Futures 164 (2024) 103490

Contents lists available at ScienceDirect

Futures

journal homepage: www.elsevier.com/locate/futures

Influence of social factors and environmental behaviour in the knowledge and opinion about circular economy

Víctor Sampedro-Beneyto, Asunción Agulló-Torres, Francisco J. Del_Campo-Gomis *, Irene Arias-Navarro

Agro-food and Agro-environmental Research and Innovation Center (CIAGRO). Department of Agro-environmental Economics. Higher Polytechnic School of Orihuela. Miguel Hernández University, Ctra. Beniel, Km 3,2, Orihuela, Alicante 03312, Spain

ARTICLE INFO

Keywords:
Knowledge
Opinion
Circular Economy
Spain
Social factors
Environmental behaviour

ABSTRACT

The United Nations and the European Union, as well as other public institutions, are engaged in significant efforts to advance the promotion of the Circular Economy. The dissemination of messages regarding such initiatives to the citizens is of great importance, as this is expected to serve as a catalyst for the transition from a linear to a Circular Economy. Therefore, the objective is to analyse the knowledge and opinion about the Circular Economy in the province of Alicante (Spain) on a convenience sample and stratified into groups by gender, age, studies and environmental behaviour. This analysis will determine whether the efforts to disseminate knowledge and improve opinion about the Circular Economy are succeeding. The results indicate that there is an accurate knowledge and good opinion about Circular Economy in the scenario analysed in Alicante province (Spain), but a lot of work should be done to improve it both through greater involvement of society and companies, and by publicizing the benefits of the Circular Economy to the society.

1. Introduction

The economy is inextricably linked to the environment. Humans extract useful elements from the environment to generate benefits, but simultaneously introduce various types of waste that originate in the environment (Common and Stagl, 2008). Since the advent of the industrial revolution, the prevailing economic model has been the linear economy, otherwise known as the 'cradle to grave' approach, which has resulted in a multitude of environmental issues. Consequently, there is an urgent need for a radical transformation of the global economy that prioritises the protection of ecosystems and the achievement of sustainable development, ensuring the continued existence of life on Earth in the long term (Acosta et al., 2020). This necessitates the adoption of a novel production model that integrates the economy, the environment and society in a unified framework (Bradley et al., 2018). This new model should be non-linear in order to serve as a viable alternative for the guarantee of economic, social and environmental sustainability of territories (Orjuela, 2019).

It can be reasonably deduced that the optimal method for achieving sustainable development is to implement the concept of the Circular Economy, otherwise known as the 'cradle to cradle' approach (Park et al., 2010). In the 1960s, the pioneering figure in environmental economics, Professor Kenneth E. Boulding, first defined the concept of the Circular Economy (George et al., 2015) as an

* Corresponding author.
E-mail address: francis.delcampo@umh.es (F.J. Del_Campo-Gomis).

https://doi.org/10.1016/j.futures.2024.103490
Received 28 November 2023; Received in revised form 14 October 2024; Accepted 17 October 2024
Available online 21 October 2024

economy that promotes a cyclical flow for the extraction, transformation, distribution, use and recovery of materials and energy from products and services available on the market (Stahel, 2016). Consequently, the Circular Economy model strives to achieve a state of equilibrium between economic growth and sustainable environmental and economic development (EMAF, 2015).

At the institutional level, the United Nations made a commitment to the Circular Economy with the implementation of the 2030 Agenda for Sustainable Development in 2015. This 15-year plan sets out 17 Sustainable Development Goals (SDGs) (UN, 2015), which are designed to achieve a sustainable future for all.

The European Union established the transition to a Circular Economy as a fundamental objective in 2015 launched its Circular Economy Action Plan under the slogan "Closing the circle." This plan was renewed in 2020 under the motto "For a cleaner and more competitive Europe" (EU, 2020). In both instances, the European Union has pledged its commitment to transitioning towards an economic development model based on the principles of the Circular Economy. This model emphasises a productive and consumption-focused approach that aims to maintain the value of products, materials and resources within the economy for an extended period, while minimising the generation of waste (EU, 2018). This EU commitment to the Circular Economy has been articulated since 2019 in the European Green Deal (EU, 2019), which represents the EU's new growth strategy. The primary objective is to make Europe the first climate-neutral continent by 2050. To achieve this, it is essential to establish a new economic policy based on the Circular Economy and energy transition.

The implementation of the aforementioned United Nations and European Union commitments in Spain resulted in the approval of the Spanish Circular Economy Strategy, "España Circular 2030", in 2020. This represents the essential strategic and action framework to facilitate and promote the transition towards a Circular Economy, thereby facilitating the achievement of a sustainable, decarbonised, resource-efficient and competitive economy (MITECO, 2020). The strategy establishes the foundations for a new model of production and consumption, wherein the value of products, materials, and resources is retained in the economy for an extended period, the generation of waste is minimised, and those that are unavoidable are utilised to the greatest extent feasible. The strategy is designed with a long-term vision, which will be achieved through the implementation of successive three-year action plans. These plans will facilitate the incorporation of necessary adjustments to complete the transition by 2030. Consequently, in 2021, the First Action Plan for the Spanish Circular Economy was initiated.

As has been illustrated, the transition to a Circular Economy presents a formidable challenge for humanity, necessitating a profound shift in societal values towards enhanced commitment to sustainable development. Consequently, a considerable number of initiatives have been pursued at all levels of governance with the objective of advancing towards this goal. This has entailed substantial planning and financial resources being allocated to this end. However, it is not yet clear to what extent these initiatives by international organisations and public institutions are reaching the general public, or what vision they have produced in this regard. As indicated by Van Langen et al. (2021), further investigation is required into the ways in which the concept of the Circular Economy and its associated transition process are perceived within society. Therefore, this article aims to address the identified gap in the literature by examining the knowledge and opinion of a specific population towards the Circular Economy. Furthermore, it will analyse both items by comparing various strata based on socioeconomic variables (gender, age, and education) and environmental behaviour. The results will indicate where public institutions should concentrate their efforts to enhance people's knowledge and opinion of the Circular Economy, thereby facilitating a more harmonious relationship between humanity and the natural environment that will endure into the future. The future that will provide Circular Economy will not be solely a different model of production and consumption; it will also be a different society, with a multitude of advantages. These advantages will be environmental, through the protection of the environment and the reduction of raw material dependence, and socio-economic, through the creation of jobs and the saving of consumers' money. However, in order to achieve this, the Circular Economy is implementing changes to the political behaviours of many countries around the world. To illustrate, the European Union's principal political objective is to become the first climate-neutral continent by 2050. This will be achieved through the implementation of the European Green Deal, which will transform the EU into a modern, resource-efficient and competitive economy. It is imperative that a transition towards a fully clean and Circular Economy be undertaken in order to achieve this goal.

The following is a description of the structure of the paper. Section 2 presents a review of the relevant literature. Section 3 delineates the methodology employed. Section 4 provides a detailed illustration of the research findings. Section 5 includes a discussion of the findings. Section 6 outlines the conclusions of the study. Finally, the paper includes a description of the limitations of the study, an outline of potential avenues for future research, details of data availability, a statement of the contributions made by the authors, a declaration of interest, acknowledgements and a list of references.

2. Literature review

A comprehensive literature review was conducted using the Web of Science database, employing the search term "Circular Economy" in conjunction with "Knowledge" and "Opinion."

In terms of the general public's knowledge of the Circular Economy, the findings of the three articles reviewed indicate a lack of insight into this subject among the populations under study. Firstly, Liu et al. (2009) observed that residents in China demonstrated a lack of comprehension regarding the principles of a Circular Economy. Secondly, Korsunova et al. (2021) stated that there is a lack of knowledge regarding how citizens envisage their role within the Circular Economy. Thirdly, Almulhim and Abubakar (2021) reported that respondents in Saudi Arabia demonstrated limited comprehension of the concept of the Circular Economy.

In four additional articles, the authors examined the perceptions of the studied populations regarding the Circular Economy, emphasizing the themes of recycling and sustainability. Firstly, in their study of the Polish population, Smol et al. (2018) found that the concept of the Circular Economy was primarily associated with the conservation of raw materials and the prevention of waste.

Secondly, Korsunova et al. (2021) found that young adults in Finland strongly associate the concept of the Circular Economy with recycling, waste sorting and re-selling/buying second-hand items. Thirdly, Rogers et al. (2021) in England identified that the majority of respondents (82 %) associated repair activities with the Circular Economy. This may indicate a level of association between repair and environmental impact or eco-friendly behaviour. Fourthly, although the focus of the study was the agricultural sector, Rótolo et al. (2022) in Argentina identified a common perception of the concept of the Circular Economy as a more sustainable production and consumption model.

A review of the literature revealed that only two studies had explored knowledge of the Circular Economy among different age groups, genders, or based on environmental behaviour. With regard to age, Smol et al. (2018) observed in Poland that younger generations demonstrated greater familiarity with the concept of the Circular Economy. As for educational level, Liu et al. (2009) in China discovered that individuals with greater awareness and comprehension of the Circular Economy exhibited a positive correlation with their educational attainment.

In examining public opinion regarding the Circular Economy, our research yielded two studies that indicated a favourable view among the populations under investigation. Firstly, Atlason et al. (2017) conducted a study in Denmark to ascertain the preferences of consumers regarding end-of-life product scenarios. These scenarios were presented as a strategy for transitioning towards a more Circular Economy. The results indicated that the majority of scenarios were perceived as favourable by consumers, who expressed satisfaction with a product that could be disposed of in accordance with a beneficial Circular Economy scenario. Secondly, Ali et al. (2022) conducted a study in Malaysia, which revealed that the perceived benefits were the most important factor influencing the adoption of the Circular Economy among bank managers.

