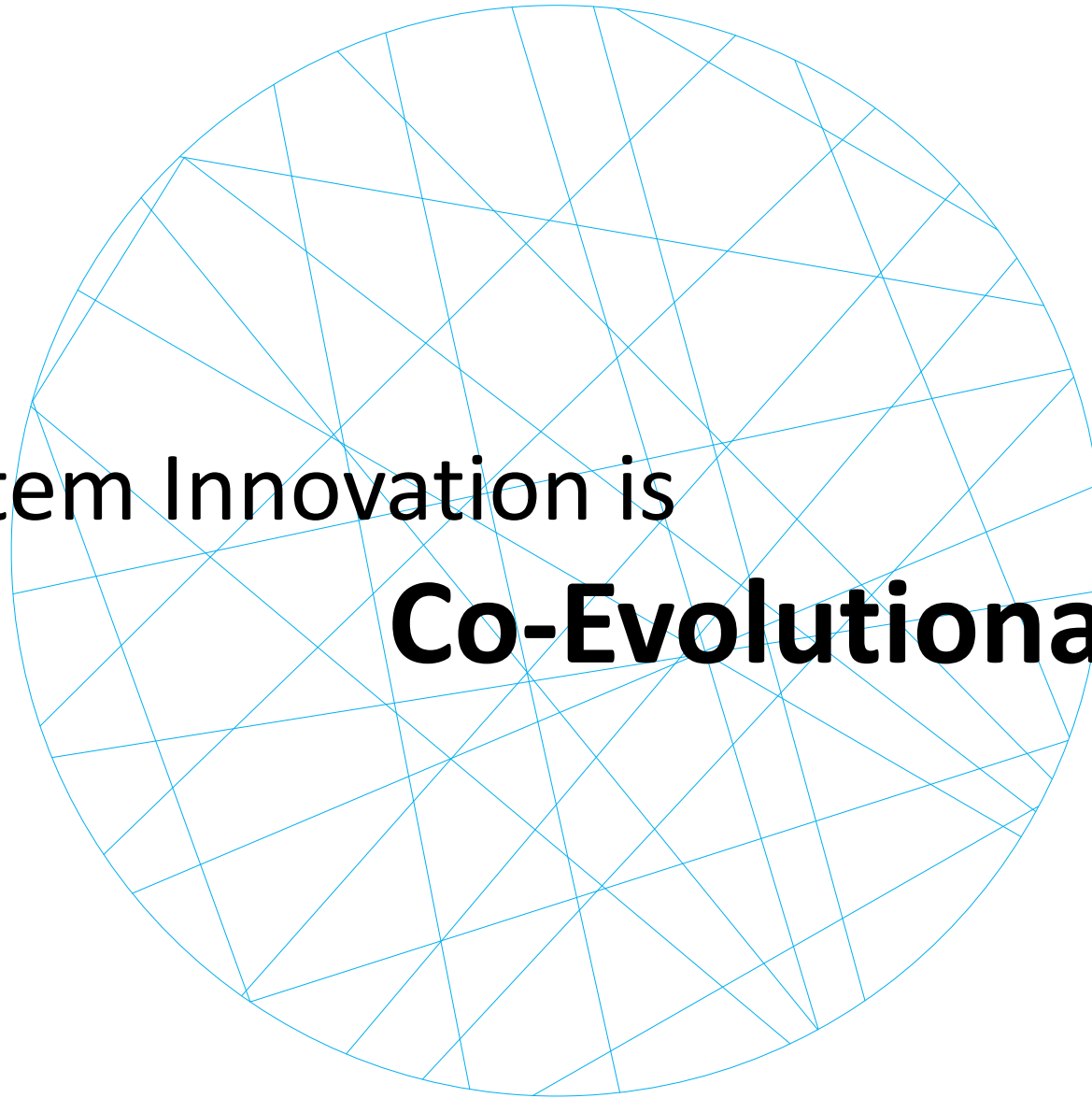
**Technological