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Integration of the Circular Economy Paradigm in Companies from the Northwest of the Iberian Peninsula

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Abstract: Over recent decades, Circular Economy (CE) has become a major topic when organizations try to develop their business amid the constrains of resource limitation and the desire to reduce their environmental impact. This study's main purpose is to assess the integration of CE practices in public and private organizations in the northwest of the Iberian Peninsula. Through an online survey distributed to 294 companies from the cited region, we assessed their perceptions on CE, including such aspects as the area(s) it was integrated in, why, with what difficulties or what was necessary to accomplish it, and how the impact of the implemented CE practices was measured. Results showed that companies associate CE mostly with "resource optimization". "Entity's vision and mission" was the main strategic area where CE was implemented. The main motivation why entities/organizations embraced CE was "environmental reasons", while "lack of information and guidance" and "lack of financial resources" represented the main obstacles to CE implementation. Non-parametrical statistical tests were used to compare the answers of three groups of people with different positions within the company/entity (manager, executive, and technician), as well as to compare the answers of two activity sectors (industry and services).

Keywords: circular economy; industry/services strategies; manager/executive/technicians' perceptions

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1. Introduction

The concept of Circular Economy (CE) was widely disseminated and promoted by British sailor Ellen MacArthur, when in 2005, in a lonely circum-navigation trip around the globe, the activist had to reuse what few resources there were available in the boat, intensifying her consciousness of the importance of their preservation [1,2]. This awareness propelled her to create a Foundation, named after herself, in 2010 [3], emerging soon after as a strong advocate for and the face of Circular Economy.

Initially, CE as a concept dealt more with how materials were kept, restored, and reintroduced cyclically in the value chain, so as to create economic advantages to suppliers and users, as well as benefitting the environment, thanks to the decreased extraction and importation of components and source-materials [4]. CE was seen as a key element to promote the decoupling between economic growth and increased consumption of resources, since, according to the circular approach, economic value is extracted from the materials already in circulation in the economy.

According to the European Commission [5], "in circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimized, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value". With CE, any economic activity should operate in a closed-loop process of resource-production-consumption-regenerated resource.

Today, CE is seen as a much wider endeavor, associated with many other concepts, such as eco-design, innovation, industrial symbiosis, reverse logistics, responsible production, optimization of resource use, bioeconomy, blue economy, new business models, etc. [6]; added to an educational character, meaningful to the entire community. CE is a new, more rational way of thinking, anticipating the conception, production, use, and end of the product's life cycle, so as to minimize, dematerialize, remanufacture, and relocate all the materials/components and resources necessary, as well as reducing the environmental and social impact in every stage of the product's life cycle. CE implies the adoption of a cleaner production, greater accountability, and awareness by the producers and consumers, and usage of renewable materials and technologies, in addition to the adoption of suitable policies and tools [7]. CE dictates, in short, a holistic transformation of business [8].

CE involves so many interconnected concepts that many authors have scrambled to find the best definition by reviewing the literature and critically debating various circular economy conceptualizations [6,7,9–14].

Other authors [15,16] propose resources and materials' reduction strategies by submitting R list or R strategies, i.e., strategies that enhance circularity within the production chain. These are normally ranked by decreasing circularity, that is, a lower R means higher circularity: R0—Refuse (making the product redundant, by having it lose its function or having a totally different product offering the same function, as can be seen with digitalization—cable TV services preventing the acquisition of CD, DVD, or Blu-ray products, as well as their respective players); R1—Rethink (making the product more intensive through sharing or with multifunctional products); R2—Reduce (increasing the production or/and usage efficiency or/and consuming fewer resources and natural materials); R3—Reuse (reuse of the discarded product by a different consumer or even the original one if it is still in good conditions and can carry on fulfilling its original function); R4—Repair (repairing and maintaining a product); R5—Refurbish (restoring an old product and updating it); R6—Remanufacture (using the discarded product's parts/components in a new product with the same function); R7—Repurpose (using the discarded product's parts/components in a new product with a different function); R8—Recycle (processing materials in order to obtain the same material with equal or lower quality); R9—Recover (recovering the materials' energy).

Despite all the talk about CE, it is still in its embryo phase [16,17]. The European Commission has proposed a series of programs [5,18–22] to accelerate the transition to CE, creating a cleaner way to promote a more competitive Europe, in cooperation with its economic agents, its consumers, its citizens, and its civil society organizations.

Even though CE has become a major slogan for Portuguese [23], Spanish [24], and European authorities, its implications for companies' policies have not yet been fully met.

Currently, there is growing pressure from all of society to create socially, environmentally, and economically sustainable development. Companies need to find the triple bottom line (people, profit, and planet), where commercial interests, society's interests, and a minimization of the environmental impact all overlap [25].

According to Naudé [26], only when companies align sustainable development with business vision and strategy can sustainable development be implemented. CE has a clear impact on sustainable development, as it is related to multiple Sustainable Development Goals (SDGs), namely concerning consumption and production (SDG12), affordable and clean energy (SDG7), industry, innovation, and infrastructure (SDG9), clean water and sanitation (SDG6), decent work and economic growth (SDG8), and sustainable cities and communities (SDG11) [11].

Many authors [7,9] highlight the particular challenges that executives and managers face when trying to implement sustainable development in the business context, in a practical and realistic manner. The same authors agree that the best way to operationalize sustainable development is through CE practices.

Panchal et al. [11] did a literature review where the articles were classified according to the sustainable development goals addressed, the type of industry, and CE performance—looking at R strategies in particular. Authors concluded that the majority of CE performance studies focuses on environmentally sustainable development and overlooks the social aspects. Kirccherr et al. [9] added that quoting good CE practices, as well as obstacles to its implementation, not only helps refine the concept of CE among academics and professionals but can also be instructive to those interested in its rollout. Questioning institutions and companies about the strategic areas CE was integrated in, why did the company embrace it, as well as any difficulties found, would be a source of great help to the whole community.

