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Mapping Circular Economy in Spain with LinkedIn data

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Abstract

This paper presents a quantitative approach that captures the LinkedIn information that can be derived regarding companies and jobs that operate in a circular economy context. To do so, we perform this analysis for the regions of Spain, providing metrics for the standardization of the companies identified, for measurement reasons, while job posts and other information is analyzed. Finally, heatmaps and other graphs demonstrate the distribution of LinkedIn information for the various regions of Spain, concluding that Spain's regions do not perform in a homogenous way in LinkedIn regarding the circular economy.

Keywords: *Circular economy; networking; social media; online job posts; LinkedIn.*

1. Introduction

Social media provide alternative and useful information regarding individuals, job posts, companies, sentiment, and other features, capable of benefiting enthusiasts and stakeholders (Utz, 2016). LinkedIn is a professional platform that operates globally, therefore a plethora of information can be derived regarding the business activity (Davis et al., 2020).

Transforming from linear to circular business models within a company is vital for enhancing business performance since it promotes resource efficiency by reducing waste and optimizing the use of materials, leading to cost savings and improved operational efficiency while boosting innovation in product design, manufacturing processes, and business models, which can drive revenue growth and market differentiation. Consequently, examining the circular economy (CE) through LinkedIn is crucial as it facilitates professional networking, highlighting business opportunities, and enabling knowledge sharing.

LinkedIn is a social network that focuses on business and employment aspects. In this regard, information can be derived for several analyses, including content effects of sales revenue on business-to-business services (Mora Cortez et al., 2023), individuals' participation impact on social capital formation in the context of LinkedIn (Mashayekhi and Head, 2022), or the relationship between the number of followers on the funds raised by companies (Banerji and Reimer, 2019).

LinkedIn has been already used for the investigation of several aspects of companies that operate in various frameworks. For example, Daglis and Tsagarakis (2024) utilize LinkedIn data to examine U.S. healthcare companies operating within a COVID-19 framework, revealing distinctive characteristics and activities primarily in the "Health, wellness, and fitness" sector. Noteworthy, there are also a few studies already examining CE aspects through LinkedIn information. Tsironis et al. (2022) utilized LinkedIn data to assess the engagement of companies in circular economy activities in the EU, while Daglis et al. (2023) used LinkedIn data to measure circular economy interest and examine the relationship between keywords related to the circular economy and sustainability, demonstrating statistical significance in how circular economy keywords affect sustainability ones. Moreover, Tsironis and Tsagarakis (2023) discuss circular economy principles in the apparel, fashion, and textiles industry sectors based on data from companies' LinkedIn profiles, highlighting the emergence of companies worldwide, with a focus on recycling, repairing, reusing, and other related activities. Finally, Tsironis et al. (2024) leveraged LinkedIn data to explore global CE business activities, revealing insights into the geographical distribution of these companies, industry sectors, employee counts, followers, and foundation years. This study highlights the significant increase in new CE companies over the last decade and identifies prevailing strategies like reuse, reduce, and recycle, evident in companies' profiles and interactions.

Despite this subject's significance, not all mentioned techniques have been collectively applied to a region, therefore, we investigate the performance of Spanish companies in LinkedIn within the circular economy framework. Acknowledging this gap in the literature, this paper provides an empirical analysis that describes the Spanish performance in a country and regional context. The results indicate that the Spanish regions do not operate homogenously in a CE context.

2. Data & Methodology

To analyze corporate engagement in Circular Economy (CE) across different regions of Spain, we start by identifying the number of companies involved in CE activities in each region. Next, we determine the total number of companies operating in each region. By dividing the number of CE-engaged companies by the total number of companies in each region, we derive a metric that allows for direct comparison of CE engagement across regions. The formula used is as follows:

$$\frac{circular\ economy-related\ companies}{total\ number\ of\ companies} \quad (1)$$

Similar indicators can be derived by checking on the number of personal profiles or jobs in the regions. Furthermore, we searched for LinkedIn jobs using the query term "circular economy" and the location 'Spain', and then applied a set of filters provided by LinkedIn for a better understanding of the circular economy job market in Spain. We ran the query on 09/03/2024 at 22:50. We decided to use the English term "circular economy" instead of the Spanish term "economía circular" because the former returns much more results. The LinkedIn search service returned 125 jobs. Out of these jobs, 49 (39.2%) were posted the past week and 101 (80.8%) the past month. As regards the language of the job description, the large majority of the jobs are described in Spanish (84%) and the remaining in English (16%). Finally, we have searched for the industries, the year of establishment, and the specialties, entered by the selected companies.

3. Emperical Findings

We first present the companies heatmap of the regions of Spain. The distribution comes first for Catalonia, followed by the Community of Madrid, then Basque country, then comes the Balearic Islands, followed by the Valencian Community, then Aragon, Region de Murcia, Galicia, Castilla and Leon, Principality of Asturias, Castilla-La Mancha, Andalusia, and finally the Canary Islands. Based on the heatmap, the northeastern Spanish regions indicate more CE-related companies, while the south and west, have the least.

