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Consumer and user acceptance in the circular economy: what are researchers missing?

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Abstract
The circular economy is a platform to transition towards a more resource efficient system. Product service systems (PSS) and remanufacturing have been proposed as strategies to achieve material decoupling. Recent studies have found that their adoption has fallen short in the business-to-consumer sector, due to lack of consumer acceptance. Literature addressing this issue has failed to provide a systematic approach to the problem. By performing a structured search on Scopus and Web of Science, 24 papers focusing on consumer and user acceptance of remanufacturing and PSS were identified. By applying qualitative research methods, the articles were analysed using six categories: problem and research questions, definitions, theoretical background, issues, methods and research gaps. Resulting from the analysis an outline for a research agenda on the topic of consumer and user acceptance of PSS and remanufactured products is suggested. Such program needs to provide a definition of consumption, consumers and users in the circular economy including their role. It should explore external factors influencing acceptance, adoption and diffusion of PSS and remanufacturing such as cultural (norms, beliefs, codes) and demographic and their interaction to each other, to guide action. Answering this questions requires tools and devices from additional fields such as anthropology and sociotechnical studies complement the contributions already made by psychology and sociology.

Introduction

The circular economy is a concept advocated by many as an idea that favours increased or optimal resource efficiency (Preston, 2012; Roos, 2014). Activities within a circular economy include cascading, re-use, repair, maintain, remanufacturing and recycling (Ellen MacArthur Foundation, 2013). Two examples strategies incorporating such activities are Product Service Systems (PSS) and remanufacturing (Hazen et al., 2016; Tukker, 2015).

PSS are the result of a transition from a goods economy to a service oriented system (Baines et al., 2016; Mont, 2002; Sakao et al., 2009; Stahel, 1982; Tukker, 2004, 2015). Remanufacturing is a reuse process that repairs, replaces or restores components of a product that are not useful anymore and aims at ensuring "operation comparable to a similar new product" (Abbey et al., 2015, p. 488). However, and despite their environmental benefits, both strategies have yet to be widely adopted in consumers markets (Abbey et al., 2015; Baines et al., 2016; Tukker, 2015).

Consumer acceptance has been highlighted as one of the main reasons for such delay. In response to this, a significant work has been done exploring different aspects of the topic for both strategies (Abbey et al., 2015a; Khor & Hazen, 2016; Rexfelt & Hiort af Ornäs, 2009; Schotman & Ludden, 2015; Van Weelden et al., 2016). However, no systematic literature review on the topic has been done so far, to the extent of the researchers' knowledge. This paper aims to address this gap by performing a critical review of the literature that looks into the contributions made by different authors to the issue of consumer/user acceptance of particular strategies contributing to the circular economy, regarding definitions, questions, theories and fields, methods, issues raised and research gaps, and by proposing a research agenda.

Methods

To answer the research questions, several steps were taken as illustrated in Figure 1. First, a web-based query was conducted on Scopus and Web of Science databases using relevant keywords. Second, different filters were applied to the results to get a robust set of papers. This resulted in 24 papers focusing on the topic. Third, each paper was read and analysed regarding the elements defined in the research questions, i.e. definitions, questions, fields, methods, issues raised and research gaps identified. To achieve this each article was coded with Nvivo11 using the predefined categories 'definitions', 'questions', 'fields', 'methods' and 'research gaps'. To identify issues, an

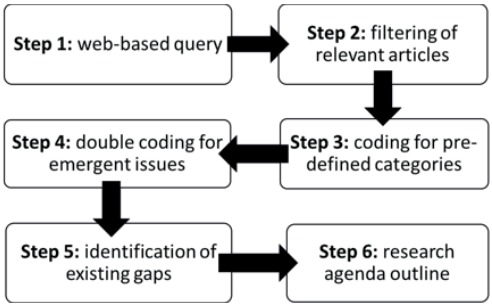

Figure 1. Steps taken to answer the research question.

inductive approach was used based on a double cycle technique (Saldaña, 2010). A first cycle was executed looking for issues emerging from the text by means of word and text queries, and a second cycle was performed by the researcher through in-depth reading and coding looking for additional codes. The results were then combined to achieve a comprehensive list of topics following the research questions of this review.

Results

This section presents the analysis of the contributions by the literature regarding the different topics explored and the proposed research agenda outline based on such analysis.

Definitions

Most articles provided harmonised definitions for PSS and remanufacturing based on seminal papers such as Mont (2002) and Tukker (2004). However, it was evident the absence of definitons of consumer and user acceptance considering that this is the departing point of most of the studies.

Problem and questions asked

Three sets of questions dominate the literature on consumption and PSS and remanufactured products as presented in Figure 2.