Insights from case studies of CE business models would also help organizations understand the decisions, management concerns, and challenges they face [27]. Several authors [27–29] use case studies of companies that adopted CE practices and identified relevant managerial practices for CE business models. According to Ünal et al. [28] and Urbinati et al. [29], managers willing to embrace CE principles may benefit from a set of practices that create and capture value, thus leveraging peculiar dimensions of the company's business model: (i) the value network; and (ii) the customer value proposition and interface. This taxonomy, considering two larger circularity dimensions, was initially proposed by Urbinati et al. [30]. Managerial practices that promote the value network include: energy efficiency initiatives (reduction of greenhouse gases' emissions and environmental impact); use of eco-friendly materials (natural, recyclable and easy to separate); engagement of supply chain stakeholders, so they can become aware of CE tools and capabilities; practices related to effective communication with the supply chain stakeholders and upstream partners; design aimed at recycling and/or remanufacturing and/or reusing and/or disassembling practices. Managerial practices that promote customer value proposition and interface dimension include: the direct sale of products, making customers responsible for their use during and at the end of their lifecycle; the offer of complementary services when the product is sold (maintenance or take-back, thus guaranteeing the producer's eventual recovery of the customer's purchases); leasing or renting products; pay-per-use (allowing customers to benefit from short term use without further commitment); promotion on the company's website; advertising and sales personnel present in the store; communication of circularity through all communication channels; and customer involvement in circularity initiatives.

Unal et al. [28] propose a third dimension, managerial commitment, as a moderating factor between the value network and the customer value proposition and the interface dimensions, essential for reaching the intended goals of circular economy businesses.

Customer involvement and interaction are considered key points for the success and design of CE business models [27,29,30], allowing for an improved perception of customer preferences and the rationality of purchasing CEBM-driven products.

However, in the case of manufacturing organizations, their sustainability is highly dependent on the sustainability of their supply chain [31].

Yadav et al. [32] performed a bibliometric study focusing on the sustainable supply chain perspective in the automotive industry, exploring the challenges for both CE and Industry 4.0. Managerial and organizational issues, economic issues, supplier issues, and socio-cultural issues were identified, in this order, as the main challenges in this particular sector.

Nandi et al. [27] also highlight the benefits of supply chain collaboration. These authors give examples of CE business models that demonstrate how supply chains can be transformed to transition into sustainable economy models. However, they warn us that some CE business model practices can harm the social and environmental sustainability

dimensions and, therefore, should be carefully evaluated and implemented in thoughtful and inclusive ways.

Bocken et al. [33] and Rosa et al. [34] performed a systematic literature review on existing Circular Business Models (CBMs) and their classification methods, by selecting the most promising ones.

The objectives of this study are to analyze and evaluate the integration of CE in companies from the northwest of Iberian Peninsula, to know the perspectives held by different groups with different positions in the company, regarding this domain, and to compare the integration of CE in different activity sectors.

The structure of this study is as follows: Section 2 describes the sample and the methods used for collecting the data (literature review and questionnaire survey) as well as the methodology followed in the data analysis (procedures, software, and used statistical tests); Section 3 presents the results that emerged from the questionnaire survey and the inferential analysis of the data. Section 4 discusses the main results of the survey (closed and open answers' descriptive analysis and inferential analysis) as well as their significance compared to the existing literature. Section 5 outlines the main conclusions. Finally, Section 6 presents some limits of the study and directions for future research.

2. Methods and Sample

2.1. Research Context

CircularLabs is an INTERREG POCTEP project (0495_CIRCULAR_LABS_6_E), which aims to promote the integration of CE in business models, counting the participation of 11 partners from three Iberian regions: north of Portugal, and Galicia and Castilla y León in Spain. According to the data made available on the Eurostat website, the largest sector in all three of these regions is the services sector, accounting for 66.7%, 68.2%, and 69.3% of all activity, respectively. This is followed by the industry and construction sector with 31.8%, 26.4%, and 25.5%, and finally the agricultural, forestry, and fishing sector with 1.5%, 5.4%, and 5.2% [35]. These regions show similarities to most Polish, Romanian, and Slovakian regions, as well as the western part of France, from Bretagne to the Côte de Azur, regarding both their activity sectors and their GDP per capita [35].

This project includes multiple transnational actions such as training initiatives, workshops, events, expositions, marketplaces, research, and others. Among its first initiatives this project launched an online survey for organizations/companies located in the Iberian northwest regions, focusing on their perception of Circular Economy and the implementation of this complex concept in their organizations' activities. The aim of this survey was to provide an insight on the current panorama concerning Circular Economy and to understand the limitations and potential for its development among organizations. Thus, our first goal was to map organizations' perception of CE, the strategic areas where it was implemented, difficulties and obstacles faced, as well as any necessary resources for the entities' transition to CE. Later, we aimed at comparing points of view from three groups occupying different positions within the companies (executives, managers, and technicians), as well as the two most representative activity sectors (industry and services) as it regards to CE.

2.2. Questionnaire Design

The questions of the online survey were based on the contents of the Circular Economy Action Plan [21], the Circular Economy in Cities and Regions Synthesis Report [36], and the Circular Economy Strategy of Castilla y León 2020–2030 [37]. The questionnaire is composed of five sections: Section 1. General information (regarding the entity in question); Section 2. Concept of Circular Economy; Section 3. Vision for Circular Economy; Section 4. Obstacles and difficulties in the implantation of CE; Section 5. Circular Economy initiatives. Section 5 shall not be covered in this paper. The survey is available in Appendix A.

2.3. Sample

This study's sample was contacted through mailing list distribution addressing organizations in the north of Portugal and the north of Spain. Over five thousand organizations (companies, foundations, local councils, etc.) were reached across the study regions. The survey remained opened between 15 December 2019 and 9 November 2020.

