

Circular Design and Consumer Involvement in Circular Economy¹

Ľubica Knošková²

Abstract

The circular economy is an approach to help reduce global sustainability pressures. In circular economy it is important to involve design from the beginning of the product lifecycle, including product ideation and material selection. Involvement of consumers and users into circular economy is very important and enables change in purchase patterns and product utilization. The paper methodology consists of a profound literature review and analysis in area of circular economy, circular design and consumer or user influence on circularity. The goal of the paper is to provide insights into the consumer involvement into a circular economy and changes in users' behavior. The research results in discussion of design strategies to slow down "resource loops", to close "resource loops", and to "narrow material flow" to enhance circular economy and business models, as well as consumer involvement in circular economy. We outline desired consumer and user behavior leading to circular economy.

Key words

Circular economy, circular design, consumer behaviour, behaviour change

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Introduction

Businesses and governmental organizations have to deal with negative effects of climate change and resource exhaustion due to human activity. Applying the principles of the circular economy in practice may substantially reduce sustainability issues. European Union included the principles of circular economy in its strategies. The European Commission focuses on strategies of recycling, repairing, reduction of material use, preventing loss of scarce material, applying new business models, and creating new work opportunities, which can help Europe in transition to "zero-waste" economy reducing environmental impacts (Bocken et al., 2016).

Bakker states that "the circular approach contrasts with the traditional linear business model of production of take-make-use-dispose and an industrial system largely reliant on fossil fuels, because the aim of the business shifts from generating profits from selling artifacts, to generating profits from the flow of materials and products over time" (Bakker et al., 2014). A circular economy represents a systemic way to economic

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² doc. Ing. Ľubica Knošková, PhD., University of Economics in Bratislava, Faculty of Commerce, Department of Commodity Science and Product Quality, Dolnozemska st. 1, Bratislava, Slovakia, e-mail: lubica.knoskova@euba.sk

growth with a shift of focus from selling products to much wider set of activities linked with product use, reuse, product repair and material regeneration which bring value to the businesses, to the consumers and the society, and to the environment.

For the linear economy the "take-make-waste model" is typical, which concentrates on rapid flow of activities in linear manner such as material excavation, production, product use and waste. In contrast to that, "a circular economy is *regenerative by design* and aims to gradually decouple growth from the consumption of finite resources" (Ellen Mac Arthur Foundation, 2020). Design and designing is very important for the circular economy as it can complement heavily to its principles: "design out waste and pollution", "keep products and materials in use" and "regenerate natural systems". *Circular design process* outlined by Ellen Mac Arthur Foundation comprises four steps:

1. Understanding the whole system including the user needs and behavior
2. Outlining the design challenge and designer aim
3. Make as many prototypes and versions as possible
4. Release the design, create loyalty with customers, deepen investment of stakeholders, create compelling story

Six strategies involving the principles of the circular economy into the design are the following:

1. Keeping the principles of "inner loops" design
2. Prioritizing services to products
3. Extending the product life
4. Choosing safe and circular materials
5. Dematerialization
6. Modularity.

Majority of products that we use today are designer for linear economy. If we want to apply the principles of circular economy, many products need to be redesigned with a much broader perspective of material flows. When we speak about material flow, we can take into consideration the two models. First, "*cradle-to-grave*" flow of materials which is typical for linear economy. Second, "*cradle-to-cradle*" flow, which is used in circular economy, and represents resource savings in circular models (Braungart et al., 2008). Stahel (2010), refers to "closed loop systems" and outlines two types of loops within a "closed loop system": (1) "Reuse of goods" and (2) "Recycling of materials".

Building on Stahel (2010), and Braungart et al. (2008), Bocken et al. (2016) and Moreno et al. (2016) four strategies concerning material flow are settled:

1. "*Slowing resource loops*: Through the design of long-life goods and product-life extension (i.e. service loops to extend a product's life, for instance through repair, re-manufacturing), the utilization period of products is extended and/or intensified, resulting in a slowdown of the flow of resources".

2. "*Closing resource loops*: Through recycling, the loop between post-use and production is closed, resulting in a circular flow of resources".

The first two approaches differ from the third approach as they can contribute to reduced resource consumption. The third strategy can in some cases contribute to rebound effect in consumption:

3. "Resource efficiency or narrowing resource flows, aimed at using fewer resources per product".

4. "Whole systems design: design for system change aimed at reducing environmental backpacks and designing regenerative systems".