Regarding the experience level of the job postings, we notice that the majority of jobs concern mid-senior level (24.8%), followed by entry-level (20%) and associate (18.4%). Internship-level jobs occupy 10.4% of all jobs, while only 2.4% (3 jobs) are of the more senior 'director' level and 1.6% (2 jobs) of 'executive' level.

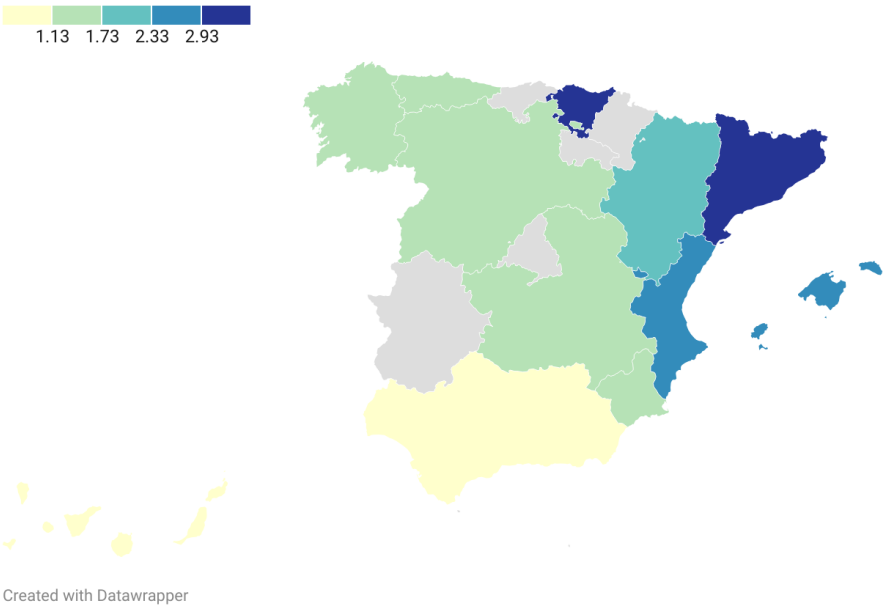

Figure 1. Heatmap for the CE companies' engagement for the Spanish regions.

Regarding the mode of operation, jobs offered are 54.4% on-site, 44.8% hybrid, and the remaining 0.8% (just one job) remote. Regarding the job type distribution, the large majority of jobs concern full-time employment (83.2%), followed by internship (7.2%) and contract (6.4%). Part-time employment is offered by only 2 jobs (1.6%). The most frequent locations of the job postings are Barcelona (19 jobs / 15.2%) and Madrid (14 jobs / 11.2%), followed by San Sebastian (9 jobs / 7.2%), Manresa (5 jobs / 4%) and Tarragona (4 jobs / 3.2%).

Figure 2 (left panel) shows the most frequent industries of the jobs. As expected, the majority of jobs are in 'Environmental Services' (13.6%), followed by 'Research Services' (10.4%), 'Engineering Services' (6.4%), 'Business Consulting and Services' (6.4%), and 'Technology, Information and Internet' (6.4%). It is also interesting that there are 7 jobs (5.6%) in the 'Oil and Gas' industry. Figure 2 (right panel) shows the most frequent job functions. We see that 'Engineering' is the most frequent function (26.4%), followed by 'Information Technology' (21.6%) and Management (16.8%). It is worth noting that oil and gas, construction, and industrial machinery manufacturing industries turn to circular economy, indicating that circular economy is desirable for various industries and fields, as well.

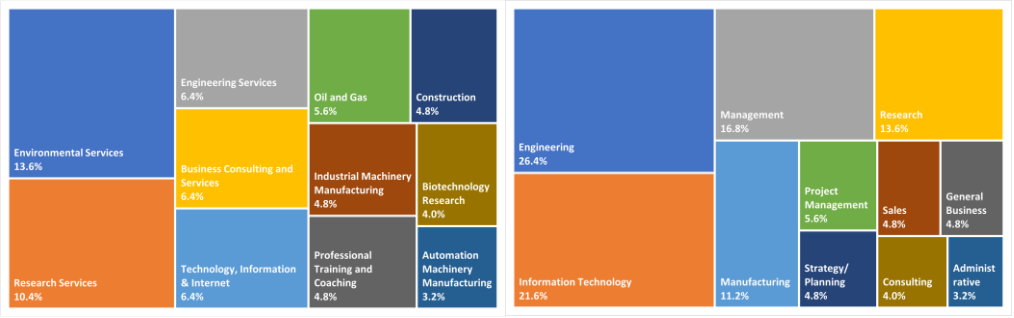

Figure 2. Job industries (left), and Job functions (right)

Based on Figure 3, the environmental services industry sector comes first, followed by renewables & environment, then comes information technology & services, plastics, higher education, packaging & containers, mechanical or industrial engineering, and many more. Note that LinkedIn company profiles are allowed to register only one Industry from a predefined list in English.