The sample is described in Table 1 and includes 294 respondents. The table shows the distribution of entities/companies per region, activity sector, number of employees, possession of some type of environmental certification, and respondent position within the company.

Table 1. Sample description.

	n	Percentage
Region		
Castilla y León	144	48.9
Galicia	69	23.5
North of Portugal	64	21.8
Others	17	5.8
Sector		
Services	100	34.0
Others	69	23.5
Industry	49	16.7
Public Sector	31	10.5
Agriculture	30	10.2
Tourism	15	5.1
Position		
Manager	105	35.7
Executive	68	23.1
Technician	60	20.4
Other	35	11.9
CEO	16	5.4
Environmental manager	10	3.4
Employees		
Less than 50	232	78.9
Between 50 and 250	30	10.2
More than 250	32	10.9
EMS Certification		
None	222	75.5
Others	30	10.2
ISO 14001	27	9.2
EMAS, ISO 14001	9	3.1
ISO 14001, Others	4	1.4
EMAS	1	0
EMAS, ISO 14001, Others	1	0
Total	294	

2.4. Data Analysis Methodology

All the closed answers, initially in Excel format, as they were multiple answer questions, allowing for more than one answer, were fragmented in *n* variables, with *n* being the number of items for each answer, and codified in 0 and 1 (0 for unselected items and 1 for every selected item). After that, the data were imported and treated with IBM-SPSS Statistics 27. In a first approach, a descriptive analysis of the answers was made. After that analysis, knowing that the respondents were mainly managers, executives, or technicians and that the sample was composed mainly of two sectors—industry and services—non-parametric statistical tests were applied. Chi-square tests of independence and goodness-of-fit were used to study the following hypotheses:

Hypothesis H1. *Proportionately, the answers' distribution to each "Question about CE" is identical;*

Hypothesis H2. *The answers to "Question about CE" are independent from "Position occupied within the company: Manager, Executive and such, or Technician";*

Hypothesis H3. *The answers to "Question about CE" are independent from "Activity sector, be it industry or services".*

The open answers were processed with the qualitative data analysis software NVivo12. The data were analyzed using Qualitative Content Analysis [38]. This method consists of an assessment of the frequency of the same or similar codes throughout a text, followed by a report that highlights the similarities and differences in the data. Thus, the open answers' analysis was conducted as follows: (1) translating the answers from Portuguese and Spanish to English; (2) back-translating the answers to their original language to confirm the translation's quality; (3) answers' codification; (4) code frequencies' analysis.

3. Results

3.1. Descriptive Analysis

3.1.1. Closed Answers

The concepts that the entities most frequently associated with Circular Economy, with the possibility of multiple choice, are shown in Figure 1. The most popular choice was "resources optimization" at 14.4%, followed by "waste reduction" at 13.4%, "responsible production" at 12.8%, and "recycling" and "repair and reuse" both with 11.5%.

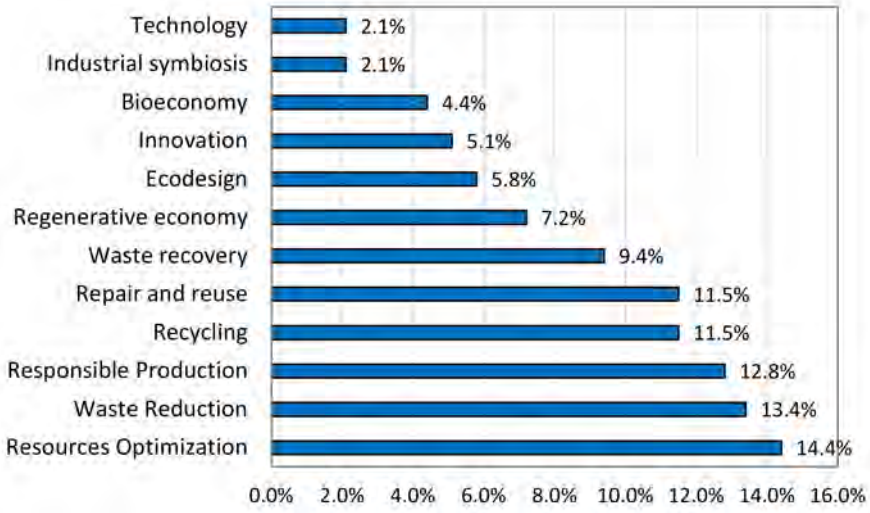

Figure 1. Concepts most frequently associated with CE.

Regarding the strategic areas where the entities/organizations most implemented CE, results can be found in Figure 2. With the option of multiple choice, we could determine that 15.8% chose "entity's mission and vision", 14.7% "environmental policy or environmental management system", and 10.3% "raw material purchasing-supply policy".

As it regards motivations to embrace Circular Economy, "environmental reasons" was the most frequently mentioned answer with 30.3%, followed by "socioeconomic reasons" (16.3%) and "corporate reputation" (16.2%). "Financial reasons", such as the access to subsidies or tax benefits, was the least reported issue, at 3.8% (Figure 3).

Regarding the difficulties faced by the entities in the process of implementing CE, the most mentioned answer was "lack of information and guidance" (21.4%), followed by "lack of financial resources" (19.6%) and "lack of technological solutions" (14.9%) (Figure 4).

Figure 2. Strategic areas where CE was implemented. R&D&I: Research and Development and Innovation; CSR: Corporate Social Responsibility.

Figure 3. Reasons why the entities embraced CE.

Figure 4. Difficulties faced by the entities in the process of implementing CE.

When asked about the factors that can ease the transition to CE, results show that many organizations reported the need for additional information and guidance, financial resources, and technological solutions. Additional less relevant factors included employees' training and more personnel (Figure 5).

