Research description

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I'm a PhD student at Chalmers University of Technology in Gothenburg and participates in the Mistra REES program, which stands for Resource Efficient and Effective Solutions - based on circular economy thinking (see www.mistrarees.se). My role in this program is to evaluate different strategies and measures that are presumably resource efficient for different products systems using life cycle assessment (LCA). Many strategies within the circular economy is believed to automatically result in less resource use and environmental impact. However, this might not always be true. It is not until one have studied the full system around a product and its whole life cycle, that it is possible to determine whether a strategy, presumed to be circular, really lead to less resource use and environmental impact. Questions like; when is it good to reuse, share, or remanufacture a product; how can consumables (short-lived products) be made circular? - are therefore thought to be answered in my research.

This work has been done in two studies so far. One case study, which included life cycle assessment of incontinence products to investigate how products such as consumables can be made more resource efficient. The study investigated measures that were possible to implement for the incontinence product system with current technology and on a short time perspective. Four very different resource efficiency measures were possible found to be implemented at different parts of life cycle (in production, during material selection and in use-phase). The measures were thereafter compared with the conventional product system alternative to analyze improvements or deterioration of the implementation of the measure. The LCA results showed that all of the measures lead to improved resource efficiency although to varying extent. Meaning, either less material resource use and/or less environmental impact.

In the other project, me together with two other PhD students, systematic reviewed a number of environmental assessment studies covering a variety of products and strategies to improve the resource efficiency and environmental performance. The aim was to answer: What physical measures aimed at RE on a product system level result in reduced physical flows and associated environmental impacts depending on the type of product? This was done by investigating which product characteristics lend themselves to different resource efficiency measures, as well as examined what trade-offs could be identified between different measures and aspects of resource efficiency. With physical measures we meant measures that could steer the physical flows in product chains. Meaning that the focus of this work was not on certain business models or policy measures, rather the physical effects of them.

The work concluded that several key product characteristics could be identified, which determined which measures could potentially be implemented and more importantly determined the outcome of the measure. An example of a finding was that sharing of products is best suited for durable and infrequently used products that tend not to reach their full technical lifetime. A corresponding trade-off was that sharing can increase car transportation from users accessing the shared stock.

These two projects have resulted in two manuscripts (under review) and were also part of my licentiate thesis which I presented in the end of September. My thesis explored more thoroughly how consumables can be made more resource efficient and what their role in the circular economy could be. This was important since rather few studies have investigated the role of consumables in the circular economy. Even if some of consumables such as different disposable (single-use plastic-based products) might not exist in the future, products such as diapers, food and detergent will continue to be needed and strategies to make these products more resource efficient and circular are needed.

In my current and future research, I will broaden my horizon and enter the design field. One thing that became very clear from the systematic reviewed of different measures and products, many if not, most measures are dependent on design. Either the measure include redesign, or the design of the product and its system determines the possibility to apply the measure as well as the outcome of the measure. This work will mainly encompass evaluating different design methods to see if the use of the methods really leads to more resource efficient product systems. The evaluation will be done by using LCA.

To conclude, my work has a clear connection to the circular economy concept since my research explores when are measures and product systems really circular and resource efficient.