Innovations**



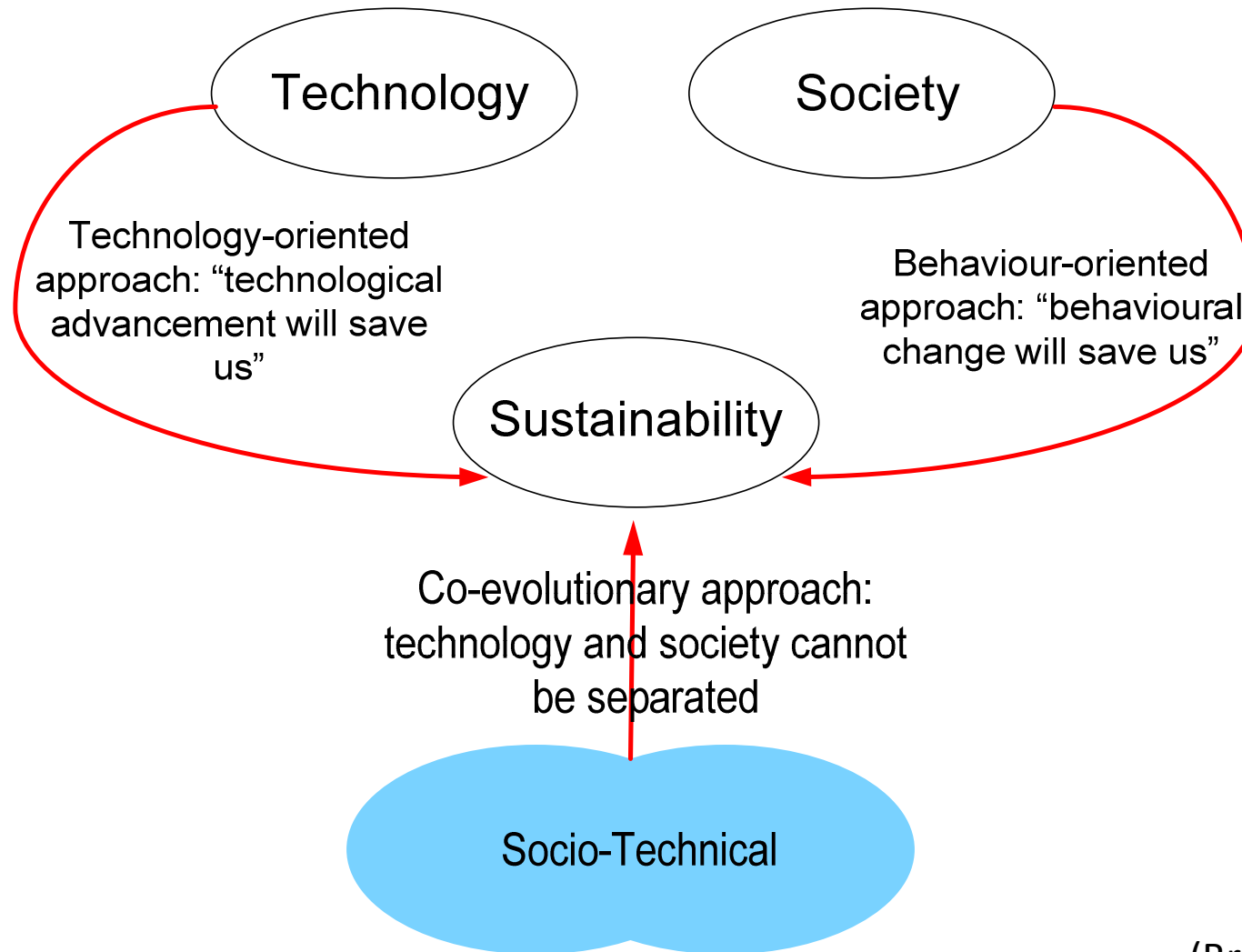
2.