- The first set investigates the role of consumption in a use-based economy (Bardhi & Eckhardt, 2012; Briceno & Stagl, 2006; Catulli et al., 2017; Dewberry et al., 2013; Mont, 2004; Mylan, 2015).

- The second set of questions explores what factors explain acceptance or lack thereof, and is addressed by the majority of the literature for both PSS and remanufacturing (Abbey et al., 2017; Abbey et al., 2015; Abbey et al., 2015a; Armstrong et al., 2015; Catulli et al., 2013; Catulli et al., 2016; Catulli et al., 2017; Catulli,et al., n.d.; Catulli & Reed, 2017; Hazen et al., 2016; Jiménez-Parra et al., 2014; Khor & Hazen, 2016; Matsumoto et al., 2016; Piscicelli et al., 2015; Rexfelt & Hiort af Ornäs, 2009; Van Weelden et al., 2016). Most of them focus on the individual, while few studies deal with the role of societal or system-level factors (Briceno & Stagl, 2006; Mont, 2004; Mylan, 2015; Petersen & Riisberg, 2017; Santamaria et al., 2016)

- The third set of questions examines how the design and development process of PSS and remanufacturing could address the consumer or user to gain acceptance. For PSS, these questions are addressed by Knot & Luiten, (2006), Mont & Plepys, (2003), Rexfelt & Hiort af Ornäs (2009), Santamaria et al., (2016), and Stacey & Tether (2015). In the case of remanufacturing, only Mugge et al., (2017) and Van Weelden et al., (2016) explore what strategies or incentives are needed to improve acceptance of refurbished products as a type of remanufactured ones.

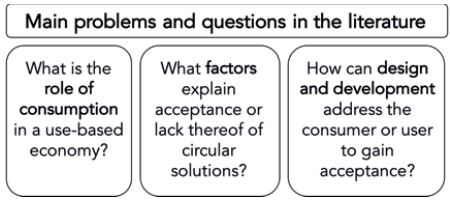

Figure 2. Problems addressed by the literature.

Fields and theoretical approaches

To answer these questions, researchers have used theoretical approaches from psychology, sociology and anthropology, mainly. Psychology provides the theoretical instruments for most authors: Briceno & Stagl (2006) use the needs framework presented by Cruz et al., (2009) to explore how PSS satisfy human needs or not. Baxter et al., (2015) use it to address ownership and object attachment in a circular context. Other authors dealing with both, PSS and remanufacturing use the Theory of Planned Behaviour (TPB) (Abbey et al., 2015; Armstrong et al., 2015; Hazen et al., 2012; Khor & Hazen, 2016; Michaud & Llerena, 2011; Piscicelli et al., 2015; Rexfelt & Hiort af Ornäs, 2009; Schotman & Ludden, 2014; Shih & Chou, 2011; Van Weelden et al., 2016). Catulli & Reed (2017) explore Personal Construct Psychology and Ertz et al. (2017) appeal to Cognitive Involvement Theory to explain why people engage in Goods Multiple Lives Practices (GMLP).

Using a more systemic perspective authors such as Catulli et al. (2017), Mylan, (2015), Petersen & Riisberg (2017), Piscicelli et al. (2015) and Santamaria et al., (2016), obtain their theoretical background from different sociological theories. Catulli et al. (2017) draw on Consumer Culture Theory to explore how PSSs fit in consumer culture values and perspectives. Mylan (2015) and Piscicelli et al. (2016) use Practice Theory as a framework to explain the potential for PSS diffusion. Petersen & Riisberg (2017) examine how a particular PSS interacts with a wider network of human and non-human actors using Latour's Actor Network Theory. Santamaria et al. (2016) analyse how semiotics and cultural studies could contribute to the understanding of contextual factors that could affect acceptance, adoption and diffusion of PSS. Authors dealing with remanufacturing questions do not use sociological theories in their research, as their studies are usually more grounded in engineering disciplines.

Finally, Bardhi & Eckhardt (2012) use a more anthropological approach to understanding how the concept of ownership in an access based economy would affect acceptance by individuals. Hazen et al., (2016) venture away from the remanufacturing tradition and explore ideas from Human Geography to explain the interaction between different factors such as price, quality, economic incentives and regulation.

