FROM ATTITUDE TO ACTION
AN INTRODUCTION TO THE CAMBRIDGE SUSTAINABLE DESIGN TOOL KIT

09.04.2014 | Bernhard Dusch

IfM | Design Management Group

UNIVERSITY OF CAMBRIDGE

INTRODUCTION

DEFINING SUSTAINABLE DESIGN

Green
Design

Individual product aspects optimised for environmental performance

DEFINING SUSTAINABLE DESIGN

Green Design

Eco-Design (DfE)

Entire product life cycle optimised for eco-efficiency

Individual product aspects optimised for environmental performance

DEFINING SUSTAINABLE DESIGN

Green Design

Eco-Design (DfE)

Sustainable Product Design (SPD)

Social aspects also considered

Entire product life cycle optimised for eco-efficiency

Individual product aspects optimised for environmental performance

DEFINING SUSTAINABLE DESIGN

Green Design

Eco-Design (DfE)

Sustainable Product Design (SPD)

Design for Sustainability (D4S)

Focus moves beyond the product

Social aspects also considered

Entire product life cycle optimised for eco-efficiency

Individual product aspects optimised for environmental performance

DEFINING SUSTAINABLE DESIGN

Green Design

Eco-Design (DfE)

Sustainable Product Design (SPD)

Design for Sustainability (D4S)

Transformative design

New scenarios envisioned

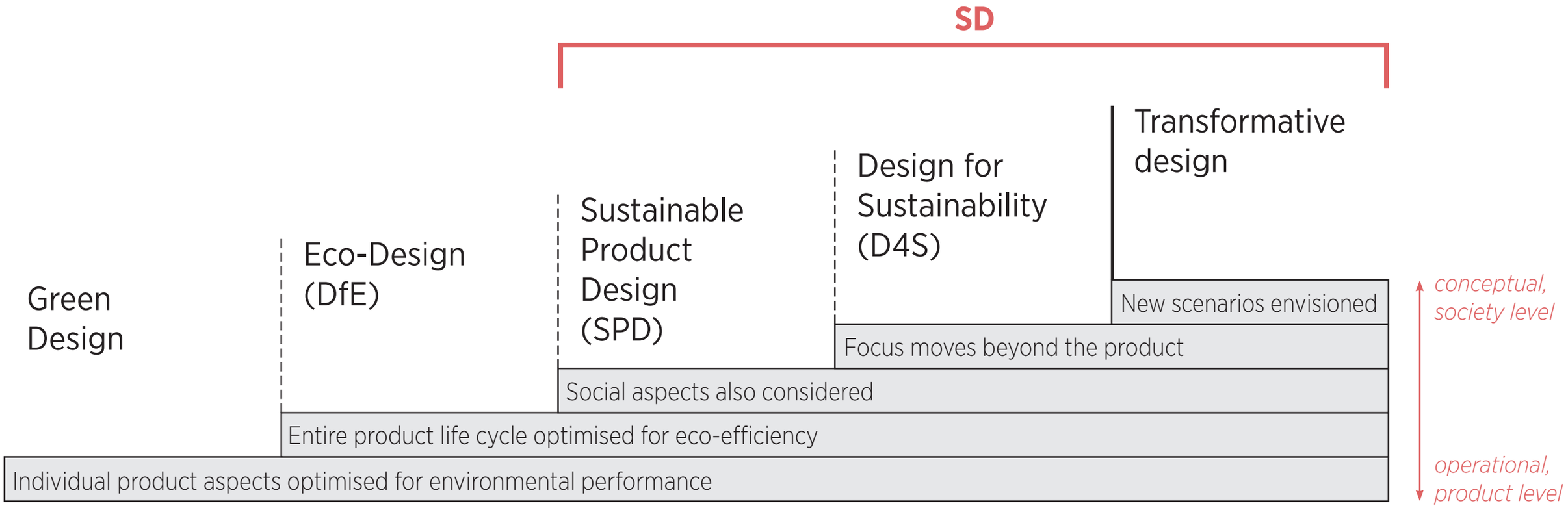
Focus moves beyond the product

Social aspects also considered

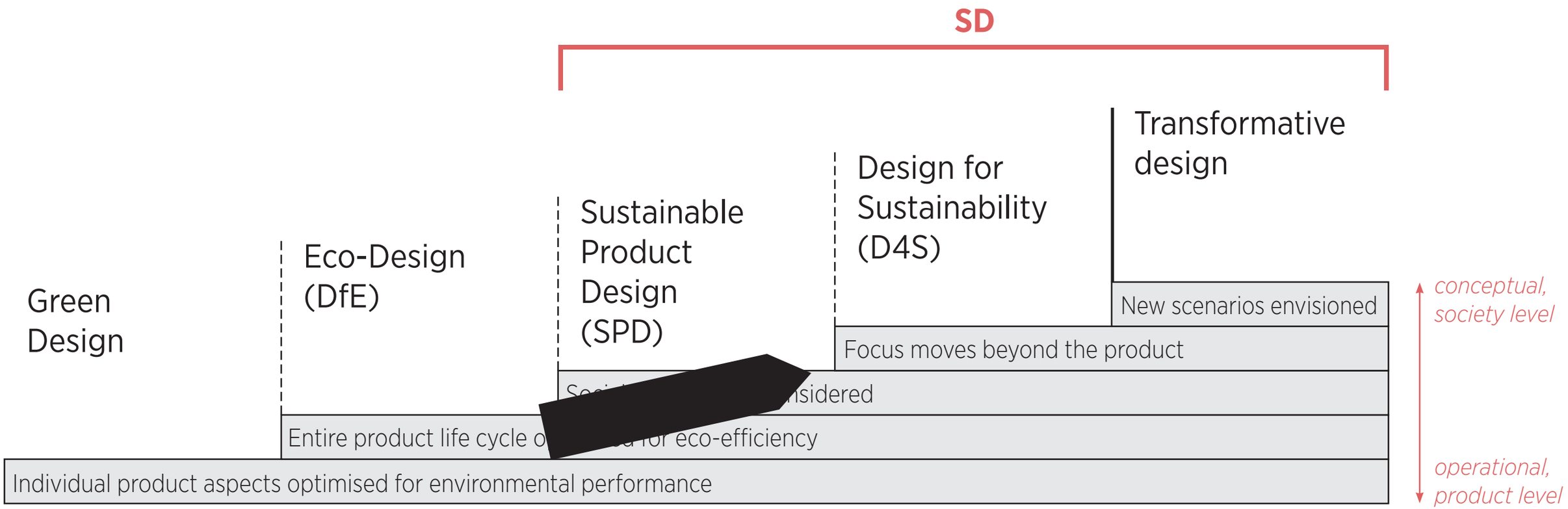
Entire product life cycle optimised for eco-efficiency