System Innovation is

**Co-Evolutionary**

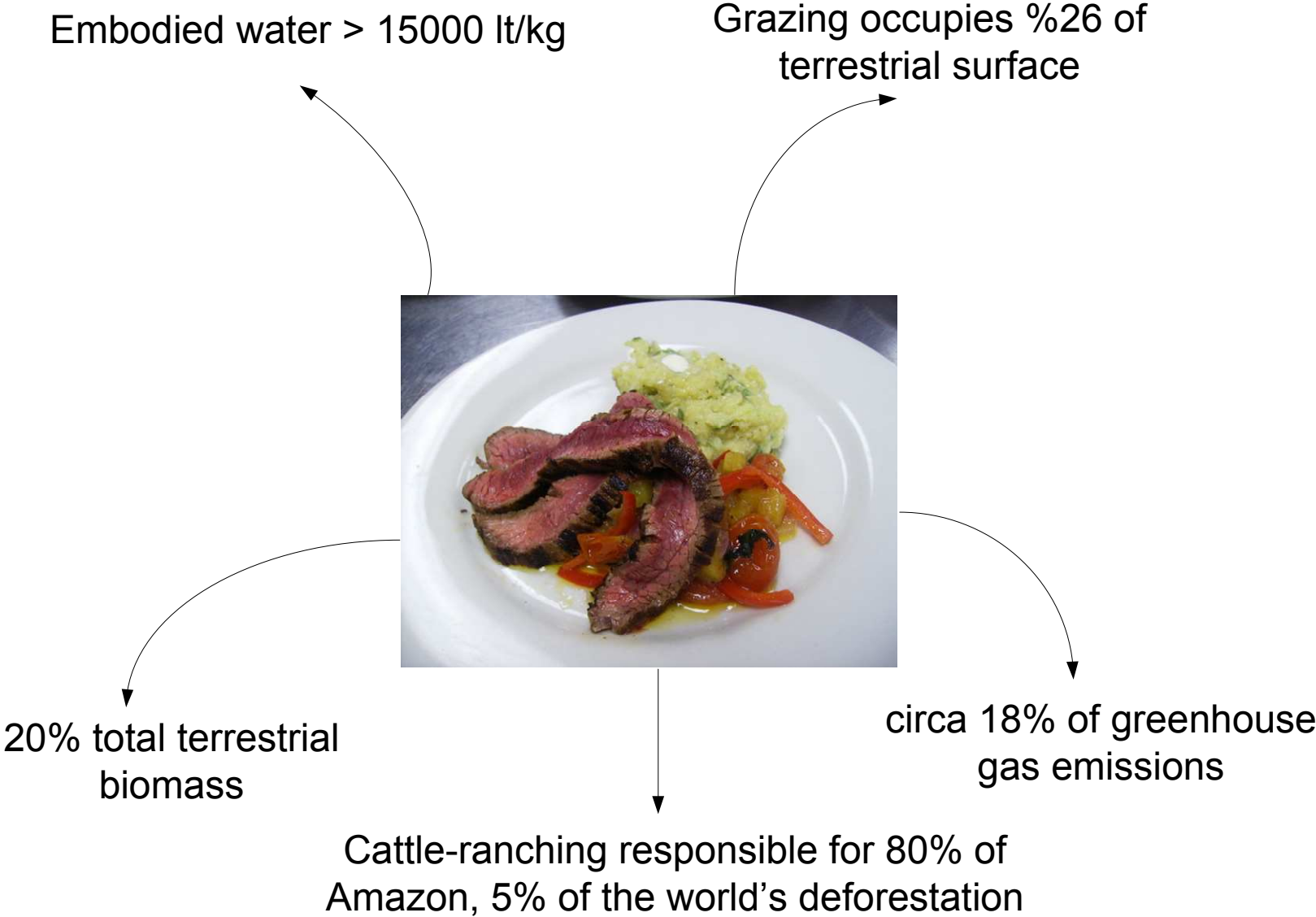


# Co-Evolutionary Innovation



(Brand, 2003)