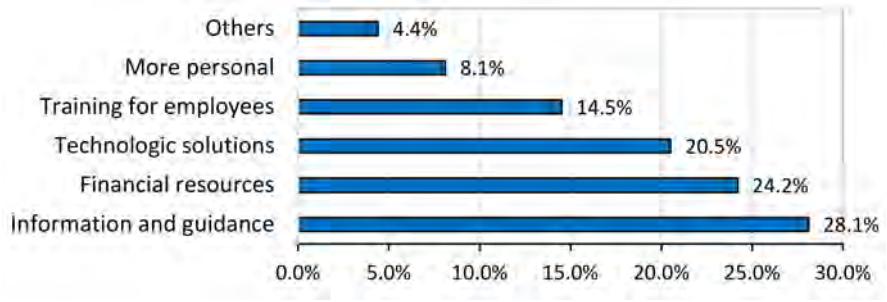

Figure 5. Factors that can ease the transition to CE.

3.1.2. Open Answers

As previously stated, the data from the open responses were analyzed with a text analysis tool, NVivo, to determine most frequently used terms. As it regarded the organizations' understanding of CE, the text analysis found the words "product" and "waste" to be the most frequent, followed by "use", "economy", "resource", and "reuse" as is illustrated in the word cloud below (Figure 6). The top ten most frequently used terms are listed in Table 2.

Figure 6. Word cloud of most frequently used terms in respondents' answer concerning what they understand by "circular economy".

Table 2. Top 10 most frequent terms used by respondents stating what they understand by "circular economy".

Term	Frequency
products	124
waste	111
use	89
economy	81
resources	79
reuse	71
materials	68
reduce	45
recycling	42
generation	40
sustainable	38
economic	38

Regarding the open question "How is circular economy's impact measured?" only 119 answers were registered. Most of the respondents, 39 (32.8%), admitted they did not measure it and four of these (3.4%) added they did not know how to perform such measurement. Other answers provided a miscellaneous perspective, composed of diverse answers such as "sales results", "rough approximation", "according to events' dissemination", "by monitoring", "team meeting", etc. These and the remaining answers are grouped in Table 3.

Table 3. Frequency distribution of the answers to the open-ended question "How is CE's impact measured?".

Answers: "How is CE's Impact Measured?"	Frequency
"It's not measured"	39
"In the implementation phase"	4
Through:	
"indicators . . . management, KPI [1], GRI [2], sustainability"	10
"consumption reduction"	7
"environmental calculation", "CO_2 emissions decrease" "carbon footprint"	6
"cost decrease"	4
"waste reduction"	4
"energy drop"	4
"% of recycled residue"	4
"client acceptance/appreciation"	4
Diverse answers	33

[1] Key Performance Indicator. [2] Global Reporting Initiative.

We would also like to stress how it is that in the bigger companies (more than 250 employees) that the use of indicators is more prevalent, as open answers suggest, while smaller companies (less than 50 employees) do not measure the impact of CE. Regarding regional differences, Galicia was where there was a greater resource to indicators, followed by Castilla y Leon and, only after that, Portugal.

3.2. Data Inferential Analysis

The Chi-square goodness of fit test was applied to all questions in order to assess whether the proportion of items selected was identical. The *p*-values were all less than 0.0005, suggesting that the proportion of responses for the different items/answers, in each question, was not the same (Table 4).

Table 4. Chi-square and *p*-value resulting from the application of the goodness of fit test to each question.

Questions	χ^2	*p*-Value
Concepts most associated with CE	159.187 ***	<0.0005
Strategic areas where CE was implemented	100.001 ***	<0.0005
Reasons why the entities embraced CE	532.875 ***	<0.0005
Difficulties faced in the implementation of CE	186.358 ***	<0.0005
Needs in order to transition to CE	155.399 ***	<0.0005

*** $p < 0.001$.

The Chi-Square test of independence was used to determine if the two nominal variables: "Questions about CE" and "Position occupied within the company: Manager, Executive, and Technician" were independent (Hypothesis H2). The obtained results of χ^2 and *p*-value are presented in Table 5.

Table 5. Chi-square and *p*-value resulting from the application of Chi-square test of independence to the nominal variables "Questions" and "Position occupied in company".

Questions	χ^2	*p*-Value
Concepts most associated with CE	55.434 ***	<0.001
Strategic areas where CE was implemented	55.431 ***	<0.001
Reasons why the entities embraced CE	32.379 **	0.009
Difficulties faced in the implementation of CE	34.391 *	0.011
Needs in order to transition to CE	11.450	0.491

* $p < 0.05$. ** $p < 0.01$. *** $p < 0.001$.

The results show that there is a significant relationship between the first four questions and "Position occupied within the company". Thus, for each item within a question we compared the answers' proportions for each position within the company, using Bonferroni's correction. The results showing differences of statistical significance are presented in Table 6.

Table 6. Proportion of answers to each question according to the positions occupied within the company and respective *p*-value, when there is a difference of statistical significance.

	Proportion (Number of Answers by Number of Individuals in a Given Position)			
Question	**Manager A**	**Executive and Such B**	**Technicians C**	***p*-Value**
Concepts most frequently associated with CE				
Eco-design	0.035	0.065	0.085	(A,C) * 0.041
Responsible Production	0.117	0.175	0.102	(B,C) * 0.042
Recycling	0.153	0.095	0.080	(A,C) * 0.018
Strategic areas where CE was implemented				
Strategic partnerships and cooperation	0.054	0.107	0.092	(A,B) ** 0.003
CSR policy	0.054	0.064	0.025	(B,C) * 0.017
Purchasing policy and relationship with suppliers	0.078	0.081	0.042	(B,C) * 0.014
Reasons why the entities embraced CE				
Socioeconomic reasons	0.171	0.154	0.103	(A,C) * 0.049
Environmental reasons	0.331	0.291	0.278	(A,C) * 0.033
Institutional reasons	0.069	0.114	0.183	(A,C) ** 0.004
Difficulties faced in the implementation of CE				
Lack of technological solutions	0.164	0.182	0.096	(B,C) * 0.015
Lack of commitment from the top management	0.020	0.057	0.072	(A,C) * 0.035
Lack of training from the employees	0.060	0.082	0.136	(A,C) * 0.022

* $p < 0.05$. ** $p < 0.01$.

