

# **Do circular economy business models capture the environmental value propositions? - Framework for evaluating of the environmental value propositions circular economy business models**

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## **Introduction**

Circular economy (CE) can provide many opportunities to minimise resource use and environmental impacts while creating new employment and business growth (SUN et al. 2015, Ghisellini et al. 2016). CE promotes the adoption of closing-the-loop of production service patterns within an economic system. The aim of the CE is to increase the resource use efficiency to achieve a better balance and harmony between economy, environment and society. (Ghisellini et al. 2016) In practice, CE can be promoted and supported by creation of new innovative business models which embed CE principles into their value propositions throughout the value cycles. However, assessing the realisation of the value propositions of new business models is not straightforward and requires comprehensive reasoning.

The aim of this study is to outline a framework for evaluation of environmental value propositions of CE business models. The core of the framework is a table of the potential environmental value propositions of different types of CE business models categories, which we firstly compiled based on literature. Secondly, we constructed step-by step approach for the realisation of the evaluation process. Further, we will test the framework in real CE business cases.

## Materials and methods

The work started by building an environmental value proposition table (EVPT). In general, the environmental value proposition here refers to a promise, which the company provides to the environment throughout the whole value chain. The environmental value propositions are comprised based on the Ellen McArthur Foundation's CE principles (Ellen McArthur Foundation 2015), the CE characteristics identified by the European Environment Agency EEA (2016) and CE business model categories suggested in literature. There are several ways to categorise CE business models, but according to Lewandowski (2016), most of the categories are very similar and somewhat overlapping. One example of such categorization is the ReSOLVE framework, developed by the Ellen McArthur Foundation (2015). The ReSOLVE framework describes a set of six actions that businesses and governments can take in order to enhance transition to a circular economy. The actions are Regenerate, Share, Optimise, Loop, Virtualise, and Exchange. Examples of CE business model types categorized under the ReSOLVE actions include such chemical leasing (Regenerate), product system service (Share) and remanufacture (Loop) (Lewandowski (2016).

In the development process of EVPT, we considered that the EEA's key characteristics of CE can be interpreted as environmental value propositions, which can be arranged under the different CE business model categories (ReSOLVE actions). The aim of the EVPT is not to be comprehensive covering all possible situations, but to give basis for consideration of environmental value propositions in CE business models.

In the development of the framework for evaluation of environmental value propositions of CE business models, previous studies of sustainability (e.g. Bocken et al. 2015, Patala et al. 2016), value creation of business model e.g. Value Mapping Tool (Bocken et al. 2015), as well as studies concentrating on the CE business model development (e.g. Bocken et al. 2016a, Kraaijenhagen 2016, Lewandowski 2016) were utilized. Additionally, Sustainable Analysis Tool (Miyang et al. 2014) and sustainable business model archetypes (Bocken et al. 2014) were used as background literature.

Further, we will test the framework in a company case. The Finnish material recycling company Destaclean was selected for the case study, because it can be categorized under the Loop of ReSOLVE category and thus represents a CE business case. Destaclean produces wood stone, which is a recycled composite product, made of recycled construction waste wood, concrete and water. The wood stones are suitable for paving yards and pathways, and they can withstand car traffic. Destaclean wood stone is 30% lighter than normal concrete material, but tougher and more durable in terms of tensile strength. (Destaclean 2014). The results of this case study will be presented in the Sustainable Innovation 2016 conference.

## Results

### Environmental value proposition table (EVPT)

The circular economy principles, environmental value propositions and CE business model categories of ReSOLVE framework are summarised in Table 1, called as environmental value proposition table (EVPT). The EVPT shows, which environmental value propositions can be arranged under the different CE business model categories (ReSOLVE actions). The four last propositions below the dashed line are more like methods to achieve the value propositions. They are, however, listed in the table, because they are mentioned in the CE characteristics of EEA (2016). The last value proposition above the dashed line is the outcome of our EVPT development process, because the ecosystem viewpoint was missing in the Regenerate category. Environmental value propositions can be set also for reclaiming, retaining or restoring the health of ecosystems.

Table 1. The environmental value proposition table (EVPT). The plain cross represents that the value proposition is realised in certain category. The cross in brackets represents that some elements of the value are realised but with certain conditions. The four last propositions below the dashed line are more like methods to achieve the value propositions. The last value proposition above the dashed line is the outcome of our EVPT development process.

