

What and how to design for a circular economy

By Tomohiko Sakao

A change is inevitable – why?

Due to the increasing pressures concerning climate neutrality, resource efficiency, and resource circularity, manufacturers are challenged to substantially change how they design, produce and offer products. In tackling this challenge, services such as maintenance, repair, and remanufacturing provide an excellent opportunity to decrease the environmental impacts while keeping or increasing competitiveness.

What needs to be changed?

What to design?

A system including both products and services can be identified as a design object. It is an enlarged system—a system of systems—for value co-creation that improves environmental performance and competitiveness. The fundamental difference between providing such a system and selling a product lies in the commitment by the provider. It's a huge difference.

What are expected outcomes?

Integrated product and service offerings can be designed to create higher customer value, such as hassle-free product operation or higher performance. Providing services separately from selling the related products, which is traditional in many sectors, is simply wasteful. The efficiency (in terms of, e.g., lifecycle cost and lifecycle CO₂ emissions) in some cases were doubled or more thanks to the integration according to research.

How to design effectively and efficiently?

Five essences have been distilled from research over the last two decades. 1 - Develop and integrate system elements; 2 - Examine the balance between the product and the service; 3 - Implement value propositions; 4 - Functionality-oriented designing; and 5 - Identify relevant actors along the product lifecycle and use them properly.

Designing with these five essences for manufacturers of complex products is highly challenging. Typical lessons learnt based on collaborative experience with large global

manufacturers are the need of strategic management of design activities to avoid design fixation and service design trap. The former concerns blind adherence to existing product-focused design solutions. The latter refers to a phenomenon where the ability of service designers over a longer timespan (including the product use phase) is not fully seized due to the constraints set by the frozen product design at the start of production; see Fig.

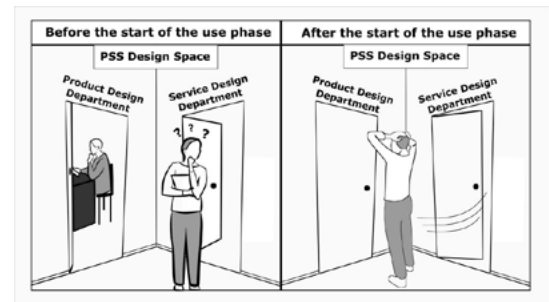


Fig.: Service design trap visualized in the context of product/service system (PSS) design. Source: DOI: 10.1017/pds.2022.198.

Recommended actions

The course of actions recommended based on research is as follows.

- Investigate if the five essences are implemented in the company internal design process.
- Seek improvement opportunities regarding 1) what decisions are taken along the entire design process, and 2) who is responsible / involved in which decision making and when.

This brief is based on the review DOI: 10.1109/ EMR.2022.3150851.