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Decoding the Circular Economy Job Market in the EU: A Quantitative and Comparative Analysis

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ABSTRACT

The circular economy (CE) is increasingly promoted as a pathway to sustainable development, yet systematic evidence on the structure of the CE labor market remains limited. Little is known about how CE-related job opportunities are distributed across countries, which job characteristics dominate this market, and how such patterns compare with indicators from other sources. In this study, we address these gaps by analyzing CE-related job postings from LinkedIn across EU countries and selected non-EU countries. Using a structured data collection and normalization approach, we examine cross-country differences in CE labor market size and key job attributes (work mode, job type, experience level, and job function). We further compare the introduced LinkedIn indicator with Eurostat employment data and research output. The findings reveal pronounced regional disparities, a negative association with official CE employment statistics, and a positive relationship with research activity, highlighting the potential of professional networking platforms in understanding labor markets.

1 | Introduction

The incorporation of sustainability principles into business practice is changing production and consumption systems and consequently labor markets. Within this transition, the circular economy (CE) is commonly viewed as a systemic alternative to the linear "take–make–dispose" model. The CE is usually described as an economic system enabled by business models that replace the end-of-life concept through strategies such as reducing resource use, reusing products, and recycling materials, thereby slowing, closing, and narrowing resource loops (Kirchherr et al. 2017; Geissdoerfer et al. 2017). More recent reviews have highlighted CE's consistent emphasis on closing material and energy loops, regenerating natural systems, and framing circularity as a systemic paradigm shift for sustainable production and consumption (Kirchherr et al. 2023).

This shift has direct implications for employment because it generates demand for new occupational roles and transforms existing jobs across industries. In this context, big data and business-oriented social networks, LinkedIn in particular, can offer valuable information for analyzing and understanding these changes. This makes LinkedIn, with over 1.2 billion members globally and more than 70 million companies registered across 200 countries, a valuable source for understanding employment across regions (LinkedIn 2026). Therefore, LinkedIn has emerged as a central point in numerous studies examining different dimensions of career development, personnel selection, talent management, and professional networking. Providing some characteristic examples, Demir and Günaydın (2023) studied the influence of social media on hiring decisions, Barata et al. (2023) investigated the rise of data science in job markets, whereas Deming and Kahn (2018) and Brumberger

and Lauer (2015) explored the skills demanded across different industries.

In the CE field, researchers have increasingly used LinkedIn and other professional networking platforms to explore organizational engagement with circularity and sustainability. Prior studies have demonstrated the value of LinkedIn data for identifying firm-level interest in CE concepts (Tsironis and Tsagarakis 2023), examining relationships between CE and sustainability (Daglis et al. 2023), and analyzing company engagement patterns across industries and countries (Tsironis et al. 2022, 2024). Country-specific case studies, such as those focusing on Germany (Knäble and Tsagarakis 2023) and Italy (Caferra et al. 2023), have further advanced understanding of how firms frame and adopt CE principles at the organizational level.

Despite these advances, existing research has mainly examined CE adoption at a firm or sectoral level, with limited attention given to how circular strategies are translated into labor market demand. As a result, we still lack systematic evidence on whether, where, and how CE principles are reflected in concrete job opportunities, how these opportunities differ across countries, and what types of roles and work arrangements characterize the CE labor market. This omission is theoretically relevant because employment constitutes a critical mechanism through which sustainability transitions are implemented. Moreover, studies on CE-related employment largely rely on official statistics that capture existing employment levels in specific sectors, offering limited insight into current labor market demand, emerging job roles, and cross-country differences. Consequently, it remains unclear how alternative (but timely) labor market data relate to official CE employment indicators and to existing knowledge production in the field.

To address these gaps, in this study, we systematically analyze CE-related job postings from LinkedIn across EU member states and selected non-EU countries. For the purposes of this study, we define a CE-related job as a LinkedIn job posting returned when searching for the term "circular economy" (or its official EU language equivalent) using LinkedIn's job search function. This is an employer-signaled definition: It captures roles where organizations themselves explicitly associate the position with the CE concept and ensure consistent, transparent, and replicable identification across more than 30 countries. At the same time, this constitutes a conservative delineation of the CE labor market, as it does not capture positions in which circular practices may be present but are not explicitly labeled as "circular economy". The rationale for this methodological choice and its implications, including potential biases toward underestimation of the full CE labor market, are discussed in detail in the limitations section. We note that the "circular economy" concept has achieved a high degree of standardization across policy, industry, and academic contexts (Kirchherr et al. 2023; European Commission 2020), providing a stable and cross-nationally consistent reference point for identifying CE-labeled roles.

We examine both the size and the characteristics of the CE job market, and compare a LinkedIn-based indicator with official Eurostat employment data and national CE research output. This analysis provides a novel perspective on the alignment (or misalignment) between policy, research, and labor market demand and contributes to a more comprehensive understanding of how CE strategies are implemented through employment and workforce development. In addition, we demonstrate how data from professional networking platforms can complement official statistics in capturing employment dynamics, with potential implications for firms, policymakers, and educators involved in CE-related workforce development.

The remainder of this work is organized as follows: Section 2 reviews the related literature and describes the research questions; Section 3 demonstrates the methodology followed; Section 4 presents the analysis results; Section 5 compares LinkedIn data with official statistics; Section 6 compares with research data; Section 7 discusses findings, implications, and limitations; and Section 8 concludes the paper.

2 | Literature Review and Research Questions

We first review the related literature and position our work, and then we detail the research questions that this study tries to answer.

2.1 | Literature Review

The adoption of CE and sustainability principles is changing the global labor market, with several implications for business practices and job opportunities. From a theoretical perspective, this study is grounded in two complementary frameworks. The first is sustainability transitions theory, specifically the multilevel perspective (Geels 2002; Markard et al. 2012), which conceptualizes the CE as a systemic sociotechnical transition that reshapes production and consumption regimes and generates new demands for skills, roles, and occupational profiles across industries and regions. This framework implies that CE-related employment should not be treated as a homogeneous or uniformly distributed phenomenon, but as an evolving and context-dependent expression of structural change, shaped by technological, regulatory, market, and cultural dynamics operating at different levels. The second framework is the labor market signaling perspective (Deming and Kahn 2018; Hershbein and Kahn 2018), a framing that has been operationalized in recent LinkedIn-based studies across different sectors (Nakash and Peretz 2025). When organizations post vacancies explicitly referencing the CE, they signal how CE strategies are being operationalized in concrete organizational contexts, making job posting data a timely, demand-side indicator of how the CE transition manifests in workforce development decisions. Together, these frameworks motivate both the use of LinkedIn job posting data as the primary empirical source and the comparative, cross-country design of the study while providing a lens through which the empirical findings can be theoretically interpreted.

As companies integrate the CE principles, the demand for sustainable jobs increases, causing shifts in hiring and personnel selection processes. Although the job market in the CE is highly heterogeneous, conventional data sources and literature are scarce regarding the skills and attributes of these jobs (Acerbi

et al. 2024). Therefore, social networks such as LinkedIn are important for this transformation, because they provide alternative ways to gather information regarding labor market characteristics, career development, and professional networking. This literature review focuses on LinkedIn's role in employment, particularly within the context of the CE, highlighting gaps in existing research on job market characteristics and employment conditions in CE sectors.

2.1.1 | LinkedIn and Employment Trends

Several studies have examined LinkedIn's multifaceted impact on employment and career development. For example, Sallach et al. (2024) argue that LinkedIn profile summaries can create expectations about organizational behavior, mediated by perceived personality traits like agreeableness, highlighting LinkedIn's significance in personnel selection processes. Moreover, Baruffaldi et al. (2017) explored LinkedIn's potential for career development, highlighting its evolution as a crucial platform for professionals and researchers. LinkedIn has expanded beyond traditional networking, as seen in Kauffman et al. (2022), who stress its growing role in education and job search activities. Other studies, such as Pena et al. (2022), argue on LinkedIn's influence on career outcome expectations, whereas Fernandez et al. (2021) underline the platform's reliability for personality assessment, showing that LinkedIn profiles can serve as indicators of personality traits relevant to job performance.

This body of work collectively demonstrates LinkedIn's relevance for understanding career development, hiring processes, and professional identity (Kwok and Muniz 2021; Orgad 2024; Alam et al. 2026; Cowley et al. 2024). Notably, Conde et al. (2025) provide longitudinal digital trace evidence that strategic LinkedIn posting behavior predicts career advancement among B2B sales professionals, further validating the platform's capacity to reflect meaningful employment dynamics beyond mere recruitment signaling. Critically, however, these contributions are subject to important limitations: most focus on individual-level outcomes, single national contexts, or specific occupational groups; they do not engage with LinkedIn's potential as a systematic, cross-nationally comparable data source for sector-specific or sustainability-oriented labor markets; and they treat the platform primarily as a recruitment tool or communication medium rather than as a structured source of labor demand signals. Viewed through the lens of labor market signaling theory, the studies reviewed here confirm that LinkedIn job postings carry meaningful signals about employer priorities, but they have not applied this insight to the CE context in a comparative, multicountry framework. This gap motivates the methodological approach of the present study.