Moreover, with respect to the analytical stratifications concerning public opinion on the Circular Economy, we have observed a significant increase in the quantity of studies that can be subjected to review. Three investigations were identified which analyse the differences of opinion on the Circular Economy stratified by gender. The findings of all three studies indicate that women tend to hold a more favourable view of adapting to the Circular Economy. Firstly, Atlason et al. (2017) analysed segments in terms of demographic (e.g. age, gender, education level) and relevant psychographic variables (e.g. environmental awareness). The analysis revealed that gender was the only significant factor influencing opinion, with women expressing greater preference for all end-of-life scenarios and a greater willingness to pay a premium price for environmentally friendly products than men. Secondly, Rogers et al. (2021) identified discrepancies between the genders in opinions about the Circular Economy, specifically in relation to repair. Repair is an essential aspect of the Circular Economy as it extends the life of products and materials. The study found that women were more inclined to trust professional repair services than men did. Thirdly, Ali et al. (2022) discovered that in Malaysia, female bank managers played a pivotal role in the adoption of the Circular Economy.

The outcomes of two studies demonstrated that opinions towards the Circular Economy exhibited age-related variations, with younger generations displaying more favourable attitudes towards the subject matter. Firstly, Smol et al. (2018) conducted a study in Poland which revealed that younger generations held more favourable attitudes towards the Circular Economy. This was attributed to their greater emphasis on waste differentiation and the purchase of recycled and remanufactured goods. Secondly, Ali et al. (2022) observed that Generation X (aged 19–40) played a pivotal role in the uptake of the Circular Economy due to their more favourable attitudes towards it.

A growing interest was observed among researchers in analysing the relationship between public opinion on the Circular Economy and the level of education attained by the population. The results of four separate studies yielded a similar conclusion: there is a positive correlation between public opinion on the Circular Economy and the level of education. Firstly, Guo et al. (2017) in China found that the knowledge of the Circular Economy in the study area was limited, with approximately 41 % of respondents indicating that they had heard of the concept. This was attributed to the lower educational level of the respondents. Furthermore, both Smol et al. (2018) in Poland and Almulhim and Abubakar (2021) in Saudi Arabia identified a positive correlation between public opinion regarding the Circular Economy concept and level of education. Ultimately, Ioannidis et al. (2023) in Greece discovered that as the level of education rises, so does the willingness to pay a higher price for renewable energy sources, which are regarded by them as a cornerstone for the transition to a Circular Economy, and their opinion of the public also increases in parallel.

A single study, conducted by Hao et al. (2020) in China, examined the relationship between environmental behaviour, specifically reuse, and attitudes towards the Circular Economy. The findings indicated that individuals demonstrated a greater inclination to engage with the Circular Economy when they were willing to pay a premium for environmental benefits.

Finally, most of the researchers made recommendations to governments in order to improve the knowledge and opinion of the population on Circular Economy and, consequently, to enable a better and faster implementation of it. Lakatos et al. (2016) in Romania suggested the adoption of measures aimed at increasing the respondents' awareness of the Circular Economy. Smol et al. (2018) in Poland recommended increasing some of the main measures adopted by the Polish government to raise awareness on Circular Economy, such as the distribution of educational materials to lecturers and students, as well as to other target groups such as children, youth, municipalities, entrepreneurs and officials.Lewandowska et al., 2019 in Poland found that, although society has a correct understanding of sustainable development and Circular Economy, there is still a need to support further education due to the need for wider and more intensive implementation of sustainable development in practice. Hao et al. (2020) in China advised that policy makers should disseminate a positive view of the potential benefits of the Circular Economy for the environment, society and economic development in society through communication channels and economic instruments as incentives to purchase green products. Virsta et al. (2020), in Romania, found that a Circular Economy guide provided by the educational authorities for residents and students was very useful and provided appropriate information for people to understand the urgent need to transition from a linear economy to a Circular Economy. Korsunova et al. (2021) said that it was generally accepted that governments, municipalities, businesses and citizens all have a role to play in the transition to a Circular Economy. Grodzińska-Jurczak et al. (2022) in Poland showed that

trustworthy knowledge in action is the main driver for achieving sustainability. Rótolo et al. (2022) in Argentina identified the need to invest in education and research, identifying citizens/society as the main agent of change. Finally, Ioannidis et al. (2023) found that although Greek citizens are aware of the concept and the benefits of the Circular Economy, but additional efforts are needed for its growth in Greece.

It can be observed that the level of commitment demonstrated by the country's authorities towards the Circular Economy has a significant impact on the knowledge and opinions held by a proportion of the population in this regard. Consequently, the recommendations put forth by the majority of researchers were in alignment with the proposition that governmental investment in the promotion of the benefits of the Circular Economy for society is a prudent course of action.

3. Methods

3.1. Research objective and application

The main objective of this study is to assess both the knowledge and opinion about the Circular Economy in general, as well as stratified by groups based on gender, age, level of studies and environmental behaviour to find out if there are statistically significant differences among them. The proposed approach is exemplified by a case study conducted in the province of Alicante in Spain, as illustrated in Fig. 1.

The province of Alicante is an administrative division of Spain, located in the south-east of the country, with a population of almost 2 million inhabitants (the fourth most populous province in the country). It has an area of 5816 km^2, giving a population density of 327 inhabitants/km^2. Its economy is based on tourism, mainly "sun and beach", as it has 254 km of Mediterranean coastline and receives around 12 million visitors a year, more than half of them from northern Europe.

3.2. Sampling and methodology

A review of the literature revealed no previous study that has analysed all the socio-demographic factors that may influence knowledge and opinion about the Circular Economy. However, some studies have conducted partial analyses in this area. It is therefore proposed that both knowledge and opinion about the Circular Economy be subjected to analysis through the application of six research questions. Moreover, an investigation of potential differences will be conducted across six population strata: gender, age, educational level and environmental behaviour during the purchase, recycling and reuse processes.

In relation to the knowledge about the Circular Economy, we establish the following six research questions:

- K1) Does the knowledge about the Circular Economy differ between people' gender?
- K2) Does the knowledge about the Circular Economy differ among people' age?
- K3) Does the knowledge about the Circular Economy differ among people' level of studies?
- K4) Does the knowledge about the Circular Economy differ according to their environmental behaviour during the purchase?
- K5) Does the knowledge about the Circular Economy differ according to their environmental behaviour during the recycling?
- K6) Does the knowledge about Circular Economy differ according to their degree of environmental behaviour in reuse?

In relation to the opinion about Circular Economy, we establish six research questions similar to those of the previous case:

- O1) Does the opinion about the Circular Economy differ between people' gender?
- O2) Does the opinion about the Circular Economy differ among people' age?
- O3) Does the opinion about the Circular Economy differ among people' level of studies?

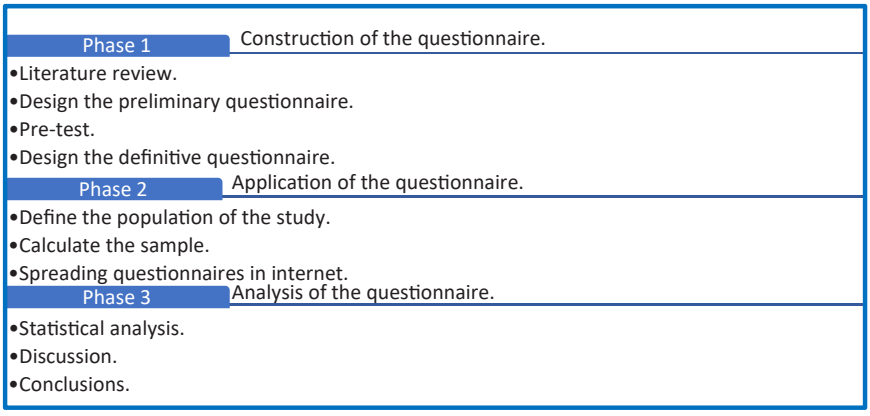

Fig. 1. Research model.

- O4) Does the opinion about the Circular Economy differ according to their environmental behaviour during the purchase?
- O5) Does the opinion about the Circular Economy differ according to their environmental behaviour during the recycling?
- O6) Does the opinion about Circular Economy differ according to their degree of environmental behaviour in reuse?

We have defined the following strata within each aspect under analysis:

- 1) Gender into two groups: Female or Male.
- 2) Age into four groups: Young (18−35), Middle (36−49); Adult (50−65) and Senior (+65).
- 3) Level of studies into three groups: Basic (Primary and Secondary), Medium (High school and Professional) or Superior (University).
- 4) Environmental behaviour during the purchase into two groups: Good (they buy the most sustainable) and Poor (they don't buy the most sustainable).
- 5) Environmental behaviour during the recycling into two groups: Good (they separate waste) and Poor (they don't separate waste).
- 6) Environmental behaviour in reuse, measured as the degree of commitment in willingness to pay more for a product made with recycled materials, in three groups in a Likert scale 1–5: Low (1,2), Medium (3) and High (4,5).

To achieve the objective, we created an anonymous questionnaire with two types of questions: with a 5-point Likert scale response and with a choice between several options. The survey was divided into three sections, each of which is described in detail in the tables indicated: the first collects the respondents' personal data (Table 1), the second aims to assess environmental behaviour (Table 2) and the third focuses on knowledge (Table 3) and opinion (Table 10) about the Circular Economy.

A convenience sample was employed, given the assumption that this non-probabilistic technique is susceptible to selection bias. Nevertheless, this is a technique that is widely used in social research, and the results obtained are similar to those obtained from probability-sampled data (Winton and Sabol, 2022). The sample comprised a total of 330 respondents of people with 18 years or more from the province of Alicante, which met the sample size proposed by Hair et al. (2010) for studies of this nature, namely 200 interviewers. A comparison with a probability sample size (calculated using the formula of Cochran 1977: $n = (N \times Z2 \times p \times q) / ((N-1) \times c2 + Z2 \times p \times q)$) for the 1556,401, inhabitants over 18 years old of the province of Alicante in 2021, reveals that a total of 330 interviews would result in a margin of error of 5.4 % with a confidence level of 95 % (p=q=0.5).

A Google Forms questionnaire was distributed via email and social networks to individuals related with the article's authors and their academic institution. This approach aligns with the methodology outlined by Perelló (2009) for conducting self-administered surveys. The anonymity of respondents was ensured at all times, and the form was accessible between 5 and 12 May 2022.

