

Emerging consumer perspectives on circular economy

Petteri Repo & Markku Anttonen
University of Helsinki, Consumer Society Research Centre
{petteri.repo,markku.anttonen}@helsinki.fi

Abstract

The concept of circular economy has become a catchphrase for describing redesign of industries and economies towards better sustainability. The consideration of consumers holds a prominent role in the concept, yet consumers are not well accounted for in literature on circular economy. This paper takes a forward-looking approach to the relationship between consumers and circular economy. It reviews an extensive and systematically collected corpus of European citizen visions on desirable and sustainable futures from this perspective, and argues that the concept of circular economy should increasingly connect to energy issues and social topics, if it is to better embrace citizens' expectations on it.

1. Introduction

Circular economy has become a concept that encompasses a number of environmental issues of interest such as restoration and regeneration of economy, rethinking of production and consumption, and reduction of waste. Key institutional developments, such as the establishment of the Ellen MacArthur Foundation (2015) and the adoption of the Circular Economy Package in the European Union (Repo et al. 2015), account for consumers in their activities. The academic community has at the same time shown interest in the concept of circular economy, and also identified consumers as players in the concept.

Yet the role of consumers is not prominent nor uniform in either. While consumers are considered as a part of the economy and in connection to the use of products, they are not seen as key actors, goal-setters nor even as domesticators of new opportunities. For consumers to become active

players in the realm of circular economy, it is of particular importance to identify how they respond to corresponding key elements of circular economy.

This paper develops a consumer centred view on circular economy through topic modelling. It starts off from a review of academic literature on circular economy, identifying key elements of circular economy: shared use of products, incentivised return, product design, waste reduction, and sustainable food production. Then it proceeds to review how these elements come forth in 62 visions on desirable and sustainable futures, which have been developed by over 1.000 people in 30 European countries (Jørgensen & Schøning 2016). The visions are topic modelled with the MALLET toolkit for natural languages (McCallum 2002), thereby identifying and describing consumer perspectives on circular economy. Two key findings emerge in the analysis: 1) energy for society is a key topic for circular economy to connect to and 2) social topics are much more prevalent in visions than they are being discussed in academic literature on circular economy. The concluding section summarizes the findings and discusses their relevance for the future of the concept of circular economy.

2. Circular economy and consumer perspectives on it

The key aim of circular economy as a concept is to change current take-use-dispose economies towards more ecologically and economically sustainable circular flows of natural resources, and to decouple current levels of resource and energy usage from economic throughput (Ghisellini et al. 2016, Murray et al. 2015). Production loops should be as closed as possible, and material flows should be pure to enable retaking them into manufacturing processes or biological cycles (Murray et al. 2015). As such, the circular economy focuses on the economic and ecological aspects of sustainability and is only little concerned with the social aspects of sustainable development (Murray et al. 2015).

To achieve decoupling from current linear take-use-dispose economies, there are calls for better industrial design and improved use of materials, which narrow down the material flows in manufacturing, with cascading use of materials, i.e. products and materials moving from their original use to other uses, or becoming resources for other industries (WEF 2014). This requires that products should be designed or re-designed (Murray et al. 2015) to enable easy take-back of resources into the manufacturing processes. Excess materials as such, and in products, then become valuable assets to the companies.

In turn, manufacturing companies need greater control over and knowledge of materials, so these can be reintroduced in manufacturing processes. This calls for advanced take-back and recycling schemes accompanied by monetary incentives such as return payments for consumers and aligned business models (Planing 2015).

Although the concept of circular economy focuses more on industry and the supply side, consumers are an important part of the equation. In addition to industry needing to recover products and materials for remanufacturing, other forms of innovative businesses and consumption (Hobson and Lynch 2016) are needed for circular economy to thrive. Examples of such innovative businesses for consumer include shared use of assets (car-sharing, power tools, etc.) and results-oriented services (lighting rather than light bulbs) (Tukker 2015). This is warranted through the idea that consumers embrace access and use of services instead of owning products as such (Hobson and Lynch 2016; Tukker 2015). Also, diverse repair and refurbishing services are seen as a central way to prolong product life and to narrow the throughput of materials in economy (Riisgaard et al. 2016). Such innovative services offer opportunities for sustainable growth, and jobs alike (Murray et al. 2015).

A review of academic research on consumers and circular economy shows that the body of literature represents only a fraction of the research on circular economy in general. A quick literature search on published journal articles on circular economy produces a pool of 426 articles (Scopus database, date 20161209). In contrast, refining the search to include both circular economy and consumer(s), and excluding all articles that do not focus on consumers, consumption or consumer society as such, produces a set of only 23 articles. Ten of these are empirical studies with the remaining being more focused on conceptual questions, such as Hobson and Lynch (2016) who argue for taking better into account the potential social implications of circular economy policies and practices.

