

Ecodesign of Single-use Products: Consideration of Design Specifications within LCA

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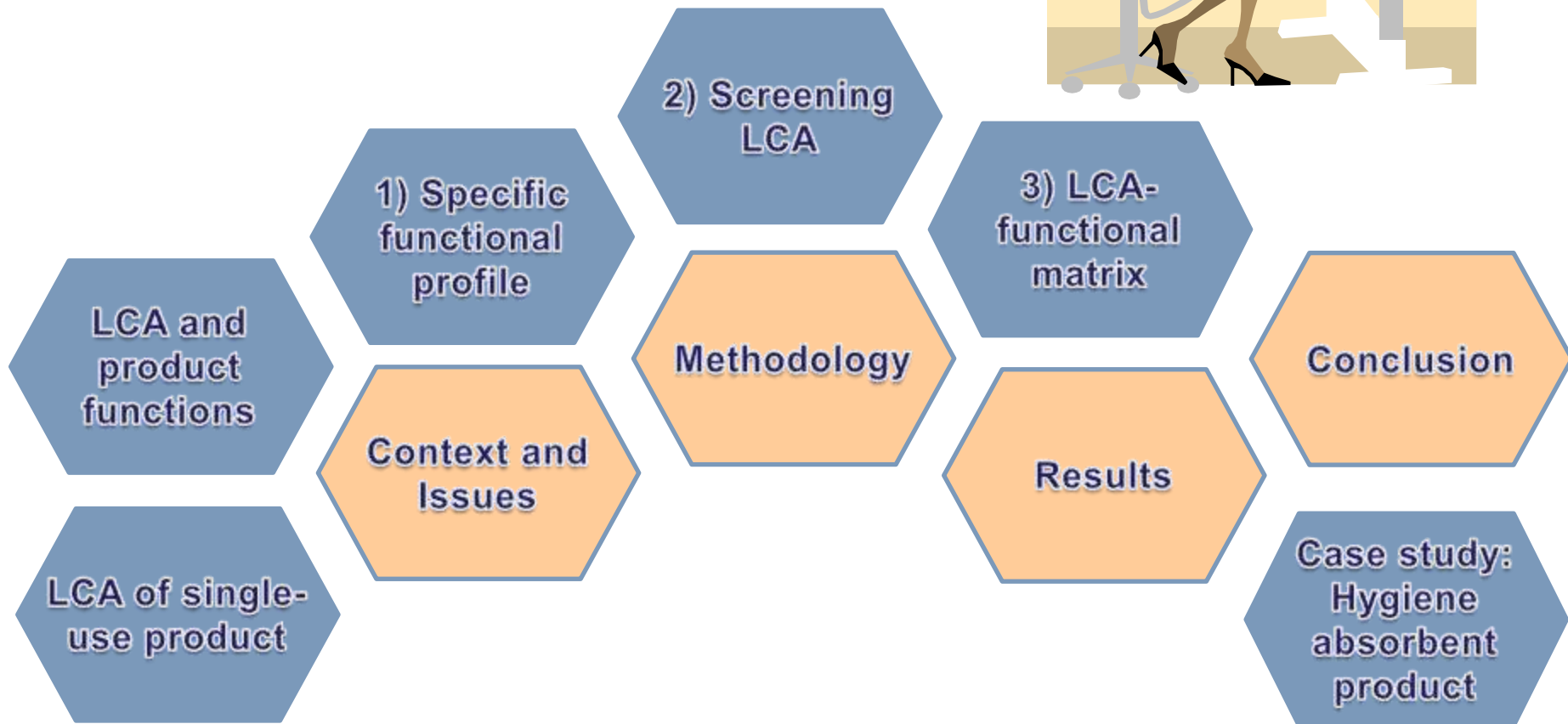
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Outline



Context and Issues: LCA and Product Functions



Context and Issues: LCA of Single-Use Products

LCA available on Medical and Hygiene Single-Use Products



Why have these products been designed to be used only once?