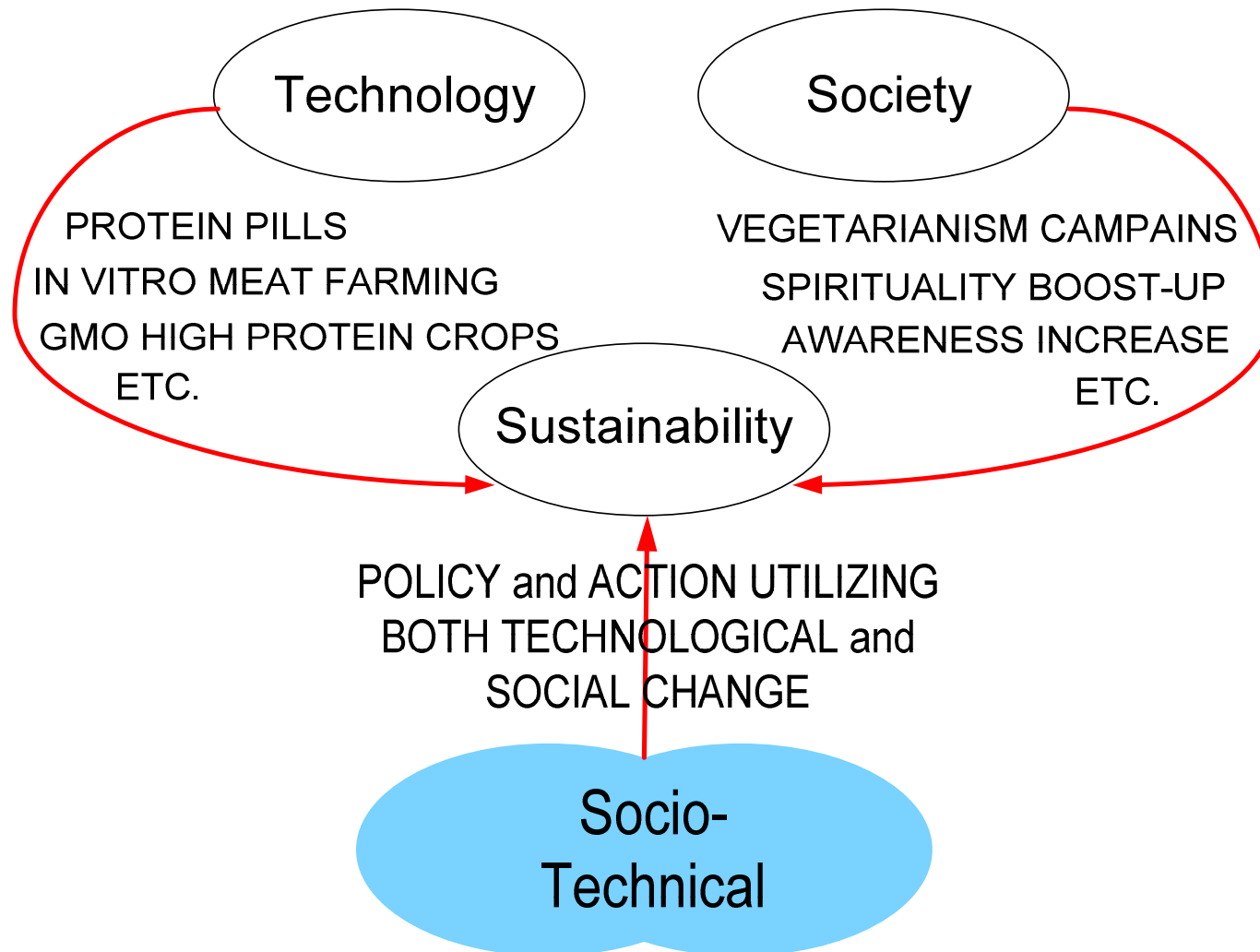
# Example: Livestock farming



OECD, 2005; FAO, 2006; Greenpeace, 2009

We need to decrease meat consumption!







3.

System Innovation is

**Radical**

# Current Approaches

Compliance;

Energy efficiency;

Waste reduction;

**IMPROVEMENT**

Recycling;