Circular economy principles	Environmental value propositions	Circular economy business model categories					
		Regenerate	Share	Optimise	Loop	Virtualise	Exchange
Principle 1: Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows.  Principle 2: Optimise resource yields by circulating products, components, and materials at the highest utility at all times in both technical and biological cycles.  Principle 3: Foster system effectiveness by revealing and designing out negative externalities.	minimised and optimised exploitation of raw materials, while delivering more value from fewer materials		x	x	x	x	(x)
	reduced import dependence on natural resources				(x)		(x)
	efficient use of all natural resources		x	x	x	x	(x)
	minimised overall energy and water use		x	x		(x)	(x)
	non-renewable resources replaced with renewable ones within sustainable levels of supply	x					
	increased share of recyclable and recycled materials that can replace the use of virgin materials	(x)					(x)
	closure of material loops	x			x		
	sustainably sourced raw materials	(x)					(x)
	reduced emissions throughout the full material cycle through the use of less raw material and sustainable sourcing	(x)	x	x	(x)	(x)	(x)
	less pollution through clean material cycles			x	(x)		(x)
	build-up of waste minimised		x	x	x	x	(x)
	incineration and landfill limited to a minimum		x		x	x	(x)
	reclaim, retain, and restore health of ecosystems	x					(x)
	dissipative losses of valuable resources minimised		(x)	x	x	x	(x)
	extended product lifetime keeping the value of products in use		x	x			
	reuse of components		x				
	value of materials preserved in the economy through high-quality recycling		x				

## Framework

The evaluation framework for CE companies is illustrated in Figure 1 and it is divided in five steps. The inner circle represents the intended environmental value propositions of CE business model case, which must be defined first. The EVPT is used as a starting point to specify the CE business model category of a company and its possible value propositions. The company's value propositions are at the same time the value propositions of the all stakeholders for the environment. Therefore all the life cycle stages of a product or service are taken into account and they are expressed as beginning of life (BOL), middle of life (MOL) and end of life (EOL).

The implementation of the value propositions takes place not only in the company but also in the product or service chain. Therefore the stakeholder perspective has an important role in the framework. Stakeholders can be divided e.g. in three groups: stakeholders internal to company, stakeholders in value chain and stakeholders in extended value chain (Tyl et al. 2015). Value chain and stakeholder perspective is discussed e.g. by Bocken et al. (2015) and Miying et al. (2014), but they focus more on developing than assessing the values. Patala et al. (2016) have dealt with the same issue by developing sustainable value propositions to evaluate the economic, environmental and social benefits of industrial products and services.

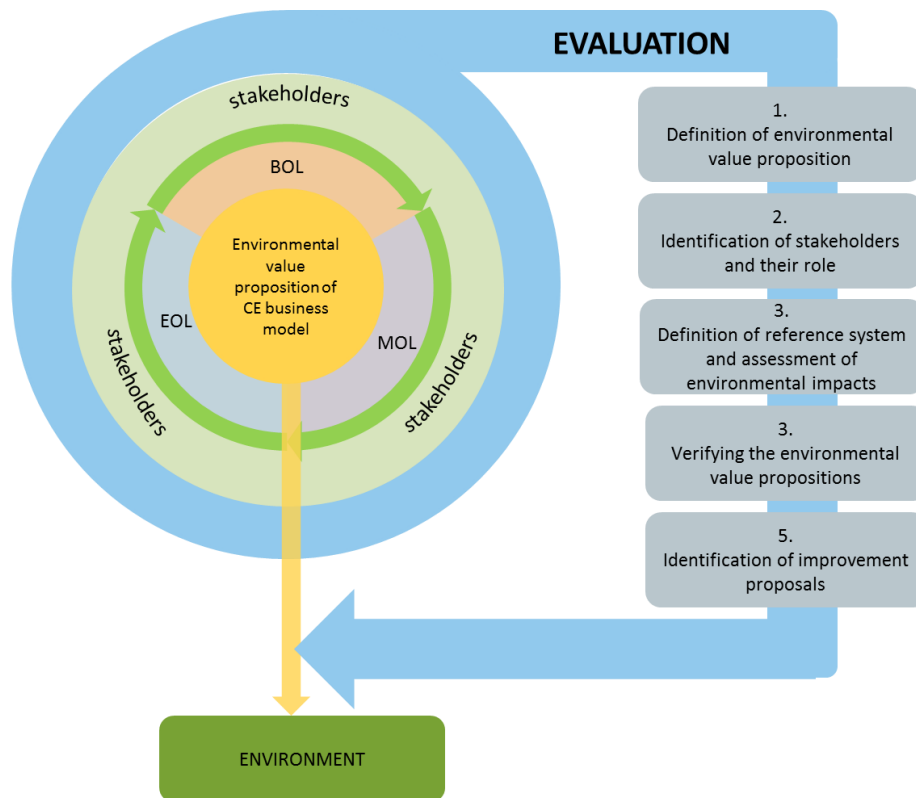


Figure 1. The environmental value proposition evaluation framework. BOL = beginning of life, MOL= middle of life, EOL= end of life.