Individual product aspects optimised for environmental performance

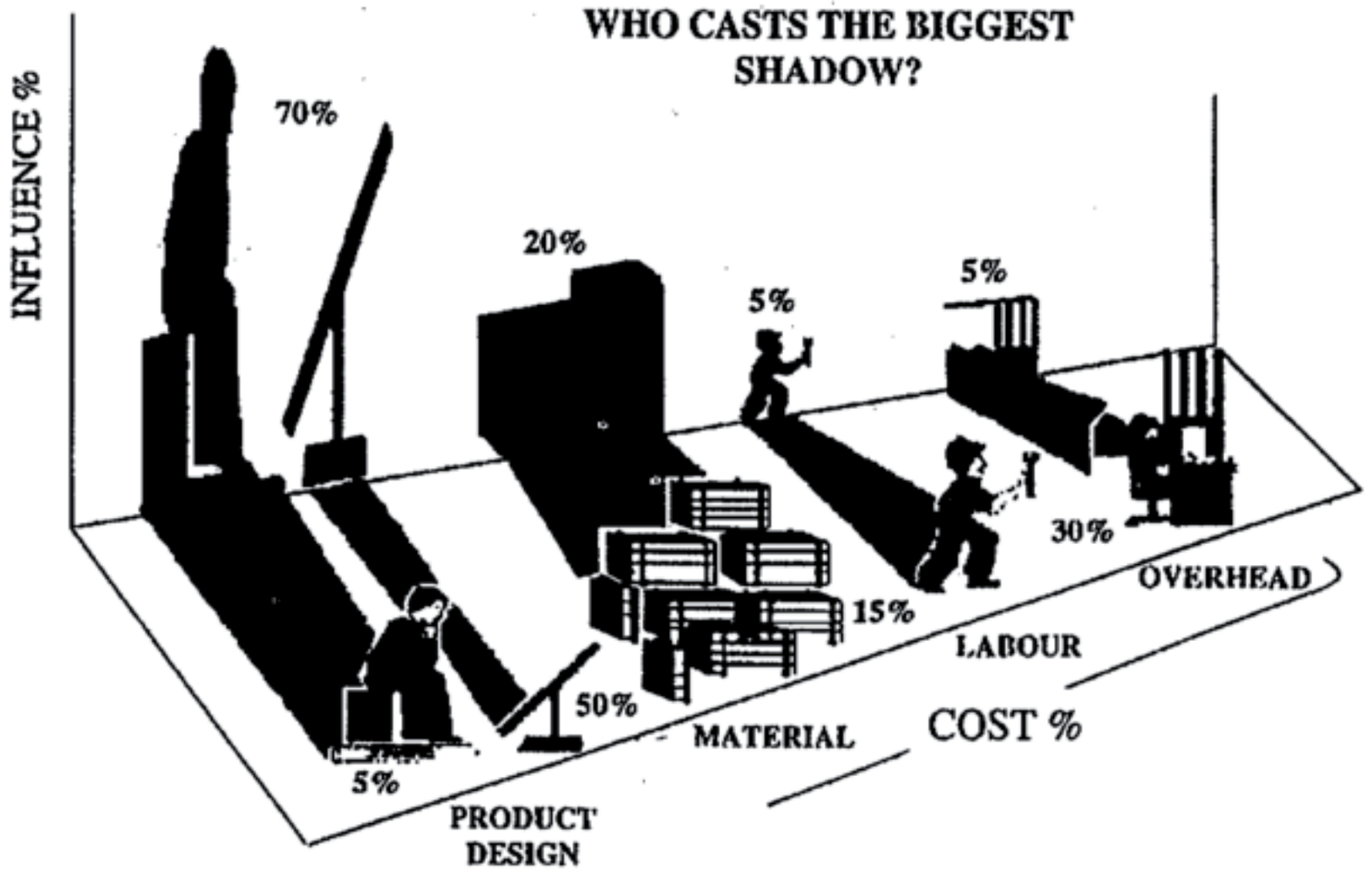
DEFINING SUSTAINABLE DESIGN



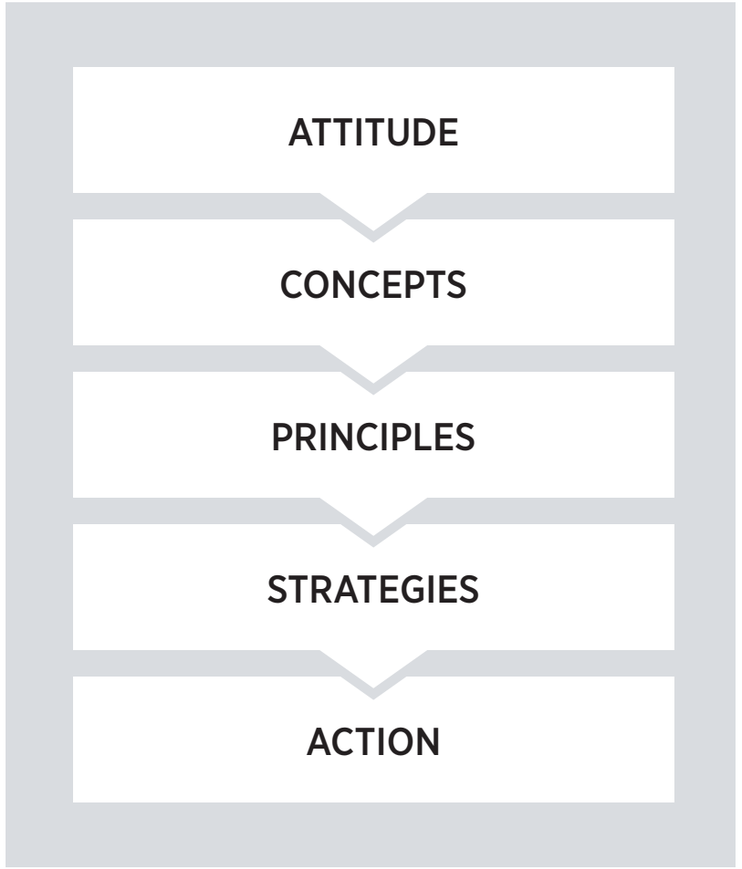
DEFINING SUSTAINABLE DESIGN



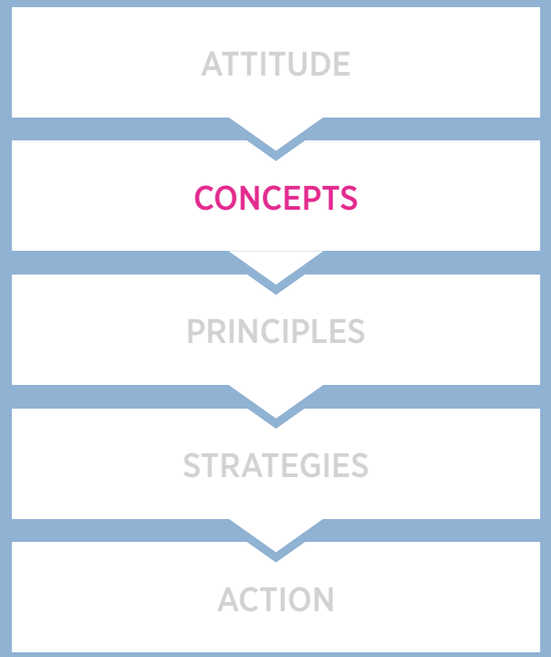
RESEARCH CONTEXT



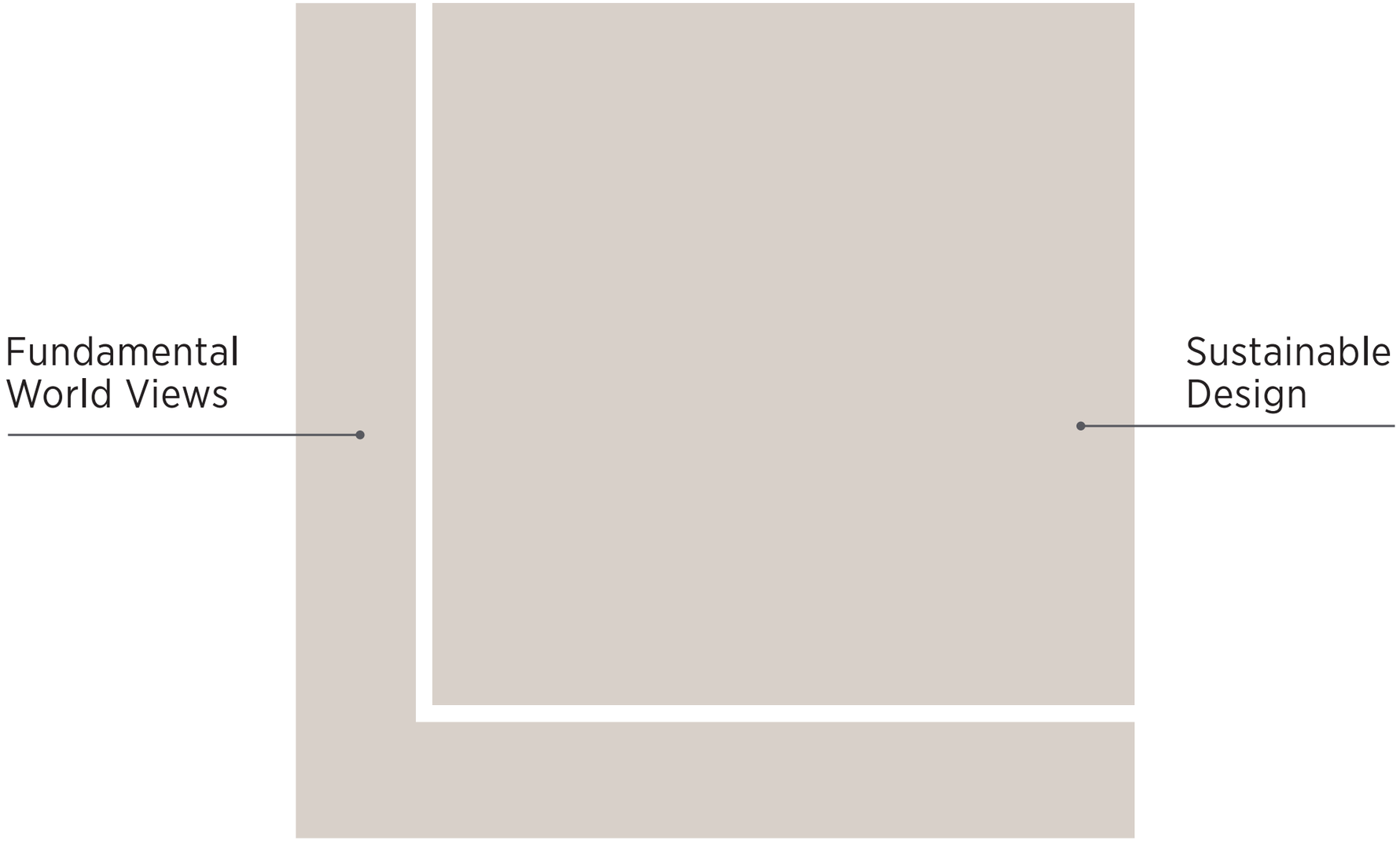
TOOL KIT CONCEPT: ‘FROM ATTITUDE TO ACTION’