2.1.2 | LinkedIn as a Data Source for Research

LinkedIn is a valuable data source for researchers investigating employment dynamics. Specifically, Daglis and Tsagarakis (2024) used LinkedIn data to analyze US healthcare companies operating within the COVID-19 framework, revealing key activities in the Health, Wellness, and Fitness sector, whereas Mora Cortez et al. (2023) explored how LinkedIn information, particularly business-to-business service posts, impacts firm performance by influencing customer engagement and sales revenue. Moreover, LinkedIn has been utilized to study key trends in emerging industries, with characteristic case studies including a focus on the profiles of data scientists, uncovering significant trends in talent development (Ecleo and Galido 2017). Finally, Chang et al. (2024) examined how external recommendations on LinkedIn affect career mobility. These studies provide insights into the merits of using LinkedIn as a tool to investigate professional trends in sustainability-oriented sectors, such as the CE, where there is limited research. To conclude, LinkedIn can offer rich information on sustainability (Dimakis et al. 2025) and CE topics (Tsironis et al. 2025), across a range of approaches, from descriptive analyses to advanced machine learning and natural language processing methods (Abdelmeguid et al. 2024). Alongside LinkedIn, Twitter/X data have also been used to study CE discourse at the practitioner level, revealing a dominance of recycling narratives and the relative neglect of short-loop R-imperatives in public CE discussions (De Lima 2022).

These studies collectively demonstrate the methodological potential of LinkedIn data as a research source across diverse domains. Researchers have used it to map career trajectories and professional identity (Navallas et al. 2024), to benchmark employer needs against academic output (Alzghaibi 2023), to automate candidate-job matching using profile data (Faliagka et al. 2014), to analyze multigenerational labor market dynamics (Alaql et al. 2023), and to track sector-specific job posting activity, as demonstrated in recent analyses of AI-related roles on LinkedIn (Nakash and Peretz 2025). Critically, however, these studies tend to focus on specific occupations, single countries, or non-CE sectors; they do not address the geographic distribution of job postings across countries or the structural characteristics of sustainability-oriented labor markets. The present study addresses precisely these gaps by applying LinkedIn job posting data to the CE context in a systematic and cross-nationally comparative manner.

2.1.3 | CE and Employment

CE aims to promote waste reduction and the efficient use of resources, increasing sustainability. Hence, CE principles often lead to changes in industrial processes, business models, and job roles. The shift towards a CE has several implications for the labor market, creating new opportunities in areas like recycling, eco-design, and green manufacturing, as well as transforming existing jobs in sectors like construction, healthcare, and fashion. More precisely, Kirchherr (2022) examines the relationship between CE and growth, arguing on the potential of postgrowth circularity and the risks of alienating practitioners, whereas Prosman and Cagliano (2022) address financial viability as a barrier to CE adoption using contingency theory to explore successful circular start-ups. Other studies, such as De Guimarães et al. (2023), focus on sustainable consumption and its drivers, offering insights into the environmental awareness that drives CE adoption. In industry-specific studies, healthcare has been examined

by Soares et al. (2023), whereas automotive and construction sectors are explored by Rizvi et al. (2023) and Guerra et al. (2021), respectively. The literature reveals the growing importance of sector-specific approaches to CE adoption. Yet this body of literature has not examined how this transition is reflected in job market dynamics, particularly at a global level. From the perspective of sustainability transitions theory, this is a significant analytical gap. If the CE is reshaping occupational structures, as the transitions literature predicts, this should be reflected in observable labor market demand signals. Yet existing CE employment research has not engaged with this demand-side dimension in any systematic or cross-national way, focusing instead on macroeconomic projections of job creation (Sulich and Sołoducho-Pelc 2022; Olekanma et al. 2024; LinkedIn 2024) or sector-level employment counts. This limits the theoretical and empirical understanding of how CE strategies are concretely implemented through workforce development and which national contexts are generating the most active labor market response to CE principles. Importantly, CE-induced employment effects are not uniform: Sector-specific analyses have shown that while reuse and recycling activities in the EU tend to gain jobs, labor-intensive production in non-EU countries may face significant losses (Repp et al. 2021). Subnational analyses further confirm this heterogeneity: In France, extension of use activities (repair, maintenance, reuse) accounts for the largest share of circular jobs, followed by recycling and waste recovery, whereas the spatial distribution of these activities follows regional administrative boundaries, reflecting the uneven influence of local public policies (Niang et al. 2024). This heterogeneity underscores the need to examine CE employment dynamics across countries and occupational functions rather than treating CE-related employment as a single, uniform phenomenon.

Overall, existing research on CE and employment has largely examined sectoral transformations, business models, or consumption patterns. There is a lack of empirical work that captures how the CE transition is translated into concrete job opportunities. In particular, systematic cross-country evidence on the job characteristics most in demand in the CE labor market remains absent. Some efforts have been made to quantify CE-related employment at the city level using input–output analysis combined with classifications of circular economic activities (Muñoz H. et al. 2022). At the subregional level, Niang et al. (2024) provide rare empirical evidence of actual CE job creation in France between 2008 and 2015, showing that CE employment grew at approximately 3%, outpacing overall employment growth of 1.49%, and that CE activities are spatially concentrated in metropolitan areas, with a strong regional effect consistent with the incentive role of local public policies. Nevertheless, national-level, cross-country, demand-side analysis of CE labor market characteristics remains underdeveloped.

2.1.4 | LinkedIn and the CE Job Market

Despite the relevance of LinkedIn for analyzing job market characteristics, few studies have examined the CE job market. For example, Daglis et al. (2023) utilized LinkedIn data to assess CE interest, focusing on how specific keywords related to CE and sustainability are employed in company profiles. Similarly, Knäble and Tsagarakis (2023) analyzed 514 German companies, revealing regional trends in CE-related activities. In addition, Tsironis et al. (2022) explored the engagement of companies in CE activities, examining geographic distribution and industry sectors.

These studies do not investigate the employment status or job opportunities within the CE sector. The analysis of job postings remains underexamined, and there is little research on the differences across regions as well as on how platforms like LinkedIn can help reveal these variations. Moreover, existing studies tend to approach CE adoption primarily at the firm/organizational level, leaving the employment dimension largely unexplored, especially in terms of job attributes and regional differences. Taken together, these critical observations point to a broader theoretical gap: Whereas sustainability transitions theory predicts that the CE should generate new, distinctive labor market demand patterns, and whereas labor market signaling theory tells us that job postings are a valid indicator of this demand, neither the CE nor the LinkedIn employment literature has brought these frameworks together to examine how CE strategies are reflected in concrete hiring activity across national contexts. This study addresses this gap directly.

2.1.5 | Positioning

Despite the growing body of research on LinkedIn and the CE, the reviewed literature reveals several important gaps. Existing studies mostly examine CE adoption at the firm, sectoral, or organizational level, or focus on individual career development and professional networking. These contributions provide valuable insights into how CE is discussed, adopted, or promoted; however, they offer limited evidence on how it is translated into labor market demand.

Specifically, prior work using LinkedIn data has largely focused on company engagement, keyword usage, or sector-specific case studies (often within single countries or industries). The job market dimension of the CE, particularly the analysis of job postings, job attributes, and regional differences, remains underexplored. In addition, existing research rarely examines CE-related employment from a comparative (across countries) perspective, despite the fact that the national policy frameworks and levels of CE adoption vary across regions. Furthermore, studies on CE-related employment that rely on official statistics typically focus on specific sectors (such as the recycling and repair sector) and tend to reflect existing employment levels, without capturing emerging roles and occupational profiles, as well as short-term changes associated with the (ongoing) CE transition. Consequently, there is still insufficient understanding of how labor market characteristics (as reflected by recent hiring activity) relate to official CE employment indicators and to knowledge production in the field.

Building on these observations, we aim to address these gaps by systematically analyzing CE-related job postings from LinkedIn across multiple countries. By examining both the

size and characteristics of the CE job market and by comparing LinkedIn-based indicators with official employment statistics and national research output, we contribute a novel, labor market-oriented perspective on the CE transition.

2.2 | Research Questions

The objective of this research is to shed light on the CE employment market, that is, how CE creates new opportunities (through innovative jobs) to support and promote sustainable development across different countries. Our key variable is the normalized number of CE-related jobs posted on LinkedIn, analyzed across countries and job attributes (mode of operation, job type, job experience level, and job function). A second objective is to examine how our results, which are based on professional networking data, compare to related data from other sources, mainly official statistics on CE employment in relevant sectors and the size of research output in the CE field. In particular, we address the following research questions (RQs):

- **RQ1**: Which countries offer the most CE jobs, both in absolute numbers and normalized by the total number of LinkedIn jobs in each country?
- **RQ2**: What are the attributes of CE jobs, in terms of mode of operation (on-site, remote, and hybrid), job type (full-time, part-time, etc.), job experience level (entry-level, midsenior level, etc.), and job function (sales, manufacturing, consulting, etc.)?
- **RQ3**: How do our findings regarding the CE job market compare to official statistics on CE employment?
- **RQ4**: What is the relation between the CE job market size (as reflected in LinkedIn data) and the research output size in the CE field across the considered countries?

These research questions aim to improve understanding of how CE principles translate to labor market demand across countries and job characteristics. The results can inform policy benchmarking, organizational decision-making, workforce development, and future research by highlighting cross-country differences, job market attributes, and divergences between labor market indicators, official statistics, and research activity. Detailed theoretical and practical implications are discussed in Section 7.

3 | Methodology

We adopt a quantitative approach to examine the CE labor market across countries using large-scale data from a professional networking platform. The analysis focuses on CE-related job postings collected from LinkedIn across all EU member states and selected non-EU countries, enabling a comparative (across countries) assessment of both labor market size and job characteristics. Our methodological approach combines systematic data collection, normalization procedures to account for cross-country differences in platform usage, and descriptive and comparative analysis. In addition, we consider data from official statistics and bibliometric sources to contextualize the LinkedIn-based indicators and assess their relationship with established measures of CE employment and research activity. Finally, platform-specific limitations are detailed in Section 7.7.