Context and Issues: LCA of Single-Use Products

Functions allow the understanding of the reasons why products have been designed to be used only once



Several of those functions are qualitative functions based on consumer's perception that cannot be neglected from a design perspective

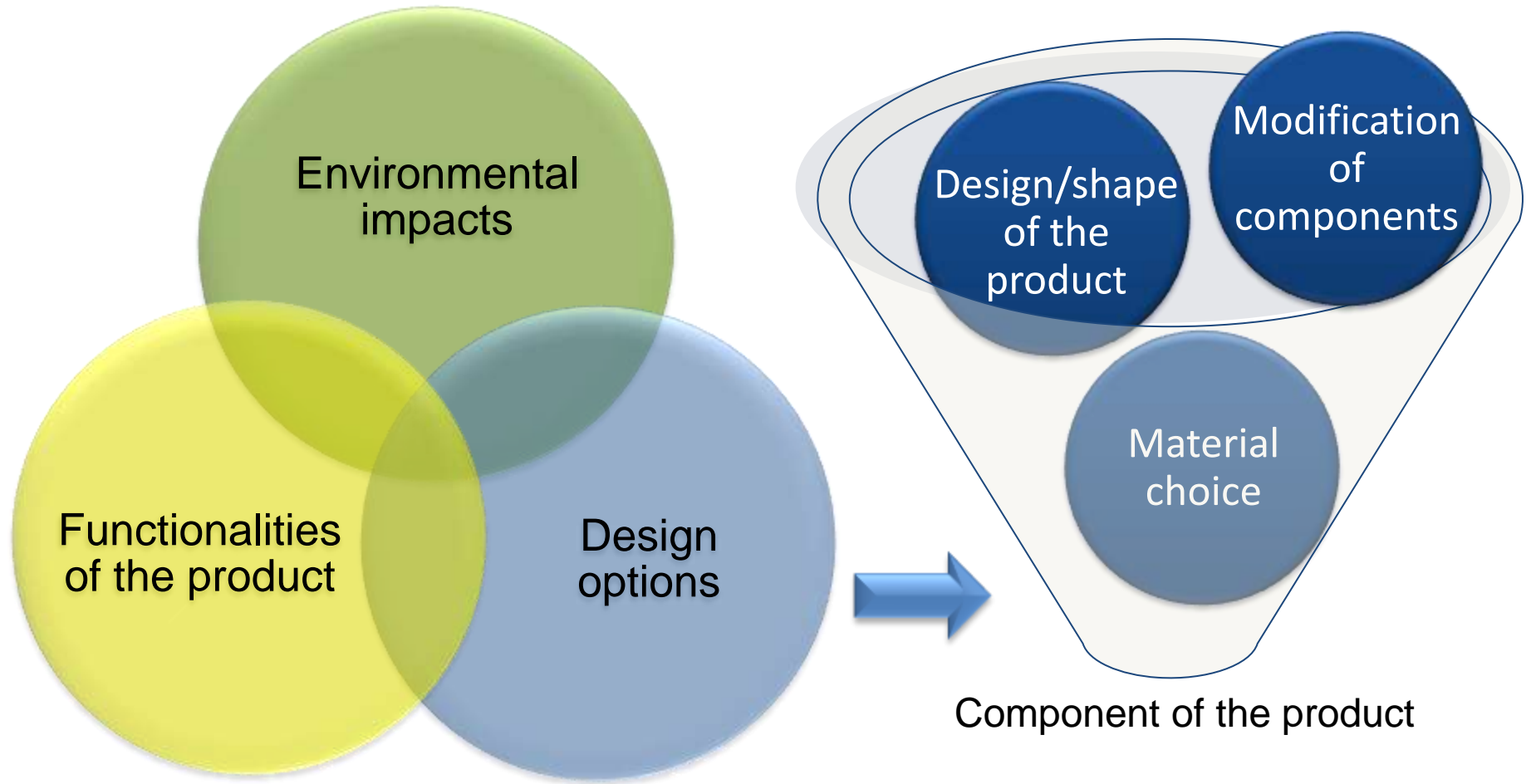


LCA is not suitable to evaluate all those secondary characteristics of products

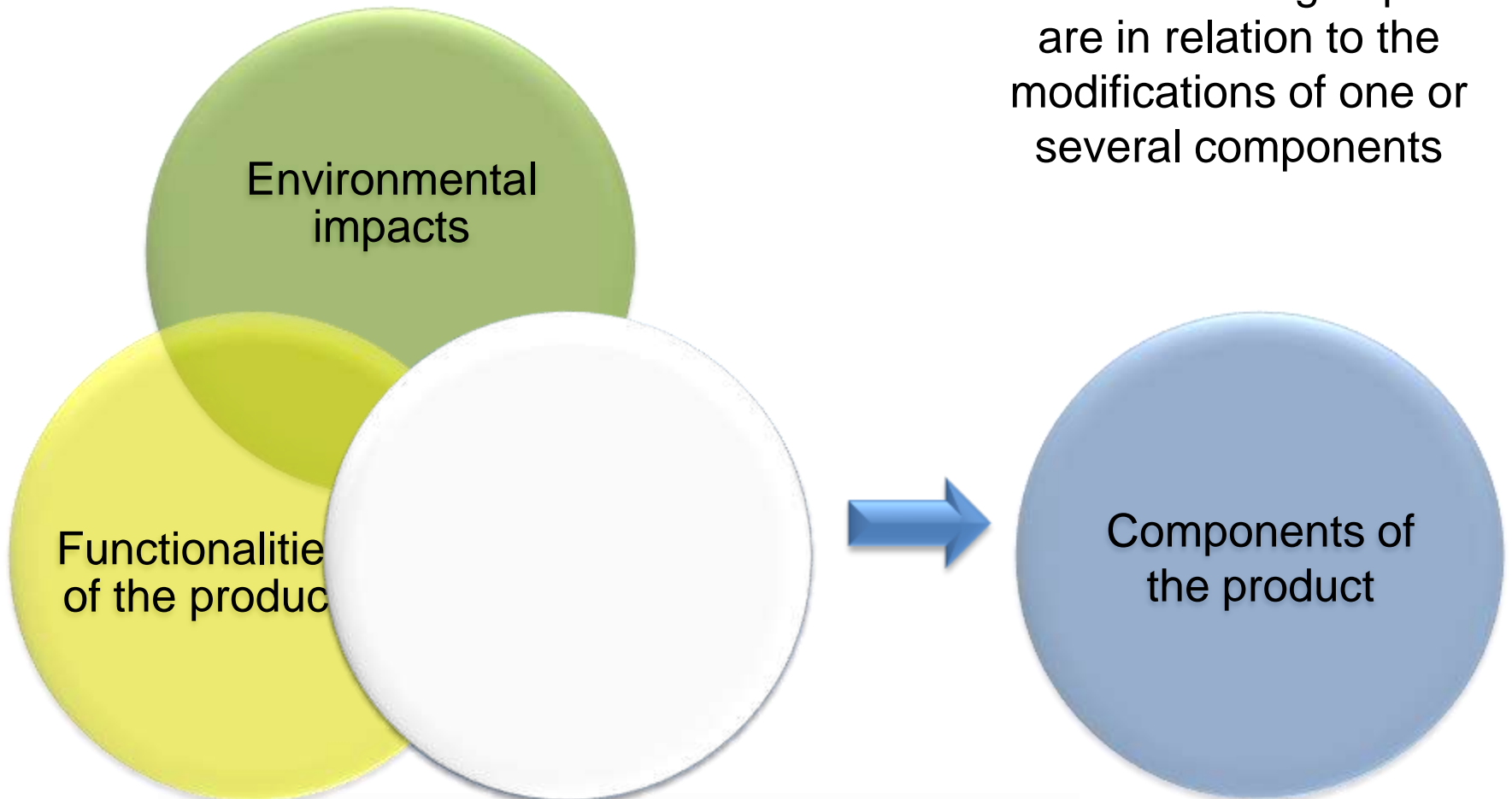


This is why, this project proposes a methodological framework to combine LCA and functional characterization