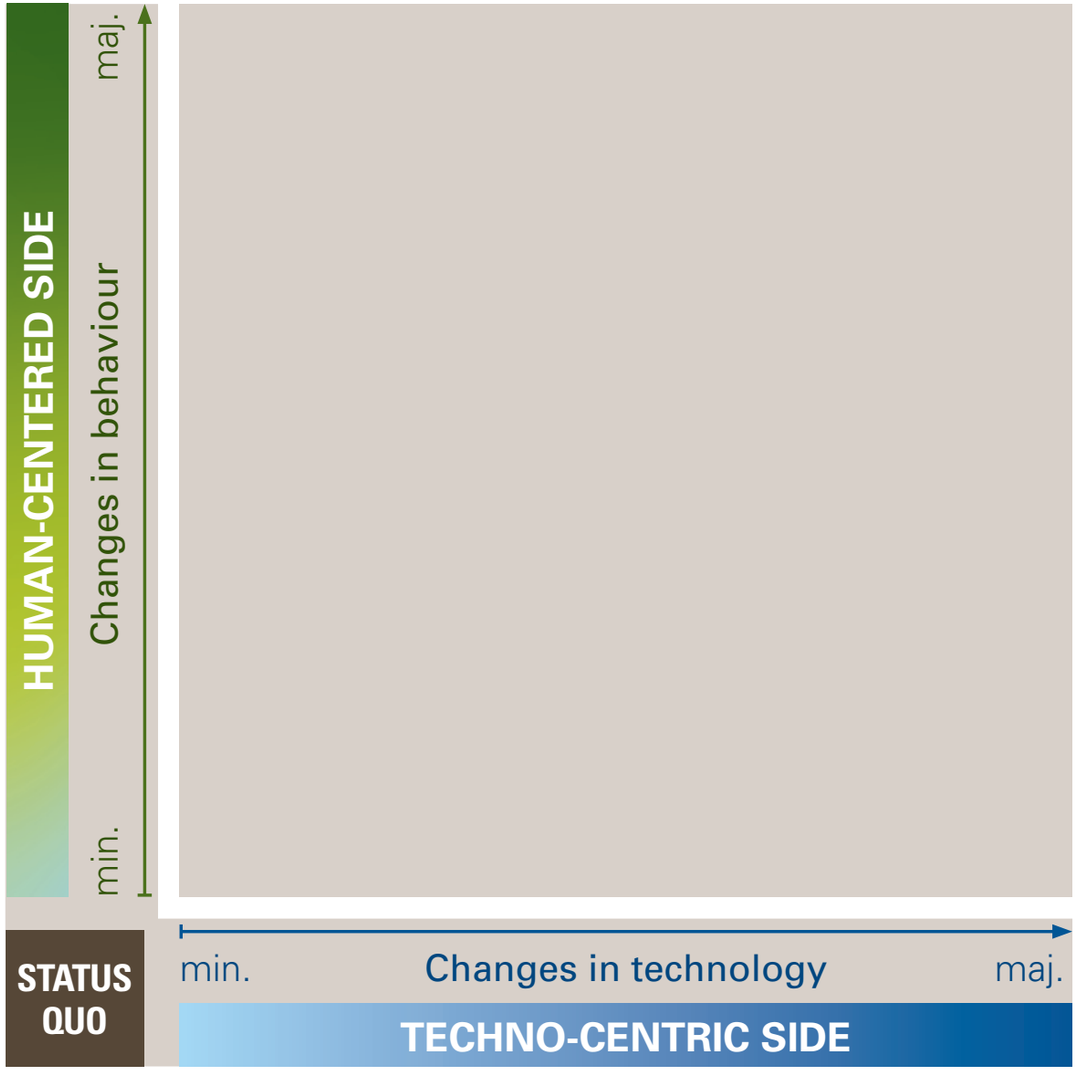
CONCEPTUAL SUSTAINABLE DESIGN MATRIX



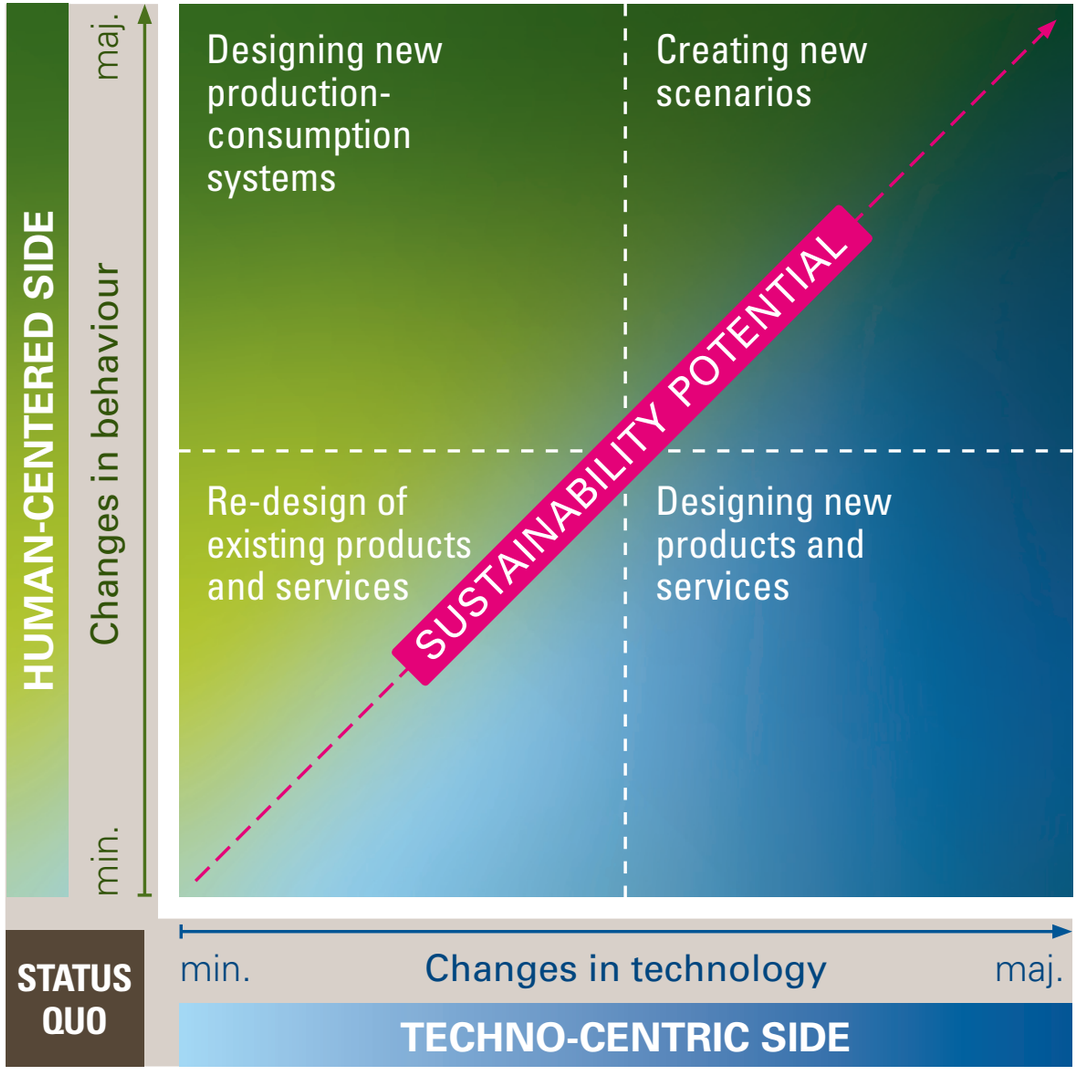
SUSTAINABLE DESIGN MATRIX



SUSTAINABLE DESIGN MATRIX

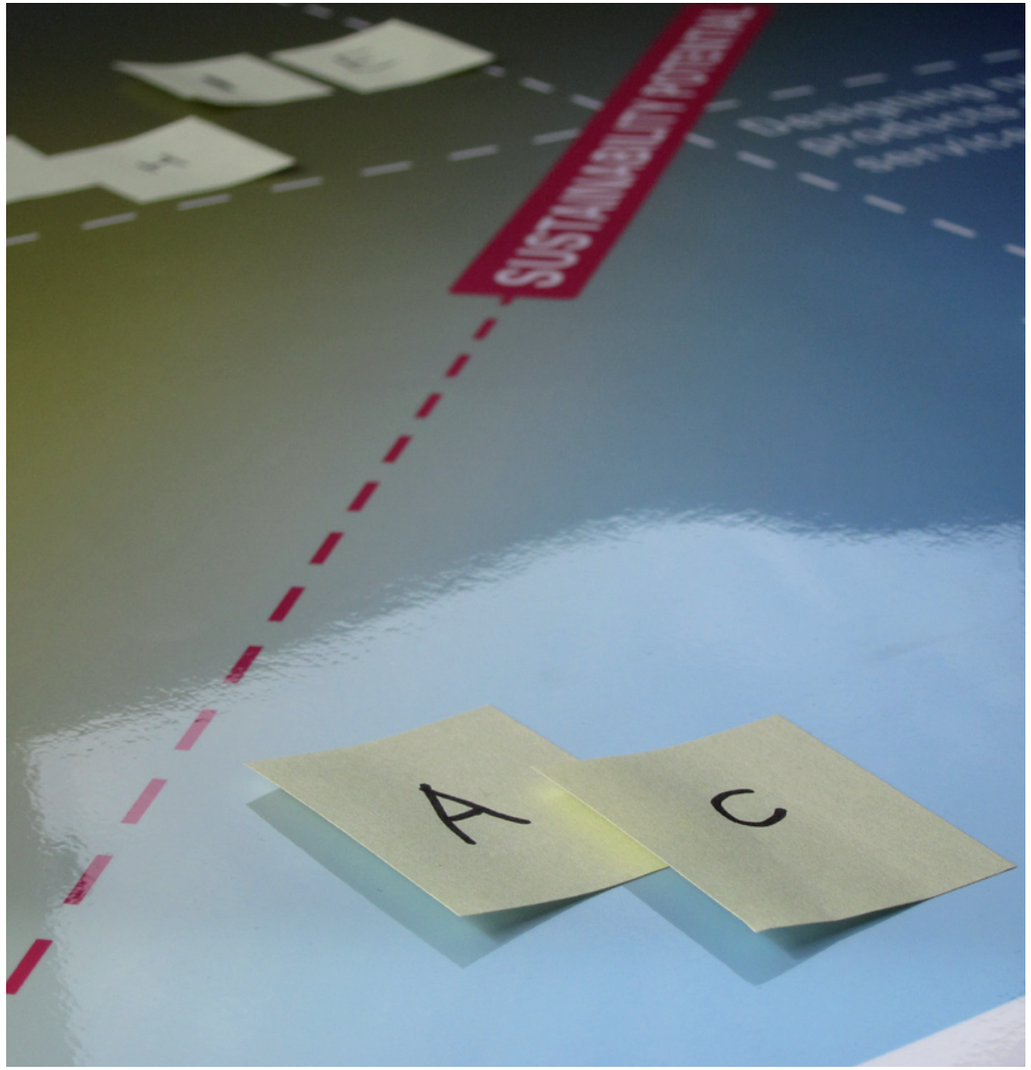


SUSTAINABLE DESIGN MATRIX

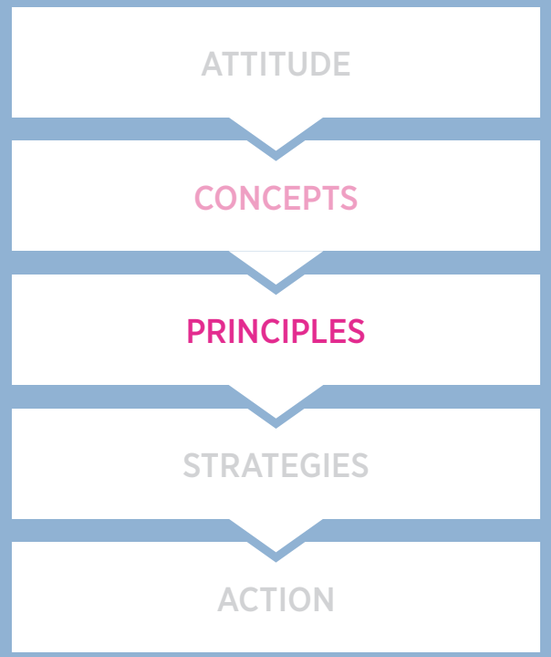


SUSTAINABLE DESIGN MATRIX

SUSTAINABLE DESIGN MATRIX IN USE

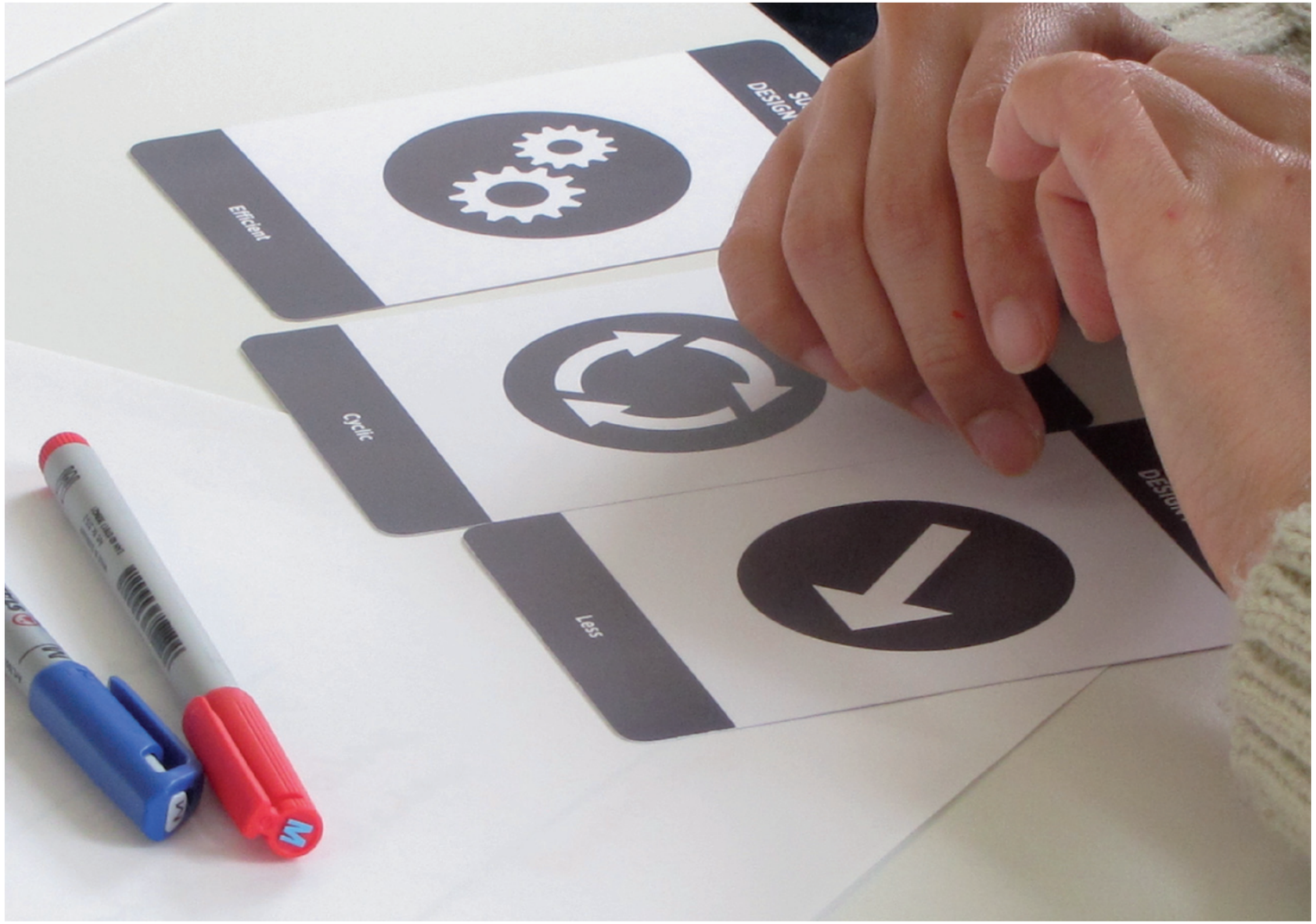


SUSTAINABLE DESIGN PRINCIPLES

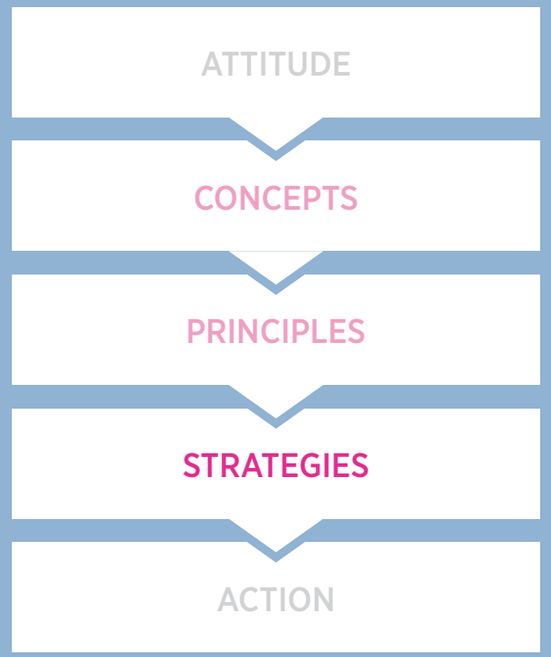


SUSTAINABLE DESIGN PRINCIPLES

SUSTAINABLE DESIGN PRINCIPLE CARDS



SUSTAINABLE DESIGN STRATEGIES



WHAT IS A STRATEGY?