3.1 | Data Collection Protocol

3.1.1 | Searching for Jobs on LinkedIn

In LinkedIn search, the user is provided with several options that can narrow searches under "people," "jobs," "posts," "companies," "schools," "groups," "events," "courses," and "services." In our study, we exploited the "jobs" option. Figure 1 shows a screenshot of the LinkedIn job search service and its different components. In this example, we search for jobs related to "circular economy," and we have set "United Kingdom" as the job location filter. The search service shows the number of retrieved jobs (231 in this example) together with the top-ranked jobs. The user can now inspect one or more of the search results or apply any of the available filters, such as "date posted', "experience level," etc.

3.1.2 | Selection of Countries

In our analysis, we included all EU member states, along with the United Kingdom, the United States, Norway, and Switzerland, given their close ties with the EU. The complete list of countries considered is provided in Table 1. Additionally, we collected results for the broader region labeled "European Union," which is available as a distinct option in LinkedIn's location search field.

3.1.3 | Tackling the Language Problem

We found the official translations of the English term "Circular Economy" in all EU languages. The LinkedIn search service supports the OR operator (LinkedIn 2025), which, in our case, allows searching for jobs that contain any of the terms separated by OR. We use the same query for all countries (Table 2), as this ensures that all relevant jobs will be considered. For example, by searching with this query and selecting the country "Greece," the search service will return the union of the jobs containing in their description "circular economy" (in English), "κυκλική οικονομία" (in Greek), or the same term in any other language. Of course, for the case of Greece, we expect results using the Greek and English terms, whereas all other translated terms are (indirectly) ignored because the OR operator is used.

3.1.4 | Disabling the Personalization of the Results

Before initiating the search process, we disable the personalization feature offered by LinkedIn. This feature considers the profile of the connected user for offering more personalized results (jobs in our case). By disabling this feature, all LinkedIn users get the same results for the same query.

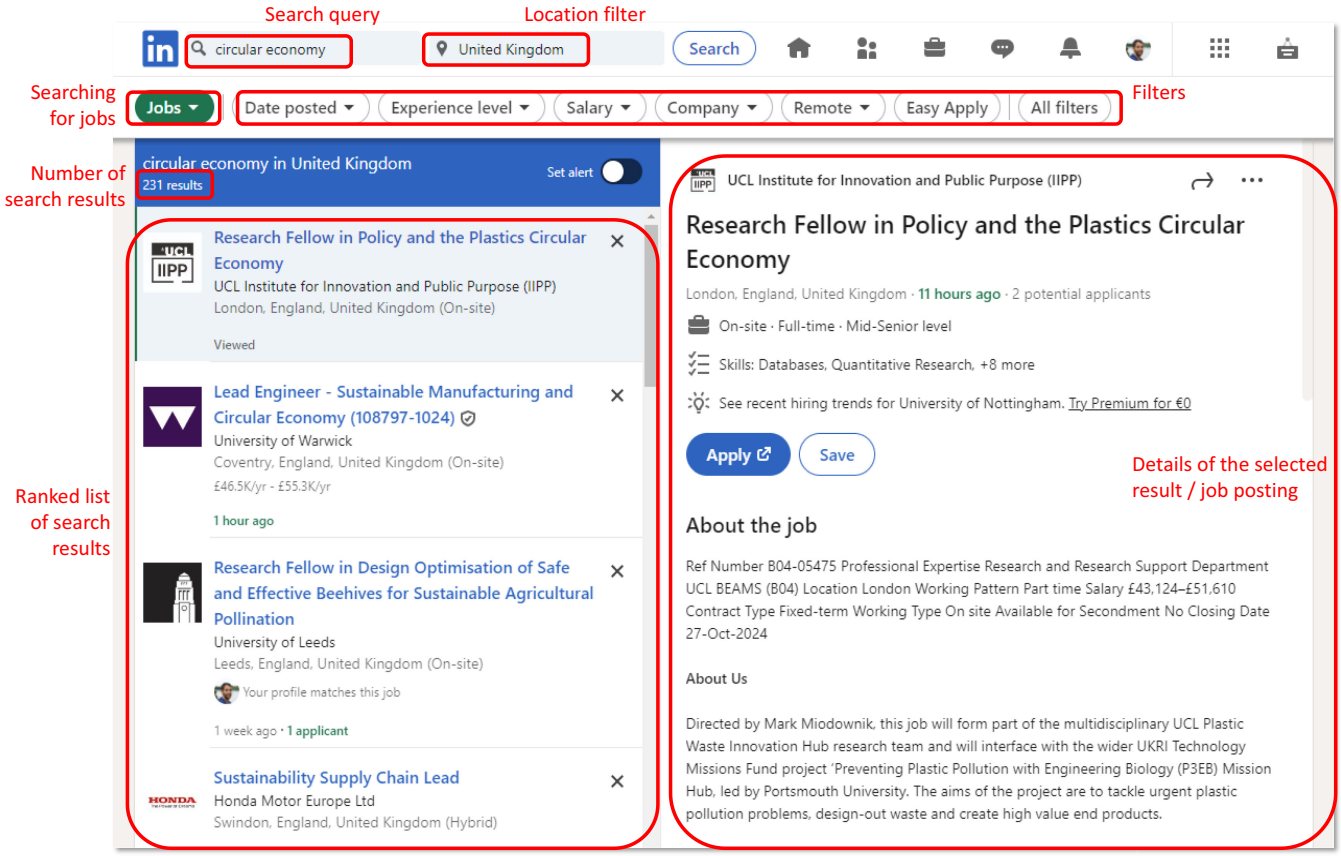

FIGURE 1 | Searching for jobs on LinkedIn.

TABLE 1 | List of considered countries and regions.

EU countries			Non-EU countries	Regions
Austria	France	Malta	The United Kingdom	European Union
Belgium	Germany	Netherlands	The United States	
Bulgaria	Greece	Poland	Switzerland	
Croatia	Hungary	Portugal	Norway	
Cyprus	Ireland	Romania		
Czechia	Italy	Slovakia		
Denmark	Latvia	Slovenia		
Estonia	Lithuania	Spain		
Finland	Luxembourg	Sweden		

TABLE 2 | The search query.

circular economy OR κυκλική οικονομία OR économie circulaire OR economia circolare OR kreislaufwirtschaft OR economía circular OR economia circular OR Кръгова икономика OR kružno gospodarstvo OR oběhové hospodářství OR cirkulær økonomi OR ringmajandus OR kiertotalous OR körforgásos gazdaság OR geilleagar ciorclach OR wirtschaft kreesfërmeg OR žiedinė ekonomika OR ekonomija ċirkolari OR circulaire economie OR gospodarka o obiegu zamkniętym OR economia circulară OR obehové hospodárstvo OR krožno gospodarstvo OR cirkulär ekonomi OR sirkulær økonomi

This feature can be disabled by navigating to the following: Settings and privacy → Data privacy → Job seeking preferences → Personalizing your job experience → Off.

All LinkedIn searches were conducted under controlled conditions to ensure independence and comparability of results across countries and time periods. Specifically, data collection was

performed using the same LinkedIn account, with personalization features disabled (as described above). The LinkedIn interface language was set to English throughout the data collection process, and the same device was used for all searches. These measures minimize potential biases related to user profiles or technical conditions and ensure that the retrieved job counts reflect consistent search conditions.

3.1.5 | Selection of Date Posted

For each country, we consider only the jobs posted during the past month by selecting the option "Past month" from the "Date posted" filter. We do this to ensure that only recent job positions are included in our analysis and not outdated positions from companies that are probably inactive.

3.1.6 | Selection of Job Attributes

For each country, we gathered statistics on the returned jobs by considering four filters (job attributes) provided by the LinkedIn search service: job mode of operation (3 values), job type (5 values), job experience level (6 values), and job function (35 values). Table 3 presents the full list of filters, grouped by filter type. Job function, particularly, describes the type of work or role category that a position belongs to, regardless of industry or title. We considered the complete set of job functions available on LinkedIn (Microsoft Ignite 2023).

TABLE 3 | List of considered job attributes.

Filter	Attributes
Job mode of operation	i. on site, ii. remote, iii. hybrid
Job type	i. full time, ii. part time, iii. contract, iv. temporary, v. volunteer
Job experience level	i. internship, ii. entry level, iii. associate, iv. midsenior level, v. director, vi. executive
Job function	i. manufacturing, ii. information technology, iii. management, iv. engineering, v. sales, vi. business development, vii. consulting, viii. research, ix. analyst, x. other, xi. project management, xii. human resources, xiii. accounting/auditing, xiv. administrative, xv. advertising, xvi. art/creative, xvii. customer service, xviii. distribution, xix. design, xx. education, xxi. finance, xxii. general business, xxiii. healthcare provider, xxiv. legal, xxv. marketing, xxvi. public relations, xxvii. purchasing, xxviii. product management, xxix. production, xxx. quality assurance, xxxi. science, xxxii. strategy/planning, xxxiii. supply chain, xxxiv. training, xxxv. writing/editing

3.1.7 | Data Fetching Process

The data fetching process is depicted in Figure 2 (as a UML activity diagram) and summarized as follows: (i) we search for jobs in LinkedIn using the query shown in Table 2, (ii) we set a country in the location filter, (iii) we set "past month" as the date posted filter, (iv) we store the number of returned jobs for the selected country, (v) we apply a series of filters (one at a time) and for each distinct filter we store the number of returned jobs, (vi) we clear the filter and repeat the same process by setting a new country, and (vii) we repeat the entire process multiple times in different dates. For enabling the normalization of the data (per thousand of total jobs offered), we also fetch the total number of LinkedIn jobs per country for the same date, that is, without providing any keyword. For simplicity, throughout the remainder of this paper, "CE jobs" will refer to jobs returned from the LinkedIn search service using the query shown in Table 2 as the search term.