### The step-by-step approach for evaluation of environmental value propositions of CE business model

The framework includes the step-by-step stages for evaluating the environmental value propositions given by a specific CE business case. The procedure requires a close cooperation with evaluators and the case company. The practical phase of the evaluation is carried out by interviews of CE case companies. The evaluation starts with discussions with company representatives by going through the whole value chain/life cycles of a product or service and defining their environmental value propositions. The knowledge of experts is often needed in the assessment of impacts.

#### 1. Definition of environmental value propositions

- To understand the system under study, the value chain/life cycles of the product or services are gone mapped.
- The business model category and specific environmental value propositions of a case company's CE business model are defined with the help of EVPT.

#### 2. Identification of stakeholders and their role

- The relevant stakeholders of the CE business model in the whole value chain are defined.
- The stakeholders' roles and actions needed to promote the fulfilment of environmental value proposition are identified.

#### 3. Definition of reference system and assessment of environmental impacts

- The reference system referring to the current situation is defined for the assessment of environmental impacts.
- The comparison of a reference system with a CE business model system and an assessment of environmental impacts, with streamlined LCA, MFA, qualitative methods etc.

#### 4. Verifying the environmental value propositions

- Based on the previous step, the realised environmental benefits are identified and compared with the environmental value proposition.
- Finally, the realisation of the environmental value propositions of a CE business model is assessed.

## **5. Identification of improvement proposals**

- Based on the previous step, possible improvement proposals for the value chain of the business model to fulfill the value proposition are identified.
- Identification of ways to prevent unintended consequences/rebound effects.

## **Discussion and conclusion**

Several scholars have studied values of business models (e.g. Bocken et al. 2015, Patala et al. 2016), but they have concentrated more on overall sustainability, while our work aimed at deepening the environmental perspective/values and assessing benefits gained by CE business models. In addition, the framework developed here is intended especially for the companies. They can utilise the framework to deal with their own business from the environmental value proposition viewpoint taken into account also stakeholders and an entire life cycle of a product or service.

The key component of the framework is the EVPT, which uses the ReSOLVE categories for identifying different types of CE business models and combines them with the EEA's CE characteristics which are interpreted as environmental value propositions. The main task of the EVPT is to give insights for companies to determine their own environmental value propositions according to the principles of CE. The EVPT is not comprehensive and can be developed further. It is also noteworthy that company's business doesn't necessarily directly fulfil the value but indirectly through stakeholders in different parts along the value cycle. The realisation of values can be evaluated by following the steps of the framework.

The evaluation of the realisation of environmental value propositions is carried out by assessing the environmental impacts reflecting from the value propositions. The assessment may be challenging, because to verify the realisation of the value propositions, a reference system has to be chosen referring to the current situation. However, CE business models often represent new solutions and systems, hence defining the reference might be difficult. Also finding appropriate data may be a problem, when assessing systems, which do not exist yet. The assessment of the consequences of scaling of the production may be challenging and predicting the systemic effects in the future even impossible. Therefore assessment methods have to be chosen carefully and ensure that results are really reflecting defined value propositions. For instance a full life cycle assessment (ISO 14040:2006) is often too time/resource demanding for the companies while a streamlined LCA could be suitable in many cases (Bocken et al. 2016b). The assessment can be conducted also by defining suitable quantitative or qualitative indicators, which set the criteria for value realisation. However, if quantitative assessment is chosen, the reference system has to be defined, to which the impacts of environmental value propositions are compared to verify gained benefits. Therefore qualitative methods may be the alternative in cases where a numeric calculation is impracticable.

With the developed framework, companies can plan and design new CE business models or they can verify the intended environmental benefits. The framework is flexible enabling modifications for various companies. In the future, the most intensive work should concentrate to develop environmental assessment methods especially feasible for companies developing new CE business models.

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