Most of the empirical studies focused on consumers' attitudes towards repaired second hand electronic device, or in two articles, second hand car parts (Matsumoto et al. 2016, Zhang et al. 2011). A majority of the reviewed articles analysed consumers' willingness to buy and use second hand devices, or in what way prior knowledge (Hazen et al. 2016), experiences (Mashhadi et al. 2016) or pricing (van Weelden et al. 2016; Yang & Wang 2011) may affect willingness to use them. Also, the development of consumer repair services of mobile device markets have been analysed (Riisgaard et al. 2016; Kissling et.al. 2013; Ongondo et al. 2013).

None of these studies analysed the development of different product services, which enable leasing, renting, access (car-sharing, etc.) or desired outcome (for example installed lighting, clean clothes). Commercial or peer-to-peer sharing was also absent, as were different take back and recycling

schemes for consumer goods. These subject areas connect either to an ample body (e.g. sustainable consumption, product services) or fast-growing field (sharing economy), but they do not seem to relate closely to the research on circular economy.

To sum up, consumer-related studies on the concept of circular economy and corresponding empirical consumer studies contribute to five key issues of interest to look for in citizen visions on desirable and sustainable futures: 1) shared use of products (for example car-sharing, outcome oriented services), 2) incentivised return (take-back schemes such as those for used car tires and plastic beverage bottles), 3) product design (making products better repairable and recyclable), 4) waste reduction (retaking materials into industrial processes), and 5) sustainable food production (material flows in biological processes).

3. Topic modelling circular economy from citizen visions

The analysed data has been collected from a set of 179 citizen visions on desirable and sustainable futures extending to the year 2050. These visions were developed across 30 European countries in the Cimulact project and involved more than 1000 citizens between November 2015 and January 2016 (Jørgensen & Schøning 2016). The visions consist of a title and a description of the content of the vision as well as of how it differs from today and how it is desirable. The visions represent a wide scope and range across 29 social needs (Warnke et al. 2016). The concepts of citizens and consumers are in this paper interchangeably, reflecting that the obtained insights originate from lay people.

The authors selected visions relating to circular economy according to the 5 criteria emerging from literature on consumers and circular economy: shared use of products, incentivised return, product design, waste reduction, and sustainable food production. Both authors separately reviewed all 179 visions for sections corresponding to these criteria and evaluated these sections with three criteria for selection: yes, perhaps, no. In the following stage both authors returned to those visions which had received differing evaluations of which one was yes, and checked if their review remained valid. Only those visions, which subsequently received two yes-reviews are included in the analysis. This led to the analysis of 62 visions on desirable and sustainable futures, each of which include a section corresponding to circular economy.

The selected visions are analysed by topic modelling with latent Dirichlet allocation, which is a technique suitable for unstructured data (Blei et al. 2003). Patterns in the vision data are observed

using the MALLET machine learning toolkit for natural languages, (McCallum 2002). Topics, i.e. probabilistic clusters of words, are identified in the data and provide integrating views on contents.

Observed topics relate to the full corpus of the 62 visions, which consists of the full texts of the selected visions. Stop words and special characters have been removed from the corpus to improve analysis, and capital letters have been replaced with lower case letters for the same reason. Topic modelling requires a selection of the number of topics to be identified. The analysis is carried out with 10 topics, after having piloted the analysis with 5, 10 and 15 topics. Modelling was carried out with the optimisation interval of 20.

The results of the topic modelling indicate in which future contexts citizens consider circular economy. They are representations rather than exact depictions and the process follows that of discourse analysis, where focus is on beyond what is directly expressed in sentences. The applied discourse analysis can be considered to be of ‘critical’ character in the sense that it focuses not only on offering explanations, but also considers issues, problems and controversies (see Gee 2014; Wodak 2009).

4. Ten topics for future circular economy

The findings emerging from the topic modelling provide 10 topics for future circular economy (Table 1). Modelling provides key words appearing in a topic and its Dirichlet parameter which indicates the weight of that topic in the corpus. The naming of the topics is performed by the authors and relates to the clusters of keywords. The topics in order of weight are the following: energy for society, balanced standards, cultural progress, healthy humanity, future choices, climate threats, equal possibilities, policy mission, accessible opportunities, and clean systems.

The topic of *Energy for society* is of substantially more weight than the other nine topics. Thereby, it should be considered an overarching facilitative topic, which connects to a number of activities and issues such as energy, people, life, food, community, society, education, production and work. Even when modelling the corpus with five and fifteen topics, energy for society emerges as the same key topic. The finding can be considered specific for circular economy also because education performs that same overarching role when analysing all 179 visions of which the 62 visions are a subset (Repo et al. 2017).