3.1.8 | Collecting Data in Different Time Periods

Given the dynamic nature of the job market data, and in order to increase the validity of the data and thus the reliability of the analysis results, we collected the data in different time periods and computed the average values for the measures considered. Specifically, we gathered the same data 22 times, with the first data collection on 26/03/2025 and the last on 11/06/2025. This not only allows us to compute and report average values for more reliable results (because job postings appear on LinkedIn at arbitrary times), but it can also support a future study on the evolution of the CE job market.

3.1.9 | Normalizing the Data

Because not all countries make equal use of LinkedIn, we compute and report values normalized by the total number of LinkedIn jobs in each country. Thus, if a country makes limited usage of LinkedIn, this is reflected in the total number of LinkedIn jobs in this country. This is an important measure towards more reliable analysis results.

3.1.10 | Raw Data Availability

We have made the data used in this study publicly available through the Zenodo repository under an open license (Fafalios and Tsagarakis 2026). The dataset includes 22 files, one for each data collection date, and is intended to support reproducibility and future research.

3.2 | Data Analysis Dimensions

We first study the average number of CE job posts per country and relate (normalize) it to each country's total number of LinkedIn jobs (Section 4.1). These measures provide an estimation of the size of the CE job market in the countries considered. The normalized measure is important because it considers a country's use of LinkedIn (if a country's companies/organizations make

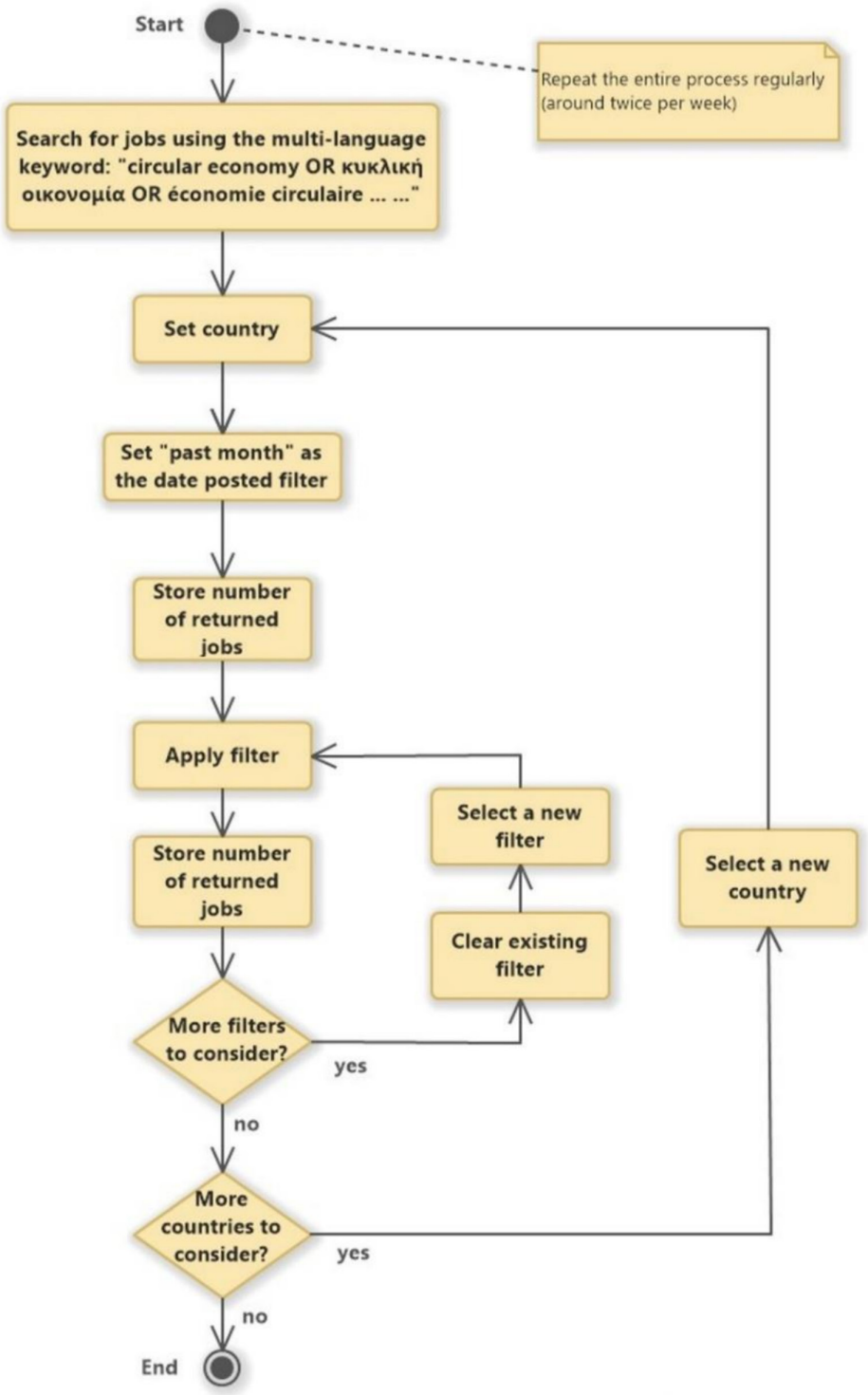

FIGURE 2 | A UML activity diagram of the data fetching process.

limited use of LinkedIn, this is reflected in the country's total number of LinkedIn jobs). This first part provides answers to RQ1, as described in Section 2.2.

Subsequently, we analyze specific job characteristics provided by LinkedIn, namely, job mode of operation (on-site, remote, and hybrid), job type (time employment), job experience level, and job function (Section 4.2). This analysis provides a country-wise overview of the features of the CE job market and can reveal interesting similarities/differences among the countries considered, as well as between the European Union and the United States. This part provides answers to RQ2 as described in Section 2.2.

Then, we compare the LinkedIn-based findings with an official indicator related to CE employment (Section 5). Through this comparison, we aim to identify possible associations between official and nonofficial indicators of CE adoption

and to highlight the importance of considering real data from alternative sources beyond conventional ones (answering RQ3).

Finally, we compare our industry-related findings with the volume of CE-related research outputs per country. The objective is to examine the relation between these two indices across the considered countries, which may reveal a strong, moderate, or weak connection between research and industry (answering RQ4).

In all our analyses, and to increase the validity of our findings, we report the average values from all collected dataset snapshots (22 in total), without examining the evolution of the job market in each country or possible shifts. Such a study would require data covering a much longer period to allow for safe conclusions and is therefore beyond the scope of this paper, but it represents an interesting direction for future work.

4 | LinkedIn Job Results

This section details the analysis of the data, first presenting a country analysis of CE job posts. Next, jobs are presented with reference to the mode of operation (on-site, remote, and hybrid), job type, experience level, and function.

4.1 | Country Analysis

First, the "European Union" location filter returned an average of 2956 CE jobs, with a standard deviation of 155.8. The relatively small standard deviation indicates that the number of jobs across data retrieval processes remains fairly stable. Figure 3 shows the number of CE jobs per country together with the corresponding standard deviation, ranked by the total number of CE jobs in descending order. We notice that the United States is first with 949 CE jobs on average, followed by Germany with 734, France with 689, the Netherlands with 484, the United Kingdom with 427, Spain with 275, Italy with 195, and Belgium with 163. All other countries have fewer than 100 CE jobs on average. On the contrary, the countries with the lowest average number of CE jobs are Cyprus, Malta, Croatia, Slovenia, Latvia, and Estonia, with fewer than two CE jobs. The "European Union" location filter returned on average 2956 CE jobs, which substantially exceeds the United States total of 949, consistent with the EU's stronger regulatory CE agenda (European Commission 2020). This is an expected finding because EU countries are leading