Methods and tools used

Studies used both quantitative and qualitative methods for data collection. PSS literature employs qualitative approaches and tools, mainly focus groups and interviews (Armstrong et al., 2016; Bardhi & Eckhardt, 2012; Besch, 2005; Catulli, 2012; Catulli et al., 2013; Dewberry et al., 2013; Ertz et al., 2017; Mylan, 2015; Piscicelli et al., 2016; Rexfelt & Hiort af Ornäs, 2009a). Less used but still important in this literature stream are surveys conducted to collect quantitative data (Armstrong et al., 2016; Briceno & Stagl, 2006; Catulli & Reed, 2017; Ertz et al., 2017; Knot & Luiten, 2000; Piscicelli et al., 2015; Shih & Chou, 2011). Other qualitative methods used were nonparticipant observation (Bardhi & Eckhardt, 2012; Petersen & Riisberg, 2017), structured interviews (Catulli & Reed, 2017), and wardrobe audits (Petersen & Riisberg, 2017).

Literature dealing with remanufactured products had a more quantitative approach to data collection, using experimental settings (Abbey et al., 2017; Abbey et al., 2015a; Abbey et al., 2015; Jiménez-Parra et al., 2014; Michaud & Llerena, 2011) or surveys (Hazen et al., 2016; Matsumoto et al., 2016; Mugge et al., 2017). Only one study used qualitative methods, namely semi-structured interviews (Van Weelden et al., 2016).

Key issues

The most prominent issue investigated by the literature was barriers for acceptance. They refer mainly to negative perceptions of remanufactured products and PSS, values (environmental and cultural) and their influence on adopting a PSS or a remanufactured product (more details presented in Table 1. Other factors being explored include beliefs (Abbey et al., 2015a; Abbey et al., 2015; Mugge et al., 2017; Van Weelden et al., 2016), attitudes (Hazen et al., 2016), and norms, both social and personal (Bardhi & Eckhardt, 2012; Khor & Hazen, 2016; Matsumoto et al., 2016; Michaud & Llerena, 2011; Mylan, 2015). Positive factors enabling acceptance are not extensively studied in the literature.

Gaps in research

Regarding gaps in research, authors working on remanufacturing issues call for more efforts to understand how external factors such as price, warranties, demographic and cultural factors affect acceptance and adoption of remanufactured products (Abbey et al., 2015; Hazen et al., 2016). They also suggest intrinsic motives need to be further explored (Abbey et al., 2015a). Finally, they advocate for better explanations of the intention-behaviour gap connected to environmental values and remanufactured products (Abbey et al., 2017).

Issues: barriers	Authors
Remanufactured and used products perform worse than new ones	Abbey et al. (2015), Jiménez-Parra et al., (2014), Matsumoto et al. (2016)
Remanufactured and used products ar not hygienic, generating disgust, fear of contagion and contaminated interaction	Abbey et al. (2015a), Bardhi & Eckhardt (2012), Catulli et al. (2013), Baxter et al. (2016).
Risk aversion	Hazen et al. (2012), Rexfelt & Hiort af Ornäs (2009)
Animosity against lack of ownership	Bardhi & Eckhardt, (2012), Catulli et al. (2016)
Unidimensional value offering	Catulli et al. (2013), Dewberry et al. (2013), Stacey & Tether (2015)
Problems to access the offering	Abbey et al., (2015a), Hazen et al. (2016), Khor & Hazen (2016)
The practice is tightly connected to other practices	Mylan (2015)
Inertia, lock-in and path dependency	Santamaria et al. (2016)

Table 1 Barriers for consumer and user acceptance of remanufactured products and PSS.

Another proposed dimension for further research relates to methods and tools for collecting relevant data. Catulli et al. (2016) suggest exploring ethnographic methods to understand PSS better. Additionally, Santamaria et al. (2016) indicate the need for tools to extract data on cultural codes that can be used to design circular offerings better. Finally, Dewberry et al. (2013) suggest that participatory design could be important in developing PSS, given the need for more local and contextualised understandings.

Some authors also suggest more research is required on the type of individuals or groups that are more susceptible to accept this kind of offerings and what is their particular context (Catulli et al., 2013; Mugge et al., 2017). Lastly, the literature invites researchers to explore strategies to improve acceptance from policy, design and communication perspectives (Hazen et al., 2016; Mugge et al., 2017).

A suggested research agenda

Although the work on consumer acceptance of circular solutions such as PSS and remanufacturing has been expanding some work remains to be done. Based on the achievements of existing work on the topic, here we suggest an outline for a research agenda that may contribute to successful interventions in the transition towards a circular economy.

Definitions, questions and problems

- Explore the role of consumption, consumers and users in the circular economy.
- Provide definitions of acceptance in the context of a circular economy.

Influencing Factors

- Further explore factors that have a positive impact on acceptance.

- Empirically explore how different factors relate to others and if there is a hierarchy.
- Interactions between cultural and demographic factors and intrinsic motives like beliefs, values and norms.
- Influence of cultural factors on acceptance.
- Individual characteristics that influence acceptance.

