Life cycle perspective checklist

This checklist has been designed to guide the user in a simplified and qualitative way to identify the potential for exploring the circular economy business opportunities and improving the environmental footprint of a product throughout its life cycle. The goal is to define the main inputs and outputs for each stage of the product life cycle and estimate their importance in terms of environmental (and possibly also social) impacts in order to scope areas of significant improvements that may be further investigated with eco-design and LCA tools. The results are presented and summarized using the working table.

Steps:

1) Indicate qualitatively the key environmental aspects within the product life cycle

With reference to the significant inputs (use of natural resources) and outputs (pollution and other risks) of a specific flow, insert a remark in the relevant Aspects cell of the working table about any related environmental aspects (positive or negative) at each phase of the product life cycle's (see working table). The goal of this analysis is not to fill in all cells but to highlight areas which have important environmental aspects.

2) List opportunities for improvement

In the relevant cell, identify opportunities for (further) improvement with respect to the identified aspects. As a checklist for thinking about opportunities for improvement, use the product design strategies listed in the Annex. These strategies can help you identify possible eco-design strategies related to each aspect along the life cycle of the product and explain how these strategies can be used for exploring the improvement potential.

The life cycle phases taken into consideration are:

- **Pre-manufacturing:** extraction/production of materials, semi-finished materials and components bought from external suppliers to make up the product including impacts related to their packaging and distribution from the site(s) of extraction/production to the manufacturing company;
- **Manufacturing:** manufacturing processes in the company and its direct impacts including transportation to and from different manufacturing sites;
- **Distribution:** transport steps necessary to distribute the product to the final users and each type of packaging in which the product is delivered;
- **Use:** of materials, additional products, components or energy necessary to maintain, repair or run the product;
- **End-of-life:** final disposal of the product at the end of its useful life;

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Borders between different phases are not strict and shifting from one phase to the other is allowed (e.g. packaging can be considered part of manufacturing or distribution – but double-counting should be avoided).

Overall design:

You can also use the table to consider some overall design strategies which can affect the aspects in multiple phases of the life cycle. Some conceptual questions can be asked here, like if new or different design strategies could be used to reduce environmental impacts while maintain the product functionalities and market demands. An example could be shifting from selling the product to selling a product - service system.

WORKING TABLE – Areas of improvement of product environmental and social footprint along the life cycle

		PRODUCT LIFE CYCLE PHASES					OVERALL DESIGN
		Pre-manufacturing (sourcing of materials)	**Manufacturing**	**Distribution**	**Use**	**End-of-life**	
FLOWS	**Materials (as natural resources and waste)**	**Aspects**					
		Opportunities for improvement					
	Energy	**Aspects**					
		Opportunities for improvement					
	Water (as water intake and waste water)	**Aspects**					
		Opportunities for improvement					
	Social impacts (including **impact on health and safety** of people or impacts to the local community etc.)	**Aspects**					
		Opportunities for improvement					

WORKING TABLE – Areas of improvement of product environmental and social footprint along the life cycle

Example filled in for a textile company producing regenerated textile yarns and recycled textile products

		PRODUCT LIFE CYCLE PHASES					OVERALL DESIGN
		Pre-manufacturing (sourcing of materials)	**Manufacturing**	**Distribution**	**Use**	**End-of-life**	
FLOWS	**Materials (as natural resources and waste)**	**Aspects**					
		The company uses mainly post industrial waste collected from companies; post-consumer waste represents only 5% of the raw material used.	Material losses in the spinning process due to outdated technology.			Lower recyclability of textiles from already regenerated yarns leads to landfilling of waste.	Limited application of regenerated yarns into consumer products
		Opportunities for improvement					
		Explore possibility to increase post consumers waste collection for example through reverse logistic models.	Losses could be reduced by implementation of RECP best practices and innovative process technology.			Explore possibility of increasing use of recycled polyester or other innovative bio-based and bio degradable chemicals to improve the length, durability and properties of regenerated yarns.	Acquire Global recycling standard Up-cycling (design of new products from regenerated yarns)
	Energy	**Aspects**					
		Energy consumption and related emission generated by transportation of raw material to manufacturing site.	High energy use in the mechanical process for recuperating fibres from textile waste and for spinning yarns.	Resource intensity of distribution system.			
		Opportunities for improvement					
		Optimize the reverse Logistic model for collecting post-industrial and post-consumer waste to	Implement Energy Efficiency programme,	Optimize transportation of products to end users			

		transport them to the manufacturing site.	and best practice for manufacturing	(textile distribution, shops, etc.).			
	Water (as water intake and waste water)	**Aspects**					
			Very little amount of water is used in the yarns regeneration process				
		Opportunities for improvement					
Social impacts (including **impact on health and safety** of people or impacts to the local community etc.)		**Aspects**					
		Significant amount of textile waste produced by consumers is not collected.					
		Opportunities for improvement					
		Introduction of a reverse logistics model focusing on post-consumer textiles; part would go for regeneration as a new raw material, and part for reuse through a charity programme					

TIPS FOR WORKING WITH THE TABLE

- This qualitative analysis requires that the user has a basic knowledge of the sector and of the main impacts along the different life cycle phases (or can obtain it from literature sources or experts), to be able to make a preliminary identification and review of all relevant aspects of the product life cycle.
- If information on possible significant risks or opportunities are not available for a specific phase of the product life cycle (for example, use of energy in the use phase or production of large amounts of waste during pre-manufacturing), the relevant cell should be left empty.
- If different product types are manufactured in the company, the analysis can be repeated for the main product types (since inputs and outputs along the life cycle stages can be quite different).