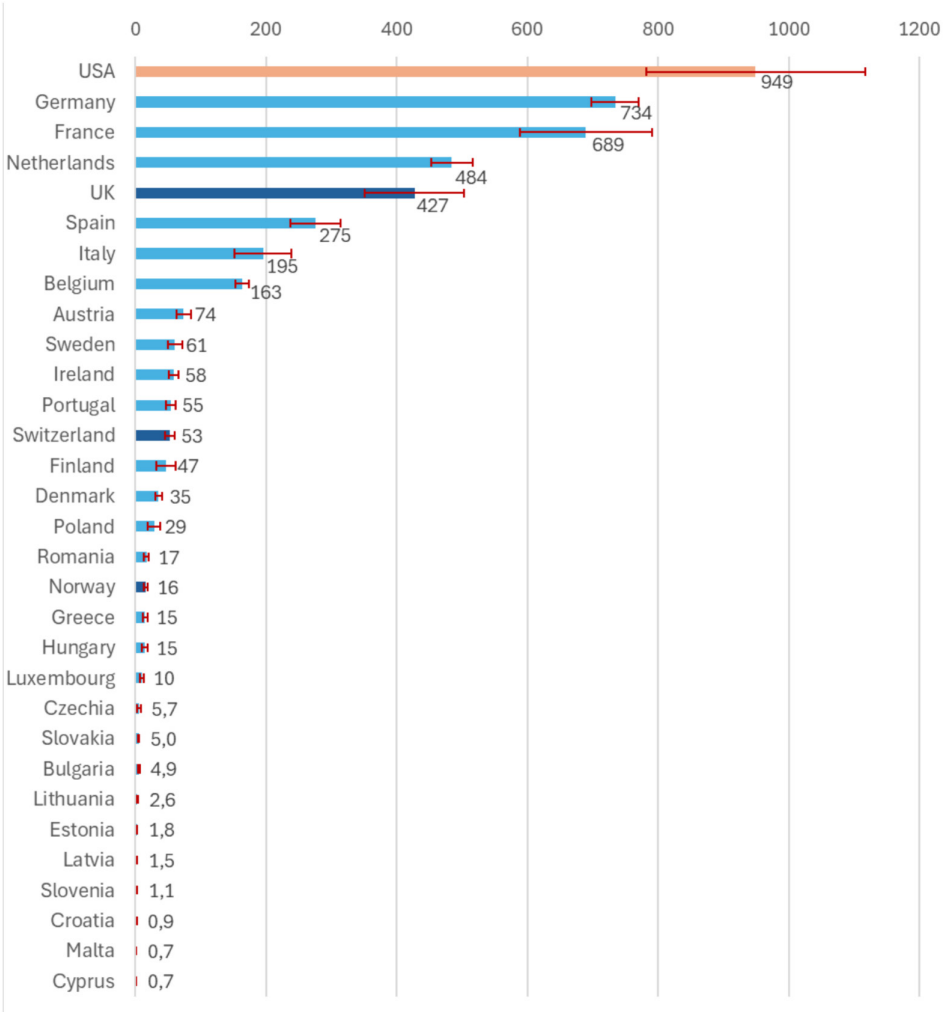

FIGURE 3 | Average number of circular economy (CE) job postings per country during the study period. The red line depicts the positive/negative error value based on the standard deviation.

the CE job market because of the European Green Deal, which promotes new policies for a better environmental quality and future (European Commission 2020; Klavins et al. 2024).

Because not all countries make equal use of LinkedIn (Auxier and Anderson 2021), considering only the aforementioned figure per country can provide misleading results. A better estimation of the status in each country is provided if we normalize the country's number of CE jobs by the total number of LinkedIn jobs in the same country, in what we call "normalized LinkedIn CE job market size" in a country *Ci*:

$$\text{Normalized LinkedIn CE job market size } (Ci) = \frac{\text{Number of CE jobs in LinkedIn } (Ci)}{\text{Total number of country jobs in LinkedIn } (Ci)}.$$

Figure 4 shows the normalized numbers. We notice that Finland currently leads with the highest normalized CE job market size with 8.8 CE jobs per 1000 total jobs on average, followed by Belgium (4.4), Spain (3.8), the Netherlands (3.5), Austria (3.1), Denmark (2.7), Ireland (2.5), and Italy (2.3). In the European Union, the average number is 2.2 CE jobs per 1000 jobs. In all other countries, the number is lower than that of the European Union. Interestingly, the United States provides one of the lowest normalized numbers. It ranks second-to-last, with 0.3 jobs per 1000 total jobs.

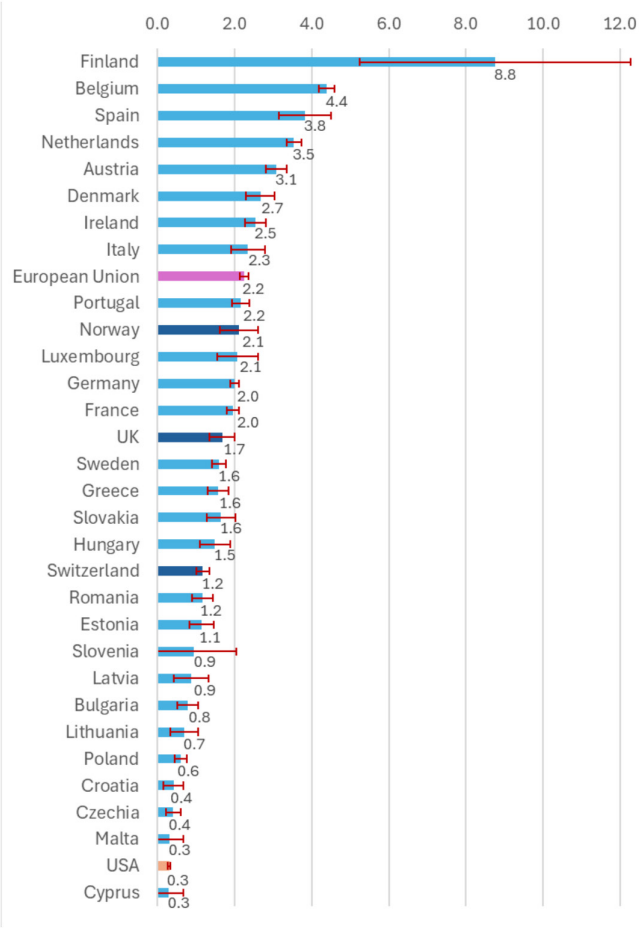

FIGURE 4 | Average number of circular economy (CE) job postings, normalized per 1000 country jobs, during the study period. The red line depicts the positive/negative error value based on a standard deviation.

4.2 | Job Characteristics

4.2.1 | Job Mode of Operation (On-Site, Remote, or Hybrid)

The mode of operation of jobs is classified as on-site, remote, or hybrid. In the European Union, on average, 63% of CE jobs are on-site, 8% are remote, and 28% are hybrid. In the United States, 75% of CE jobs are on-site, 8% are remote, and 13% are hybrid. A first observation is that the proportion of hybrid job positions is significantly higher in the European Union than in the United States.

In other countries (Figure 5), we notice that the highest percentage of on-site jobs is offered in Denmark (87%), Luxembourg (82%), Switzerland (81%), and Sweden (80%). Regarding remote CE jobs, Italy is the leading country with 47% of CE jobs being remote, followed by Slovenia (35%) and Portugal (12%). In all other countries, the percentage of remote jobs is less than 10%. The countries with the lowest percentage of remote jobs are Luxembourg, Hungary, Croatia, Estonia, Malta, and Cyprus, with an average of less than 1%. As regards hybrid CE jobs, Latvia ranks first with 97%, followed by Slovakia (82%), Lithuania (80%), Cyprus (80%), Bulgaria (75%), and Poland (72%). Conversely, Denmark offers the lowest number of hybrid jobs (12%), followed by the United States (13%), Switzerland (17%), and Luxembourg (18%).

4.2.2 | Job Type

The job type is selected from full-time, part-time, contract, temporary, volunteer, and other. In the European Union, the majority of CE jobs concern full-time employment (84%), whereas all other job types account for less than 5%. In the United States, the percentage of full-time jobs is much higher (93%).

For most of the other countries, the percentage of full-time jobs is very high, as expected, as shown in Figure 6. Cyprus and Malta have a very high percentage of contract jobs (70% and 61%, respectively), followed by Slovenia (49%), Croatia (47%), and Latvia (31%). Regarding the other job types, Switzerland offers the highest number of part-time jobs (7%), followed by the United Kingdom (6%). The United Kingdom, France, and Greece offer 5% of their CE jobs as temporary, whereas in Italy, 10% of the CE jobs are of type "other." Finally, Luxembourg is the country with the highest percentage of volunteer jobs (3%).

A general remark regarding employment type is that, as expected, full-time employment far outnumbers all other employment types in most countries, whereas for the other types, each country follows different patterns.

4.2.3 | Job Experience Level

The job positions are classified into internship level, entry level, associate level, midsenior level, director level, and executive level. In the European Union, most CE jobs are at the midsenior level (31% on average), followed by entry level (24%), internship level (16%), associate level (14%), director level (3%), and