The Cronbach's alpha coefficient was calculated at 0.830 in order to assess the reliability of the survey, based solely on responses pertaining to knowledge and opinion sections. This value is deemed to be within the acceptable range as defined by Nunnally and Bernstein (1994), who recommend reliabilities of between 0.70 and 0.95.

The surveys were analysed using the free software program R 4.2.0. (R Core Team, 2022). To ascertain whether there were statistically significant differences in the variables under consideration with respect to gender, age, level of studies and environmental behaviour, a variety of statistical techniques were employed.

In the case of qualitative variables, the χ^2 test was employed, or, in instances where the value of a group was less than 5 %, the Fisher Exact Test (FET) was utilised. With regard to questions formulated on a 5-point Likert scale, the U-Mann-Whitney test (for two groups) or the Kruskal-Wallis test (for three or more groups) was employed.

In order to ascertain whether there are statistically significant differences, a p-value of less than 0.05 was employed when comparing two groups. However, when evaluating the differences among three or more groups, the Bonferroni correction was utilised, which implies a p-value of less than 0.016 for three groups and a p-value of less than 0.0083 for four groups.

4. Results

The socio-demographic characteristics of the sample and the real values of the province of Alicante are shown in Table 1. There are some differences between both due to the way in which the survey was distributed. Firstly, a gender imbalance in favour of women in

Table 1
Socio-demographic values of respondents and population of the province of Alicante.

		Respondents	Province of Alicante
1. Gender	Male	*65.5 %*	*49.5 %*
	Female	*34.5 %*	*50.5 %*
2. Age	Young: 18–35	*47.2 %*	*22.6 %*
	Middle: 36–49	*26.7 %*	*25.6 %*
	Adult: 50–65	*20.5 %*	*27.7 %*
	Senior: +65	*5.6 %*	*24.0 %*
3. Level of studies	Basic (Primary and Secondary)	*12.1 %*	*15.1 %*
	Medium (High school and Professional)	*30.9 %*	*66.0 %*
	Superior (University)	*57.0 %*	*18.9 %*

Table 2
Respondents groups stratified by environmental behaviour.

Environmental behaviour during the purchase					
1. When buying a product, do you look at the material and the labelling of the packaging with which it is made and buy the most sustainable one?					
Yes	25.2 %	No	74.8 %		
Environmental behaviour in recycling					
2. Do you think the separation of waste is important?					
Yes	91.5 %	No	8.5 %		
Environmental behaviour in reuse					
3. With what degree of commitment would you be willing to pay a higher amount for a product that has been made with recycled materials? (Likert scale 1–5)					
Low (Likert 1 and 2)	15.1 %	Medium (Likert 3)	37.3 %	High (Likert 4 and 5)	47.6 %

Table 3
Knowledge about Circular Economy of all respondents.

Qualitative variables (select one option)	%
1. Which of the definitions of the Circular Economy best suits your thinking?	
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	5.8 %
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*54.5 %*
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	21.2 %
- It is one in which the available resources, both material and energy, are maximized so that they remain as long as possible in the production cycle.	18.5 %
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?	
- Renew, resume, retire and repair.	7.3 %
- *Renew, recover, repair and redesign.*	*57.3 %*
- Reorder, redesign, recirculate and redistribute.	29.4 %
- Reorganize, collect, renew and distribute.	6.1 %
3. Indicate for yourself in which process the cycle of the Circular Economy begins.	
- Eco-design.	45.8 %
- Production.	18.5 %
- Consumption.	10.3 %
- Recycling.	25.5 %

Note: Correct answers are in italics and shading.

the sample (65.5 % of respondents compared to 50.5 % of the province of Alicante). Secondly, an age distribution in the sample that favours those who use social networks (47.2 % of young people in respondents compared to 22.6 % of young people on the population of the province of Alicante). Thirdly, a different distribution of the level of education of the respondents in the sample (57.0 % with high studies) compared to the population of the province of Alicante (66.0 % with medium studies). All this leads us to conclude that this is an exploratory study and, in consequence, the obtained results are an approximation to reality, since it was not possible to obtain a sample that would accurately reflect the real distribution of the strata in the province of Alicante.

It is also noteworthy that the three questions in Table 2, which assess three environmental behaviours (in purchase, recycling and reuse), enabled the formation of different strata according to each of them. This methodology is similar to that employed by Hao et al. (2020) in China. Following this, a comparison analysis of knowledge and opinion regarding the Circular Economy among the different strata was conducted for each environmental behaviour.

The initial stratification categorises the respondents into two distinct groups based on their environmental conduct at the time of purchase (Table 2, question 1). The initial cohort, comprising 25.2 % of respondents, encompasses those who, when purchasing a product, assess the material and labelling of the packaging and select the most sustainable option. The second group, comprising the majority of respondents (74.8 %), includes those who do not buy the most sustainable product. This is either because they do not consider the material or labelling, or if they do, they do not select the most sustainable option.

The second stratification by environmental behaviour also divides the respondents into two groups, but according to their recycling practices (Table 2, question 2). The majority of respondents (91.5 %) identified waste separation as a priority. The second group, comprising only 8.5 % of respondents, exhibits a complete lack of concern regarding waste separation.

The third stratification of the respondents by environmental behaviour is based on awareness of reuse. Three groups were identified based on the degree of commitment to which they would be willing to pay a higher amount for a product made with recycled materials (answering on a Likert scale from 1–5, from very low to very high) (Table 2, question 3). The first stratum, comprising 15.1 % of respondents, indicates a low level of commitment by selecting either option 1 or 2 on the Likert scale. The second group, comprising 37.3 % of respondents, demonstrates a medium level of commitment to reuse, as indicated by a rating of 3 on the Likert scale. The third group, comprising the majority of respondents (47.6 %), exhibits a high level of commitment to reuse, as indicated by selecting either the 4 or 5 values on the Likert scale.

4.1. Knowledge about circular economy

In order to evaluate the knowledge of the principles of the Circular Economy of the respondents, we presented three questions with

four potential answers (see Tables 3 to 9). Participants were instructed to select the most appropriate option. In the tables of results, we have highlighted the correct answers in italics and shading to facilitate their identification.

In the initial question, four definitions of the Circular Economy were presented, and participants were asked to evaluate their knowledge in the event that they selected the definition put forth by the European Union (EU, 2020) that is "Circular Economy consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum". The second question was designed to assess the respondents' knowledge of the Circular Economy by proposing one of the four alternatives representing the 4Rs (renew, recover, repair and redesign), which, together with the original 3Rs (reduce, reuse and recycle) of ecological thinking, form the 7Rs of the Circular Economy (Reike et al., 2018). The third question was designed to measure knowledge of the Circular Economy cycle and participants were presented with four options and asked to identify the process considered the first in the cycle, which is "eco-design" (EU, 2020).

The results of the survey, indicating the respondents' knowledge of the Circular Economy, are shown in Table 3. In answer to question 1, which presented a definition of the Circular Economy, over half of the respondents (54.5 %) selected the definition proposed by the European Union. In question two on the 7Rs, 57.3 % of respondents identified the correct answer by adding the new 4Rs. Furthermore, 45.8 % of respondents correctly answered that eco-design represents the initial phase of the Circular Economy.

The results on knowledge of the Circular Economy, stratified into two groups by gender in Table 4, demonstrate statistically significant differences only in question 3, where women (53.5 %) exhibit in identifying eco-design as the process that initiates the Circular Economy a greater degree of accuracy than men (41.7 %). No statistically significant differences are observed in the other two questions. First, in question 1, which pertains to the identification of the definition of the Circular Economy as set forth by the European Union (57 % of women and 53.2 % of men correctly identified the definition). Second, in question 2, which refers to the identification of the correct answer to the four Rs of the Circular Economy (57 % of women and 57.4 % of men successfully identified the correct answer).

Regarding knowledge of the Circular Economy by age in Table 5, the only statistically significant difference is in question 1, where the young group has a higher success rate (62.8 %) in identifying the definition of the Circular Economy than the other three age groups (47.4 % middle, 47.1 % adult and 44.4 % senior). There are no statistically significant differences in the remaining two questions, indicating a high degree of similarity in the observed results. For instance, in question 2, which pertains to identifying the appropriate Rs that complete the 7Rs of the Circular Economy, the majority of the four groups provided the correct response (66.7 % senior, 66.0 % young, 50.0 % middle, and 44.1 % adult). Similarly, in question 3, which determines the initial process of the Circular Economy, the four groups also selected the correct answer in the same order of age but with varying degrees of intensity (83.3 % senior, 46.2 % young, 43.2 % middle and 38.2 % adult).

In terms of knowledge of the Circular Economy, stratified by respondents' studies in Table 6, statistically significant differences emerge in questions 2 and 3. In question 2, only 35 % of respondents of the basic studies group provided the correct answer to the additional 4Rs, which completes the 7Rs of the Circular Economy. In contrast, over half of the respondents in the other two studies groups (64.4 % high and 52.9 % medium) identified the correct answer. In question 3, the high studies group demonstrated the highest level of comprehension, with the 53.7 % correctly identifying eco-design as the inaugural process of the Circular Economy. In opposition, the other two studies groups exhibited a significantly lower level of understanding, with 25.0 % of basic and 39.2 % of medium respondents providing a correct answer. In response to question 1, the three studies groups indicated the EU definition of the

Table 4
Knowledge about Circular Economy stratified by gender.

Gender	Female	Male			
Qualitative variables (select one option)	%	%	χ2 FET	df	p-value
1. Which of the definitions of the Circular Economy best suits your thinking?			0.441	3	0.932
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	5.3 %	6.0 %			
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*57.0 %*	*53.2 %*			
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	20.2 %	21.8 %			
- It is one in which the available resources, both material and energy, are maximized so that they remain as long as possible in the production cycle.	17.5 %	19.0 %			
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?			2.123		0.554
- Renew, resume, retire and repair.	9.6 %	6.0 %			
- *Renew, recover, repair and redesign.*	*57.0 %*	*57.4 %*			
- Reorder, redesign, recirculate and redistribute.	28.9 %	29.6 %			
- Reorganize, collect, renew and distribute.	4.4 %	6.9 %			
3. Indicate for yourself in which process the cycle of the Circular Economy begins.			4.677	3	0.019*
- *Eco-design.*	*53.5 %*	*41.7 %*			
- Production.	17.5 %	19.0 %			
- Consumption.	7.9 %	11.6 %			
- Recycling.	21.1 %	27.8 %			

Note: Correct answers are in italics and shading.
*p value $<$ 0.05: statistically significant differences

Table 5
Knowledge about Circular Economy stratified by age.