Together with the topic of *Climate threat*, *Energy for society* are the only topics in which consumption and consumers are directly addressed in their key words. Interestingly, neither overall

sustainability nor energy were amongst the criteria for selecting vision data for the analysed corpus, which further highlights the importance of these topics.

Table 1. Ten topics for future circular economy

Topic	Dirichlet parameter	Key words in topic
1. Energy for society	29,001	energy people life food community society education production work resources environment vision green nature social time consumption ecological local water
2. Balanced standards	3,767	level accordance rural city workers conscious pierino members secure leisure meat story common standard sustainable active vehicle triple healthcare mix
3. Cultural progress	3,736	eat great consequences supporting cultural progress days built interests alternatives group child replacing fair public case gardening species polluters doubts
4. Healthy humanity	3,698	healthier higher global costs restrictions citizen professions problems reduced large stylish humanity cohesive embedded ethics heart end satisfaction set person
5. Future choices	3,620	modern children concern relation cars supported plastic walls holistic volunteering close cultural favour squares codes civil developing choices sense experiences
6. Climate threats	3,543	oil rooftop fish learning climate principle measures employment ensure money generation town consumer scale customers actively meeting programme start science
7. Equal possibilities	3,548	perspective possibilities ideas everyones equally sick ecologically lead climate milk add herbs grandparents regional holders house racists wanted auto accept
8. Policy mission	3,439	give balanced nowadays regions policy bodies dwelling technical heritage quantum reserves mission typical democracy operating find models differences valued benefit
9. Accessible opportunities	3,381	accessible universal educated remote farmers opportunities efficient part main building people fruits corporate earlier lawn playing seas cleaner wellbeing shower
10. Clean systems	3,048	part systems relationships clean adapted resist burden simple cleaner interest virtuous success cradle street involvement integrate dialogue immaterial wishes due

The topic of *Balanced standards* relates to finding appropriate solutions between differing contexts such as rural areas and cities, and work and leisure. *Cultural progress* deals with eating, interests, alternatives and fairness while considering doubts about biodiversity. *Healthy humanity* considers health in terms of costs, restrictions, professions and problems. *Future choices* responds to a variety of forward-looking selections having to do with relations, materials and senses. *Equal possibilities* takes inclusion into account, pointing at everyone, acceptance and racism in relation to ecology and climate. *Policy mission* pays attention to regions, institutional bodies, mission, democracy and finding operating models. *Accessible opportunities* relate to accessibility, universality, education and opportunities with a slight emphasis in the material world through farmers, fruits, lawns and seas. *Clean systems* considers relationships between part of system, adaptation and resistance as well as cleanliness.

All but two topics connect to the social dimensions of circular economy. Alongside the magnitude of the energy topic which is also positioned socially, this is a key result of the analysis. The social dimension is indeed highlighted in forward-looking consumer and citizen visions on desirable and sustainable futures that relate to circular economy. In comparison, the ecological dimension plays a subdued role.

Technology is often considered an enabler for new solutions, but it relates only to three topics. This can be interpreted either to question the technological emphasis of circular economy or to leave it to the industry of supply side to address. Similarly, the economic dimension draws little attention, again accentuating the social character of circular economy in citizen visions.

5. Discussion

The concept of circular economy considers consumers, yet this connection has received limited attention in academic literature. There is, in particular, a lack of empirical and consumer-centred work on circular economy. This paper has responded to that knowledge gap by reviewing how European citizen visions on desirable and sustainable futures relate to the concept of circular economy. Visions were selected to be included in the analysed corpus according to the following content criteria: shared use of products, incentivised return, product design, waste reduction, and sustainable food production.

Applying the methodology of topic modelling to analyse the visions that relate to circular economy, two consumer-centred key findings emerge: 1) energy is a key topic for the concept of circular economy to connect to and 2) social aspects are very prevalent when people think of the future opportunities of circular economy. These forward-looking discourses exhibit how people relate to features included in the concept of circular economy (see Gee 2014; Wodak 2009), and do differ from the standard concept, which accentuates ecological, technological and economic dimensions.

The findings exhibit forward-looking expectations citizens have on the concept of circular economy. To stimulate the acceptance and take-up of the concept of circular economy amongst citizens in Europe, it would seem worthwhile to highlight its relationship to challenges relating to energy and social sustainability.