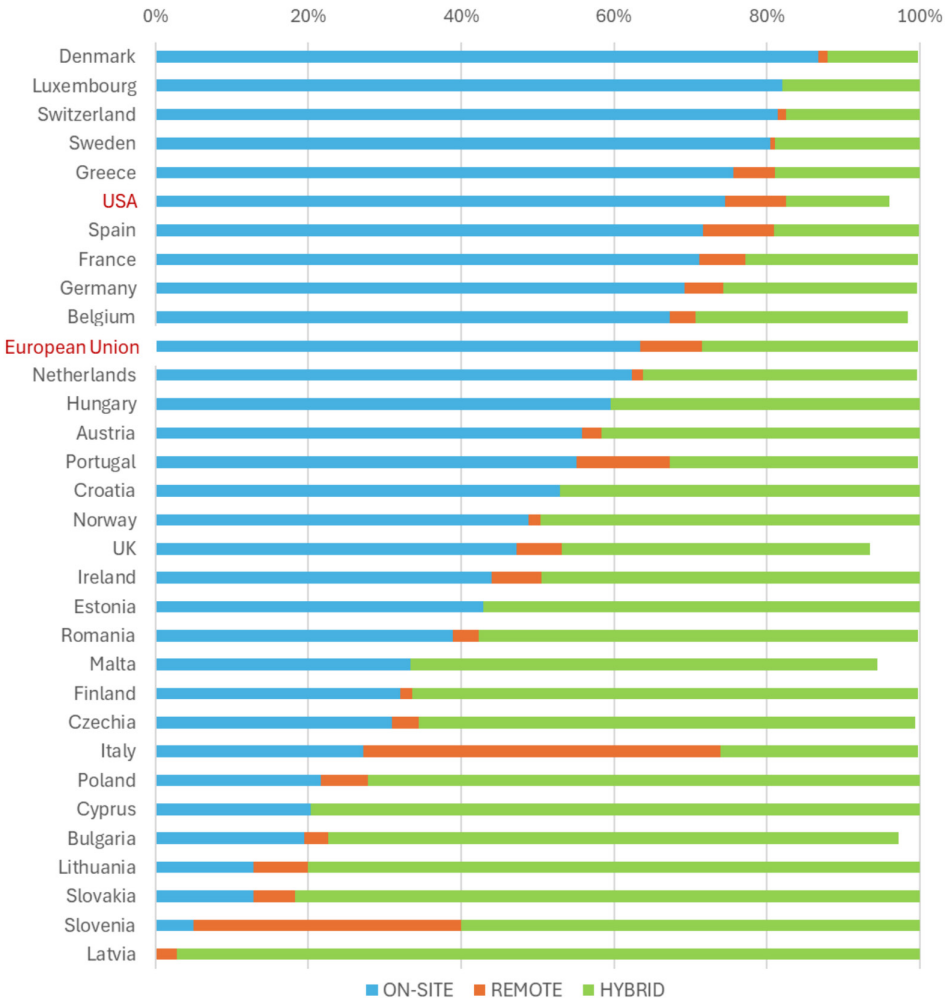

FIGURE 5 | Percentage of on-site, remote, and hybrid CE job posts per country.

executive level (1%). In the United States, the distribution is as follows: 41% midsenior level, 31% entry level, 10% associate level, 4% internship level, 4% director level, and 1% executive level.

An interesting finding is that the percentages are very low for the two most senior levels (director and executive). This indicates that CE jobs at higher managerial levels are mostly covered through promotions rather than open call for applications. In addition, jobs offered in the United States tend to be at a more senior level than those in the European Union. Specifically, 46% of CE jobs in the United States are at the three most senior levels (midsenior, director, and executive), whereas in the European Union, the corresponding percentage is 35%.

Figure 7 shows the percentages for all the considered countries. We notice that the majority of CE jobs are at the midsenior level in most cases. Croatia offers the highest percentage of this level (94%), followed by Slovakia (85%) and Cyprus (80%). As regards the entry level, Finland ranks first with 38% of CE jobs, followed by Germany (34%) and the Netherlands (33%), whereas at the bottom is Latvia with 0%, followed by Greece (2%) and Bulgaria (5%). At the internship level, Italy holds the first place with 41%, followed by Denmark (23%) and Germany (22%).

If we consider both internship and entry levels together (the two more junior levels), Germany and Italy share the leading position at 56%, followed by Finland (44%), Switzerland (42%), and Austria (41%). These countries can therefore be considered as offering the most opportunities for young people entering the CE sector. By contrast, the percentages are very low (less than 7%) in Latvia, Greece, Croatia, and Bulgaria.

4.2.4 | Job Function

The function of a job position describes the work type or role category that the position belongs to, regardless of the company's industry or the title of the position. Figure 8 shows the average percentage of CE jobs per job function in the European Union and the United States. In the European Union, we see that "information technology" is first with 17%, followed by engineering (16%), other (15%), manufacturing (13%), management (13%), sales (12%), and business development (10%). All other job functions apply to less than 8% of the total CE jobs. In the United States, we notice a different pattern. First is manufacturing with 38%, followed by management (32%). Next are information technology (19%), sales (17%), engineering (16%), other (10%), and business development (10%), with the remaining accounting for equal or less than 6%.

Table 4 presents the top five functions of CE jobs per country. We should note here that a job position may fall under more

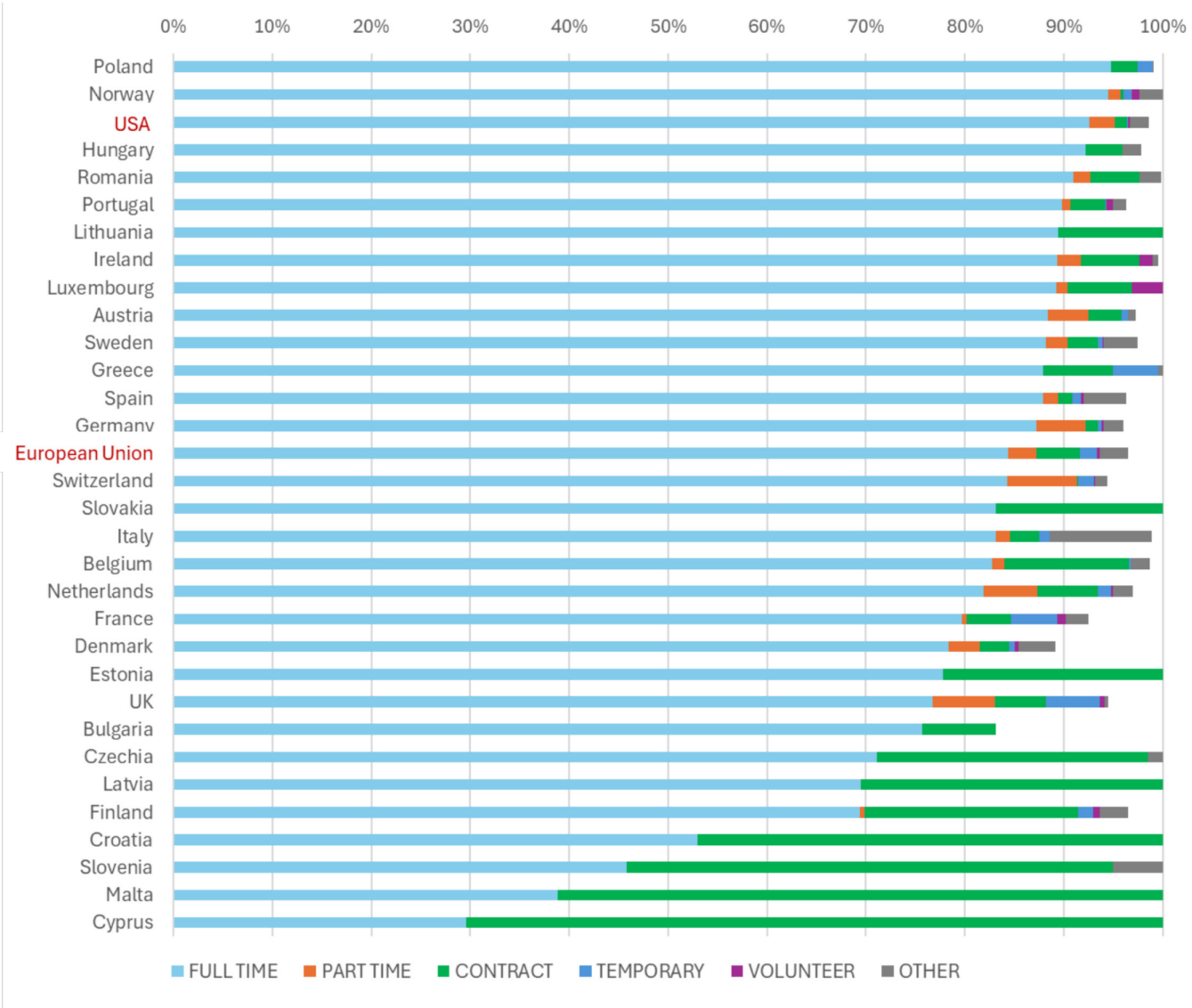

FIGURE 6 | Percentage of each time employment type of CE job posts per country.

than one function. Information technology is the job function that most frequently appears in the first position (13 out of 31 countries). However, the variety of top job functions across countries highlights certain national specializations. For example, business development is an important required role in CE-related jobs in Spain, whereas in Bulgaria, the required roles are project management and administration. These findings may indicate the most fertile ground for new businesses to grow. Nevertheless, it should be noted that some high percentages in specific countries are influenced by the relatively low number of available jobs in those countries.

As regards the country with the highest average percentage of CE jobs per job function, Lithuania is first in manufacturing and management with 49.5% in each, Poland in information technology with 45.6%, Ireland in Engineering with 48.7%, Latvia in sales with 36.1%, Lithuania in business development with 70.3%, Cyprus in consulting with 70.4%, Croatia in research with 47.1%, Malta in analyst with 27.8%, Slovenia in other with 84.2%, Hungary in project management with 29.6%, Italy in human resources with 42.2%, Greece in accounting—auditing with 14.4%, Bulgaria in administrative with 19.4%, Sweden in advertising with 1.6%, Estonia in art creative with 11.9%, Czechia in customer service with 9.4%, Portugal in distribution with 7.3%, Ireland in design with 21.5%, Germany in education with 7.6%, Slovakia in finance with 30.3%, Spain in general business with 12.4%, Denmark in health provider with 2.3%, Luxembourg in legal with 20.4%, Greece in marketing with 10.2%, the United Kingdom in public relations with 5.2%, Czechia in purchasing with 20.8%, Luxemburg in product management with 13.9%, Bulgaria in production with 8.7%, Czechia in quality assurance with 3.6%, Ireland in science with 2.5%, Luxembourg in strategy—planning with 7%, Czechia in supply chain with 18.2%, Germany in training with 8.3%, and the United Kingdom in writing—editing with 5.2%.