It is important to involve design and designers in the very beginning of the product creation, mainly if it is done in multidisciplinary teams. Creating products and solutions for circular economy expects engaging consumers, users or prospective users and marketing experts in product creation process to be able to build on changing consumption patterns in line with societal needs.

Recent studies in several countries or regions (including the EU territory) point to the fact that, in general, around 55-60% of the innovations include environmental benefits, that contribute to sustainability and sustainable growth. This implies that eco-innovation is already an integral part of design and innovation activities both within and outside businesses (SBA, 2018).

1 Methodology

The research project methodology consists of a profound literature review and analysis in area of circular economy, circular design and consumer or user influence on circularity. Author studied and analyzed numerous sources from Web of knowledge, Web of science and Scopus, European Union strategic documents, studies by European Commission on consumer behavior linked to Circular Economy, Flash Eurobarometer 397 on perception of product safety and environmental claims' impact on purchasing decisions. The goal of the paper is to provide insights into the consumer involvement into a circular economy and changes in users' behavior.

We posed following research questions:

1. What are up-to-date "circular design strategies" and "circular business models"?
2. What is consumer engagement in circular economy and what are the driving factors?
3. What is the desired consumer behavior in circular economy?

2 Results and Discussion

In order to address the research questions we analyzed the institutional approach of European Union, and the literature on Circular Design, Circular Business Models and consumer behavior in Circular Economy.

In 2015, the European Union started to implement the package to enable the transition to circular economy. Three years after, the Circular economy action plan was completed. In 2016, employment in circular economy sectors increased by 6% compared to 2012. More than four million people were working in circular economy sectors. New business models brought new circular solutions for domestic and foreign markets. "In

2016, circular activities such as repair, reuse or recycling generated almost €147 billion in value added while accounting for around €17.5 billion worth of investments". (European Commission, 2019)

In 2018, EU implemented "*EU Strategy for Plastics in a Circular Economy* as the first EU-wide policy framework adopting a material-specific lifecycle approach to integrate circular design, use, reuse and recycling activities into plastics value chains. Under the new plans, all plastic packaging on the EU market will be recyclable by 2030, the consumption of single-use plastics will be reduced and the intentional use of microplastics will be restricted" (European Commission, 2018 b).

To be able to fight with climate change and environmental degradation, European Union needed a new growth strategy. To overcome the environmental challenges, the new strategy that can make Europe resource-efficient and competitive economy was introduced.

The *European Green Deal*, introduced in December 2019, is "the roadmap for making the EU's economy sustainable. This will happen by turning climate and environmental challenges into opportunities across all policy areas and making the transition just and inclusive for all. Within the frameworks of the European Green Deal, the new *Circular Economy Action Plan* was introduced in March 2020" (European Commission, 2020). It presents new initiatives in order to modernize the European economy and take environmental issues as a priority. It is driven by the ambition to make sustainable products that last and to enable European citizens to take full part in the circular economy and benefit from the positive change that it brings. It is evident also from flash eurobarometer 397 that growing amount of waste is on the top three list of consumers' environmental concerns. Changing consumption patterns is inevitable.

2.1 Design strategies and business models for circularity

In the following section we discuss several "circular design strategies" that help to reduce the speed of material flow during the product life cycle and to utilize the material in its full potential in different cycles. Further we outline business models which can be applied by companies to implement "circular design strategies" in business practices. The summary of the design strategies and business models is of course not exhaustive. Established business model that a company uses is difficult to abandon and to replace by a new one. Changing company behavior and acceptance of circular business models requires a lot of effort and understanding the benefits for a company, for consumers and for the whole society. Design strategies and business models for circularity (tab. 1) are adapted from Bocken et al. (2016), Moreno et al. (2016), Wastling et al. (2018) and Ellen MacArthur Foundation (2020). Authors in their works discuss the design strategies and business models in more detail.

Tab. 1 Design strategies and Business models for circularity

Design strategies to reduce the speed of material flow during product life cycle "Slow down loops"	Design strategies to utilize the material in its full potential in cycles "Close down loops"	Business models
Designing products with long product life	<ul style="list-style-type: none"> • Designing for full recyclability of material 	Access and performance model
<ul style="list-style-type: none"> • Designing reliable and durable products 	<ul style="list-style-type: none"> • Designing within a biological cycle 	Extending product value
<ul style="list-style-type: none"> • Designing products for relationships and trust 	<ul style="list-style-type: none"> • Designing disassembled and reassembled products 	Classic long life model and encourage sufficiency
Designing product-life extension		Extending resource value
<ul style="list-style-type: none"> • Designing repairable products with easy maintenance 		Industrial symbiosis
<ul style="list-style-type: none"> • Designing upgradable and adaptable products 		
Designing compatible and standardized products		
Designing disassembled and reassembled products		