Age	Young 18–35	Middle 36–49	Adult 50–65	Senior +65			
Qualitative variables (select one option)	%	%	%	%	χ2 FET	df	p-value
1. Which of the definitions of the Circular Economy best suits your thinking?					29.330	12	0.004*
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	1.9 %	0.8 %	10.3 %	16.7 %			
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*62.8 %*	*47.7 %*	*47.1 %*	*44.4 %*			
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	21.8 %	23.9 %	17.7 %	27.8 %			
- It is one in which the available resources, both material and energy, are maximized, so that they remain as long as possible in the productive cycle.	13.5 %	21.6 %	27.9 %	11.1 %			
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?					19.802		0.012
- Renew, resume, retire and repair.	5.1 %	8.0 %	11.8 %	5.6 %			
- *Renew, recover, repair and redesign.*	*66.0 %*	*50.0 %*	*44.1 %*	*66.7 %*			
- Reorder, redesign, recirculate and redistribute.	21.8 %	39.8 %	33.8 %	27.8 %			
- Reorganize, collect, renew and distribute.	7.1 %	2.2 %	10.3 %	0.0 %			
3. Indicate for yourself in which process the cycle of the Circular Economy begins.					19.946		0.014
- *Eco-design.*	*46.2 %*	*43.2 %*	*38.2 %*	*83.3 %*			
- Production.	21.2 %	12.5 %	22.1 %	11.1 %			
- Consumption.	7.1 %	13.6 %	14.7 %	5.6 %			
- Recycling.	25.6 %	30.7 %	25.0 %	0.0 %			

*p value (with Bonferroni correction for 4 groups) < 0.0083: statistically significant differences Note: Correct answers are in italics and shading.

Table 6
Knowledge about Circular Economy stratified by studies.

Studies	Basic	Medium	Superior			
Qualitative variables (select one option)	%	%	%	χ2 FET	df	p-value
1. Which of the definitions of the Circular Economy best suits your thinking?				2.172	3	0.537
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	7.5 %	7.9 %	6.9 %			
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*47.5 %*	*50.8 %*	*52.7 %*			
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	22.5 %	21.6 %	21.8 %			
- It is one in which the available resources, both material and energy, are maximized so that they remain as long as possible in the production cycle.	22.5 %	19.7 %	18.6 %			
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?				20.441		0.002*
- Renew, resume, retire and repair.	12.5 %	11.8 %	3.7 %			
- *Renew, recover, repair and redesign.*	*35.0 %*	*52.9 %*	*64.4 %*			
- Reorder, redesign, recirculate and redistribute.	40.0 %	27.5 %	28.2 %			
- Reorganize, collect, renew and distribute.	12.5 %	7.8 %	3.7 %			
3. Indicate for yourself in which process the cycle of the Circular Economy begins.				19.303	6	0.004*
- *Eco-design.*	*25.0 %*	*39.2 %*	*53.7 %*			
- Production.	15.0 %	22.5 %	17.0 %			
- Consumption.	17.5 %	13.7 %	6.9 %			
- Recycling.	42.5 %	24.5 %	22.3 %			

*p value (with Bonferroni correction for 3 groups) < 0.016: statistically significant differences Note: Correct answers are in italics and shading.

Circular Economy as their initial response, with no statistically significant differences observed (52.7 % high, 50.8 % medium and 47.5 % basic).

The stratification of the data into two groups in Table 7 for the three questions of knowledge about the Circular Economy pertaining to environmental behaviour at the time of purchase reveal no statistically significant differences. In question 1, in both environmental behaviour groups the majority of respondents answered the EU definition of the Circular Economy correctly (55.5 % poor and 51.3 % good). In question 2, both environmental behaviour groups demonstrated an enhanced ability to identify the additional 4Rs of the Circular Economy, with a notable consistency in their responses. However, there was an alternation in the order of the groups, because the 62.8 % in the good and 55.6 % in the poor gave the correct answer. Finally, in question 3, both environmental behaviour groups

Table 7
Knowledge about Circular Economy stratified by environmental behaviour during the purchase.

Behaviour group	Good	Poor			
Yes, buy the most sustainable or Not buy the most sustainable.	Yes	Not			
Qualitative variables (select one option)	%	%	χ2 FET	df	p-value
1. Which of the definitions of the Circular Economy best suits your thinking?			0.768	3	0.857
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	6.4 %	5.6 %			
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*51.3 %*	*55.5 %*			
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	24.4 %	20.2 %			
- It is one in which the available resources, both material and energy, are maximized so that they remain as long as possible in the production cycle.	17.9 %	18.7 %			
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?			1.440		0.709
- Renew, resume, retire and repair.	6.5 %	7.5 %			
- *Renew, recover, repair and redesign.*	*62.8 %*	*55.6 %*			
- Reorder, redesign, recirculate and redistribute.	26.9 %	30.2 %			
- Reorganize, collect, renew and distribute.	3.8 %	6.7 %			
3. Indicate for yourself in which process the cycle of the Circular Economy begins.			3.321	3	0.345
- *Eco-design.*	*46.1 %*	*45.6 %*			
- Production.	15.4 %	19.4 %			
- Consumption.	15.4 %	8.8 %			
- Recycling.	23.1 %	26.2 %			

*p value < 0.05: statistically significant differences Note: Correct answers are in italics and shading.

Table 8
Knowledge about Circular Economy stratified by environmental behaviour during recycling.

Behaviour group	Good	Poor			
Yes, it separates waste or Not separate waste	Yes	Not			
Qualitative variables (select one option)	%	%	χ2 FET	df	p-value
1. Which of the definitions of the Circular Economy best suits your thinking?			1.583		0.681
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	6.2 %	0 %			
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*54.5 %*	*56.0 %*			
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	21.3 %	20.0 %			
- It is one in which the available resources, both material and energy, are maximized so that they remain as long as possible in the production cycle.	18.0 %	24.0 %			
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?			0.329		0.963
- Renew, resume, retire and repair.	7.2 %	8.0 %			
- *Renew, recover, repair and redesign.*	*57.4 %*	*56.0 %*			
- Reorder, redesign, recirculate and redistribute.	29.2 %	32.0 %			
- Reorganize, collect, renew and distribute.	6.2 %	4.0 %			
3. Indicate for yourself in which process the cycle of the Circular Economy begins.			1.207	3	0.751
- *Eco-design.*	*46.3 %*	*40.0 %*			
- Production.	18.7 %	16.0 %			
- Consumption.	9.8 %	16.0 %			
- Recycling.	25.2 %	28.0 %			

*p value < 0.05: statistically significant differences Note: Correct answers are in italics and shading.

identified eco-design as the initial process of the Circular Economy. However, neither of them had a majority of correct answers, with almost identical values (46.1 % good and 45.6 % poor).

As with the preceding question, no statistically significant differences are identified when the data were stratified into two groups for any of the three questions of knowledge about the Circular Economy based on environmental behaviour at the recycling stage (Table 8). In question 1, both environmental behaviour groups answered correctly to the EU definition of the Circular Economy in a majority and in a similar manner (56.0 % poor and 54.5 % good). In question 2, both environmental behaviour groups demonstrated an enhanced ability to identify the additional 4Rs of the Circular Economy, with a notable consistency in their responses. However, there was an alternation in the order of them, with 57.4 % in good and 56.0 % in poor. Finally, in question 3, both environmental behaviour groups identified eco-design as the first process of the Circular Economy, but neither of them correctly answered more than half of the questions (46.3 % good and 40.0 % poor).

In the final stratification of knowledge about the Circular Economy based in environmental behaviour in reuse and showed in Table 9, statistically significant differences emerge among the three groups in questions 1 and 3. In both cases, the order of behaviour is

Table 9
Knowledge about Circular Economy stratified by environmental behaviour in reuse.

Behaviour group	Low	Medium	High		
Degree of commitment in willingness to pay more for a product made with reused materials (Liker scale)	1 or 2	3	4 or 5		
Qualitative variables (select one option)	%	%	%	FET	p-value
1. Which of the definitions of the Circular Economy best suits your thinking?				16.040	0.012*
- It is an alternative to the linear model of extracting, producing, consuming and throwing away.	10.0 %	1.7 %	7.3 %		
- *It consists of achieving an economic and productive model in which the value of products, materials and resources is maintained in the economy for as long as possible, and in which the generation of waste is reduced to a minimum.*	*46.0 %*	*50.0 %*	*60.4 %*		
- It is a model of production and consumption that implies sharing, renting, reusing, repairing, renewing and recycling existing materials and products as many times as possible to create added value.	16.0 %	27.6 %	18.3 %		
- It is one in which the available resources, both material and energy, are maximized so that they remain as long as possible in the production cycle.	28.0 %	20.7 %	14.0 %		
2. The 3 Rs (reduce, reuse and recycle) are the basis of ecological thinking, but the Circular Economy expands them to 7Rs. What do you think are the other 4Rs?				9.626	0.132
- Renew, resume, retire and repair.	14.0 %	7.9 %	3.4 %		
- *Renew, recover, repair and redesign.*	*44.0 %*	*57.3 %*	*62.9 %*		
- Reorder, redesign, recirculate and redistribute.	38.0 %	28.7 %	26.8 %		
- Reorganize, collect, renew and distribute.	4.0 %	6.1 %	6.9 %		
3. Indicate for yourself in which process the cycle of the Circular Economy begins.				20.321	0.002*
- *Eco-design.*	*30.0 %*	*44.0 %*	*51.8 %*		
- Production.	38.0 %	17.2 %	13.4 %		
- Consumption.	2.0 %	12.1 %	11.6 %		
- Recycling.	30.0 %	26.7 %	23.2 %		

*p value (with Bonferroni correction for 3 groups) < 0.016: statistically significant differences Note: Correct answers are in italics and shading.

identical. In response to question 1, which presents the definition of the Circular Economy as outlined by the European Union, respondents from each environmental behaviour group demonstrated a high level of comprehension providing the correct answer (60.4 % high, 50 % medium and 46 % low). With regard to question 3, which concerns the correct selection of eco-design as the initial stage of the Circular Economy, the environmental behaviour groups are again ordered in a similar manner (high 51.8 %, medium 44 % and low 30 %). Finally, in question 2, while the majority of the groups concur with the 4Rs that supplement the 7Rs of the Circular Economy, no statistically significant differences were observed. However, the order of responses of the environmental behaviour groups remained consistent with the previous analysis (high 62.9 %, medium 57.3 % and low 44.0 %).