PRINCIPLES	+ AREA OF APPLICATION	= STRATEGY
	Material Selection	• “Select clean materials” • “Select safe materials” • “Select cyclic materials”

'Downloadable' designs – designs that can be downloaded from the Internet – such as cutting plans, instructional videos – so that users can DIY and assemble their own designs.

Efficient use of raw and manufactured materials – reducing materials used and minimizing waste production.

Existing manufactured components – use of stocks of existing but unused components rather than making new components.

Innovation and revitalization of traditional (low impact) technologies – using inherently low environmental impact, traditional or craft, technologies in an innovative way, e.g. weaving plant fibres for furniture or boat construction.

and trying to reduce the total energy used.

Reduction in use of consumables – reducing consumables used during the manufacturing process.

Reduction of production waste – achieved by more efficient designs and/or manufacturing processes, to reduce costs, production times and resource depletion.

Regulation and standards compliant – manufacturing compliant with latest sector specific regulations and legislation. For example, within the electrical and electronic sector: Restriction of Hazardous Substances (RoHS), Waste Electrical and Electronic Equipment (WEEE) and Energy Use Products (EuP) Directives in the European Union Standards for sustainable building include LEED in the USA and BREAM in the UK.

actions. Proper
pollution. For example, tuning an automobile engine improves fu
economy while reducing toxic tailpipe emissions. On the other
delaying or ignoring maintenance can damage a product and
useful life.

Designers wishing to create product systems that are easy to
tain should address the following topics:

- downtime, tool availability, personnel skills
- complexity of required procedures
- potential for error
- accessibility to parts, components, or system to be
- frequency of design-dictated maintenance

This is not an exhaustive list, but it identifies some key
fecting maintenance. Most of these criteria are interrelated. For
nance is complex, specialized personnel are required, downtime

A two-step process is
First, a diagnosis identifies the
resource management should

- Should the product
- Are other compone
fail soon?
- Should the defectiv
remanufactured, o

Answers to these ques
quences.

Factors relating to
important in repair a
also rely on interchan
ally applies to parts
fers to compatible p
Standardization ma
accepted design st

Preferably

3c. Lower/cleaner energy consumption

Aim to reduce energy consumption in existing production

Rules-of-thumb

- Motivate the production department and suppliers to
production processes more energy efficient.
- Encourage them to make use of renewable energy
natural gas, low-sulphur coal, wind energy, water power
Where possible, reduce the use of fossil fuels and reduce
impact by, for example, choosing low-sulphur coal or

3d. Less production waste

The existing production process is optimized with respect
and emissions. The efficiency with which materials
such as possible to reduce waste and emissi

should be

4a. Less/cleaner/reusa

This principle involves pre
required, the greater is th
for transport.

Rules-of-thumb

- If all or some
appeal, use an attr
- For transpor
packaging in co
- Use appro
the use of PVC
- Use mini
- Make s
foldability a

4b. Energ

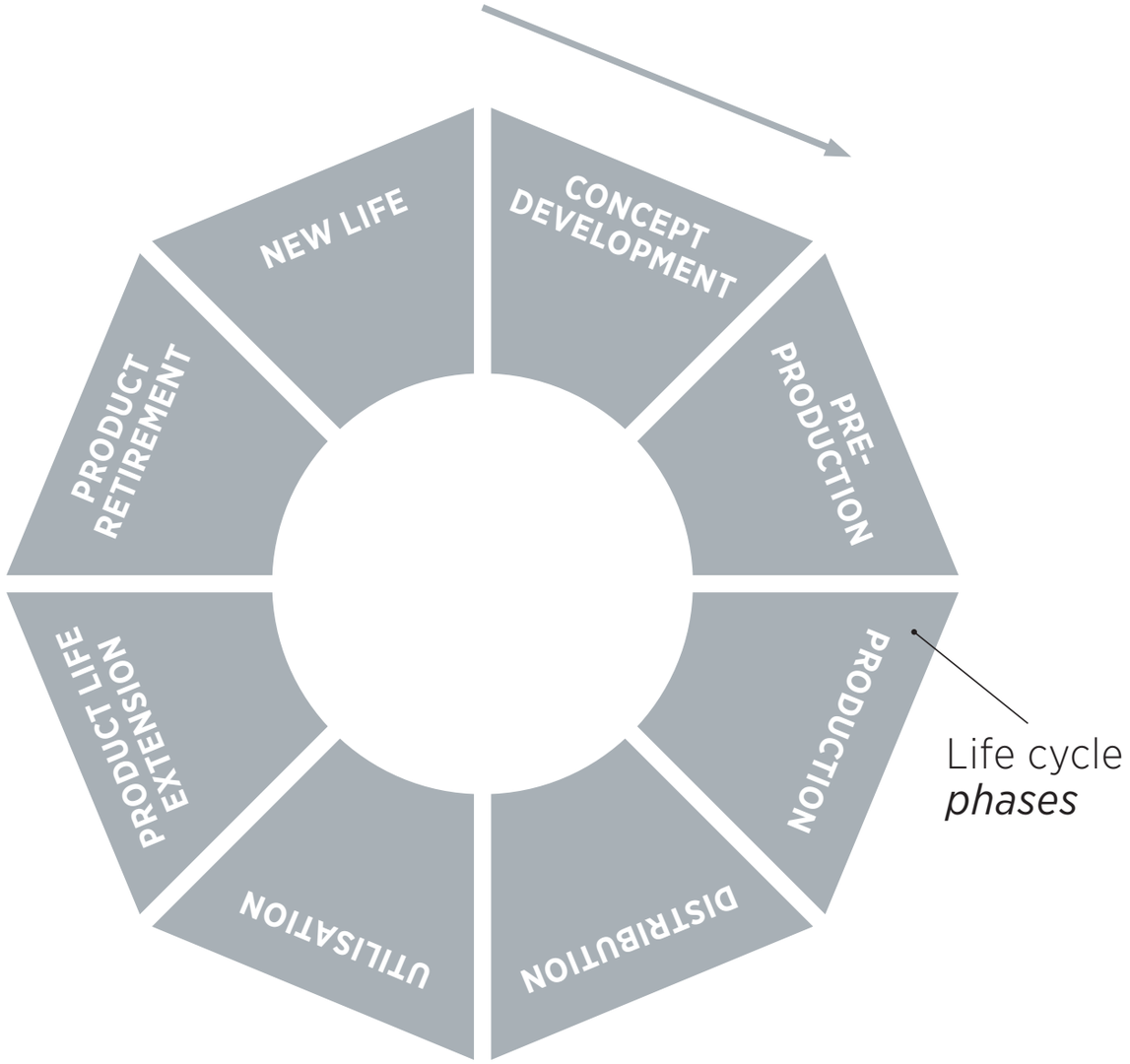
The enviro
sea. This

Ensure healthy inputs and outputs by: [21; 24]
alling protection against release of pollutants and hazardous substances [7; 25]
ifying non-hazardous and otherwise environmentally "clean" substances, especially in regards
; 28-32]
ring that wastes are water-based or biodegradable[5; 6; 16; 30]
fying the cleanest source of energy [5; 7; 25; 31]
ling labels and instructions for safe handling of toxic materials [7-9; 29-33]
ying clean production processes for the product and in selection of components [7; 16; 29; 3
ntrating toxic elements for easy removal and treatment [7; 24; 25; 29; 30; 33]

Table 3: Principle C - Production and Transport

nsure minimal use of resources in production and transportation phases by: [24; 32]
ng the functions and appeals of packaging through the product's design [7; 25]
ng folding, nesting or disassembly to distribute products in a compact state [7; 25]
g structural techniques and materials to minimize the total volume of material [4-9; 16;
g lightweight materials and components [6; 8; 16; 25]
g materials that do not require additional surface treatment or inks [5; 7; 25]

STRATEGIES & LIFE CYCLE



05 MATERIAL PROPERTIES

A) Select clean materials

1 Select chemical-free materials
2 Select non-polluting materials
3 Select biomass crops
4 Select biopolymers

B) Select safe materials

1 Select “legislation safe” materials
2 Select non-toxic and non-hazardous materials
3 Select non gene-manipulated materials