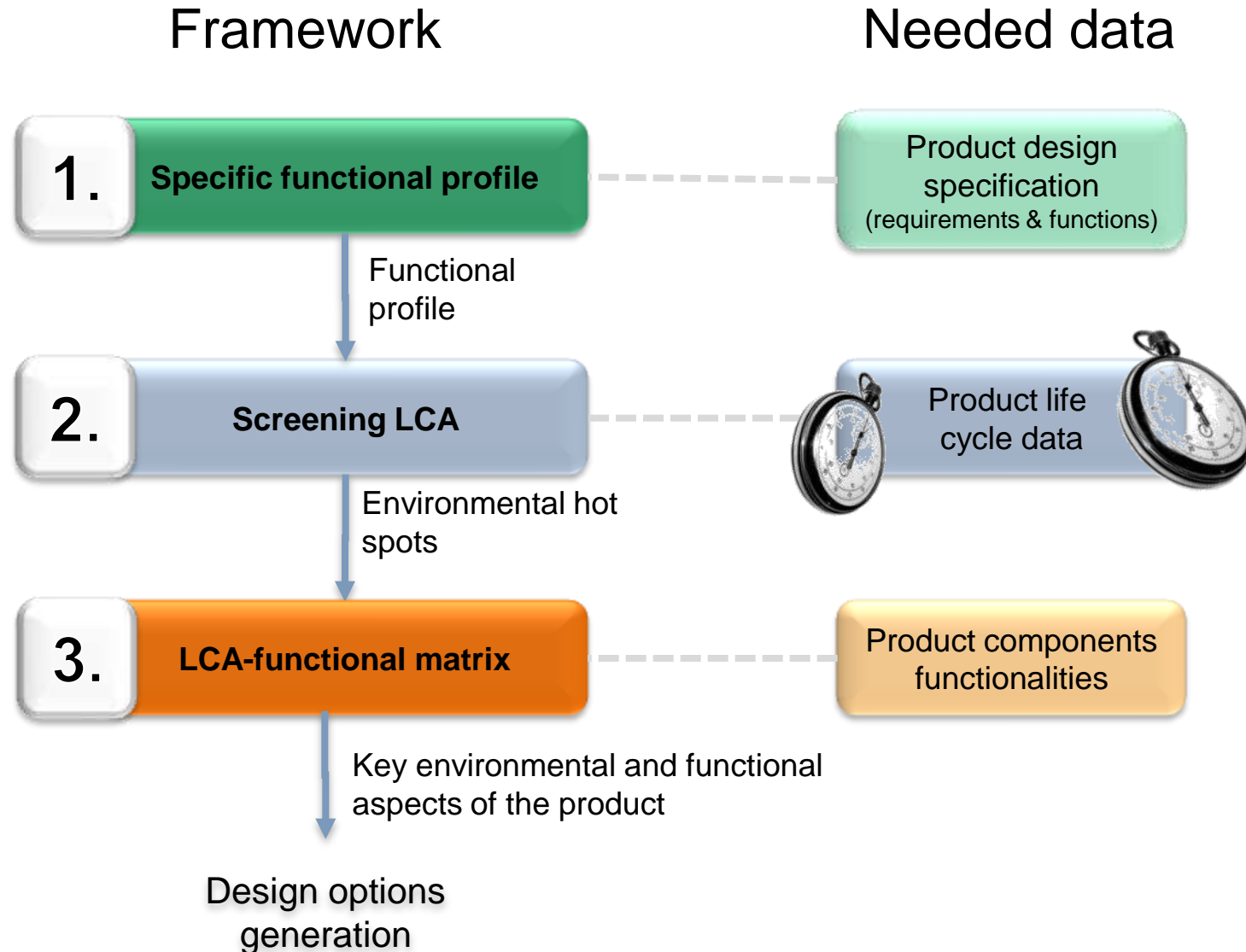
Methodology



Methodology



Methodology



Methodology: 1) Specific Functional Profile

Type of Products	Main / Required function	Secondary / Positioning function	Market irrelevant characteristic
Personal Hygiene Products	Absorb / retain fluid (with a certain efficiency during a “normal” time of use)	<ul style="list-style-type: none">• Sense of cleanliness• Discretion• Comfort• Cost• Easiness of use• Reliability• Aesthetic• Odor control	<ul style="list-style-type: none">• Cost (economic and environmental) of the end-of-life treatment