5 | LinkedIn Data Versus Official Statistics

This section examines the relation of official statistics related to the CE job market and our findings, which considered social

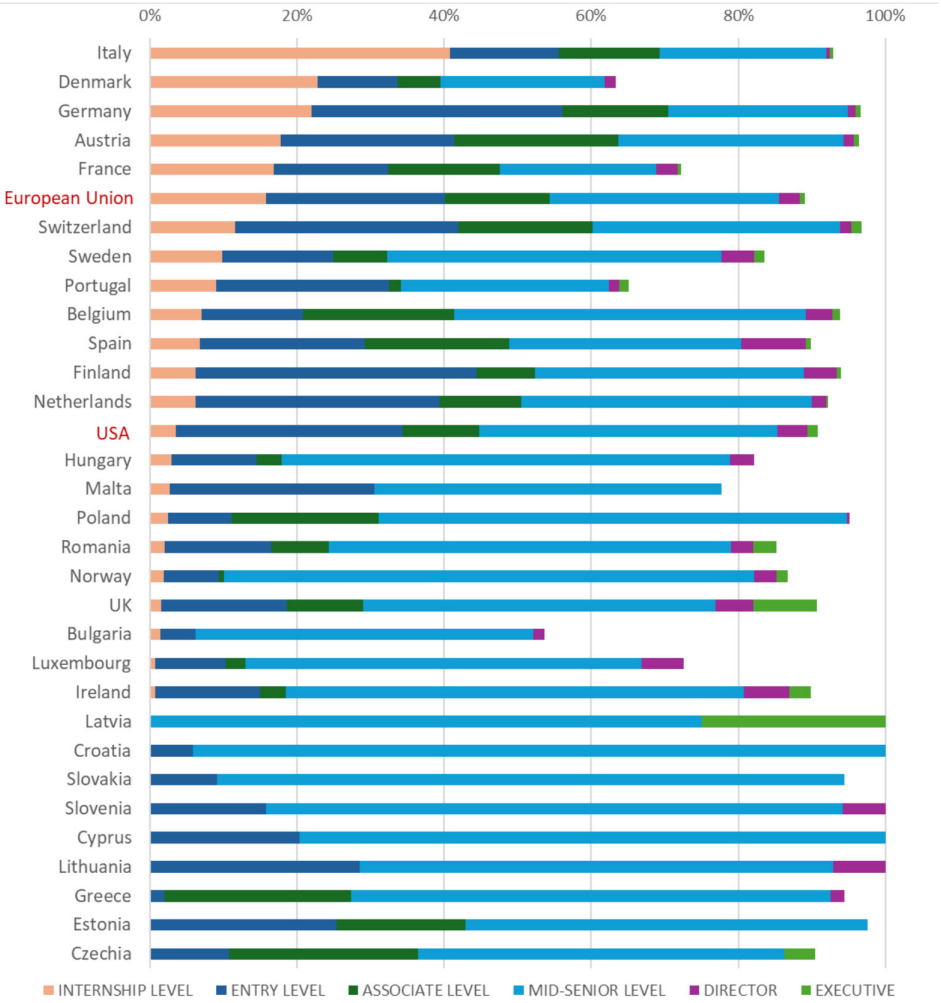

FIGURE 7 | Percentage of each job experience level of CE job posts per country.

networking data. We consider the indicator "Persons employed in circular economy sectors" provided by Eurostat for all EU countries for the year 2023 (at the time of writing, no more recent figures were available from official sources). The indicator measures the number of persons employed in the following three sectors: (i) the recycling sector, (ii) the repair and reuse sector, and (iii) the rental and leasing sector (Eurostat 2023). Specifically, "number of persons employed is defined as the total number of persons who work in the observation unit, i.e., the firm (inclusive of working proprietors, partners working regularly in the unit and unpaid family workers), as well as persons who work outside the unit who belong to it and are paid by it, e.g., sales representatives, delivery personnel, repair and maintenance teams. It excludes manpower supplied to the unit by other enterprises, persons carrying out repair and maintenance work in the enquiry unit on behalf of other enterprises, as well as those on compulsory military service" (Eurostat 2023).

In our analysis, we consider the normalized values in which jobs are expressed as a percentage of total employment in the respective country. Figure 9 shows the values per EU country. We see that the top country is Estonia with 7.9%, followed by Lithuania (4.2%), Luxembourg (4.2%), Croatia (3.9%), and Latvia (3.6%). At the other end, the Netherlands is last with 1.1%, followed by Belgium (1.2%), Ireland (1.3%), Denmark (1.3%), and Austria (1.4%).

A very interesting finding is that the Eurostat data are quite different compared to the normalized LinkedIn data presented in Section 4.1 (Figure 4). Specifically, we notice a large number of EU countries (17/27; 63%) that are either high in the Eurostat index and low in the LinkedIn index, or low in the Eurostat index and high in the LinkedIn index. The scatter plot in Figure 10 confirms this negative association, suggesting that countries with higher existing CE workforces tend to have lower CE job demand on LinkedIn.

Table 5 further explores this association, showing the position of each country in each of the two indexes and the difference (delta) in these ranks. A large negative number (from −26 to −10) indicates a high position in the Eurostat index but a low position in the LinkedIn index, whereas a large positive number (from 10 to 26) indicates a low position in the Eurostat index but a high position in the LinkedIn index. We notice that 2/3 of the countries fall under these categories. Countries with small changes in the two lists are: Romania, Hungary, Portugal, Greece, Sweden, and France.

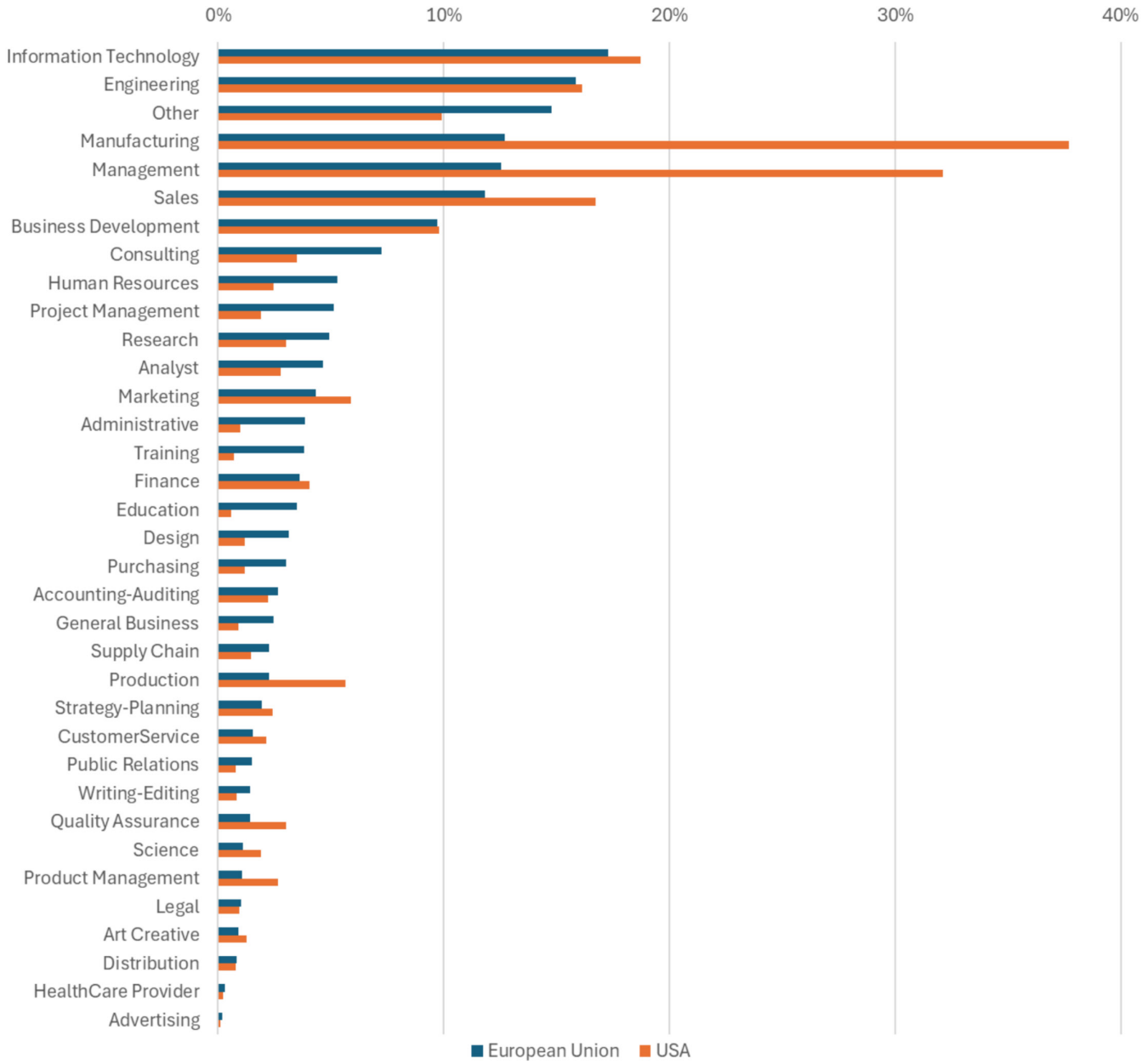

FIGURE 8 | Percentage of LinkedIn CE jobs per job function in the European Union and the United States.