C) Select durable materials

1 Select precious materials
2 Select simple and true materials
3 Select long lasting (durable) materials

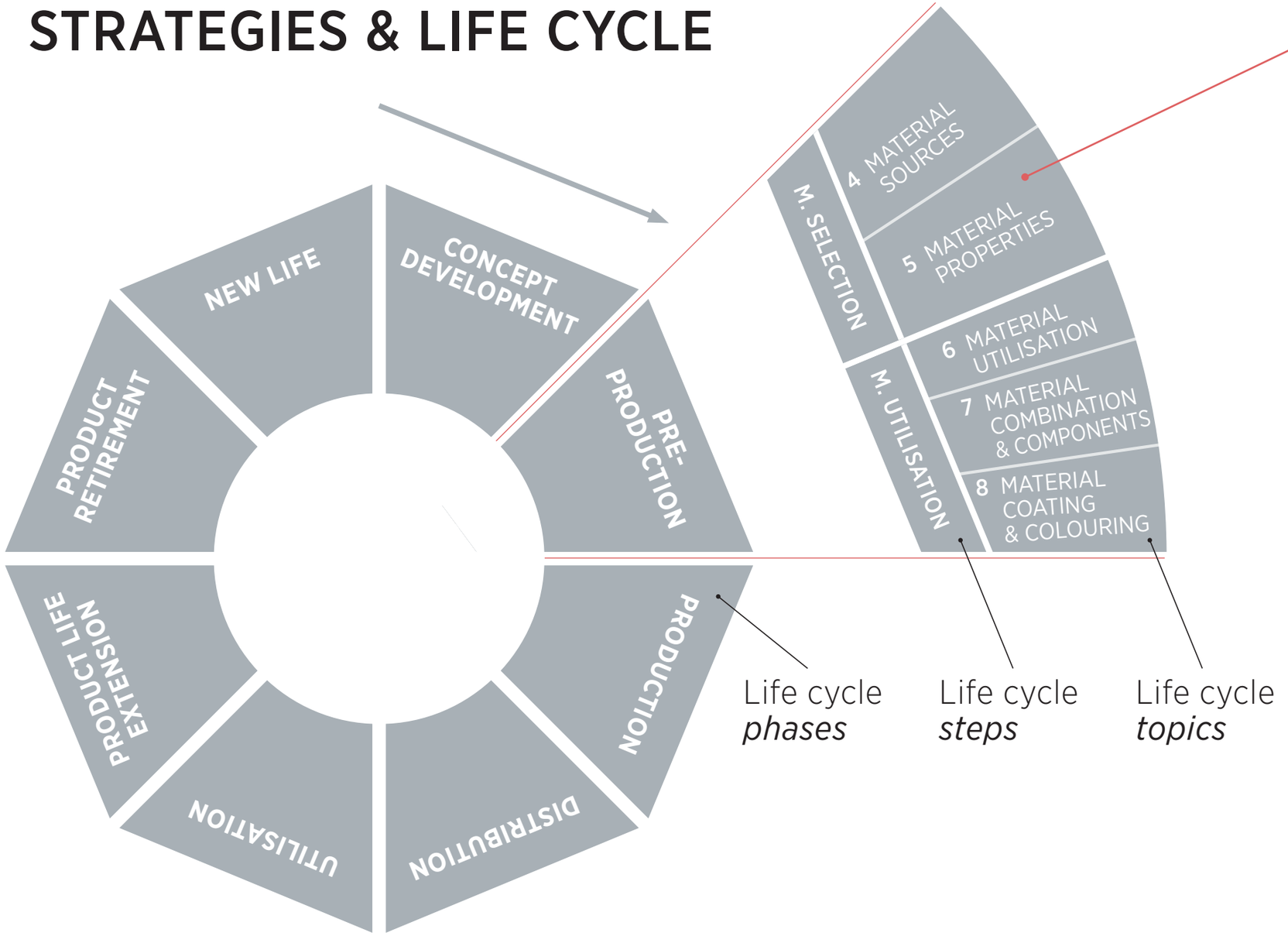
D) Select cyclic materials

1 Select wasted and reclaimed materials
2 Reuse materials
3 Select recycled materials
4 Chose recyclable materials

E) Select ecologically beneficial materials

1 Select abundant materials
2 Select light weight materials
1 Select materials with clean energy history
2 Select materials with low energy intensity
3 Select energy efficient materials

STRATEGIES & LIFE CYCLE



05 MATERIAL PROPERTIES

A) Select clean materials

1 Select chemical-free materials
2 Select non-polluting materials
3 Select biomass crops
4 Select biopolymers

B) Select safe materials

1 Select “legislation safe” materials
2 Select non-toxic and non-hazardous materials
3 Select non gene-manipulated materials

C) Select durable materials

1 Select precious materials
2 Select simple and true materials
3 Select long lasting (durable) materials

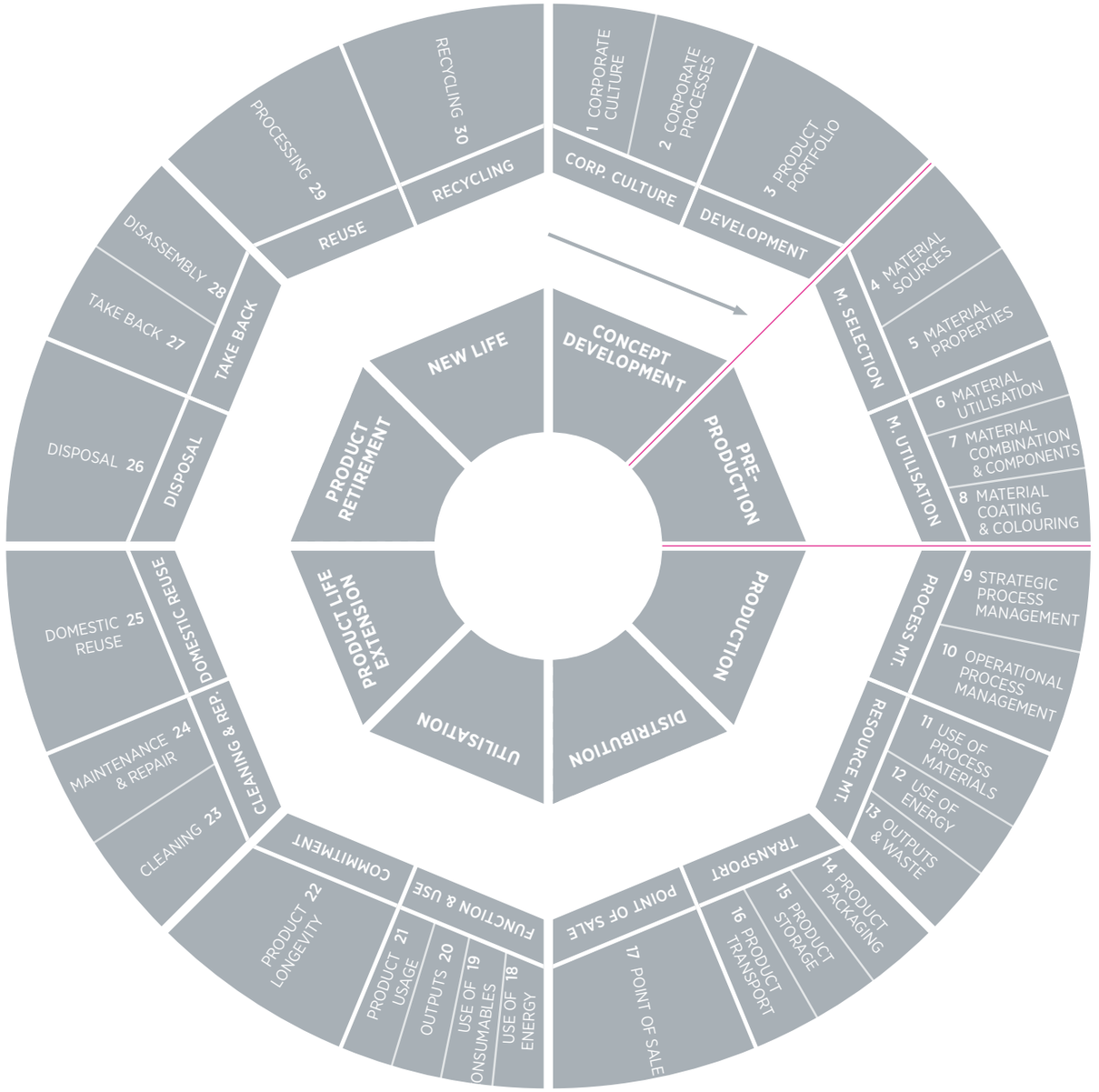
D) Select cyclic materials

1 Select wasted and reclaimed materials
2 Reuse materials
3 Select recycled materials
4 Chose recyclable materials

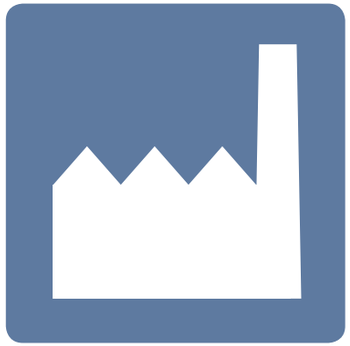
E) Select ecologically beneficial materials

1 Select abundant materials
2 Select light weight materials
1 Select materials with clean energy history
2 Select materials with low energy intensity
3 Select energy efficient materials