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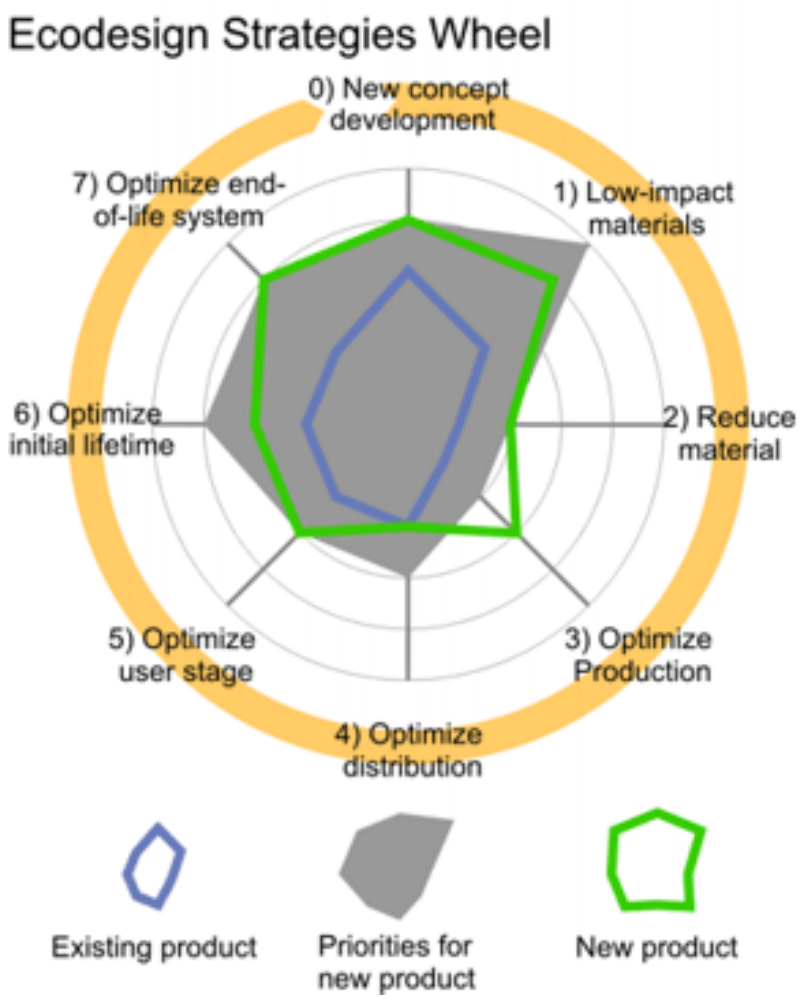
- While thinking about possible eco-design strategies, the company should not limit its thinking to the phases which are under its direct control only. If some important opportunity is identified in a phase of the product's life cycle which is out of the company's control, this finding could possibly initiate communication with the actual owner of the given phase in order to implement the improvement and possibly share the benefits.

ANNEX

Checklist with questions related to Eco-design Strategies Wheel



0) Can we develop New Product Concept?
0a) Dematerialisation
0b) Shared use of product
0c) Integration of functions
0d) Functional optimization of product (components)

1) Can we select Low-impact Materials?
1a) Non-hazardous materials
1b) Renewable materials
1c) Low energy content materials
1d) Recycled materials
1e) Recyclable materials

3) Can we optimise Production Techniques?
3a) Alternative production techniques
3b) Fewer production processes
3c) Low/clean energy consumption
3d) Low generation of waste
3e) Few/clean production consumables
Remark: This phase of life cycle is addressed directly in a TEST project.

4) Can we have more Efficient Distribution System?
4a) Less/cleaner packaging
4b) Efficient transport mode
4c) Efficient logistics

5) Can we reduce Environmental Impact during the User Stage?
5a) Low energy consumption
5b) Cleaner energy sources

	5c) Less consumables needed during use 5d) Cleaner consumables during use **6) Can we optimise Initial Lifetime?** 6a) Reliability and durability 6b) Easy maintenance and repair 6c) Modular product structure 6d) Classic Design 6e) User taking care of the product **7) Can we optimise End-of-life System?** 7a) Reuse of product 7b) Remanufacturing/refurbishing 7c) Recycling of materials

References

Step 1 was developed by amending for the needs of TEST the materials used for an indicative analysis of the life cycle in the PRESOURCE project (2014) (www.resourceefficiencyatlas.eu), with the kind agreement of the authors.

The Eco-design Strategies Wheel used in the Annex is taken from H. Brezet and C. van Hemel (1997), “Eco-design: A promising approach to sustainable production and consumption”, UNEP, France.