Source: adapted from Bocken et al. (2016), Moreno et al. (2016), Wastling et al. (2018) and Ellen MacArthur Foundation (2020)

Circular design strategies and business models can serve businesses as a source in a search of their own circular approach to business. *"Slowing down loops"* means creating products with *long product life*, using long-lasting consumer relationships with products based on emotional attainment and trust, creating products that are durable because of quality material, creating products that are reliable and work without failures or creating products that can be *expanded and modified in future* by design and allow upgradable and adaptable solutions in time. Standardization allows compatibility with other products, while reassembly and disassembly makes the material to be used to its full potential.

"Closing down loops" means using and reusing the materials in cycles. Based on Ayres (1994), there are only "two possible long-term possibilities for waste materials: either recycling and reuse, or dissipative loss (e.g. lubricants or detergents). Two distinct strategies for product design were developed: dissipative losses are to be made compatible with biological systems, fit for the "biological cycle"; whereas other materials are to be completely recycled, fitting a "technological cycle." Products that mix materials of both cycles and thereby inhibit the recovery of the materials".

Business models propose approaches to enhance circularity in product strategies (Bocken, 2016):

- The “access and performance model” proposes services instead of the ownership of product to satisfy consumer’s needs.
- “Extending product value” proposes recovery of product after it stopped functioning without the need of the new material.
- The “classic long life model” proposes long durability and reparability interconnected with high product quality and high level of service.
- The “encourage sufficiency” represents a “non-consumerist approach to sales”. It builds on good user relationship to product and low level of mental obsolescence.
- “Extending resource value” is about the collection or using materials that would be wasted to bring new value.
- “Industrial symbiosis” proposes using the waste material of one process as an input material to another process or product line.

2.2 Consumer involvement in circular economy

Consumer behavior can have an influence over applied design strategies. Wastling et al. (2018) state that “product lifetime depend as much on *human factors* as on *functional product durability*. If the products are not in property of users, they treat them with less care, in some cases leading to higher environmental impacts”. Consumers also prevent “closing down resource loops” when they do not use the products frequently and keep them stored in the cellars for long time avoiding recycling.

Bakker et al. (2014), assume “the principles of the linear model of production as designing something, manufacturing it as the lowest possible cost, selling it at the highest possible price and forgetting about it as soon as possible”.

When we speak about circular economy, the principles of production change. They involve circular material selection, and the interest is given also to other stages of product life such as product use (whether in user ownership or service), re-use, disassembling, reassembling and recycling. Consumer and user behavior in B2C models heavily influences the process of value creation and material flow (Wastling et al., 2018).

We were analyzing the results of “Behavioral Study on Consumers’ Engagement in the Circular Economy”, (European Commission 2018 a). We can conclude that consumers express their willingness to be involved in circular economy activities. 64% of respondents used to repair their products in the past, 36% did not do it. Majority of respondents (~90%) have no experience with renting products or buying second hand products, which represents rather low involvement in circular economy activities. Low involvement can be explained by missing information on “*product durability and reparability*” and underdeveloped markets for second hand products, renting or sharing services.

From the study *it is evident that providing information on durability and reparability* can heavily influence consumer decision towards products with greater durability and reparability. From the survey it is also evident that the consumers go for easier solutions.

If the repair requires lot of effort, consumers do not go for it and they prioritize trash the product. There is a big opportunity to shift consumer behavior *towards actual involvement in circular economy activities* by making repair services more available.

93% of respondents declare that they keep their products for long time, 78% recycle/sell/give away products they do not want, and 64% repair broken products. Such consumer behavior does not indicate the presence of the "throwaway culture". Just a minority of respondents, (from 10 to 25%) wanted to lease or rent the products instead of buying them. The consumers who expressed the will to participate in circular economy also expressed the will to repair the products and buy from second hand.

"*Durability and reparability*" was much more important in case of rather expensive products such as home appliances and consumer electronics, and less important for trendy stuff such as apparel and smartphones. Consumers expressed their will to purchase fashion products (apparel and smartphones) in second hand stores or use renting/leasing services.

It is evident that durability which is linked with product quality is more important for consumers than reparability which is linked with spare parts availability.