PRODUCT LIFE CYCLE



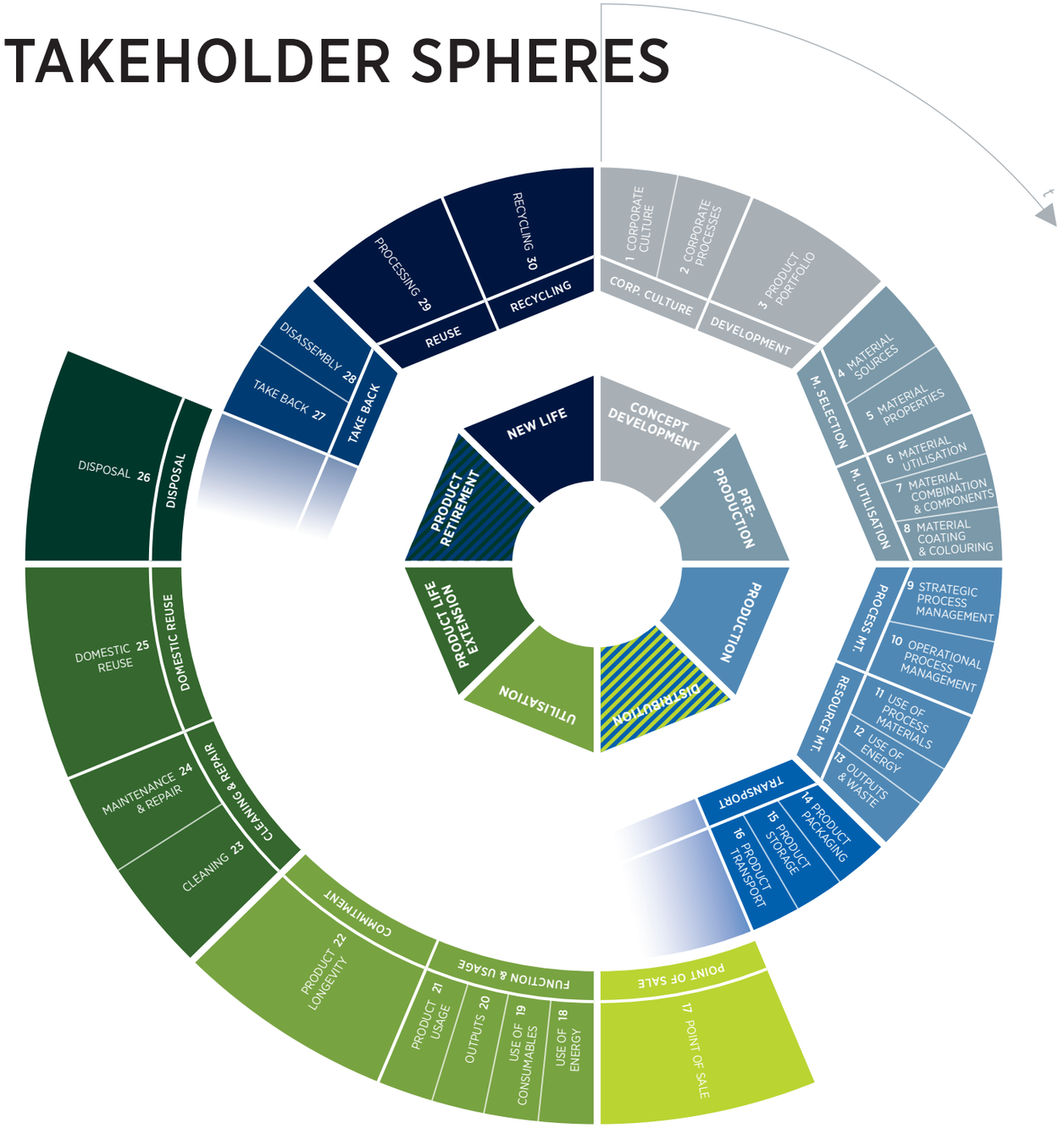
STAKEHOLDER SPHERES



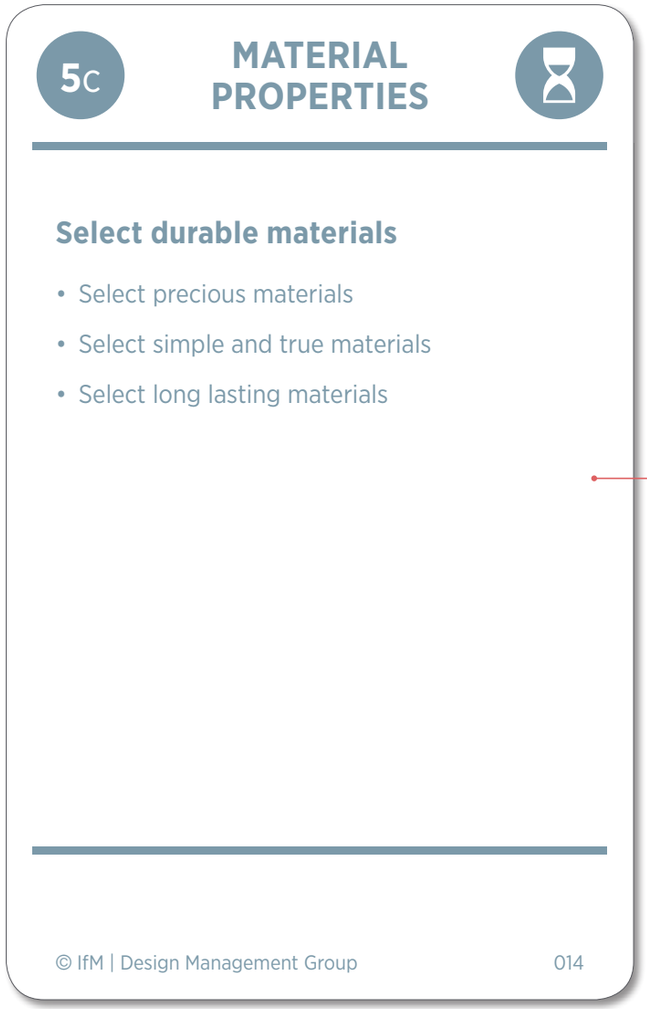
Producer sphere

User sphere

LIFE CYCLE & STAKEHOLDER SPHERES



STRATEGIES ON STRATEGY CARDS



05 MATERIAL PROPERTIES

A) Select clean materials

1 Select chemical-free materials
2 Select non-polluting materials
3 Select biomass crops
4 Select biopolymers

B) Select safe materials

1 Select “legislation safe” materials
2 Select non-toxic and non-hazardous materials
3 Select non gene-manipulated materials

C) Select durable materials

1 Select precious materials
2 Select simple and true materials
3 Select long lasting (durable) materials

D) Select cyclic materials

1 Select wasted and reclaimed materials
2 Reuse materials
3 Select recycled materials
4 Chose recyclable materials

E) Select ecologically beneficial materials

1 Select abundant materials
2 Select light weight materials
1 Select materials with clean energy history
2 Select materials with low energy intensity
3 Select energy efficient materials

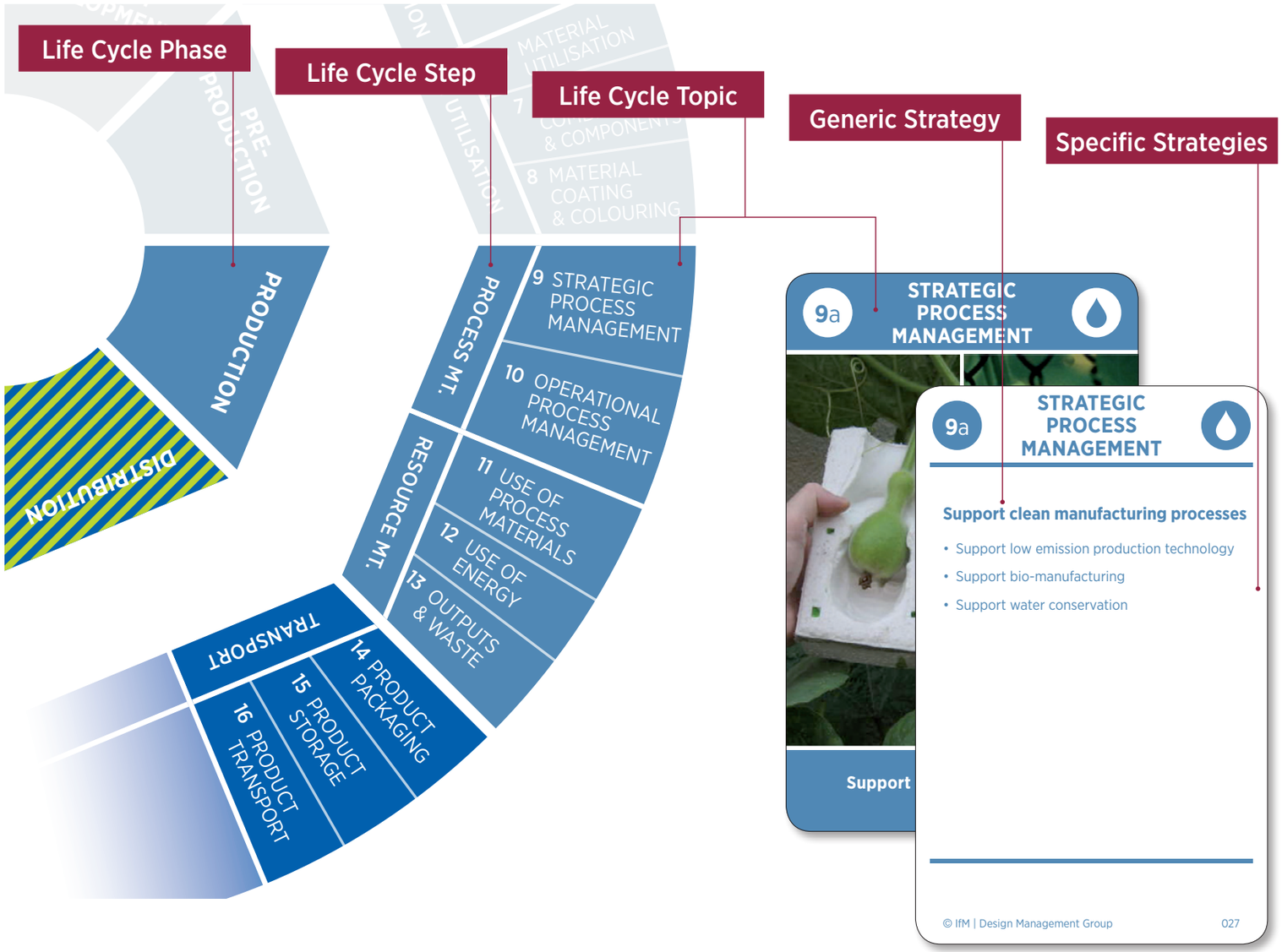
IfM Design Management Group

SUSTAINABLE DESIGN STRATEGY CARDS

IfM Design Management Group

UNIVERSITY OF CAMBRIDGE

LINK BETWEEN LIFE CYCEL AND STRATEGY CARDS



THE TOOL KIT


KIT
UNIVERSITY OF CAMBRIDGE
PROCESS MANAGEMENT
PRODUCT TRANSPORT
CLEANING & REPAIR
DISPOSAL
INDUSTRIAL REUSE


THE CAMBRIDGE
SUSTAINABLE DESIGN
TOOL KIT
UNIVERSITY OF CAMBRIDGE
PROCESS MANAGEMENT
PRODUCT TRANSPORT
MATERIAL UTILISATION
CLEANING & REPAIR
DISPOSAL
RECYCLING
FUNCTION & USAGE
INDUSTRIAL REUSE
NEW LIFE
IfM Design Management Group