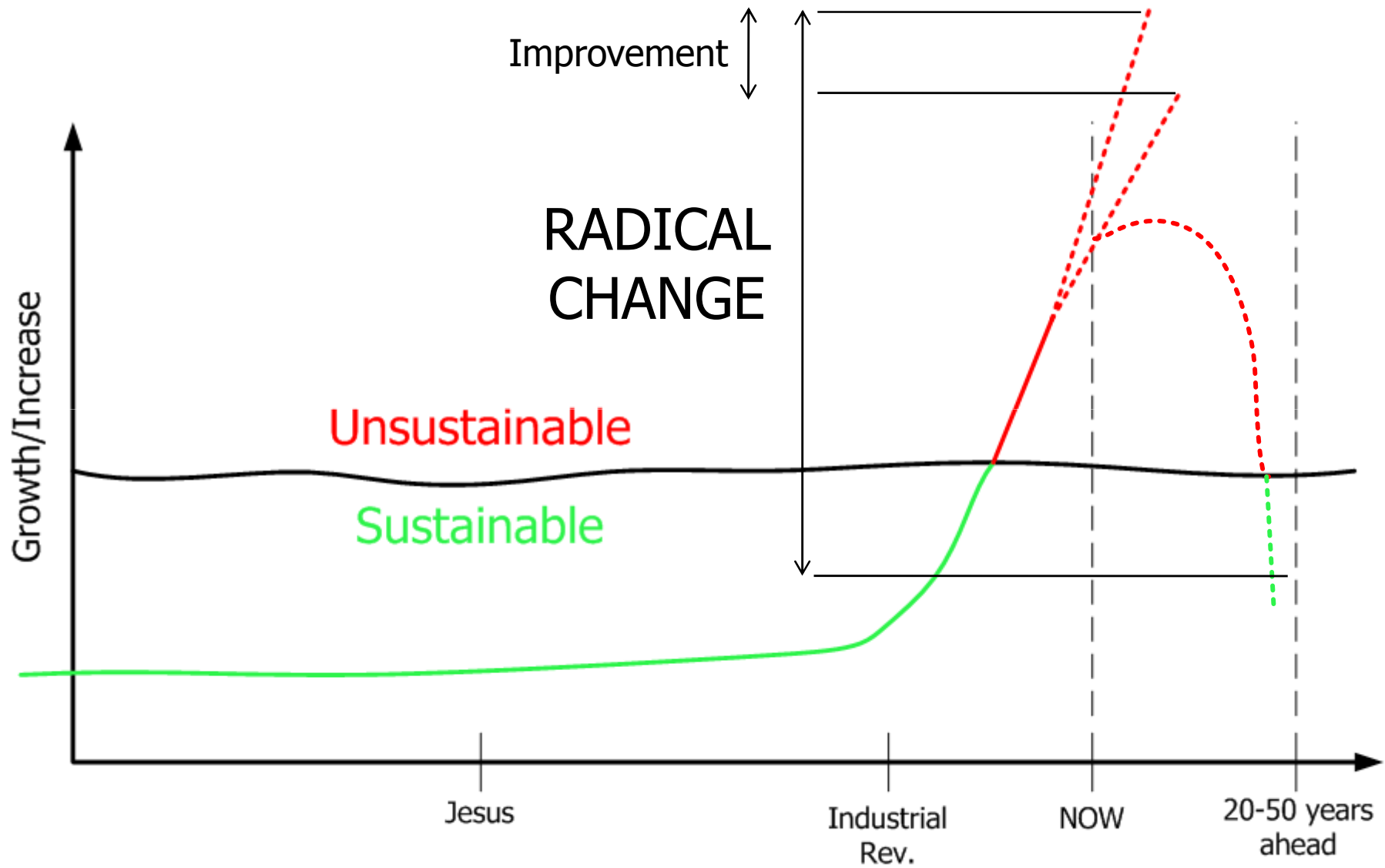
Cleaner production;

Design for X;

Risk assessment;

Life-cycle assessment;

Etc.