"*Price-quality ratio is the most important driver and simultaneously barrier for consumer engagement in the circular economy, followed by convenience*". Low prices attracted consumers who were interested in product durability and reparability to switch their decision in favor to low-priced product neglecting circularity. If it is easier to buy a new product and replace the old one, consumers do not go for repair, mainly in case of fashion products and technology/trends driven consumers.

Perception of the safety of non-food products and impact of environmental claims on purchasing decisions

Further we analyzed flash eurobarometer 397 (European Commission, 2015) and synthesized the insights on perception of the safety of non-food products and impact of environmental claims on purchasing decisions.

Increasing number of consumers (55%) think that *some non-food products* on the market are not safe. Increasing number of consumers (25%) also think that many non-food products on the market are not safe. Quite small and decreasing number of consumers (only 14%) think that all the products are safe which represents a decline in *consumer confidence*. Only 54% of respondents believe that "most environmental claims about goods and services in their country are reliable". In spite of that 55% of respondents agree that "environmental impact influenced their choice of products or services last week:

- 17% say all or most of their purchases were influenced,
- 29% say some were influenced and,
- 9% say only one or two purchases were influenced".

Respondents state that their shopping choices were influenced by environmental factors much more often than in 2012 (+14%). We can conclude that environmental

issues impact purchase decisions with rising trend and environmental claims gain growing importance.

Sustainability related information and consumer behavior

Luchs, Brower, and Chitturi (2012) in their study investigated how information on environmental impacts and sustainability influences consumer decision in purchase process. They found out, that consumers prioritize products with high level functionality over the products with high level of sustainability features. If the product reached minimum accepted level of functionality, "*superior aesthetic design*" was a decisive factor that shifted consumer decision towards "*sustainability-advantaged*" products and drove confidence.

Wang and Wu (2016) analyzed influence of emotions to purchase behavior when shopping for household appliances. They found out that "*Pride, guilt, and respect* have positive impacts on purchasing energy conserving household appliances and resisting non-energy conserving household appliances". They also found out that "*negative emotion - anger* can have stronger influence on the decision to buy sustainable product than positive emotion. It is important to highlight that emotions such as "pride" and "anger" could be actively used to promote sustainable products.

Maccioni, Borgianni, and Basso (2019) studied *value perception of green products*. Consumers who value sustainability, assign high value to green products which required effort searching for information – they attributed high value to "the creative solutions still believed of high quality". On the other side, non-green products receive higher value as they are often perceived as reliable and high performance.

Conclusion

The goal of the paper was to provide insights into the consumer involvement into a circular economy and changes in users' behavior. We surveyed up-to-date circular design strategies and circular business models and identified consumer engagement in circular economy.

From the research studies that we analyzed, desired consumer and user behavior can be specified to help circular business models function and encourage creating products with circular design. Desired consumer behavior may differ based on product ownership model (owned by user or by service provider).

If the product ownership is with the user it is important that the users *do not forget about the products they own*, it is important that the consumers *value the products* they have. Unused products are often overlooked by consumers and do not contribute to circular economy by *repurchase* or *sending unused product back to the producer*. If we want to slow down consumption it is necessary to *increase the use phase* of products and establish the *relationship between consumer and producer* which is important for *enhancing proper use, product care, reliability and durability of product*. Direct contact with manufacturer also provides proper after sales service. Users may need to have

maintaining behaviors, cleaning products and keeping them running in their top form. *Self-repair* in case of simpler products also helps to prolong product life.

If the product ownership is with the provider, access to the product and product performance is important to the user. In this case, desired user behavior is linked with *keeping to the contractual obligations* (e.g. monthly paying), *using the product in the intended way*, not to break a product or *misuse* the product, *acceptance by the community of users by good product care*, *return in good condition*, some providers require users to *swap broken parts* - return parts which break and send them proper parts, specific care – e.g. not to overcharge batteries, get involved in picking up products and returning it to a local pick up point which is *reducing operational cost*.

Encouraging desired behavior is possible through training, education, persuasion, financial incentives or providing value, making it as convenient as possible to get things out of the house (to second hand store better as to the separated trash for recycling), returning old stuff to the producer without obstacles, building trust and attachment (to product, service or manufacturer depending on the business mode).

This paper tried to answer the question of consumer involvement in a circular economy and changes in users' behavior. Of course, it does not provide a complete answer, but it provides a base for further discussion in area of circular design and circular user behavior. Future research may focus on the ways to enhance the circular behavior and acceptance of circular products and creation of appropriate business models.

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