FROM ATTITUDE TO ACTION

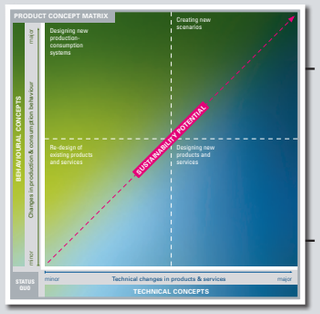
ATTITUDE

CONCEPTS

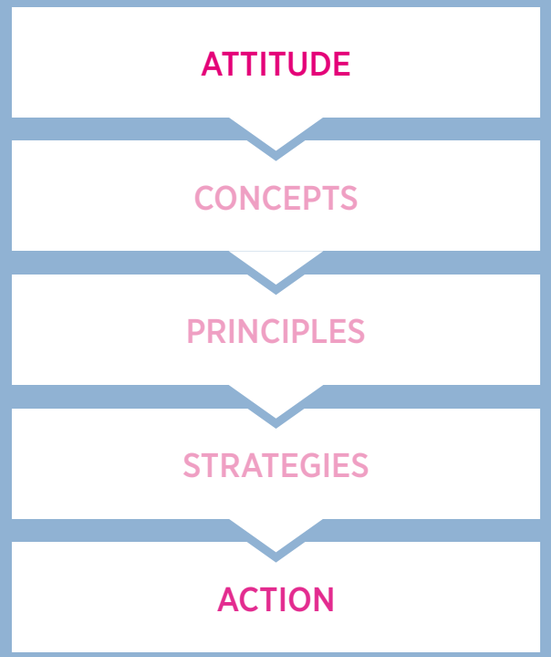
PRINCIPLES

STRATEGIES

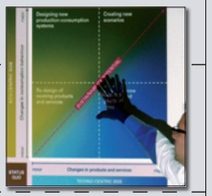
ACTION



WORKSHOP PROCESS



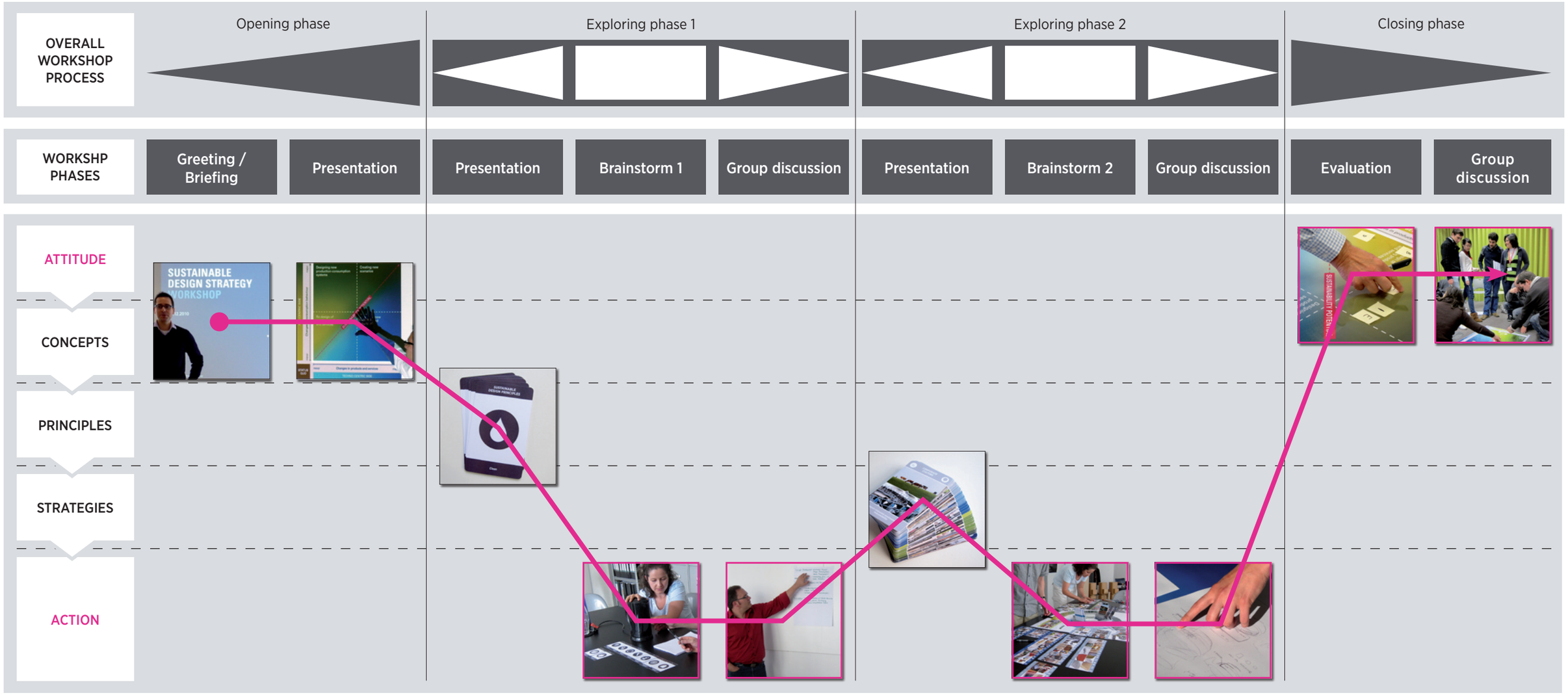
WORKSHOP PROCESS

	Opening phase	Exploring phase 1			Exploring phase 2			Closing phase	
OVERALL WORKSHOP PROCESS									
WORKSHP PHASES	Greeting / Briefing	Presentation	Presentation	Brainstorm 1	Group discussion	Presentation	Brainstorm 2	Group discussion	Evaluation	Group discussion
ATTITUDE										
CONCEPTS										
PRINCIPLES										
STRATEGIES										
ACTION										

IfM Design Management Group

UNIVERSITY OF CAMBRIDGE

WORKSHOP PROCESS

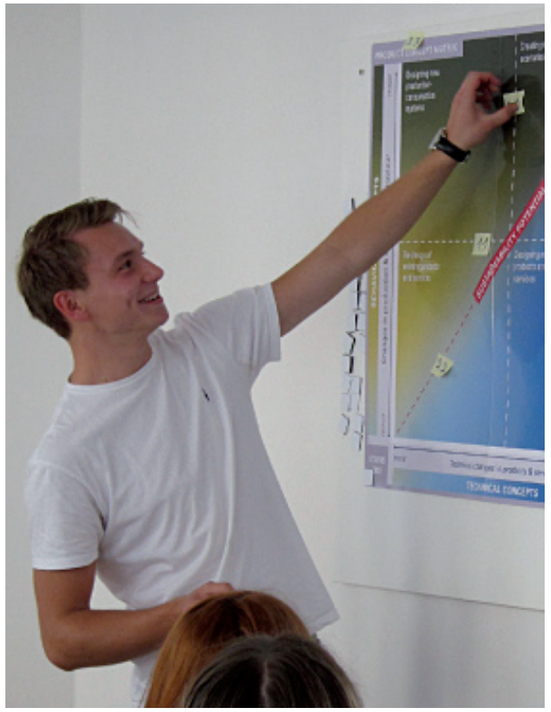


TESTING THE TOOL KIT AND WORKSHOP PROCESS

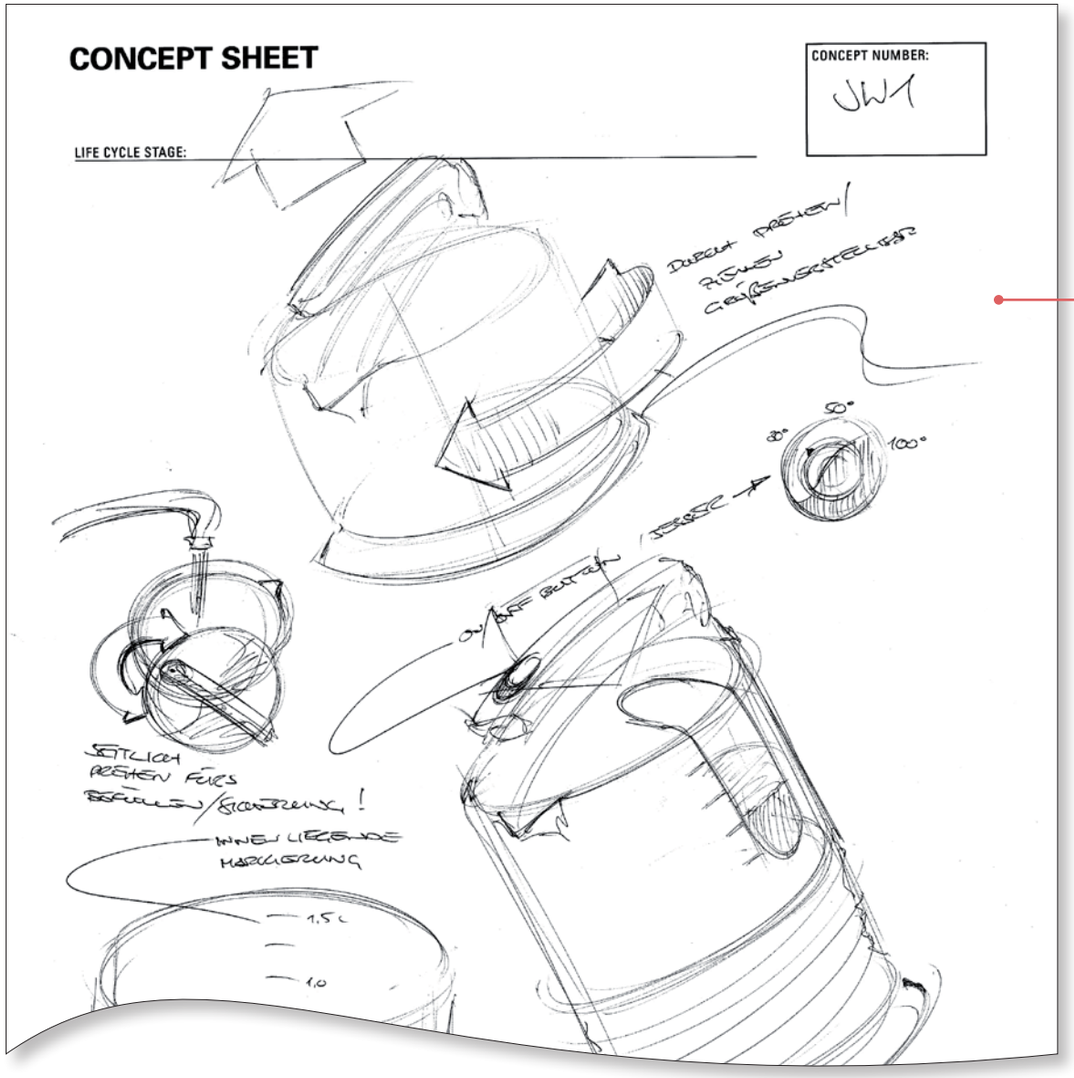
FOCUS GROUPS

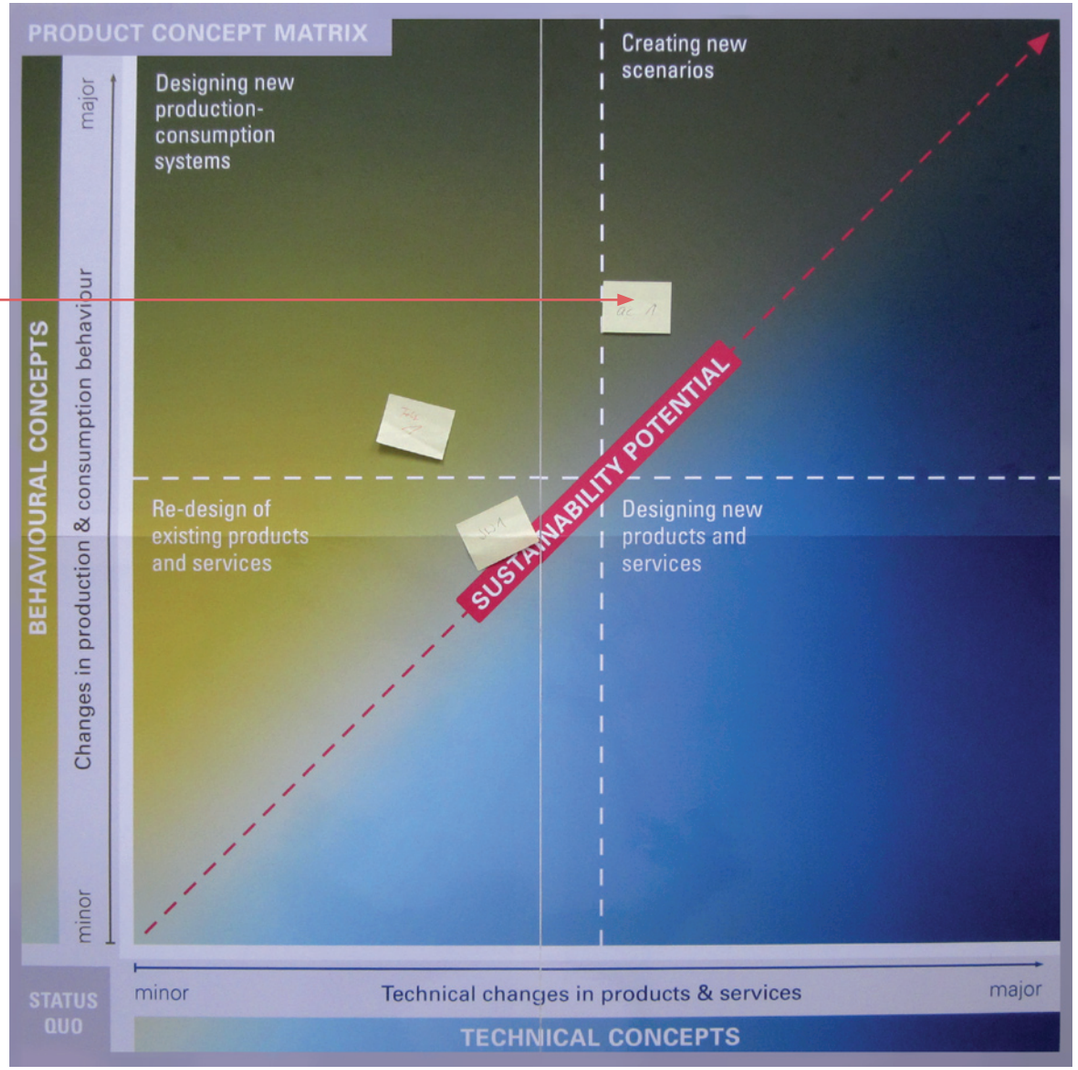
Activities supported by the tool kit	Industry		Consultancies	Academia
	multinational	SMEs		
Education / Learning	✓	✓	✓	✓
Teambuilding exercises	✓		✓	
Internal communication	✓		✓	
External communication	✓		✓	
Product development support	X	✓	✓	