The results, based on a two-sided test, show that, proportionately, technicians associate "eco-design" to CE more significantly than other positions, and the difference in answers between technicians and managers is statistically significant (*p*-value = 0.041). Alternatively, managers associate CE with "recycling" proportionately more than the other two positions, and, like before, there is a statistically significant difference in comparison with the technicians' answers (*p*-value = 0.018). Executives give higher importance to "responsible production", with differences of statistical significance (0.042) between the proportion of executives' answers and those of technicians.

Regarding the strategic areas where CE was implemented, a greater proportion of executives' answers include "strategic partnerships and cooperation", "CSR (Corporate and social reputation) policy", and "purchasing policy and relationship with suppliers".

Differences of statistical significance can be found in the executives and managers' answers' proportion for "partnerships and cooperation", as a strategic area of CE implementation, as well as in the executives and technicians' answers' proportion for the other two areas.

Concerning the reasons why entities chose to embrace CE, differences of statistical significance were found between the managers' and technicians' positions: while the first highlight "environmental and socioeconomic reasons", the latter value "institutional reasons".

As it regards to the difficulties faced in the implementation of CE, technicians emphasize "lack of commitment from top management" and "lack of employee training", demonstrating differences of statistical significance when compared to the managers. Executives consider that difficulties come from "lack of technological solutions", showing differences of statistical significance when compared to the technicians as well.

Similarly, the Chi-square test of independence was used to determine if the two nominal variables, "Questions about CE" and "Activity sector: Industry and service" were independent (Hypothesis H3). The results of χ^2 and *p*-value are shown in Table 7.

Table 7. Chi-square and *p*-value resulting from the application of Chi-square test of independence to the nominal variables "Questions" and "Activity sector: industry or services".

Question	χ^2	*p*-Value
Concepts most associated with CE	21.865 *	0.039
Strategic areas where CE was implemented	31.303 **	0.003
Reasons why the entities embraced CE	14.463	0.070
Difficulties faced in the implementation of CE	13.320	0.149
Needs in order to transition to CE	8.327	0.215

* $p < 0.05$. ** $p < 0.01$.

Only the answers to the two first questions depend on the activity sector. Thus, for each item within a question, we compared the answers' proportions between the two activity sectors using Bonferroni's correction. The results with differences of statistical significance are shown in Table 8.

Table 8. Proportion of answers to each question according to sector—industry or services—and respective *p*-value, when there is a difference of statistical significance.

	Proportion (Number of Answers by Number of Individuals in a Given Position)		
Question	**Industry**	**Services**	***p*-Value**
Concepts most associated with CE			
Responsible production	0.161	0.100	0.031 *
Recycling	0.084	0.141	0.048 *
Repair and reuse	0.077	0.138	0.034 *
Strategic areas where CE was implemented			
Environmental policy or environmental management	0.130	0.110	0.033 *
Raw material purchasing and supply policy	0.120	0.073	0.001 **
R&D&I area	0.060	0.031	0.013 *

* $p < 0.05$. ** $p < 0.01$.

Regarding the question about "concepts most associated with CE", we noted that industry makes a stronger connection with the concept of "responsible production", while services are more inclined to "recycling" and "repair and reuse", with differences of statistical significance (*p*-value < 0.05). As it concerns the strategic areas where CE was implemented, industry shows a greater tendency to introduce CE in "environmental policy or environmental management system", "raw material purchasing and supply policy", and "R&D&I" than the services sector.

4. Discussion

4.1. Descriptive Analysis

Regarding the concepts most frequently associated with CE, we would like to stress how, among the five most mentioned words, we found the 3 R's (reduce, reuse, recycle), the three starting CE principles. CE perception comprises preemptive practical actions (resources optimization, waste reduction) and corrective actions (recycling, repair, and reuse)—which is in line with previous studies [39,40]. According to Darmandieu et al. [40], companies initially go for a combination of preemptive and corrective actions, so as to enhance resource efficiency, and only at a later stage do they progress to more expensive practices, demanding more considerable investments. Maybe this mindset explains why concepts such as "innovation", "eco-design", and other practical preemptive efforts that call for an early investment are quoted to a lesser degree. The industry sector amounts to 16.7% of our sample and just 2.1% of respondents picked "industrial symbiosis". Considering that the majority of industries today belong to some sort of industrial association, and the greater part of industries are located in their own designated site, close to each other, in industrial parks, it would be expected that industrial symbiosis would naturally develop. Nevertheless, this concept was among the least chosen.

On the other hand, companies' awareness of sustainable development is clearly present when "responsible production" is the third most cited concept.

"Entity's vision and mission" was the strategic area where entities most admitted to having integrated CE (15.8%). Considering how sustainable development operationalization is best achieved through CE practices [7,9] and, according to Naudé [26], only when companies align sustainable development with business vision and strategy can it be successfully implemented, our results suggest that entities from the studied regions are on track to achieve sustainable development. The second most quoted strategic area was "environmental policy or environmental management system" (14.7%). According to Garcés-Ayerbe et al. [41], the first CE practices implemented by small and medium sized enterprises, at the time, pertained to pollution control; currently, companies implement strategies that involve proactive environmental strategies of pollution prevention. Banerjee [42] proposes that companies integrate environmental issues in the company's strategy because they have discovered that the more proactive they are in what regards environmental issues, the more sustainable the company becomes in the long term. These environmental concerns are in line with the priority objectives of the eighth General Union Environment Action Program (EAP) to guide the EU's environmental policy to 2030 and align it with the European Green Deal [20,43].