included in the functional unit of an LCA



related to user benefit



not related to the user

LCA system

Supply

- Production of component
- Transport of component

Component A
~~Component B~~
Component B
Component C

Production

- Production process

Distribution

- Transport from plant to distribution centers, to retailers

Use

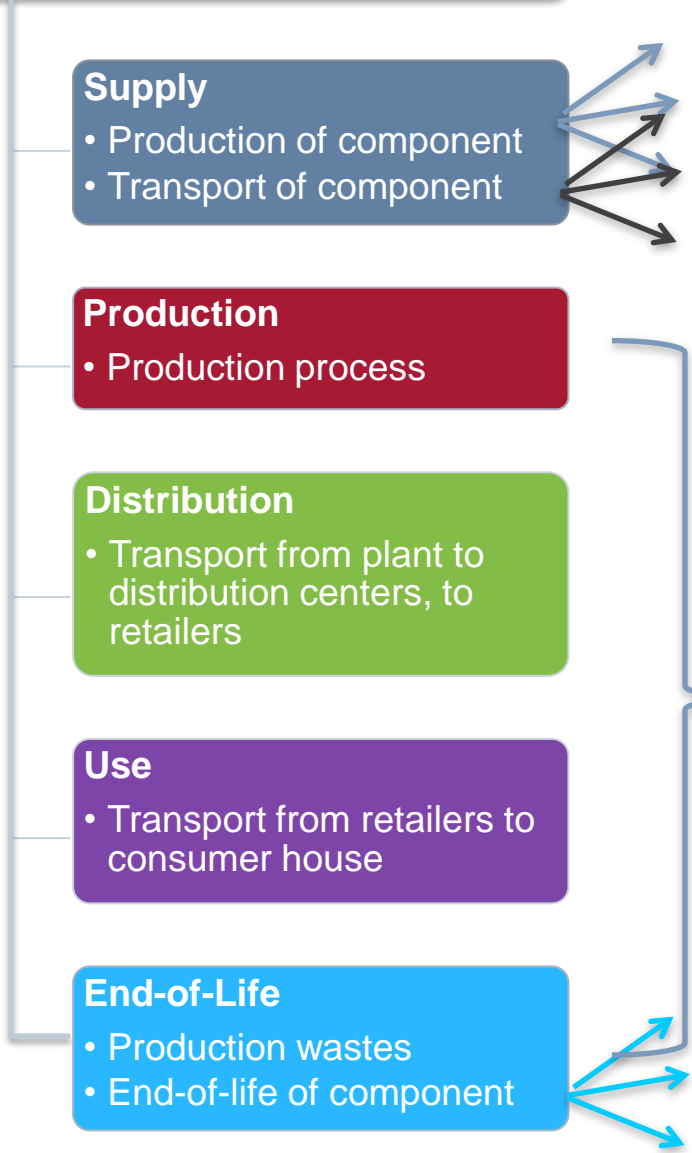
- Transport from retailers to consumer house

End-of-Life

- Production wastes
- End-of-life of component

Allocation to the component by weight

Component A
Component B
Component C



Methodology: 3) LCA-Functional Matrix

			Components of the product									
Name of the Product			Component A	Component B	Component C	Component D	Component E	Component F	Component G	Component H	Component I	
Main Function												
			Score									
Functional profile	Function I											
	Function II											
	Function III											
	Function IV											
	Function V											
	Function VI											
	Function VII											
Env. profile (IMPACT 2002+)	Human Health											
	Ecosystem Quality											
	Climate Change											
	Resources											

Relationships between the components and the functions

**Strong relationship: ++
Weak relationship: +**

Relative contribution of the components to the environmental impacts (LCA results)

Results: Hygiene Absorbent Product

Product: Absorbent product Function: Absorb/Retain fluids		Components of the product											
		A	B	C	D	E	F	G	H	I	J	K	L
Functional profile	Retain/absorb fluids												
	Product shape (comfort)												
	Protection during the transport												
	Reliability												
	Aesthetics												
	Discretion												
	Odor control												
	Time of use												
	Softness												
	Adhesion to the underwear												
	Perception of effectiveness												
	Cost of the product												
	Maintain the product architecture												

Results: Hygiene Absorbent Product

Product: Absorbent product Function: Absorb/Retain fluids		Components of the product												
		A	B	C	D	E	F	G	H	I	J	K	L	
Functional profile	Retain/absorb fluids	10	++	++		+	+							
	Product shape (comfort)	9	+	++		++	++		+					
	Protection during the transport	4									++	+	+	
	Reliability	8	++	++		++	+		+					
	Aesthetics	6		+	++		++							
	Discretion	5	+	+							+	++	+	
	Odor control	7	+								++			
	Time of use	4	+	+	+	+	++		+	+	++			
	Softness	7					++							
	Adhesion to the underwear	8						+		++				
	Perception of effectiveness	3			++		+							
	Cost of the product	6	++	+	+	+	++	+	+	+	+	+	+	+
	Maintain the product architecture	3							++					