4.2. Opinion about circular economy

In order to ascertain the prevailing opinions on the subject of the Circular Economy, we proposed three questions (Tables 10 to 16). In two of the questions (1 and 3), respondents were invited to rate five items on a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). In the remaining question 2, they were presented with four alternatives and asked to select the one that

Table 10
Opinion about Circular Economy of all respondents.

Quantitative variables (Likert scale 1–5)	Mean
Qualitative variables (select one option)	%
1. 1. Evaluate the influence of the following items for a transition to the Circular Economy.	
- Financial support.	3.99
- Transportation of materials.	3.77
- Social support.	4.35
- The extension of the useful life of the products.	4.31
- The willingness of the companies to its implementation.	4.37
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?	
- Due to the increase in demand for raw materials and the scarcity of resources.	23.0 %
- To avoid a greater amount of garbage in the seas.	17.0 %
- To reduce climate change as much as possible.	58.5 %
- To start new business models.	1.5 %
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.	
- Reduce the consumption.	4.06
- Reuse everything that can have a second life.	4.45
- Repair electronic devices.	4.08
- Recycle all waste.	4.42
- Acquire products with recycled and recyclable packaging.	4.30

best reflected their opinion. In the first question, respondents were asked to indicate the extent to which they believed a number of key factors would influence the transition to a Circular Economy. These included financial support, transportation of materials, social support, the extension of product lifespans and the willingness of companies to implement such a transition. Respondents were asked to rate the influence of each factor on a Likert scale, with 1 indicating no influence and 5 indicating a very high level of influence. In the second question, respondents were invited to identify the main reason for the transition towards a Circular Economy, with four options presented for their consideration. In the third question, we sought to ascertain the perceived importance of integrating specific aspects of the Circular Economy into one's lifestyle, with the aim of facilitating the transition towards a Circular Economy. This was evaluated on a Likert scale, with responses ranging from 1 (not important) to 5 (very important).

The results of the respondents' opinions are presented in Table 10. In question 1, all the aspects surveyed are considered important for making the transition to a Circular Economy. The most important aspects, in order of priority, were the willingness of companies to implement the necessary changes (4.37), social support (4.35) and the extension of the useful life of products (4.31). The remaining two options were of slightly lesser importance: financial support (3.99) and the transportation of materials (3.77). In response to question 2, which examines the motivations for adopting a Circular Economy, over half of the respondents (58.5 %) cited the reduction of climate change as their primary reason. An additional 23 % identified an increase in demand for raw materials and a scarcity of resources as a key driver, while 17 % opted to avoid a greater accumulation of waste in the oceans. Only 1.5 % selected the development of new business models as their rationale. Question 3 assesses the importance of incorporating different aspects of the Circular Economy into our lifestyles. The majority of respondents considered all aspects to be important, but in the following order of priority: reuse everything you can have a second life (4.45), recycle all waste (4.42), purchase products with recycled and recyclable packaging (4.30), repair electronic devices (4.08), and reduce consumption (4.06).

The results presented in Table 11 show statistically significant gender-based differences in responses to the opinion about Circular Economy, with the most pronounced discrepancies evident in questions 1 and 2. In question 1, statistically significant differences emerge in two items, with men attributing greater importance to the influence on the transition to a Circular Economy than women. Firstly, men were more likely than women to value not only financial support (4.11 vs 3.76), but also the transport of materials (3.94 vs. 3.43). In question 2, statistically significant differences between gender groups can be observed. The primary reason for adopting a Circular Economy, as identified by both groups, was to reduce climate change. However, men demonstrated greater support for this rationale than women (62.5 % vs. 50.9 %) did. Finally, in question 3, there are no statistically significant differences between genders groups with regard to the importance of incorporating certain aspects of the Circular Economy into their lifestyle in order to facilitate the transition. The majority of responses exceeded a value of 4, with the exception of one instance. The most significant response for male group was to recycle all waste, with a mean value of 4.46. In contrast, the most important response for female group was to reuse any item that can have a second life, with a mean value of 4.50.

With regard to the respondents' opinions on the Circular Economy by age in Table 12, it can be observed that statistically significant differences between age groups are evident in only one item of question 3, which pertains to the reduction of consumption as an aspect of the Circular Economy to be incorporated in the lifestyle to facilitate the transition to it (senior 4.61, young 4.21, middle 3.94 and adult 3.71). The most crucial element to integrate into our lifestyle in order to facilitate the transition to a Circular Economy is the recycling of all waste, which was rated 4.47 by the young group, 4.36 by the middle group, and 4.89 by the senior group. Additionally, the reuse of materials that can be repurposed is identified as a significant factor by the adult group, with a rating of 4.35. When examining the influence of various factors on the transition to a Circular Economy, as assessed in question 1, no statistically significant differences emerge across age groups, with the majority of ratings exceeding 4. The most crucial factors marked in young and adult groups were the willingness of companies to implement the transition (4.56 and 4.17, respectively), while for middle and

Table 11
Opinion about Circular Economy stratified by gender.

Gender	Female	Male			
Quantitative variables (Likert scale 1–5)	Mean	Mean	U Mann–Whitney		p-value
Qualitative variables (select one option)	%	%	FET		p-value
2. 1. Evaluate the influence of the following items for a transition to the Circular Economy.					
- Financial support.	3.76	4.11	10.306		0.010*
- Transportation of materials.	3.43	3.94	9.247		0.000*
- Social support.	4.32	4.36	11.919		0.585
- The extension of the useful life of the products.	4.34	4.30	11.953		0.622
- The willingness of the companies to its implementation.	4.37	4.37	12.251		0.932
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?			7.869		0.041*
- Due to the increase in demand for raw materials and the scarcity of resources.	28.1 %	20.4 %			
- To avoid a greater amount of garbage in the seas.	17.5 %	16.6 %			
- To reduce climate change as far as possible.	50.9 %	62.5 %			
- To start new business models.	3.5 %	0.5 %			
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.					
- Reduce the consumption.	3.99	4.10	11.364	.220	0.220
- Reuse everything that can have a second life.	4.50	4.42	11.954	0.611	0.611
- Repair electronic devices.	4.11	4.06	11.794		0.504
- Recycle all waste.	4.34	4.46	11.518		0.257
- Acquire products with recycled and recyclable packaging.	4.22	4.34	11.532		0.287

*p value $<$ 0.05: statistically significant differences.

Table 12
Opinion about Circular Economy stratified by age.

Age	Young 18–35	Middle 36–49	Adult 50–65	Senior +65		
Quantitative variables (Likert scale 1–5)	Mean	Mean	Mean	Mean	H Kruskal-Wallis	p-value
Qualitative variables (select one option)	%	%	%	%	FET	p-value
1. Evaluate the influence of the following items for a transition to the Circular Economy.						
- Financial support.	4.08	4.05	3.98	4.17	4.678	0.322
- Transportation of materials.	3.88	3.86	3.62	3.69	8.156	0.086
- Social support.	4.28	4.28	4.03	4.33	11.925	0.018
- The extension of the useful life of the products.	4.43	4.17	4.25	4.22	3.974	0.410
- The willingness of the companies to its implementation.	4.56	4.26	4.17	4.15	11.045	0.026
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?					14.338	0.080
- Due to the increase in demand for raw materials and the scarcity of resources.	21.8 %	21.6 %	20.6 %	50.0 %		
- To avoid a greater amount of garbage in the seas.	14.1 %	21.6 %	19.0 %	11.1 %		
- To reduce climate change as much as possible.	63.5 %	55.7 %	57.4 %	33.3 %		
- To start new business models.	0.6 %	1.1 %	2.9 %	5.6 %		
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.						
- Reduce the consumption.	4.21	3.94	3.71	4.61	18.007	0.001*
- Reuse everything that can have a second life.	4.46	4.40	4.35	4.88	7.002	0.135
- Repair electronic devices.	4.08	4.00	4.01	4.67	8.319	0.081
- Recycle all waste.	4.47	4.36	4.26	4.89	8.145	0.086
- Acquire products with recycled and recyclable packaging.	4.37	4.14	4.25	4.72	6.739	0.150

*p value (with Bonferroni correction for 4 groups) < 0.0083: statistically significant differences

Table 13
Opinion about Circular Economy stratified by studies.

Studies	Basic	Medium	Superior		
Quantitative variables (Likert scale 1–5)	Half	Half	Half	H Kruskal-Wallis	p-value
Qualitative variables (select one option)	%	%	%	FET	p-value
1. Evaluate the influence of the following items for a transition to the Circular Economy.					
- Financial support.	3.85	4.05	3.99	1.413	0.493
- Transportation of materials.	3.40	3.73	3.87	3.543	0.170
- Social support.	3.95	4.26	4.47	7.217	0.027
- The extension of the useful life of the products.	4.22	4.16	4.41	2.969	0.227
- The willingness of the companies to its implementation.	4.13	4.34	4.44	1.867	0.393
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?				12.315	0.041
- Due to the increase in demand for raw materials and the scarcity of resources.	12.5 %	27.5 %	22.9 %		
- To avoid a greater amount of garbage in the seas.	30.0 %	20.6 %	12.2 %		
- To reduce climate change as far as possible.	57.5 %	50.0 %	63.3 %		
- To start new business models.	0.0 %	2.0 %	1.6 %		
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.					
- Reduce the consumption.	3.63	3.96	4.21	8.367	0.015*
- Reuse everything that can have a second life.	4.38	4.38	4.49	0.491	0.782
- Repair electronic devices.	4.15	3.95	4.13	1.444	0.486
- Recycle all waste.	4.30	4.36	4.48	0.557	0.757
- Acquire products with recycled and recyclable packaging.	4.28	4.23	4.35	0.890	0.641

*p value (with Bonferroni correction for 3 groups) < 0.016: statistically significant differences

senior respondents the social support reason was of paramount importance (4.28 and 4.33, respectively). In reference to question 2, which inquires as to the primary motivation for transitioning to a Circular Economy, the young, middle, and adult groups indicated a preference for the reduction of climate change as the most significant factor (63.5 %, 55.7 %, and 57.4 %, respectively). In contrast, the senior groups identified the increasing demand for raw materials and the scarcity of resources as the primary reason (50.0 %).