This statement helps us frame our own results which show that the main motivation for companies to embrace CE was "environmental reasons" (30.3% of answers), with "socioeconomic reasons" (16.3%) in second place. Socioeconomic reasons include production costs reduction, material and energetic resources reduction, the creation of new business models, job creation, etc. Darmandieu et al. [40] concluded that circularity in production processes generates a reduction of firms' production costs. Cutting down costs is a great motivation for companies to implement circular practices [44,45]. Coincidentally, product circularity creates what are known as green jobs, which seem to be related to the increased revenues—benefit of environmental innovation in products [46].

"Corporate reputation" was also pointed out as one of the reasons to change to CE, at 16.2%. In a UN Global Compact-Accenture CEO Study [47], where 766 CEOs from all around the globe were interviewed, 75% stated that the main reasons for selecting sustainability strategies were the enhancement of corporate reputation and the potential to decrease costs and increase revenue. Currently, companies face both internal and external social pressures if they do not implement sustainable development strategies and practices, in addition to the permanent need to remain economically competitive and viable [26,48,49]. A study about small and medium Spanish enterprises showed that companies were worried about their company's image [50]. It is expected that prestige and company image improvement come from real sustainability strategies' communication,

dissemination and promotion to customers [50], which ends up translating to an increase in market shares.

Regarding any difficulties and obstacles faced in the implementation of CE, "lack of information and guidance" (21.4%), "lack of financial resources" (19.6%), and "technological solutions" (14.9%) rank highest. Funding plays a central role in CE innovation and stimulation. There are several European programs, such as Horizon 2020, Life Programme, COSME, EEAGrants, European Fund for Strategic Investments, Climate-Kic, etc., as well as instruments and initiatives at the national level (Portugal and Spain) that may function as funding opportunities for companies. Nevertheless, information about financial and fiscal support mechanisms to companies who may want to invest in CE do not seem to have been efficiently communicated. This statement is endorsed by the fact that only 4.2% of respondents selected financial reasons (subsidies, tax benefits, etc.) as a motivation to embrace CE.

The lack of information exchange between companies regarding CE benefits is also pointed out by Van Eijk [51] and Van Buren et al. [52] as a barrier to the implementation of CE business models. The transition from a linear economy to a circular one will only be possible if there is a collective effort from all stakeholders, aiming at a knowledge and innovation exchange. If a company's information is considered confidential, it will be harder to develop CE business models [53].

However, information is frequently deemed confidential due to the fierceness of the competition and how economic interests often overshadow social and environmental ones.

"Lack of financial resources" and "lack of technical skills" (technical and technological know-how) were also the most frequently mentioned barriers in literature review papers about small and medium enterprises [50,54]. The authors consider these two barriers to be intimately connected, since without financial means companies cannot invest in employee training, much less in hiring external specialists.

In a literature review by Aranda et al. [55], it was concluded that fund availability, the quality of the company's financial resources, and public subsidies and incentives have a positive effect in stimulating the implementation of CE policies, since they reduce exposition to risk and increase financial feasibility and the profitability potential of the CE investment projects. Ritzén and Sandström [56] claim the barriers for moving towards CE to be financial and technological, as well as structural, operational, and attitudinal: structural due to the lack of information exchange and unclear responsibility distribution, operational due to the lack of infrastructure (responsibilities and task division), and attitudinal due to the great aversion to risk and the business logic of taking small safe steps in the development of the organization.

These difficulties/obstacles described by companies from Spain and the north of Portugal are later requalified as company needs in the following question.

When you ask for a definition of CE in open-ended questions, most answers do not show a comprehensive understanding of the concept, giving only a definition which covers but a fraction of what CE entails. The definitions we received mainly focused on products/materials and waste. Here are some examples from answers we got: "Products which come back into the productive cycle", "a new production, consumption and valorization model in which waste is a resource; the end of single use economics", "It's reusing materials, products and waste", "Processes to limit the use of new materials, rather choosing to lengthen the life cycle of products which are to be thrown away". The top ten most frequently used words in this question confirms the results found by Nobre and Tavares [10].

From the 294 answers we got to the question "How is circular economy impact measured?", 175 (59.5%) were blank. From the 119 answers, 39 (32.8%) said it was not being measured. It is important to stress that if we count our blank answers as "not being measured", that means 72.8% of companies are not measuring the impact of CE. Golinska et al. [57] claimed that the problem with sustainable development application to daily business operations was the lack of sustainability indicators. The same authors did a

literature review and came up with a set of criteria/indicators used to assess companies' performance in the economic, environmental, and social areas. In our present study, looking at the number of ambiguous and subjective answers concerning the way CE's impact is being measured, as well as the answers stating clearly that measuring procedures are not known, we seem to be facing a problem of unfamiliarity with the existence of indicators and/or how to apply them. Nevertheless, the use of indicators to calculate economic, social, and environmental payback from the implementation of CE practices in a company is absolutely crucial.

From the ten respondents who used indicators, only two mentioned using those which rated the company's sustainability performance in all three areas (economical, environmental, and social)—using GRI and sustainability indicators. If we consider that "waste reduction", "energy drop", "consumption reduction", and "percentage of recycled waste" contribute to the company's environmental performance, we can say that 25 companies (21% of organizations resorting to them) use environmental indicators—once again showcasing CE origins, originally considered as a tool for projecting environmental solutions.

4.2. Inferential Analysis

The outcome suggests that the focus of managers is on reactive actions or end of the pipe interventions, such as recycling, that allow companies to decrease costs of raw material transportation and the final destination of waste, such as landfills or incineration.

On the other hand, technicians highlight eco-design, an action that precedes the productive process itself, allowing a better management of the product's life cycle, its value chain, and integration in closed loops processes. In these processes, waste is used as an input, thus eliminating the notion of an undesirable by-product within and outside the industrial system [58], highlighting the technicians' greater knowledge and sensitivity to the sustainability issue. Once again, the results suggest that there is a need to raise awareness to the subject, especially among management members, towards whom training should be directed. Finally, executives value "responsible production" more than other company roles. This group seems to be more concerned with the "minimization of waste, energy, and pollution", as well as the company's image to be presented to stakeholders and the community at large. Executives, having a significant influence over the company's strategy, when considering CE implementation, give proportionately more attention to the areas of "strategic partnership and cooperation", "corporate and social responsibility policy", and "purchasing policy and relationship with suppliers", than their managers and technicians counterparts.

