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# Consumer perceptions of the circular economy and bio-based products

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**Key words:** bioeconomy, circular economy, consumer study, agro-waste and by-products

## Introduction

Since the United Nations Brundtland report (Brundtland et al. 1987), sustainability has been one of the key words in global political agendas and research. As potential pathway to develop sustainable economic systems, two major partly complementary concepts are currently being promoted by European policies: the bioeconomy and circular economy (EC 2012; EC 2015). Within the bioeconomy, fossil fuels are replaced by renewable biological resources, which are converted into value-added products such as food, feed, bio-based products and bioenergy, via technological innovation (Bugge et al. 2016). Others look at the bioeconomy as an engine of rural development, focusing on agriculture, fisheries, forestry and aquaculture (Priefer et al. 2017). The circular economy, however, aims to shift from the current linear ‘take-make-dispose’ model to closing loops by recycling and reusing products, components and materials and keeping their value as long as possible, and by reducing waste to a minimum, via new organisations of value chains and industrial systems (EMF 2013; Murray 2015). Hence, despite important similarities of the two approaches, the bioeconomy is mainly centred on bio-technological resource-based innovations and also on land use practices for rural development, while the circular economy focuses on novel industrial urban processes for the most efficient utilization and (re-)valorisation of resources, including waste management and recycling (D’Amato et al. 2017; EEA 2018).

Shifting from a fossil-based, linear to a sustainable, bio-based and circular economy requires a change at a system level, involving all actors of different chains and sectors (EMF 2013). Moreover, the commercialisation and adoption of new technologies, products and services is considered as challenging due to e.g. high switching costs, lack of quality standards, and insufficient market development towards final consumers (O’Reilly 2017). Until now, consumer research within the bio-and/or circular economy domain is sparse (Sijtsema et al. 2016; Camacho-Otero et al. 2018), although there is general agreement that consumers will play an important role in the transition process.

Therefore, our research aim is to investigate current consumers’ awareness, knowledge, perceptions and attitudes towards circular economy and bio-based products, and more specifically, products based on agro-waste and by-products. After describing the methodology, results are briefly presented and discussed.

## Methodology

Firstly, a qualitative survey was conducted to gather consumers’ responses to various bio-based products and their knowledge and beliefs on circular economy. 14 consumers participated in this survey. All interviews were transcribed in order to build a quantitative questionnaire. The qualitative survey helped to select appropriate bio-based products; it also highlighted that participants do not seem to know what circular economy is.

Secondly, the quantitative survey started by presenting pictures of four different bio-based products (chips made from vegetable peels, shampoo containing olive leaves extract, grape seed oil, and dried fruits with defects). For each product, remarks regarding the product were collected (via an open question); and people were asked about their attitude and purchase intention (via psychometric measures using Likert scales from 1 to 5; Spears and Singh, 2004; Dreezens et al, 2005). Then, the survey studied consumers’ awareness and knowledge on circular economy through a short yes/no question (“have you already heard about circular economy?”) followed by an open question (“what

do you think it is?”). After a presentation of the circular economy by means of a scheme, participants had to say which of the following seven concept(s) they associated with circular economy (closed question): sustainable procurement, eco-design, industrial and territorial ecology, functional economy, responsible consumption, extension of product lifetime, recycling and recovery of waste.<sup>1</sup> Finally, participants were asked to choose from four labels the one that represents the best circular economy for him/her. Apart from the usual sociodemographic data, participants were characterized through their environmental concern as measured by the New Environmental Paradigm Scale (Dunlap et al, 2000) and their place attachment (Williams and Vaske, 2003).

## Results

The survey was conducted online on a sample of 387 individuals, representative of the French population in terms of age, sex, and socio-professional category.

Participants have a rather negative attitude towards chips of vegetable peels (average 2,2), and consequently a low purchase intention (average 2,2). They are significantly lower<sup>2</sup> than attitude and purchase intention for olive leaves' shampoo (attitude: 3,4; purchase intention: 3,2), or than those for grape seed oil or dried fruits with defects (attitude is around 3,6 for the two products, and purchase intention is around 3,4). Answers to the open question (“which remarks do you have concerning this product?”) reveal that people often show disgust reactions to chips of vegetable peels: 'beurk!' (ugh!), 'that's for the bin', 'that's for chickens'... whereas they have more neutral or positive reactions to the other products. Disgust has been proven to be a strong determinant of behaviour (Rozin and Fallon, 1980), and particularly of food behaviour (Hartman and Siegrist, 2018). However, remarks show that consumer choices on bio-based products (versus traditional ones) depend on the expected benefits of the bio-based in comparison to the traditional product as highlighted by Camacho-Otero et al (2018).

Most of the participants (81,6%) never heard before about circular economy. However, some of the people who didn't know about it tried to answer to the question: "what do you think it is?". These people most often cited ideas in relation with economic organisation (51 total answers in relation to this topic), such as 'autarky', 'local', 'short supply chains' or 'barter economy'. The second idea was about environment and ecology (24 answers linked to this), with the most frequent answers related to 'recycling' and 'no waste'. People who already heard about circular economy perceived it more frequently as an environmental issue: 44 answers to the open question “what do you think it is?” evoked environment and ecology. The most frequent answer related to this topic was 'recycling, no waste'. Economic organisation was cited as a component of circular economy: 28 answers concerned this topic, with a majority of 'local' (13 answers).

In relation with these findings, the concept most frequently associated to circular economy is 'recycling and recovery of waste' (70% of the participants), then sustainable procurement (54%). The concepts less frequently associated with circular economy are 'industrial and territorial ecology' (22%) and 'functional economy' (24%). However, participants prefer labels that highlight the 'circular' economy rather than a label 'no waste'.

## Discussion and conclusion

This work has its limits, such as the hypothetical nature of some questions, the wording of other ones, the effect of the choice of the products or the visual representations used in the questionnaire. However, it shows that knowledge of circular economy by consumers is yet very poor. If the concept of recycling and no waste seems to be rather well known, the concept of functional economy (i.e. product sharing or rental) is less frequently identified in an open as well as closed question. This

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1 Seven pillars of the circular economy as presented by ADEME: <https://www.ademe.fr/expertises/economie-circulaire/leconomie-circulaire>

2 T tests have been done and show the statistical significance of these differences.

suggests that either consumers do not identify functional economy as a way to preserve natural resources, or most of the consumers do not really 'practice' functional economy.

Reactions of consumers to several bio-based or circular economy products indicate that various factors might influence consumers' choice, such as the degree of familiarity, disgust, or personally expected benefits. As highlighted by Camacho-Otero et al (2018), other benefits should be included into the analysis, for instance environmental or social benefits, knowledge, or risk and uncertainty (includes safety due to contamination, disgust, trust...). Our further analysis of individual answers regarding bio-based products in relation with knowledge of circular economy, environmental concern (NEP scale) and place attachment will help to highlight how personal differences influence attitude and purchase intention for these products.

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