Results: Hygiene Absorbent Product

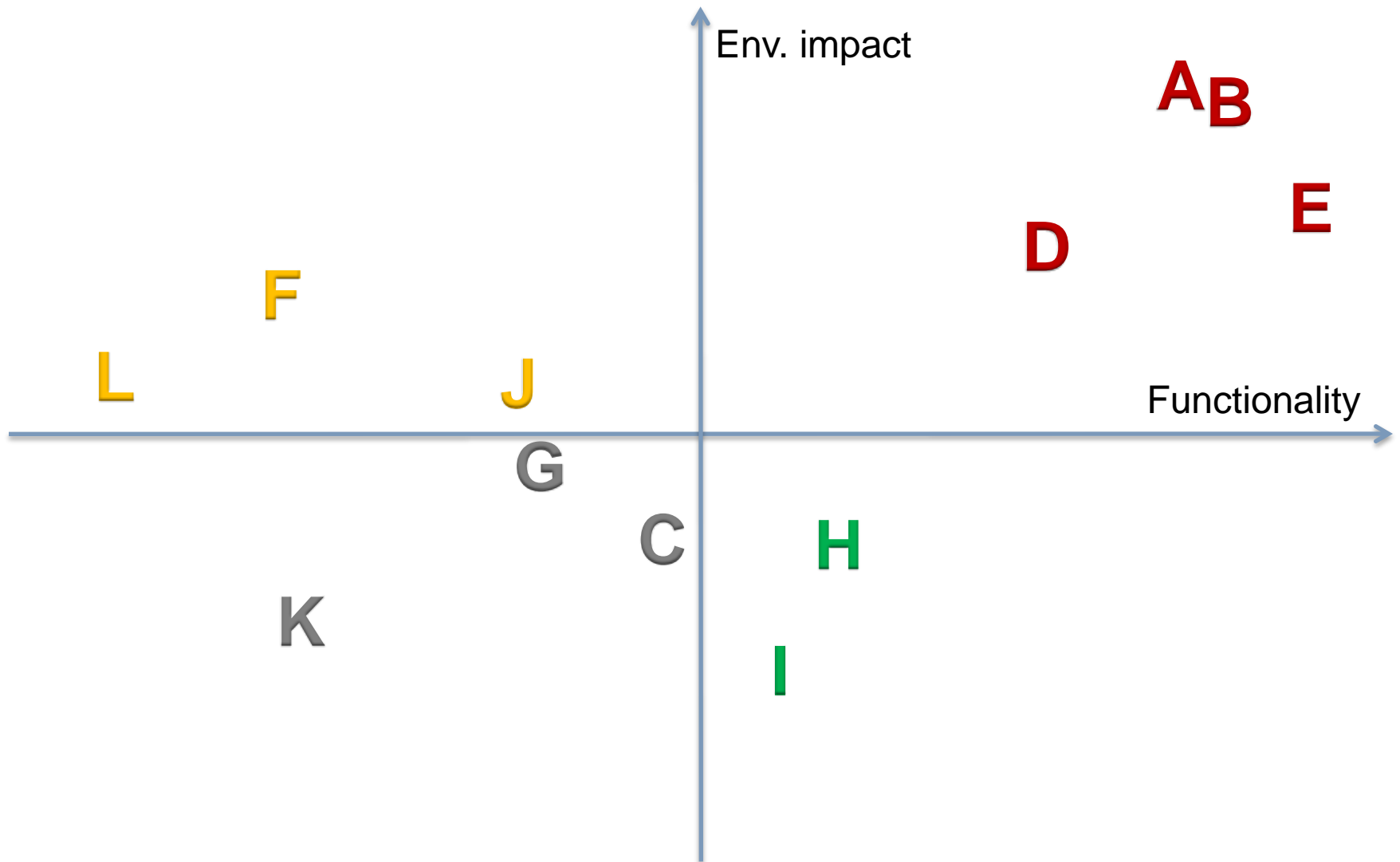
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		A	B	C	D	E	F	G	H	I	J	K	L
Env. profile (IMPACT 2002+)	Human Health												
	Ecosystem Quality												
	Climate Change												
	Resources												