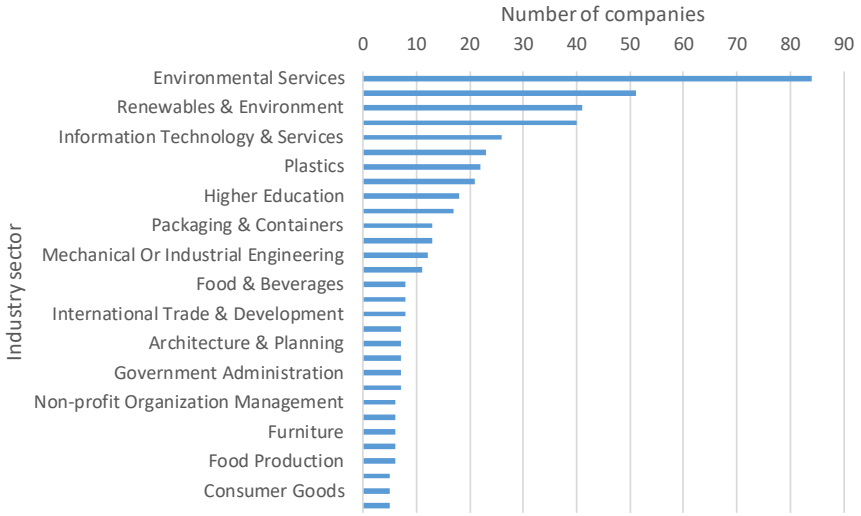

Figure 3. Industry sector frequency

The year with the highest number of companies' foundations is 2020, followed by 2021, and then 2018. After the year 2020 a decreasing trend is evidenced, more details about the historical evolution of company profiles related to CE are displayed in Figure 4.

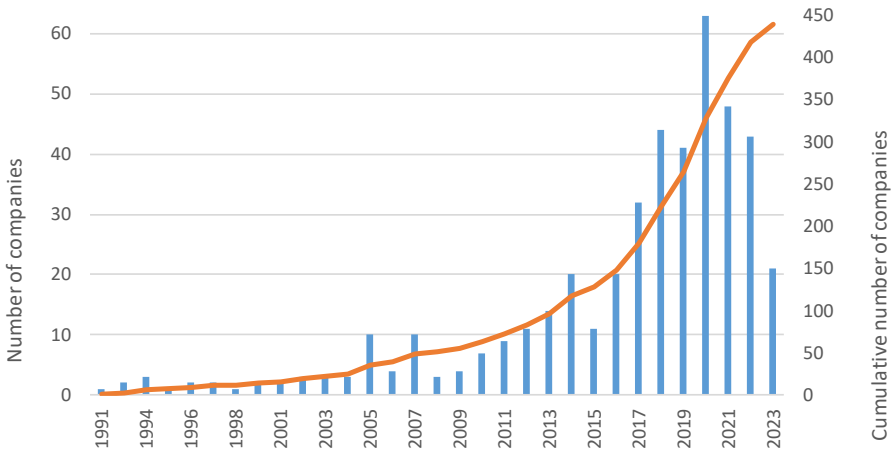

Figure 4. Year of establishment distribution.

Additionally, we investigated the descriptive statistics available for two significant metrics bound to the examined profiles, the followers and the number of LinkedIn registered employees. More analytically, followers indicate an average of 4037.5 and a standard error of 835.43, while staff count is 106.9, and 33.08, respectively (Table 1).

Table 1. Descriptive statistics of followers and staff

Statistics	Followers	Staff
Mean	4037.5	106.9
Standard Error	835.43	33.08
Median	425	3
Standard Deviation	20446.78	809.57
Kurtosis	110.54	239.21
Skewness	10.03	14.71
Minimum	0	0
Maximum	266494	14540
Sum	2418461	64012

Finally, we present the wordcloud for specialties (Figure 5) for the companies identified. Note that for each profile it is possible to enter from none to 20 specialties, which is equivalent to keywords. This is open to any number of words or languages. It is possible to get additional information from the descriptions of the companies, which is an open text. An initial assessment based on a word cloud is provided in Figure 6. These world clouds provide an initial assessment of the dominant activities, for example in the description section of the companies there is frequent mention to solution, product, service, innovation, material, and sustainability. There is however place for further cleaning and treatment to obtain a final classification.

Figure 5. Wordcloud for the specialties of the companies

Figure 6. Wordcloud for the description of the companies

4. Conclusions

Big data from social media can give essential information on topics of interest. Through this work, we provide an example of how data can be retrieved and analyzed for the circular economy, which can also be extended to any topic, focusing on any desired region or country, as well. Such an approach can provide important insights into the dynamics of circular economy attributes regarding various aspects of the domain of employment, at a regional, or global level. Our work provides important insights for stakeholders and decision-makers, who can benefit from trends and geographical indicators developed from this data. Finally, our work can be

expanded to a higher level of regional breakdown, scrutinizing the LinkedIn data per each region of Spain, and also providing a comparison, to demonstrate trends and probable future directions.

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