Radical  
Change



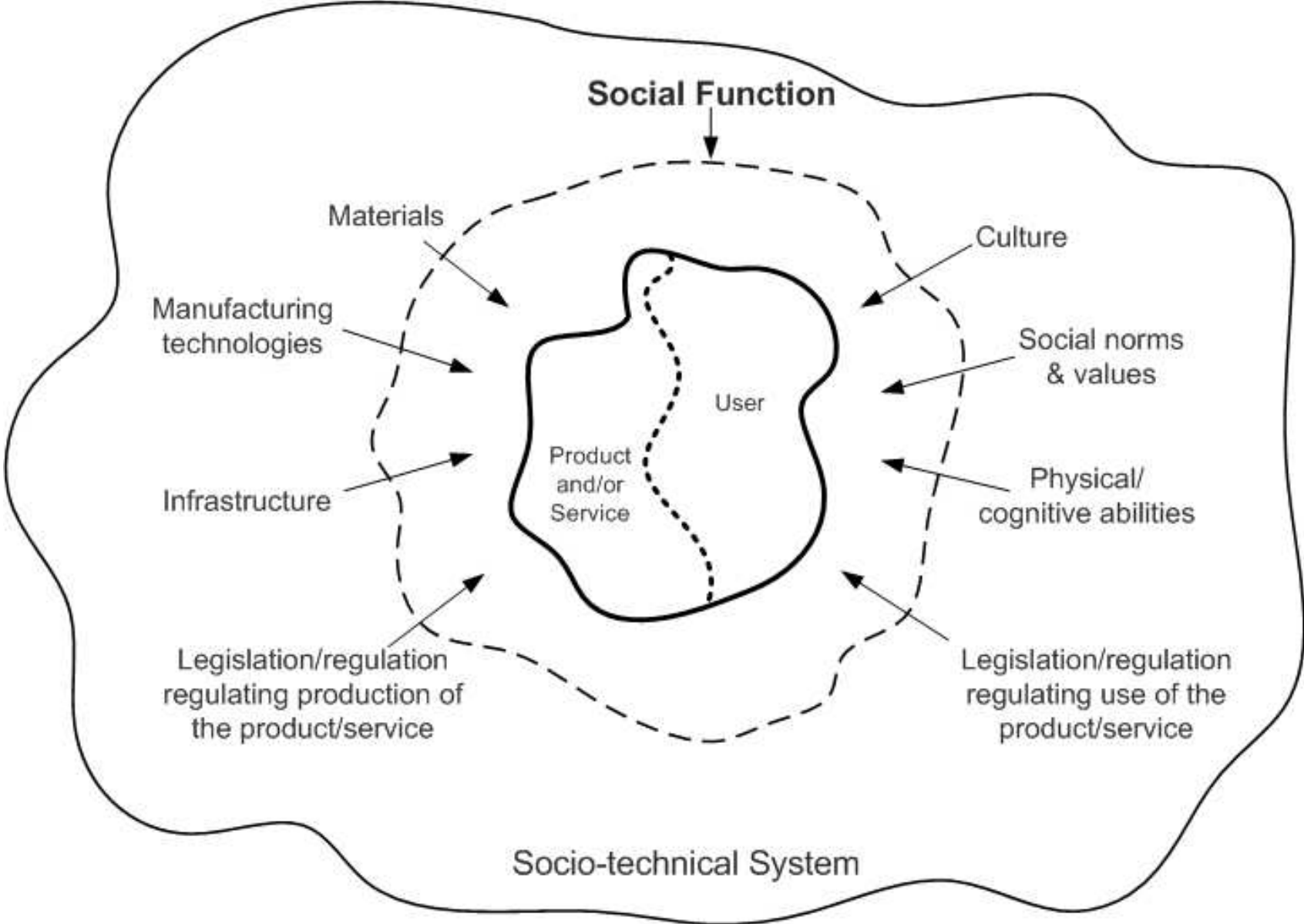
Radical  
Technological  
Innovation

Radical  
Change

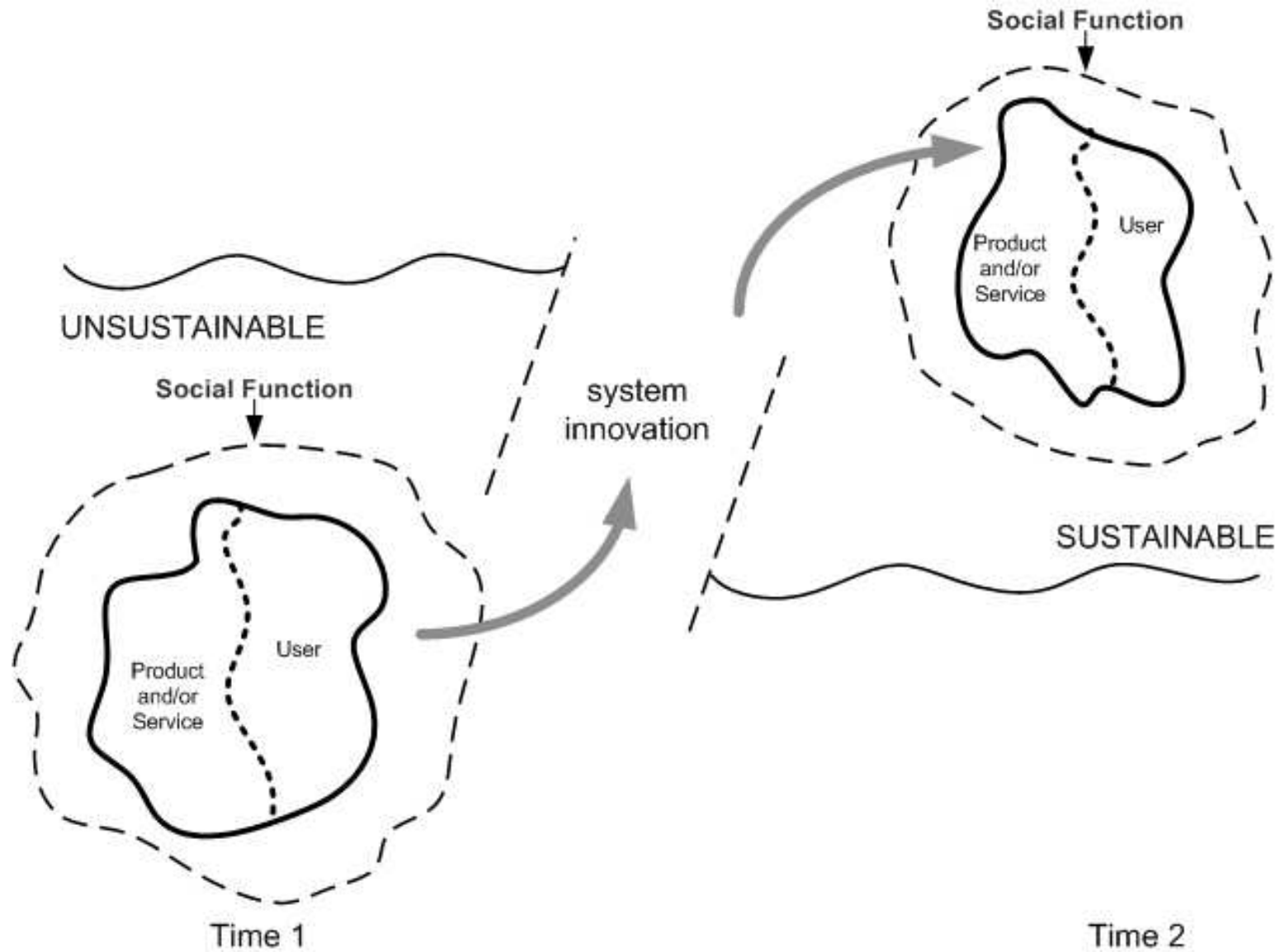


Radical  
Transformation at  
the System Level

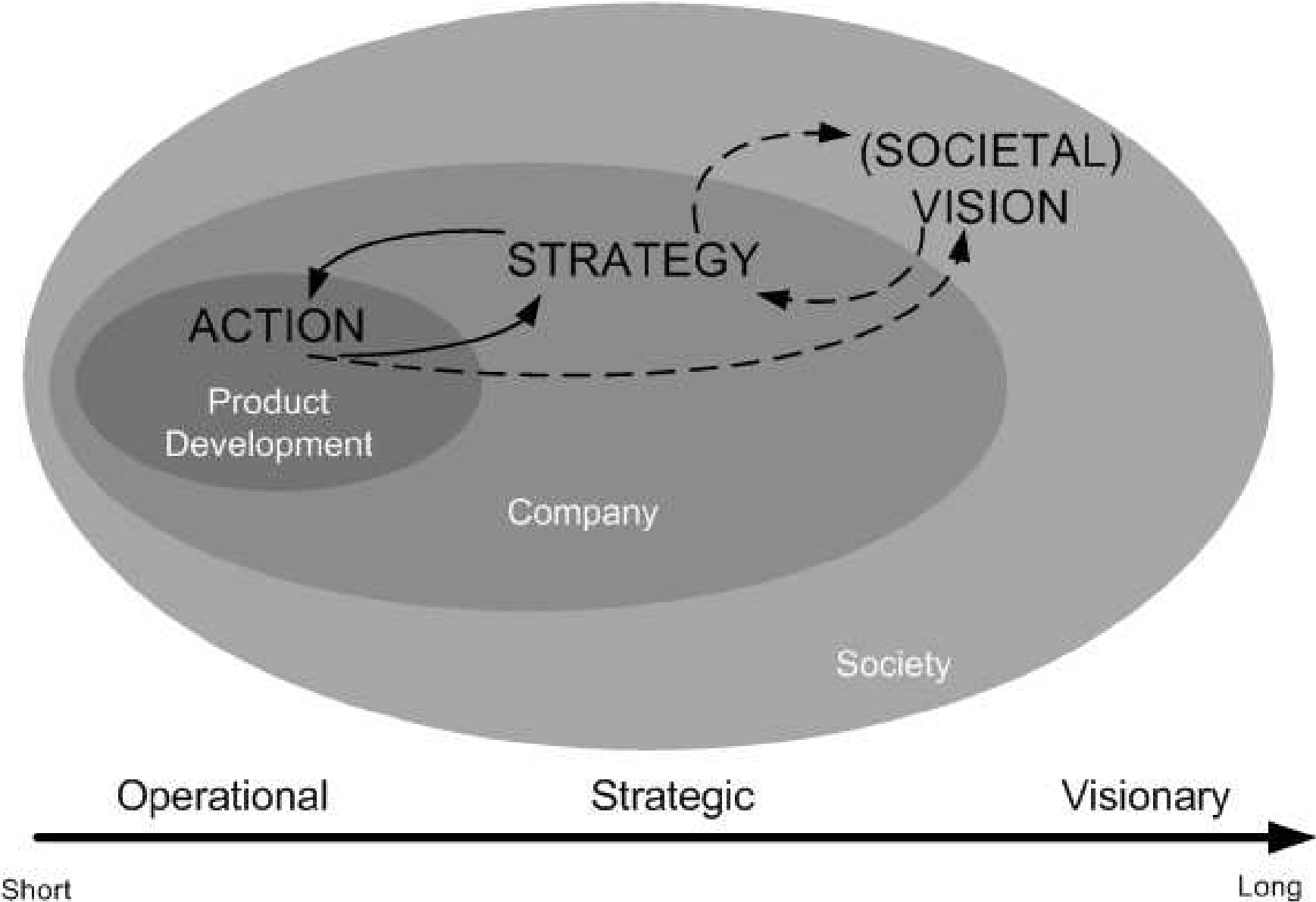
# “Social Function”



# System Innovation at Micro-Level



# Linking Micro-Level to Macro-Level



# Challenges ahead:

Prevailing business culture:

short-termism, growth for the sake of it, NIMBY (not in my backyard; exporting environmental and social problems elsewhere)

Prevailing consumerist culture

Prevailing economic paradigm (not having a good indicator for “progress”)

Barriers for long-term thinking (political, financial, cultural, operational, etc.)

Lack of enabling technologies

Lock-in effect of current technologies

Lack of in depth understanding of sustainability risks at industrial and governmental level

Challenge of activating and coordinating collective transformation (leadership)

# Keys to move forward:

Good understanding of sustainability risks, their implications on the current product/service portfolio and associated opportunities for new product development

Being a “niche-hunter”, creating niches if possible

Thinking systemically (tapping into technological and non-technological solutions simultaneously in product development)

Thinking conceptually (not “out of the box” but “no box”)

Thinking long-term

Developing new approaches to competition

Identifying broader scale stakeholders and establishing new partnerships to implement innovative ideas

“Now I have studied philosophy, medicine and the law, and unfortunately, theology, wearily sweating, yet I stand now, poor fool, no wiser than I was before; I am called Master, even Doctor, and for these last ten years have led my students by the nose--up, down, crosswise and crooked. Now I see that we know nothing, finally.”

Faust  
J. W. von Goethe

# Thank you!

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