WORKSHOP EXAMPLES

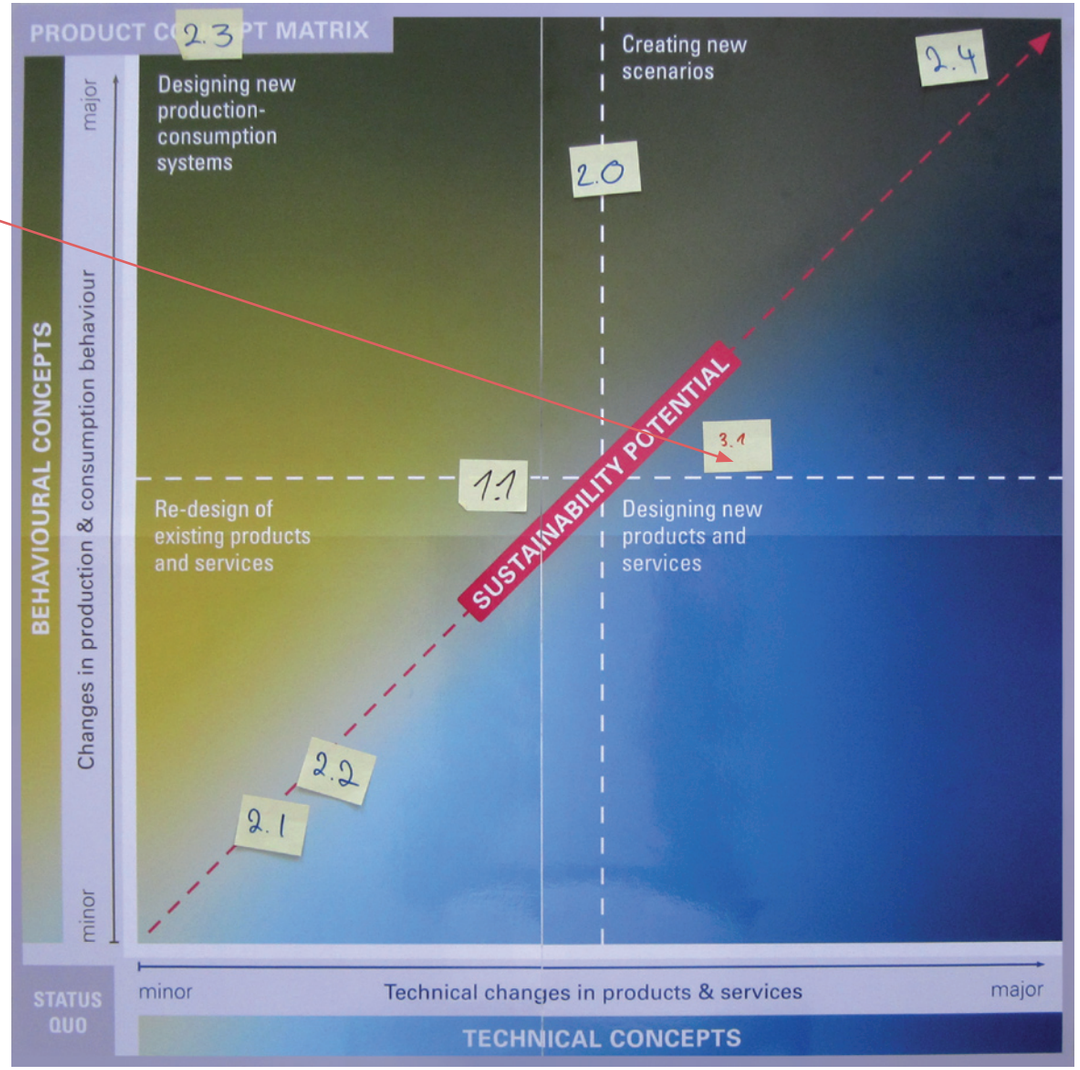


WORKSHOP RESULTS

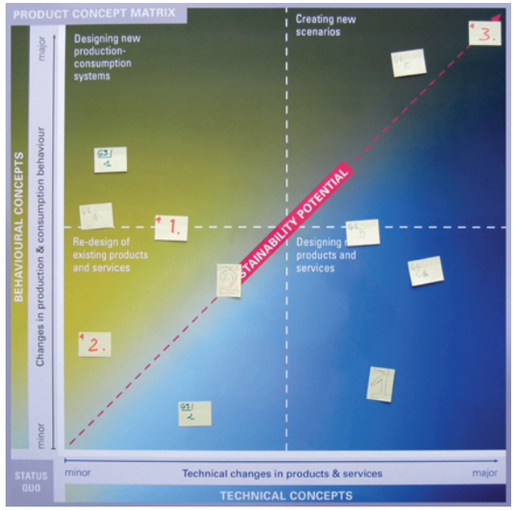


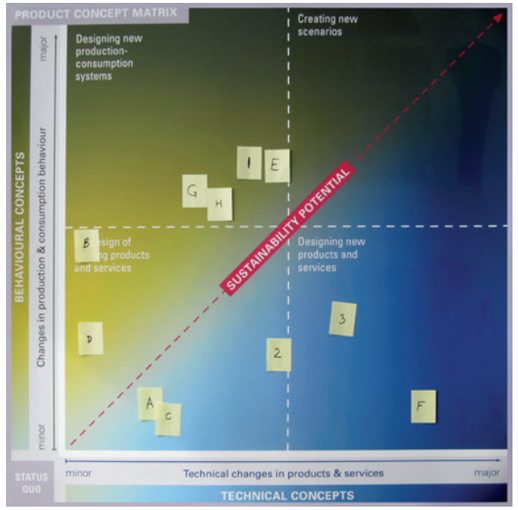


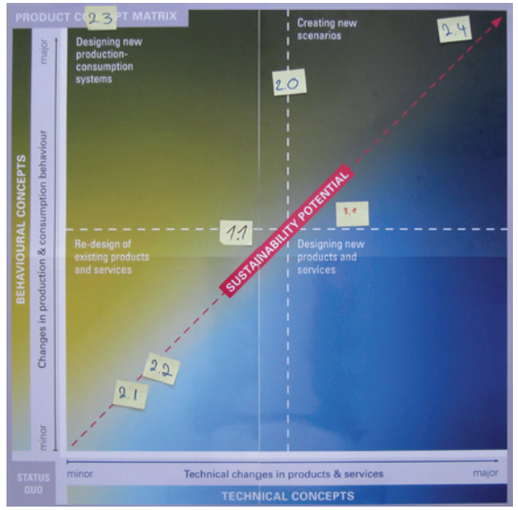
WORKSHOP RESULTS

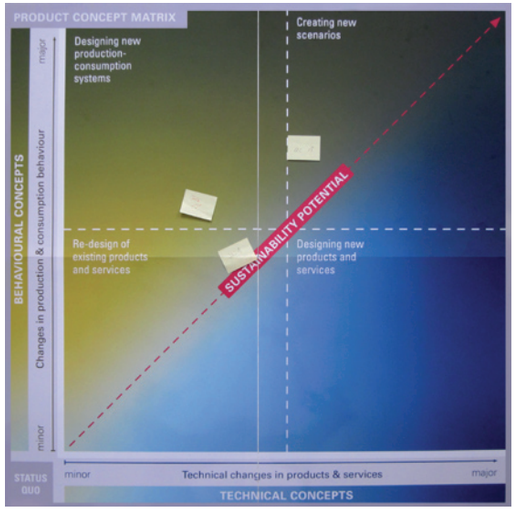


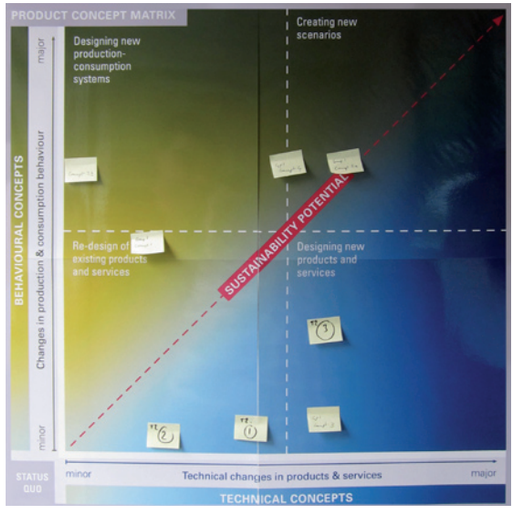
WORKSHOP RESULTS

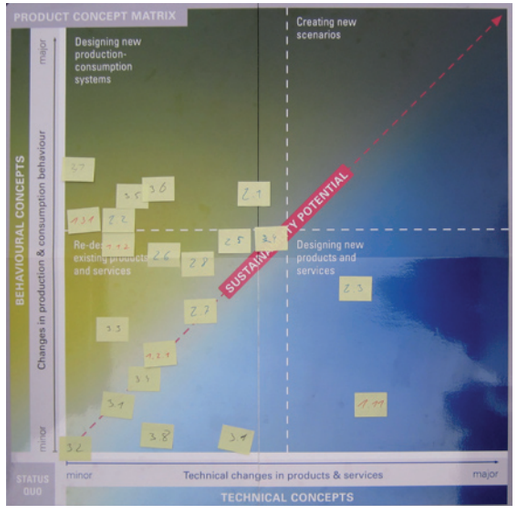


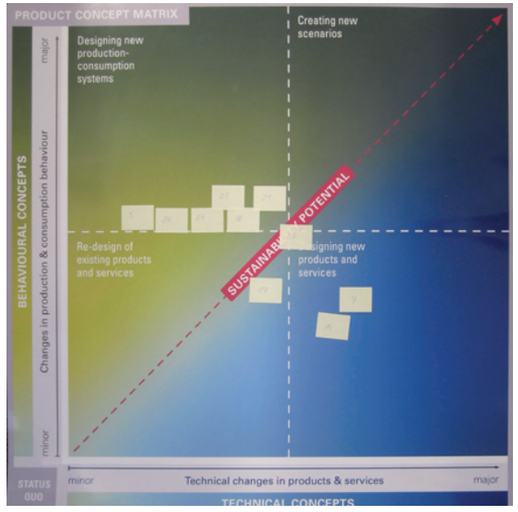


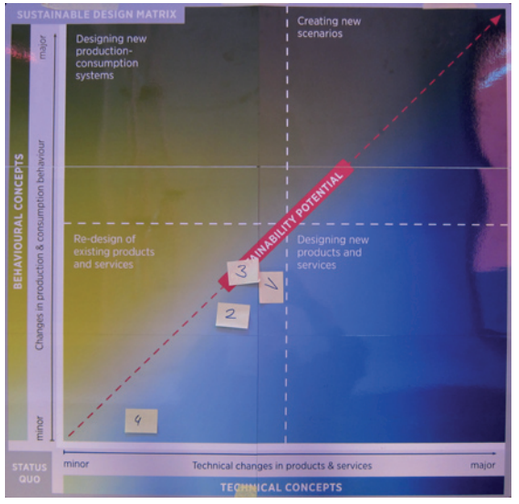












IfM Design Management Group

UNIVERSITY OF CAMBRIDGE

THANK YOU

Bernhard Dusch

Design Management Group
Institute for Manufacturing
Department of Engineering
University of Cambridge

E-mail: bd302@cam.ac.uk