References

- Blei, D.M., Ng, A.Y. & Jordan, M.I. (2003). Latent Dirichlet Allocation. *Journal of Machine Learning Research* 3(Jan), 993-1022.
- Gee, J. P. (2014). *An Introduction to Discourse Analysis: Theory and Method*. London: Routledge.
- Ghisellini P., Cialani C. and Ulgiati S. (2016). A Review on Circular Economy: The Expected transition to a Balanced Interplay of Environmental and Economic Systems. *Journal of Cleaner Production* 114: 11-32.
- Hazen B., Mollenkopf D. and Yang Y. (2016). Remanufacturing for the Circular Economy: An Examination of Consumer Switching Behavior. *Business Strategy and the Environment*, in press.
- Hobson K. and Lynch N. (2016). Diversifying and De-growing the Circular Economy: Radical Social Transformation in a Resource-Scarce World. *Futures* 82: 15-25.
- Jørgensen, M. L. & S. Schøning (2016), *Vision Catalogue*. Encompassing the visions from all 30 countries. Cimulact project, Deliverable 1.3. Accessed 1.12.2016 at <http://www.cimulact.eu/wp-content/uploads/2016/06/D1.3final.pdf>
- Kissling R., Coughlan D., Fitzpatrick C., Boeni H., Luepschen C., Andrew S. and Dickeson J. (2013). Success factors and barriers in re-use of electrical and electronic equipment. *Resources, Conservation and Recycling* 80: 21 - 31.
- Ellen MacArthur Foundation (2015) *Towards a Circular Economy: Business Rationale for an Accelerated Transition*. Cowes: Ellen MacArthur Foundation.
- Matsumoto M., Chinen K. and Endo H. (2016). Comparison of U.S. and Japanese Consumers' Perceptions of Remanufactured Auto Parts. *Journal of Industrial Ecology*, in press. DOI: 10.1111/jiec.12478
- McCallum, A.K. (2002). MALLET: A Machine Learning for Language Toolkit. Accessed 1.4.2017 at <http://mallet.cs.umass.edu>.
- Mashhadi A. R., Esmaelian B., Cade W., Wiens K. and Behdad S. (2016). Mining consumer experiences of repairing electronics: Product design insights and business lessons learned. *Journal of Cleaner Production* 137: 716 - 727.
- Murray A., Skene K. and Haynes K. (2017). The Circular Economy: An Interdisciplinary Exploration of the Concept and Application in Global Context. *Journal of Business Ethics* 140: 369-380.
- Ongondo F.O., Williams I.D. and Carroll C. (2013). ICT reuse in socio-economic enterprises. *Waste Management* 33: 2600 – 2606.
- Planing P. (2015). Business Model Innovation in a Circular Economy Reasons for Non-Acceptance of Circular Business Models. *Open Journal of Business Model Innovation*, in press.
- Repo, P., Matschoss, K., Van Eynde, S. & Ramioul, M. (2015). An Evolving European Policy Application of Circular Economy. In Damianova, Z., Kozarev, V., Chonkova, B. & Dimova, A. (Eds.) *CASI in the wider policy context*. CASI project, Deliverable 7.3. Accessed 1.4 at www.casi2020.eu/app/web1/files/download/casi-d7-3-first-policy-report.pdf
- Repo, P., Matschoss, K., & Timonen, P. (2017). *Sustainable futures: comparing methodologies for identifying topics across citizen visions*. Paper presented at the 13th Nordic Environmental Social Science Conference Hopefulness 2017, Tampere, Finland, June 6th-8th.

- Riisgaard H., Mosgaard M. and Overgaard Zacho K. (2016). Local Circles in a Circular Economy – the Case of Smartphone Repair in Denmark. *European Journal of Sustainable Development* 5: 109 – 124.
- Tukker A. (2015). Product Services for a resource-efficient and circular economy – a review. *Journal of Cleaner Production* 97: 76-91.
- Warnke, P., Meroni, A., Rossi, M., Selloni, D. & Ospina Medina, A. M. (2017). *First draft of social needs based research scenarios*. Deliverable 2.1 of the Cimulact project. Available at www.cimulact.eu.
- van Weelden E., Mugge R. and Bakker C. (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.
- Wodak, R., & Meyer, M. (2009). Critical Discourse Analysis: History, Agenda, Theory, and Methodology. In R. Wodak & M. Meyer (Eds.) *Methods for critical discourse analysis*. London: Sage.
- World Economic Forum, WEF (2014). Towards the Circular Economy: Accelerating the scale-up across global supply chains. Prepared in collaboration with the Ellen MacArthur Foundation and McKinsey & Company. Available at www3.weforum.org/docs/WEF_ENV_TowardsCircularEconomy_Report_2014.pdf.
- Zhang T., Chu J., Wang X., Liu X. and Cui P. (2011). Development pattern and enhancing system of automotive components remanufacturing industry in China. *Resources, Conservation and Recycling* 55: 613 - 622.