Alternatively, "strategic partners and cooperation" is the least relevant area to managers, who seem to be more focused on their own company—at the micro level. The benefits that can emerge from the meso level—an industrial park, for example [59]—are in line with the 17th Sustainable Development Goal of the UN's "Partnerships for the goals" [60]. Companies in the same region and even in the same sector of activity should create symbiosis, such as sharing infrastructure and equipment.

Regarding the reasons why entities chose to embrace the transition to CE, results suggest that there are no great differences between the three groups' perspectives as it regards to their valuing of socioeconomic and environmental reasons, even if managers value this perspective more than executives and technicians. Nevertheless, from an institutional point of view, executives and technicians seem to have a better understanding of CE repercussions.

Langen et al. [61], in a study about the perceptions and awareness of three professional groups—administrators, economists, and researchers—concluded that administrators/managers were also more focused on socioeconomic issues, in particular, in using CE for economic growth and job creation.

Managers' lesser sensibility towards institutional motivations for adopting CE suggests that, once again, this group is focused on a micro-vision of their business, on their own company, and are not as aware of the benefits that may come from listening to stakeholders'

opinions and analyzing their close competitors' behavior. We had already seen this when looking at the importance managers gave to strategic partners and cooperation.

Regarding the obstacles faced in CE implementation in companies, it is interesting to see that the lack of technological solutions is mentioned at a greater scale by executives and managers and less so by technicians, which suggests that technicians might be aware of solutions that are not known, valued, or even considered by their hierarchical superiors, maybe due to reasons of a financial nature.

On the other hand, sustainable and environmentally friendly production and consumption technologies depend on technical know-how which can often be found in the innovative solutions offered by the company's suppliers and customers. The company itself frequently has neither the time nor the financial means to spend looking for solutions [52,62]. If we consider this, it is not surprising that executives and managers highlight the absence of technological solutions and consider "purchasing policy and relationship with suppliers" the main area for CE application, significantly more so than their technician counterparts.

Regarding "lack of commitment from the top management", this is relatively devalued by managers, and more significantly stressed by technicians and executives, which suggests that even if top management is in fact committed to CE, that is not the perception of their collaborators. On the other hand, "lack of commitment from the top management" can be a consequence of other barriers such as "lack of CE awareness", "lack of CE knowledge", and "lack of sense of urgency to the implementation of CE", aggravated by lack of know-how [61]. According to Droege et al. [63], "lack of commitment from the top management" is a cultural barrier which leads to structural problems in the company. Managers' aversion to risk can make CE implementation more difficult, even after an assessment of the benefits associated with it [53,64].

Regarding the concepts most associated with CE, the industry sector values "responsible production", while services give precedence to "recycling" and "repair and reuse"—concepts which align themselves with the activity sector.

In fact, "responsible production" has been receiving increasing attention from the industrial sector [65] since it was presented as the 12th objective for sustainable development [60]. Responsible production is based on an Extended Producer Responsibility (EPR) approach [66], a policy which makes the company accountable for the environmental impact of their products manufacture, since its conception, until the end of its life cycle [67]. Since it makes the producer directly responsible for the real impacts of production, it is easy to understand why the industrial sector is so focused on responsible production.

Alternatively, the services sector does not assume any responsibilities of this kind. In a study conducted by the University of Gloucestershire in the UK, it was possible to determine that the hospitality sector dedicates itself mainly to waste management and recycling [68]. The food sector also focuses its CE efforts on recycling, namely waste, cooking oil, and paper, as well as paying some attention to energy and resources minimization [69]. Regarding the strategic areas in which CE was implemented, the industry sector values "environmental policy or environmental management system", "raw material purchasing and supply policy", and "R&D&I" more than the services sector.

The importance attributed to "environmental policies and environmental management" is a consequence of the growing pressure on industrial activity, namely in what regards emission restriction, production of solid waste, and waste dumping in landfills [58]. Concerning the purchase of material resources and stocking policies, we have already discussed Extended Producer Responsibility (EPR) [66]. On the other hand, it is important to highlight that the supply chain and its management are considered to be of great importance to responsible production in the literature [65]. Moreover, there is empirical evidence encouraging the promotion of circular supply chains, aiming for increased operational efficiency, company competition, and economic performance [70,71]. This means that on a micro and meso level, there is evidence that a sustainable supply chain allows for CE performance improvement in eco-industrial parks [59].

Finally, the current focus of research, development, and innovation is lined up with the perception that the industrial sector's focus should be the innovative conception of products [72], eco-innovation [44,73], green technologies [74], responsible production [75], and use technologies from Industry 4.0, such as Artificial Intelligence (AI), Internet of Things (IoT), Blockchain, and Big Data [71,76–81]. The literature further states that innovation is the basis for new ways of producing goods, retaining resources value in the productive processes, and promoting disruption and reformulation, thus contributing to the application of CE [82].

5. Conclusions

This study offers some perspective on the current CE integration panorama in organizations from three regions in the north of the Iberian Peninsula, allowing for the understanding of their motivations, difficulties, and needs.

The concept of CE, as perceived by the majority of respondents, does not really encompass its complexity, particularly if we consider the fact that the most commonly offered definitions entail the concepts of waste valorization/reduction/reuse/recycle. Nevertheless, results indicate that there is a greater awareness from these companies' officials regarding sustainable development and responsible production, in particular. On the other hand, industrial symbiosis seems to be underdeveloped in these regions. In that sense, existing regional industrial associations should take measures to increase industrial symbiosis between their affiliated companies.