With reference to the respondents' opinions on the Circular Economy stratified by their studies in Table 13, only question 3 demonstrates statistically significant differences. This question assesses the reduction of consumption as a component of the Circular Economy in our lifestyle, with the objective of facilitating the transition to it. The superior studies group assigned greater importance to this aspect (4.21) than the medium (3.96) and the basic (3.63) studies groups. The most crucial aspect of the Circular Economy to integrate into our lifestyle in order to facilitate its transition was consistent across three groups: the reuse of all materials with the potential for a second life (4.49 for the superior studies group and 4.38 for the medium and basic studies groups). No statistically significant differences are observed among the three groups in questions 1 and 2. In question 1, the most important item for a transition to the Circular Economy differed for all three groups. For basic studies group, this was extending the useful life of products (4.22). For medium studies groups, it was the willingness of companies to implement it (4.34). And, for superior studies group, it was social support (4.47). With regard to question 2, all three groups identified the reduction of climate change as the most important reason for transitioning to a Circular Economy, with the following order of priority of studies groups: 63.3 % superior, 57.5 % basic and 50.0 %

Table 14
Opinion about Circular Economy stratified by environmental behaviour during the purchase.

Behaviour group	Good	Poor			
Yes, buy the most sustainable or Not buy the most sustainable.	Yes	No			
Quantitative variables (Likert scale 1–5)	Mean	Mean	U Mann–Whitney		p-value
Qualitative variables (select one option)	%	%	FET		p-value
1. Evaluate the influence of the following items for a transition to the Circular Economy.					
- Financial support.	3.82	4.04	8.852		0.074
- Transportation of materials.	3.81	3.75	9.714		0.871
- Social support.	4.24	4.38	8.942		0.168
- The extension of the useful life of the products.	4.26	4.33	9257		0.379
- The willingness of the companies to its implantation.	4.22	4.42	8667		0.067
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?			3.191		0.346
- Due to the increase in demand for raw materials and the scarcity of resources.	20.5 %	23.7 %			
- To avoid a greater amount of garbage in the seas.	11.5 %	18.7 %			
- To reduce climate change as much as possible.	66.7 %	56.0 %			
- To start new business models.	1.3 %	1.6 %			
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.					
- Reduce the consumption.	4.05	4.06	9.616	.220	0.759
- Reuse everything that can have a second life.	4.46	4.44	9.628	.611	0.750
- Repair electronic devices.	3.92	4.13	8.592		0.074
- Recycle all waste.	4.45	4.41	9.620		0.740
- Acquire products with recycled and recyclable packaging.	4.45	4.25	8.649		0.071

*p value < 0.05: statistically significant differences

Table 15
Opinion about Circular Economy stratified by environmental behaviour during recycling.

Behaviour group	Good	Poor			
It does separate waste or It does not separate waste	Yes	No			
Quantitative variables (Likert scale 1–5)	Mean	Mean	U Mann–Whitney		p-value
Qualitative variables (select one option)	%	%	FET	df	p-value
1. Evaluate the influence of the following items for a transition to the Circular Economy.					
- Financial support.	4.01	3.80	3.290		0.229
- Transportation of materials.	3.75	3.92	3.543		0.540
- Social support.	4.34	4.36	3.703		0.784
- The extension of the useful life of the products.	4.32	4.20	3.530		0.485
- The willingness of the companies to its implantation.	4.35	4.56	3.314		0.208
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?			7.307		0.053
- Due to the increase in demand for raw materials and the scarcity of resources.	21.3 %	44.0 %			
- To avoid a greater amount of garbage in the seas.	16.7 %	20.0 %			
- To reduce climate change as far as possible.	60.4 %	36.0 %			
- To start new business models.	1.6 %	0.0 %			
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.					
- Reduce the consumption.	4.06	4.04	3.772	.220	0.925
- Reuse everything that can have a second life.	4.46	4.32	3.564	.611	0.525
- Repair electronic devices.	4.10	3.80	3.278		0.215
- Recycle all waste.	4.42	4.44	3.745		0.863
- Acquire products with recycled and recyclable packaging.	4.31	4.16	3.315		0.222

*p value < 0.05: statistically significant differences

medium.

No statistically significant differences can be identified between the two stratified categories on environmental behaviour at the time of purchase in their opinions regarding the Circular Economy across the three questions in Table 14. In question 1, the majority of responses exceed a value of 4. With regard to the influence of this item on the transition to a Circular Economy, the extension of the useful life of products is rated the highest in the good environmental behaviour group (4.26). Conversely, in the poor environmental behaviour group, the highest value was assigned to the willingness of companies to implement the aforementioned measures (4.42). In question 2, both environmental behaviour groups identified reducing climate change as the main reason for transitioning towards a Circular Economy, with 66.7 % in the good and 56.0 % in the poor. Finally, in question 3, both environmental behaviour groups identified reuse as the aspect of the Circular Economy that facilitates the transition to it most effectively (4.45 good and 4.41 poor).

The analysis revealed no statistically significant differences in opinion between the two groups stratified according to environmental behaviour during recycling about the Circular Economy in Table 15. In question 1, the willingness of the companies to implement it was the most influential item for a transition to the Circular Economy in both environmental behaviour groups (4.56 good and 4.35 poor). In question 2, the two environmental behaviour groups proffered disparate reasons for the transition towards a Circular Economy: 60 % of the good environmental behaviour group identified the reduction of climate change as a primary objective, whereas 44 % of the poor environmental behaviour group recognised the increase in demand for raw materials and the scarcity of

Table 16
Opinion about Circular Economy stratified by environmental behaviour in reuse.

Behaviour group	Low	Medium	High		
Degree of commitment in willingness to pay more for a product made with reused materials (Liker scale)	1 or 2	3	4 or 5		
Quantitative variables (Likert scale 1–5)	Mean	Mean	Mean	H Kruskal-Wallis	p-value
Qualitative variables (select one option)	%	%	%	FET	p-value
1. Evaluate the influence of the following items for a transition to the Circular Economy.					
- Financial support.	3.60	4.03	4.08	7.739	0.021
- Transportation of materials.	3.28	3.87	3.84	15.041	0.001*
- Social support.	3.84	4.41	4.44	15.621	0.000*
- The extension of the useful life of the products.	3.70	4.35	4.40	17.761	0.000*
- The willingness of the companies to its implantation.	4.02	4.42	4.45	8.790	0.012*
2. What is in your opinion the main reason why we should make a transition towards a Circular Economy?				6.898	0.330
- Due to the increase in demand for raw materials and the scarcity of resources.	22.0 %	25.0 %	22.0 %		
- To avoid a greater amount of garbage in the seas.	24.0 %	12.1 %	18.3 %		
- To reduce climate change as much as possible.	50.0 %	62.0 %	58.5 %		
- To start new business models.	4.0 %	0.9 %	1.2 %		
3. Indicate the importance for you of incorporating the following aspects of the Circular Economy into our lifestyle to facilitate the transition to it.					
- Reduce the consumption.	3.48	4.04	4.25	21.373	0.000*
- Reuse everything that can have a second life.	4.10	4.47	4.54	10.592	0.005*
- Repair electronic devices.	3.80	4.02	4.21	6.253	0.044
- Recycle all waste.	4.08	4.44	4.51	9.357	0.009*
- Acquire products with recycled and recyclable packaging.	3.52	4.37	4.49	31.734	0.000*

*p value (with Bonferroni correction for 3 groups) < 0.016: statistically significant differences

resources as a key driver. Lastly, in question 3, the lifestyle factor that most facilitates the transition to the Circular Economy was the reuse of items that can be repurposed, with a score of 4.46 for the good environmental behaviour group. For the poor environmental behaviour group, the optimal solution was to recycle all waste, with a score of 4.44.

In the final stratification by environmental behaviour in reuse, an analysis of the respondents' opinions about the Circular Economy in Table 16 reveals statistically significant differences among the three groups in the majority of items from questions 1 and 3. In question 1, statistically significant differences were observed in four items, exhibiting a strikingly similar pattern of behaviour. The findings suggest that the importance given to the influence of the items on the transition to a Circular Economy increases with the level of environmental behaviour in reuse. The medium and high environmental behaviour groups exhibited two items with the same maximum influence: social support (4.41 and 4.45, respectively) and the willingness of the companies to implement it (4.41 and 4.45, respectively). Additionally, the group with a low behaviour deemed the willingness of companies to implement it as the most pivotal factor, albeit with diminished influence (4.02). Question 3 reiterated the same preceding environmental behaviour as question 1: the significance of integrating specific elements into our lifestyle to facilitate the transition to the Circular Economy is proportional to the level of environmental behaviour in reuse. All environmental behaviour groups identified the reuse of items with the potential for a second life as the most crucial aspect to incorporate into our lifestyle in order to facilitate the transition to a Circular Economy, with the following values per group: high 4.54, medium 4.47 and low 4.10. Finally, an analysis of question 2 reveals no statistically significant differences among the three environmental behaviour groups with regard to the main reason for transitioning towards a Circular Economy. Furthermore, the majority of respondents from the three environmental behaviour groups concur that the principal reason

Table 17
Fulfilment of the research questions of Knowledge about Circular Economy.