Results: Hygiene Absorbent Product

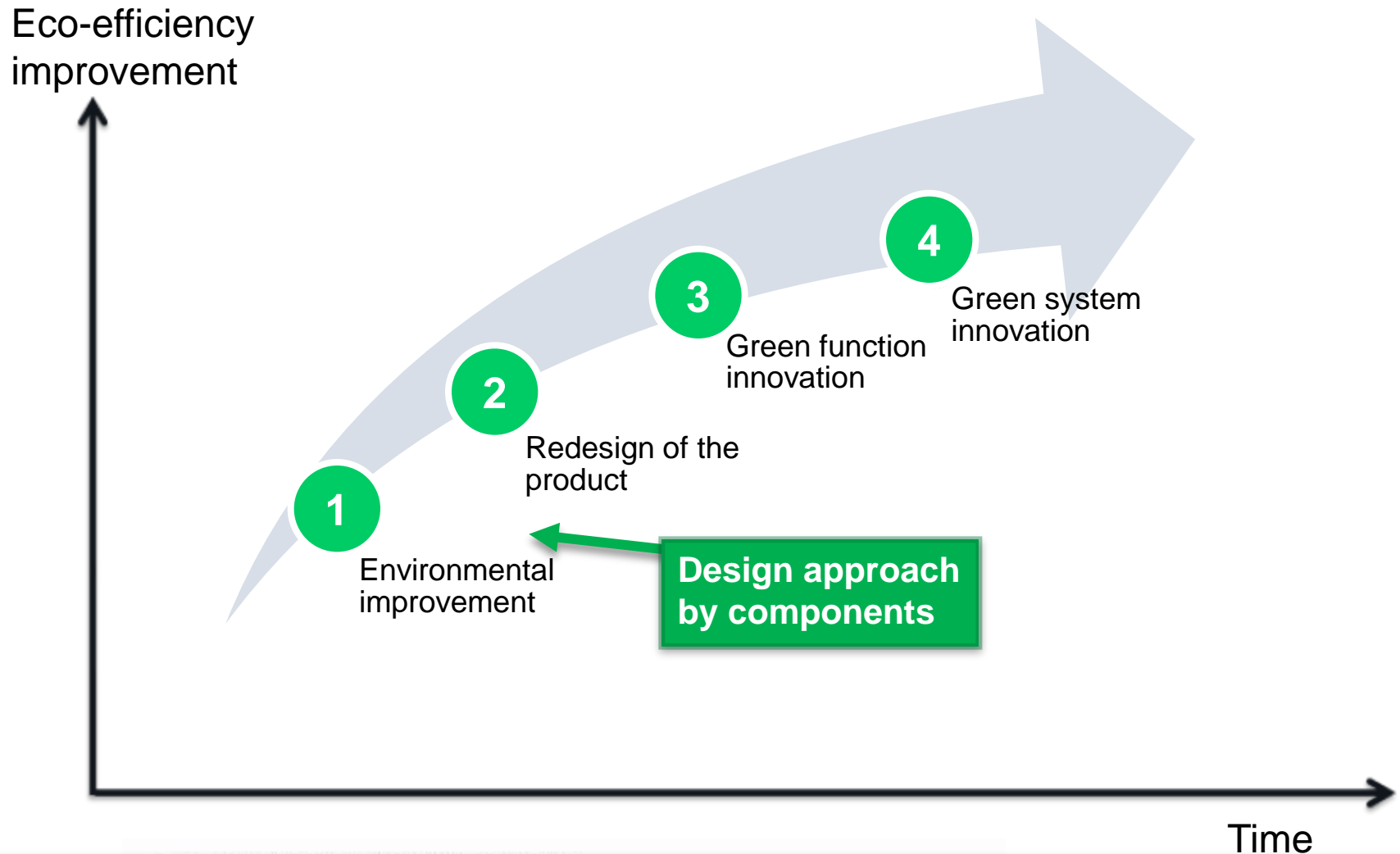
Product: Absorbent product Function: Absorb/Retain fluids		Components of the product											
		A	B	C	D	E	F	G	H	I	J	K	L
Env. profile (IMPACT 2002+)	Human Health	19%	23%	2%	9%	22%	8%	4%	2%	0,1%	5%	1%	5%
	Ecosystem Quality	37%	32%	4%	2%	3%	13%	1%	1%	0,1%	1%	0,2%	6%
	Climate Change	20%	18%	1%	14%	19%	7%	6%	4%	0,1%	5%	1%	5%
	Resources	16%	18%	1%	16%	21%	6%	5%	3%	0,2%	8%	1%	5%