Fields

- Use insights and tools from anthropology and areas such as sociotechnical studies to address the interface between the individual and the collective.

Methods

- Explore the utility of nonparticipant observation and ethnographies to collect data.
- Examine the role of participatory methods to develop PSS and product proposals.

Other aspects

- It is necessary to include other circular economy strategies in this review (e.g. sharing economy, collaborative consumption and product re-use).
- Expanding the review to conference papers could provide a fresh view on what new topics, early stage researchers and established scholars are exploring.

Conclusions

This article aimed at providing a general review of the literature dealing with consumer and user acceptance of two particular circular solutions, PSS and remanufactured products. Based on the findings the paper outlined a research agenda on the topic. Twenty-four articles were reviewed in depth, searching for inputs on six main categories: definitions, problem and research questions, definitions, theoretical background, issues, methods and research gaps. Base on this analysis a set of questions to be addressed was suggested that can work as the seed for a research agenda in the topics of circular economy strategies and consumption.

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References

Abbey, J. D., et al., (2017). The Role of Perceived Quality Risk in Pricing Remanufactured Products. Production and Operations Management, 26(1), 100–115.

Abbey, J. D., et al., (2015a). Consumer Markets for Remanufactured and Refurbished Products. California Management Review, 57(4), 26–43.

Abbey, J. D., et al., (2015). Remanufactured products in closed-loop supply chains for consumer goods. Production and Operations Management, 24(3), 488–503.

Armstrong, C. M., et al., (2016). A Use-Oriented Clothing Economy? Preliminary Affirmation for Sustainable Clothing Consumption Alternatives. Sustainable Development, 24(1), 18–31.

Baines, T. S., et al., (2016). Servitization : Revisiting the State-of-the-art and Research Priorities. International Journal of Operations & Production Management, (July), 1–28.

Bardhi, F., & Eckhardt, G. M. (2012). Access-Based Consumption: The Case of Car Sharing. Journal of Consumer Research, 39(December), 000–000.

Baxter, W. L., et al., (2015). A psychological ownership approach to designing object attachment. *Journal of Engineering Design*, *26*(4-6), 140-156.

Baxter, W. L., et al., (2016). Materials, use and contaminated interaction. *Materials & Design*, *90*, 1218-1227.

Besch, K. (2005). Product-service systems for office furniture: Barriers and opportunities on the European market. Journal of Cleaner Production, 13(10–11), 1083–1094.

Boote, D. N., & Beile, P. (2005). Features: Scholars Before Researchers : On the Centrality of the Dissertation Literature Review in Research Preparation. Educational Researcher, 34(6), 3–15.

Briceno, T., & Stagl, S. (2006). The role of social processes for sustainable consumption. Journal of Cleaner Production, 14(17), 1541–1551.

Catulli, M. (2012). What uncertainty? Journal of Manufacturing Technology Management, 23(6), 780–793.

Catulli, M., et al., (2016). Product Service Systems Users and Harley Davidson Riders: The Importance of Consumer Identity in the Diffusion of Sustainable Consumption Solutions. Journal of Industrial Ecology, 0(0), 1–10.

Catulli, M., et al., (2017). Consuming use orientated product service systems: A consumer culture theory perspective. Journal of Cleaner Production, 141, 1186–1193.

Catulli, M., et al., (n.d.). What Value do consumers really expect of Product Service Systems ? Reflections on how a different conception of value could facilitate the implementation of PSS in consumer markets, 1–10.

Catulli, M., et al., (2013). What is Mine is NOT Yours: Further insight on what access-based consumption says about consumers. Retrieved from https://uhra.herts.ac.uk/dspace/handle/2299/5549

Catulli, M., & Reed, N. (2017). A Personal Construct Psychology Based Investigation Into A Product Service System For Renting Pushchairs To Consumers. Business Strategy and the Environment.

Cruz, I., et a., (2009). Towards a systemic development approach: Building on the Human-Scale Development paradigm. Ecological Economics, 68(7), 2021–2030.

Dewberry, E., et al., (2013). Critical reflections on designing product service systems, 16(4), 408–430.

Ellen MacArthur Foundation. (2013). Towards the circular economy 1: economic and business rationale for an accelerated transition (Vol. 1). Retrieved from http://www.ellenmacarthurfoundation.org/business/reports

Ertz, M., et al., (2017). Life after death? Study of goods multiple lives practices. Journal of Consumer Marketing, 34(2), 108–118.