Research questions		Table number	Answers with SSD* to interview questions		Answer to research question
			Yes	No	
K1	Does the knowledge about the Circular Economy differ between people' gender?	4	1	2	No
K2	Does the knowledge about the Circular Economy differ among people' age?	5	1	2	No
K3	Does the knowledge about the Circular Economy differ among people' level of studies?	6	2	1	Yes
K4	Does the knowledge about the Circular Economy differ according to their environmental behaviour during the purchase?	7	0	3	No
K5	Does the knowledge about the Circular Economy differ according to their environmental behaviour during the recycling?	8	0	3	No
K6	Does the knowledge about Circular Economy differ according to their degree of environmental behaviour in reuse?	9	2	1	Yes

*SSD = statistically significant differences.

for transitioning to a Circular Economy was to mitigate climate change to the greatest extent possible with the next values: 62.0 % in medium, 58.5 in high and 50.0 % in low.

5. Discussion

This section presents a separate discussion of knowledge and opinions about the Circular Economy in the case study of the province of Alicante (Spain), not only for the total number of respondents, but also in terms of the stratification carried out. It should be noted that the strata are considered to have different positions in terms of knowledge and opinion if, in the set of responses for each stratum, the majority are those with statistically significant differences.

In order to analyse the six research questions regarding knowledge about the Circular Economy, we have devised a system of evaluating their veracity based on three key questions. We consider a research question to be confirmed if it meets the criterion of statistically significant differences across at least two of the aforementioned questions (see Table 17).

Conversely, the analysis of the six research questions concerning opinion about Circular Economy involves the examination of eleven items for each one. We consider that the confirmation of a hypothesis is determined by the presence of six or more statistically significant differences on the analysed items (Table 18).

5.1. Knowledge about circular economy

In terms of knowledge regarding the concept of the Circular Economy, the findings indicate that slightly over half of the respondents were able to correctly identify the definition of the Circular Economy as set forth by the EU, as well as the additional 4Rs that complete the 7Rs of the Circular Economy. Nevertheless, slightly less than half of the respondents indicated that eco-design represents the initial phase of the Circular Economy, which was deemed to be the correct answer. Therefore, the average knowledge of the Circular Economy in the respondents of the province of Alicante is superior to that observed by Liu et al. (2009) in China and Almulhim and Abubakar (2021) in Saudi Arabia. However, this knowledge requires further enhancement through the efforts of the relevant authorities. The majority of respondents of the province of Alicante got the correct definition of Circular Economy provided by the European Union. This finding corroborates the perspective put forth by Smol et al. (2018) in Poland and Rótolo (2022) in Argentina, which emphasises the paramount importance of maintaining the value of products in the economy over an extended period. Furthermore, these discovers are in accordance with those of Smol et al. (2018) in Poland and Korsunova et al. (2021) in Finland with regard to the minimisation of waste.

Two of the three responses pertaining to the K1 research question demonstrate no statistically significant discrepancies among respondents from the Alicante province. Furthermore, this data indicates that there is no notable discrepancy in the comprehension of the Circular Economy between genders (Table 17).

The results in Table 17 indicate that only statistically significant differences appear in one of the three answers given regarding the K2 research question. Consequently, the findings suggest that the knowledge about the Circular Economy does not differ among the respondents of different age groups in the respondents of the province of Alicante. This discover is at odds with the results reported by Smol et al. (2018), who observed that younger generations in Poland demonstrated greater familiarity with the concept of the Circular Economy.

In regard to research question K3, there are statistically significant differences in two of the three responses. Therefore, knowledge of the Circular Economy differs according to the level of study in the respondents of the province of Alicante (Table 17). This discrepancy is attributable to an increase in the level of knowledge as the level of studies was higher in the three questions asked (Table 5), corroborating the same pattern observed by Liu et al. (2009) in China. However, in the initial question, related to the definition of the Circular Economy, statistically significant differences were not evident. In consequence, it would be beneficial to

Table 18
Fulfilment of the research questions of Opinion about Circular Economy.

Research questions		Table number	Answers with SSD* to interview questions		Answer to research question
			Yes	No	
O1	Does the opinion about the Circular Economy differ between people' gender?	11	3	8	No
O2	Does the opinion about the Circular Economy differ among people' age?	12	1	10	No
O3	Does the opinion about the Circular Economy differ among people' level of studies?	13	1	11	No
O4	Does the opinion about the Circular Economy differ according to their environmental behaviour during the purchase?	14	0	11	No
O5	Does the opinion about the Circular Economy differ according to their environmental behaviour during the recycling?	15	0	11	No
O6	Does the opinion about Circular Economy differ according to their degree of environmental behaviour in reuse?	16	8	3	Yes

*SSD = statistically significant differences.

implement initiatives that enhance the understanding of the Circular Economy among individuals with a basic or medium level of education.

The three questions on knowledge of the Circular Economy in the research questions K4 and K5 do not demonstrate statistically significant differences. Consequently, the knowledge about the Circular Economy does not differ according to environmental behaviour during the purchase and recycling in the respondents of the province of Alicante (Table 17).

Nevertheless, it can be confirmed that there is a correlation between knowledge of the Circular Economy and environmental behaviour in reuse. This is evidenced by the statistically significant differences observed in two of the three responses of the research question K6 (Table 17). Furthermore, the three responses exhibited a consistent pattern of behaviour across groups, with greater knowledge of the Circular Economy associated with more environmentally responsible reuse practices (Table 9). It can thus be deduced that initiatives designed to raise knowledge levels regarding the Circular Economy should prioritise those individuals exhibiting low levels of reuse.

5.2. Opinion about Circular Economy

We will commence this section by offering commentary on the elements that emerge as particularly notable in light of the general opinion of those interviewed in the province of Alicante on matters pertaining to the Circular Economy. Firstly, the item that most influences the transition to the Circular Economy was the willingness of companies to implement it, which is in line with the findings of Ali et al. (2022) in Malaysia, who identified perceived benefits as the most important factor in promoting the adoption of the Circular Economy. This was also supported by the findings of Atlason et al. (2017) in Denmark, where users expressed high satisfaction with a product that could be disposed of according to a favourable Circular Economy scenario. Secondly, the primary motivation for transitioning towards a Circular Economy was the reduction of climate change to the greatest extent possible (58.5 %). Thirdly, the most significant aspect of the Circular Economy that could be integrated into our daily lives to facilitate its transition was the reuse of items that can be repurposed. However, the importance of repair was also highlighted, as evidenced by Rogers et al. (2021) in England, who identified repair activities as a crucial aspect of the Circular Economy.

The results indicate that there are statistically significant differences in only three of the eleven items related to the research question O1. Consequently, the data suggested that there is no significant difference in opinion about the Circular Economy by gender between men and women in the respondents of the province of Alicante (Table 18). This contrasts with the findings of Atlason et al. (2017) in Denmark, Rogers et al. (2021) in England and Ali et al. (2022) in Malaysia, which indicated that women held more positive views than men.

In general, the young and senior groups hold more favourable opinions than the middle and adult groups. However, only in one of the eleven responses to the O2 research question (Table 18) do statistically significant differences emerge. Therefore, there are no significant differences in opinion about the Circular Economy according to age in the respondents from the province of Alicante. However, the results obtained in this study contradict those reported by Smol et al. (2018) in Poland and Ali et al. (2022) in Malaysia, where the younger generation expressed a higher opinion of the Circular Economy.

The O3 research question evidence that ten of the eleven responses exhibit no statistically significant differences. Consequently, the opinion on the Circular Economy does not differ according to the level of study of the respondents in the province of Alicante (Table 18). However, a slight increase with level of studies was observed in all of them. The results obtained are in accordance with those reported by Guo et al. (2017), Smol et al. (2018) in Poland, Almulhim and Abubakar (2021) in Saudi Arabia and Ioannidis et al. (2023) in Greece. These studies similarly identified a positive relationship between the opinion about the Circular Economy and the level of studies. However, in the present case, the relationship could not be confirmed statistically.

The eleven items pertaining to opinion towards the Circular Economy in research questions O4 and O5 do not exhibit any statistically significant differences. Therefore, in both cases, can be stated that there is no significant difference in opinion regarding the Circular Economy according to the environmental behaviour of respondents in the province of Alicante with regard to purchase and recycling (Table 18).

In contrast, in the research question O6 there are statistically significant differences in eight of the eleven responses. Consequently, it can be derived that the opinion about Circular Economy of the respondents in the province of Alicante differs according environmental behaviour in reuse. This finding corroborates the result obtained by Hao et al. (2020) in China, which revealed that the willingness of people to participate in the Circular Economy is higher in those who are willing to pay more for the environment. The result of this hypothesis is analogous to that of the knowledge research question (K6), thus the recommendation is identical and should be to concentrate the programmes to enhance the opinion of the Circular Economy in those who reuse infrequently.

6. Conclusions

The principal conclusions that can be derived from the analysis of the findings of the research conducted in the province of Alicante, Spain, on the impact of social factors and environmental behaviour on the knowledge and opinion about the Circular Economy are as follows.

Firstly, it is notable that over half of the population surveyed demonstrated an accurate understanding of the Circular Economy. Nevertheless, it is evident that there is a necessity for enhancement in the knowledge base of individuals who have attained only a basic or medium level of education, as well as those whose environmental conduct with regard to reuse is relatively limited.

Secondly, with regard to the opinion of the analysed population on the Circular Economy, it can be asserted that the involvement of both companies and society is essential for the transition to the Circular Economy to be achieved. This transition should be primarily

oriented towards mitigating the problem of climate change. Consequently, many aspects of the Circular Economy should be incorporated into our lifestyles in a significant manner. Among these characteristics, the reuse of items with the potential for a second life, the purchase of products with recycled and recyclable packaging, and the recycling of all waste materials stand out as particularly noteworthy. In addition, the opinion about Circular Economy of the population analysed in which low environmental behaviour in reuse should be improved.

Finally, it can be stated with certainty that, although there is a good knowledge and a high level of accuracy in the opinions expressed about the Circular Economy in the scenario analysed in the province of Alicante (Spain), a great deal of work remains to be done to enhance it. This should be achieved through a greater involvement of society and companies, as well as through the dissemination of information about the benefits of the Circular Economy for society at large. It is thus recommended that future efforts should be made to advance towards the creation of a more sustainable and environmentally conscious society.