Environmental issues continue to be the main reason for CE practices implementation in organizations. However, the image the company transmits to employees, stakeholders, and the community has been gaining importance, with corporate reputation as a secondary factor.

Many companies complain about the lack of information and guidance, not only concerning productive and operational processes that can lead the way for a transition to CE, but also concerning the availability of financial and fiscal support, namely for those companies that are interested in investing in CE. It is noticeable that there is a general unfamiliarity with European and transnational financial guidance, and information regarding support programs.

Moreover, results show that the answers to questions concerning the perception on CE, its integration and difficulties faced in its implementation depend on the respondent's position within the company (manager, executive, and technician). Similarly, we were able to find differences between the two different activity sectors—industry and services, as it regards to their perception of CE and areas of its implementation. Because these opinions are representative of each particular sector/organization and position occupied, these results may be used in future research with due caution, if applied to a different context.

Our results further show that the majority of companies, about 72.8%, does not measure the impact of implemented CE practices. Consequently, there is a need for strengthening the dissemination of information and training indicators regarding CE in general, and particularly regarding monitoring indicators. Larger companies show a greater awareness about the need for assessment indicators when compared to smaller companies. Changing our measuring practices is paramount as it can help demonstrate the benefits of CE implementation, ensuring recognition of its competitive advantages, beyond short term perception.

It is crucial and urgent to stimulate every entity/organization and society at large to raise awareness of the importance of CE as a vital premise for long term sustainability.

Overall, this article offers a new perspective to the current knowledge on Circular Economy practices implemented by organizations in a cross-border context, between Portugal and Spain. Additionally, it can be considered a valuable contribution to the current knowledge on the factors affecting CE implementation by organizations. As its results were already used as a basis for the actions developed under the Circular Labs POCTEP Project, this article offers valuable contributions that should be considered in the

future development of CE initiatives, such as awareness campaigns, funding programs, or cooperative actions.

6. Limitations and Future Research

The answer dispersion through each question's items hindered the application of some statistical tests, namely for inter-region comparisons, which was made impossible by low frequencies. As previously mentioned, the data were collected from three regions in the Iberian Peninsula and although some valuable conclusions can be deducted, the study would profit from more data from these regions. Looking at future work, it would also be interesting to replicate the study in different regions and check if the results are the same.

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Appendix A Questionnaire

1. General Information

1.1 What position do you occupy within your company?
1—Head of environmental management
2—Manager
3—CEO and such
4—Technical staff
5—Administration and finance
6—Other
If you answered "other" please specify: Your answer
1.2 Which sector does your entity belong to?
1—Industry
2—Services
3—Agrarian
4—Tourism
5—Public sector
6—Other
If you answered "other" please specify: Your answer
1.3 How many employees does your company have?
1—From 0 to 50 employees
2—From 50 to 250 employees

3—Greater than 250 employees
1.4 Does your company have any kind of environmental certification? *
1—None
2—EMAS
3—ISO 14001
4—Other
1.5 In what region is your company located?
1—Castilla y Leon
2—Galicia
3—North of Portugal
4—Other

2. Circular Economy

2.1 State the three concepts you most associate with circular economy.
1—Bioeconomy
2—Eco-design
3—Regenerative economy
4—Innovation
5—Responsible production
6—Waste reduction
7—Recycling
8—Resource optimization
9—Repairing and reusing
10—Industrial symbiosis
11—Technology
12—Waste valorization
What do you understand by circular economy? Your answer

3. Vision for Circular Economy in Your Company

3.1 In what strategic area was circular economy integrated in your company?
1—Entity's mission and vision
2—Environmental policy or environmental management system
3—Raw material purchasing-supply policy
4—Engineering and design
5—Staff policy
6—Business model
7—R&D&I policy
8—Strategic partnerships and cooperation
9—CSR policy
10—Communication strategies and corporate branding
11—Marketing and sales policy
12—Purchasing policy and relationship with suppliers
13—R&D&I area
Give other examples if needed: Your answer
3.2 In your opinion, why has your company embraced a transition to circular economy?
1—Socioeconomic issues (economic crisis, new business models, shortage of material and energetic resources, job creation, production costs economy, . . .)
2—Environmental issues (climate emergency, environmental impact, . . .)
3—Institutional issues (global pacts, strategies, plans and government programs, . . .)
4 -Technological issues (key sectors' technological development, promotion of innovation, . . .)
5—Financial issues (subsidies, tax benefits, . . .)
6—Growing customer demand
7—Corporate reputation
8—Sales strategy

4. Obstacles and Difficulties

4.1 What are the main obstacles you faced in trying to implement circular economy in your company?

1—Lack of information and guidance
2—Lack of technological solutions
3—Lack of financial resources
4—Lack of staff
5—Lack of a clear legal and/or regulatory framework
6—Lack of customer interest
7—Lack of commitment from top management
8—Lack of employees' training
9—Other
If you answered "other" please specify: Your answer

4.2 What would you need to facilitate your company's transition to a circular economy?

1—Information and guidance
2—Technological solution
3—Financial resources
4—More staff
5—Employees' training
6—Other
If you answered "other" please specify: Your answer

4.3 If circular economy actions are already in place in your company, please state how their impact is being measured: Your answer

5. Circular Economy Practices

If you wish to share or promote any good circular economy practices already in place in your organization, please state so in the following boxes.

5.1 Ecologic design for products or services (aiming at waste prevention, product durability, recycling and repairing potential):

5.2 Purchasing criteria (supply of secondhand product with ecologic tags, remanufactured or updated, made from recycled materials):

5.3 Servitization and new business models (co-operative economics, subscribing to a service, rather than buying a product, etc., . . .):

5.4 Cooperation or commercial symbiosis (subproducts and material resources swap, resources or equipment sharing, etc.):

5.5 Staff training in environmental issues and/or circular economy.

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