Product: Absorbent product Function: Absorb/Retain fluids			Components of the product											
			A	B	C	D	E	F	G	H	I	J	K	L
Functional profile	Retain/absorb fluids	10	++	++		+	+							
	Product shape (comfort)	9	+	++		++	++			+				
	Protection during the transport	4										++	+	+
	Reliability	8	++	++		++	+		+					
	Aesthetics	6		+	++		++							
	Discretion	5	+	+							+	++	+	
	Odor control	7	+								++			
	Time of use	4	+	+	+	+	++		+	+	++			
	Softness	7					++							
	Adhesion to the underwear	8						+		++				
	Perception of effectiveness	3			++		+							
	Cost of the product	6	++	+	+	+	++	+	+	+	+	+	+	+
	Maintain the product architecture	3							++					
Env. profile (IMPACT 2002+)	Human Health		19%	23%	2%	9%	22%	8%	4%	2%	0,1%	5%	1%	5%
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	Climate Change		20%	18%	1%	14%	19%	7%	6%	4%	0,1%	5%	1%	5%
	Resources		16%	18%	1%	16%	21%	6%	5%	3%	0,2%	8%	1%	5%

Conclusion : Case Study of a Single-Use Product



Conclusion : Level of Ecodesign



Conclusion: Strengths and Limits of the Approach

Proposed Matrix-Based Approach:

- ✓ Highlights the relationships between quantitative LCA results and qualitative functionalities
- ✓ Allows a more comprehensive identification of product “hot spots”
- ✓ Adaptable ecodesign tool for decision-making based on LCA results



Conclusion: Strengths and Limits of the Approach

Proposed Matrix-Based Approach:

- ✓ Ecodesign by components is less appropriate for higher ecodesign level
- ✓ Requires data collection and expertise to conduct the matrix (especially to perform a screening LCA)

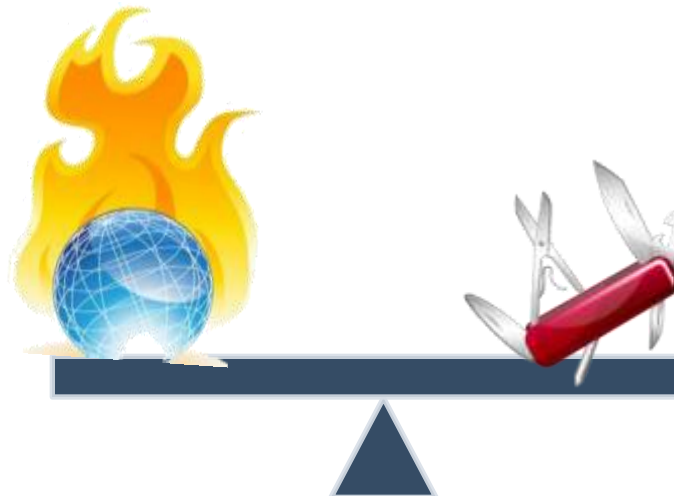


Conclusion : Case Study of a Single-Use Product

Identification of components for ecodesign projects:

A, B, D, E Key components because high functional and environmental contributions

F, J, L Improvement priorities because can cause more environmental damage than offer functionalities



Acknowledgements



Originality

	Proposed matrix	Lagerstedt, 2003	Bovea and Wang, 2007
Design process	Eco-redesign based on components	Early design stage	Eco-redesign based on components
Environmental assessment	LCA results expressed in damage (IMPACT 2002+)	Environmental profile assess by expert judgment	LCA results expressed in single-score (Eco-Indicator'99)
Functional assessment	Designers assessment	Designers assessment	Voice of customers
Case study	Hygiene absorbent single-use product	Firefighter radio	Office table