6.1. Limitations of the study

The principal limitation of the research is that it is an exploratory study, as the sampling method employed was convenience sampling. As a result, there is a potential for selection bias, with a greater representation of younger individuals and females. Nevertheless, the results indicate trends in this field, and as such, they must be interpreted. Consequently, this study can be used as a foundation for further research, with the aim of proposing alternative policies that could enhance the understanding and attitudes towards the Circular Economy among diverse groups within a country. In addition, the survey instrument did not include an option for respondents to indicate that they were unsure of the answer to a given question. Consequently, respondents may have been compelled to select an answer that was not the most accurate or informed, particularly if they lacked sufficient knowledge on the subject matter.

6.2. Future research directions

It would be advantageous for future research to prioritise the attainment of greater representativeness of the analysed population through the utilisation of probability sampling, with the objective of extrapolating the results to the population of the province of Alicante. Furthermore, it would be beneficial to develop the capacity to expand and further specify the characteristics that define the environmental behaviours under examination.

CRediT authorship contribution statement

Conceptualization, VS and AA; methodology, VS, AA, and FD; Formal analysis, AA, VS and IA; Investigation, VS, AA and FD; Writing — original draft preparation, AA, FD and IA; Writing — review & editing, AA, FD and IA.

Declaration of Competing Interest

The authors declare that they have no conflict of interest and that this research did not receive any funds.

Acknowledgments

We would like to express our gratitude to all those who took the time to complete the questionnaire and provide their invaluable input.

Data Availability

Data will be made available on request.

References

Acosta, I., Marrero, F., & Espinosa, J. (2020). La economía circular como contribución a la sostenibilidad en un destino turístico cubano de sol y playa. *Estudios York Perspectivas Eno¯sis Turismo, 29*(2), 406–425. ⟨https://dialnet.unirioja.es/servlet/articulo?codigo=7316508⟩.

Ali, Q., Parveen, S., Yaacob, H., Rani, A. N., & Zaini, Z. (2022). Environmental beliefs and the adoption of Circular Economy among bank managers: Do gender, age and knowledge act as the moderators? *Journal of Cleaner Production, 361*, Article 132276. https://doi.org/10.1016/j.jclepro.2022.132276

Almulhim, A. I., & Abubakar, I. R. (2021). Understanding Public Environmental Awareness and Attitudes toward Circular Economy Transition in Saudi Arabia. *Sustainability, 13*, 10157. https://doi.org/10.3390/su131810157

Atlason, R. S., Giacalone, D., & Parajuly, K. (2017). Product design in the Circular Economy: Users' perception of end-of-life scenarios for electrical and electronic appliances. *Journal of Cleaner Production, 168*, 1059–1069. https://doi.org/10.1016/j.jclepro.2017.09.082

Bradley, R., Jawahir, I., Badurdeen, F., & Rouch, K. (2018). A total life cycle cost model (TLCCM) for the Circular Economy and its application to post-recovery resource allocation. *Resources, Conservation Recycling, 135*, 141–149. https://doi.org/10.1016/j.resconrec.2018.01.017

Cochran, W. G. (1977). *Sampling Techniques* (3rd Edition). , New York: John Wiley & Sons.

Common, M., Stagl, S., 2008. Introducción a la economía ecológica. Ed. Reverté, Barcelona, España.

EMAF (Ellen Macarthur Foundation), 2015. Towards the Circular Economy, EMAF, London, UK. [online: 20.07.2021].

EU (European Union), 2018. Establishment of a framework to facilitate sustainable investment. COM/2018/353.

EU (European Union), 2019. The European Green Deal. COM/2019/640.

EU (European Union), 2020. A new Circular Economy Action Plan. For a cleaner and more competitive Europe. COM/2020/98.

George, D. A., Chi-Ang, B., & Chen, Y. (2015). A Circular Economy model of economic growth. *Environmental Modelling Software, 73*, 60–63. ⟨https://doi.org/10.1016/j.envsoft.2015.06.01417⟩.

Grodzińska-Jurczak, M., Krawczyk, A., Akhshik, A., Dedyk, Z., & Strzelecka, M. (2022). Contradictory or complementary? Stakeholders' perceptions of a Circular Economy for single-use plastics. *Waste Management, 142*, 1–8. https://doi.org/10.1016/j.wasman.2022.01.036

Guo, B., Geng, Y., Sterr, T., Zhu, Q., & Liu, Y. (2017). Investigating public awareness on Circular Economy in western China: a case of Urumqi Midong. *Journal of Cleaner Production, 142*, 2177–2186. https://doi.org/10.1016/j.jclepro.2016.11.063

Hao, Y., Wang, Y., Wu, Q., Sun, S., Wang, W., & Cui, M. (2020). What affects residents' participation in the circular economy for. *Sustainable Development? Evidence from China Sustainable Development*. https://doi.org/10.1002/sd.2074

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate Data Analysis* (7th Edn. Ed.). New York, USA: Pearson.

Ioannidis, F., Kosmidou, K., & Papanastasiou, D. (2023). Public awareness of renewable energy sources and Circular Economy in Greece. *Renewable Energy, 206*, 1086–1096. https://doi.org/10.1016/j.renene.2023.02.084

Korsunova, A., Horn, S., & Vainio, A. (2021). Understanding Circular Economy in everyday life: Perceptions of young adults in the Finnish context. *Sustainable Production and Consumption, 26*, 759–769. https://doi.org/10.1016/j.spc.2020.12.038

Lakatos, E. S., Dan, V., Cioca, L. I., Bacali, L., & Ciobanu, A. M. (2016). How Supportive Are Romanian consumers of the circular economy concept: a survey. *Sustainability, 8*, 789. https://doi.org/10.3390/su8080789

Lewandowska, A., Rogatka, K., & Lopata, E. (2019). Social awareness of the Circular Economy as an integral part of sustainable development. Observations from Poland. *Civil and Environmental Engineering Reports, 32*, 132–153. https://doi.org/10.2478/ceer-2022-0023

Liu, Q., Li, H., Zuo, X., Zhang, F., & Wang, L. (2009). A survey and analysis on public awareness and performance for promoting circular economy in china: a case study from Tianjin. *Journal of Cleaner Production, 17*, 265–270. https://doi.org/10.1016/j.jclepro.2008.06.003

MITECO (Ministry for the Ecological Transition and the Demographic Challenge of Spain), 2020. España Circular 2030. Estrategia Española de Economía Circular. ⟨https://www.miteco.gob.es/content/dam/miteco/es/calidad-y-evaluacion-ambiental/⟩ temas/economia-circular/espanacircular2030_def1_tcm30-509532_mod_tcm30-509532.pdf.

Nunnally, J., & Bernstein, L. (1994). *Psychometric Theory*. New York, USA: McGraw-Hill.

Orjuela, W. A. (2019). Economía circular como estrategia de innovación y transformación territorial y empresarial. *Innovación con enfoque multidisciplinario*. Colombia: Fundación EXINFU. ⟨https://www.researchgate.net/publication/341966983_Economia_circular_como_estrategia_de_innovacion_y_transformacion_territorial_y_empresarial⟩. ISBN 978-958-56994-3-4.

Park, J., Sarkis, J., & Wu, Z. (2010). Creating integrated business and environmental value within the context of China's circular economy and ecological modernization. *Journal of Cleaner Production, 18*(15), 1494–1501. https://doi.org/10.1016/j.jclepro.2010.06.001

Perelló, S., 2009. Metodología de la investigación social. Ed. Dykinson.

R Core Team. (2022). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. URL ⟨https://www.R-project.org/⟩.

Reike, D., Vermeulen, W., & Witjies, S. (2018). The circular economy: new or Refurbished as CE 3.0? — exploring controversies in the conceptualization of the circular economy through a focus on history and resource value retention options. *Resources, Conservation Recycling, 135*, 246–264. https://doi.org/10.1016/j.resconrec.2017.08.027

Rogers, H. A., Deutz, P., & Ramos, T. P. (2021). Repairing the Circular Economy: Public perception and participant profile of the repair economy in Hull, UK. *Resources, Conservation and Recycling, 168*, Article 105447. https://doi.org/10.1016/j.resconrec.2021.105447

Rótolo, G. C., Vassillo, C., Rodriguez, A. A., Magnano, L., Milo Vaccaro, M., Civit, B. M., Covacevich, M. S., Arena, A. P., & Ulgiati, S. (2022). Perception and awareness of Circular Economy options within sectors related to agriculture in Argentina. *Journal of Cleaner Production, 373*, Article 133805. https://doi.org/10.1016/j.jclepro.2022.133805

Smol, M., Avdiushchenko, A., Kulczycka, J., & Nowaczek, A. (2018). Public awareness of circular economy in southern poland: case of the malopolska region. *Journal of Cleaner Production, 197*, 1035–1045. https://doi.org/10.1016/j.jclepro.2018.06.100

Stahel, W. (2016). The circular economy. *Nature, 531*, 435–438. ⟨https://www.nature.com/articles/531435a⟩.

UN (United Nations), 2015. Transforming our world: the 2030 Agenda for Sustainable Development. A/RES/70/1.

Van Langen, S. K., Vassillo, C., Ghisellini, P., Restaino, D., Passaro, R., & Ulgiati, S. (2021). Promoting Circular Economy transition: a study about perceptions and awareness by different stakeholder groups. *Journal of Cleaner Production, 316*, Article 128166. https://doi.org/10.1016/j.jclepro.2021.128166

Virsta, A., Sandu, M. A., & Daraban, A. E. (2020). Dealing with the transition from in line economy to Circular Economy - public awareness investigation in Bucharest. *Agrolife Scientific Journal, 9*(1), 355–361. ⟨https://agrolifejournal.usamv.ro/pdf/vol.IX_1/Art43.pdf⟩.

Winton, B. G., & Sabol, M. A. (2022). A multi-group analysis of convenience samples: free, cheap, friendly, and fancy sources. *International Journal of Social Research Methodology, 25*, 861–876. https://doi.org/10.1080/13645579.2021.1961187