Guide, V. D. R., & Van Wassenhove, L. N. (2009). OR FORUM—The Evolution of Closed-Loop Supply Chain Research. Operations Research, 57(1), 10–18.

Hazen, B. T., et al., (2016). Remanufacturing for the Circular Economy: An Examination of Consumer Switching Behavior. Business Strategy and the Environment.

Hazen, B. T., et al., (2012). The role of ambiguity tolerance in consumer perception of remanufactured products. International Journal of Production Economics, 135(2), 781–790.

Jiménez-Parra, B., Rubio, S., & Vicente-Molina, M. A. (2014). Key drivers in the behavior of potential consumers of remanufactured products: A study on laptops in Spain. Journal of Cleaner Production, 85, 488–496.

Khor, K. S., & Hazen, B. T. (2016). Remanufactured products purchase intentions and behaviour: Evidence from Malaysia. International Journal of Production Research, 7543(June), 1–14.

Knot, M., & Luiten, H. (2006). User involvement in the development of sustainable product-service systems. User Behavior and Technology Development, 263–276.

Matsumoto, M., Chinen, K., & Endo, H. (2016). Comparison of U.S. and Japanese Consumers' Perceptions of Remanufactured Auto Parts. Journal of Industrial Ecology, 0(0).

Michaud, C., & Llerena, D. (2011). Green consumer behaviour: An experimental analysis of willingness to pay for remanufactured products. Business Strategy and the Environment, 20(6), 408–420.

Mont, O. (2002). Clarifying the concept of product – service system. Journal of Cleaner Production, 10, 237–245.

Mont, O. (2004). Institutionalisation of sustainable consumption patterns based on shared use. Ecological Economics, 50(1–2), 135–153.

Mont, O., & Plepys, A. (2003). Customer satisfaction : review of literature and application to the product-service systems Customer satisfaction : review of literature and application to the, (July 2016), 1–62.

Mugge, R., et al., (2017). How to sell refurbished smartphones? An investigation of different customer groups and appropriate incentives. Journal of Cleaner Production, 147, 284–296.

Mylan, J. (2015). Understanding the diffusion of Sustainable Product-Service Systems: Insights from the sociology of consumption and practice theory. Journal of Cleaner Production, 97, 13–20.

Petersen, T. B., & Riisberg, V. (2017). Cultivating Developing a Circular System for the Acquisition and Use of Baby Clothing. Fashion Practice, 9(2), 216–236.

Piscicelli, L., Cooper, T., & Fisher, T. (2015). The role of values in collaborative consumption: Insights from a product-service system for lending and borrowing in the UK. Journal of Cleaner Production, 97, 21–29.

Preston, F. (2012). A Global Redesign? Shaping the Circular Economy. Energy, Environment and Resource Governance, (March), 1–20.

Rexfelt, O., & Hiort af Ornäs, V. (2009). Consumer acceptance of product-service systems. Journal of Manufacturing Technology Management, 20(5), 674–699.

Roos, G. (2014). Business Model Innovation to Create and Capture Resource Value in Future Circular Material Chains. Resources, 3, 248–274.

Sakao, T., et al., (2009). Framing research for service orientation of manufacturers through PSS approaches. Journal of Manufacturing Technology Management, 20(5), 754–778.

Saldaña, J. (2010). The Coding Manual for Qualitative Researchers.

Santamaria, L., et al., (2016). Switch the channel: Using cultural codes for designing and positioning sustainable products and services for mainstream audiences. Journal of Cleaner Production, 123, 16–27.

Schotman, H., & Ludden, G. D. S. (2014). User acceptance in a changing context: why some product-service systems do not suffer acceptance problems. Journal of Design Research, 12(3), 188–203.

Shih, L.-H., & Chou, T. Y. (2011). Customer concerns about uncertainty and willingness to pay in leasing solar power systems. International Journal of Environmental Science and Technology, 8(3), 523–532.

Stacey, P. K., & Tether, B. S. (2015). Designing emotion-centred Product Service Systems: The case of a cancer care facility. Design Studies, 40, 85–118.

Stahel, W. (1982). The product life factor. In An Inquiry into the Nature of Sustainable Societies: The Role of the Private Sector (Series: 19). NARC.

Tukker, A. (2015). Product services for a resource-efficient and circular economy - A review. Journal of Cleaner Production, 97, 76–91.

Van Weelden, et al., (2016). Paving the way towards circular consumption: Exploring consumer acceptance of refurbished mobile phones in the Dutch market. Journal of Cleaner Production, 113, 743–754.

Wang, Y., & Hazen, B. T. (2016). Consumer product knowledge and intention to purchase remanufactured products. International Journal of Production Economics, 181, 460–469.