A statistical analysis further confirms this negative association. Pearson's correlation coefficient ($r_p = -0.41$, $p = 0.033$) indicates a statistically significant, moderate negative linear association, suggesting that countries with a higher number of LinkedIn CE jobs tend to have a lower relative share of their total workforce employed in CE sectors. Spearman's rank correlation coefficient ($r_s = -0.73$, $p < 0.001$) shows an even stronger and highly significant negative monotonic association, implying that this inverse relationship is particularly evident when countries are compared in terms of their rankings.

This comparison should be interpreted as exploratory in nature because the Eurostat data differ from the LinkedIn data both temporally and conceptually. The Eurostat employment figures refer to an earlier reference period and focus on specific sectors that capture only part of CE-related activities. On the contrary, LinkedIn job postings reflect more recent labor market demand and span a broader set of occupations. Therefore, the observed relationships should not be interpreted as direct correspondence or causal association. Instead, the comparison aims to highlight potential alignments or mismatches between established (and policy-relevant) sector-based employment indicators and emerging labor market indicators. In this sense, the analysis provides insights into how different measurement approaches capture complementary dimensions of the CE labor market.

Overall, these findings suggest that while some countries generate relatively more CE LinkedIn jobs in normalized terms, these jobs may represent sectors other than recycling, repair and reuse, rental and leasing, or a smaller proportion of total employment in these sectors, possibly reflecting differences in overall labor market size and structure. One possible explanation is that countries with a high number of persons already employed in CE sectors may have

TABLE 4 | The top five job functions of CE LinkedIn jobs per country.

Country	First job function	Second job function	Third job function	Fourth job function	Fifth job function
Austria	Other (20.9%)	Information technology (13.1%)	Finance (12.4%)	Engineering (10.9%)	Management (10.5%)
Belgium	Manufacturing (18.8%)	Engineering (18.6%)	Information technology (15.6%)	Management (14.1%)	Sales (14.0%)
Bulgaria	Project management (22.4%)	Administrative (19.4%)	Sales (13.9%)	Other (13.7%)	Business development (12.2%)
Croatia	Other (47.1%)	Consulting (47.1%)	Research (47.1%)	Administrative (5.9%)	—
Cyprus	Consulting (70.4%)	Information technology (20.4%)	Engineering (20.4%)	—	—
Czechia	Other (28.9%)	Purchasing (20.8%)	Supply chain (18.2%)	Consulting (15.3%)	Finance (14.2%)
Denmark	Information technology (32.6%)	Business development (16.0%)	Sales (13.9%)	Other (13.7%)	Analyst (11.8%)
Estonia	Consulting (43.7%)	Business development (39.7%)	Project management (23.0%)	Information technology (20.6%)	Other (17.5%)
Finland	Information technology (26.4%)	Other (25.4%)	Management (22.0%)	Manufacturing (20.7%)	Engineering (20.5%)
France	Information technology (18.3%)	Engineering (15.6%)	Manufacturing (13.9%)	Other (13.6%)	Sales (12.8%)
Germany	Information technology (19.0%)	Other (14.7%)	Management (12.8%)	Sales (12.2%)	Manufacturing (11.9%)
Greece	Engineering (34.4%)	Other (24.7%)	Accounting—auditing (14.4%)	Consulting (11.5%)	Information technology (11.1%)
Hungary	Information technology (41.1%)	Project management (29.6%)	Other (22.9%)	Manufacturing (8.0%)	Supply chain (7.2%)
Ireland	Engineering (48.7%)	Consulting (23.4%)	Design (21.5%)	Information technology (18.9%)	Other (15.6%)
Italy	Human resources (42.2%)	Engineering (11.1%)	Information technology (11.1%)	Sales (10.3%)	Consulting (8.8%)
Latvia	Sales (36.1%)	Business development (36.1%)	Consulting (30.6%)	Information technology (11.1%)	Research (2.8%)
Lithuania	Business development (70.3%)	Manufacturing (49.5%)	Management (49.5%)	Sales (20.4%)	Consulting (18.0%)

(Continues)

TABLE 4 | (Continued)

Country	First job function	Second job function	Third job function	Fourth job function	Fifth job function
Luxembourg	Information technology (29.7%)	Legal (20.4%)	Project management (16.9%)	Management (15.4%)	Product management (13.9%)
Malta	Other (63.9%)	Consulting (61.1%)	Analyst (27.8%)	Information technology (8.3%)	Manufacturing (2.8%)
Netherlands	Engineering (21.9%)	Other (20.5%)	Management (15.1%)	Consulting (13.8%)	Manufacturing (13.4%)
Norway	Information technology (24.9%)	Finance (17.2%)	Sales (15.9%)	Management (12.0%)	Business development (11.5%)
Poland	Information technology (45.6%)	Sales (29.9%)	Consulting (27.4%)	Engineering (12.0%)	Accounting-auditing (8.4%)
Portugal	Information technology (27.5%)	Management (25.0%)	Manufacturing (22.0%)	Engineering (19.3%)	Other (14.8%)
Romania	Information technology (38.4%)	Engineering (31.1%)	Consulting (21.9%)	Other (16.9%)	Accounting—auditing (8.4%)
Slovakia	Finance (30.3%)	Other (16.8%)	Engineering (15.3%)	Consulting (11.3%)	Purchasing (8.0%)
Slovenia	Other (84.2%)	Consulting (49.2%)	Sales (5.8%)	Business development (5.8%)	Research (5.0%)
Spain	Business development (15.3%)	Engineering (12.7%)	General business (12.4%)	Management (11.8%)	Manufacturing (11.6%)
Sweden	Information technology (22.1%)	Other (16.2%)	Management (15.5%)	Sales (14.4%)	Business development (14.2%)
Switzerland	Information technology (23.2%)	Manufacturing (16.7%)	Management (15.5%)	Engineering (11.9%)	Other (10.8%)
The United Kingdom	Information technology (26.0%)	Manufacturing (21.3%)	Management (20.0%)	Sales (19.2%)	Engineering (13.1%)
The United States	Manufacturing (37.7%)	Management (32.1%)	Information technology (18.7%)	Sales (16.7%)	Engineering (16.1%)

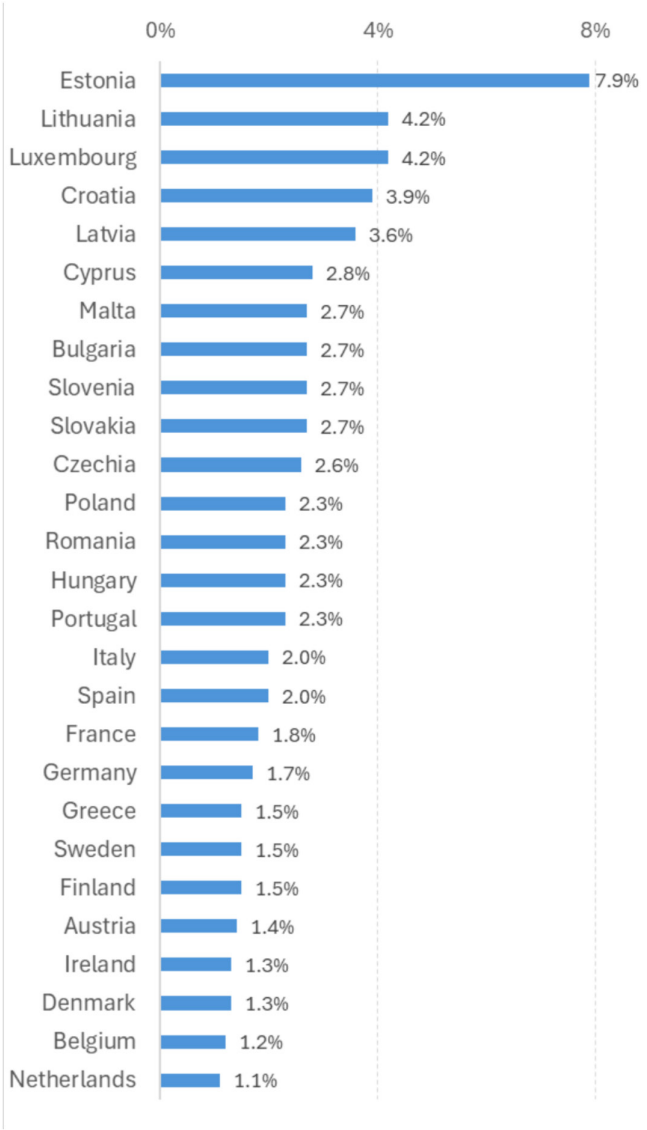

FIGURE 9 | Percentage of persons employed in CE-related sectors per EU country (2023). Data from Eurostat.

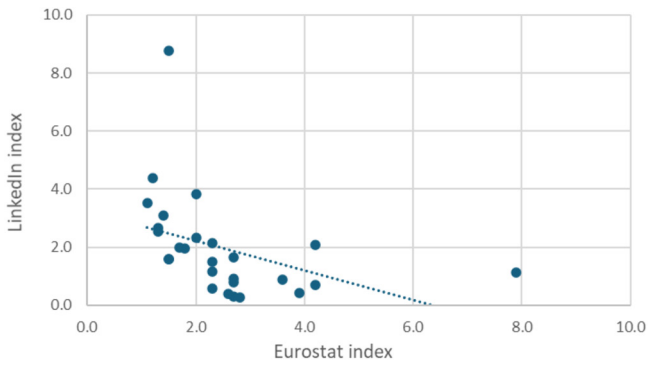

FIGURE 10 | Relationship between existing workforce in CE sectors (Eurostat) and CE job demand (LinkedIn) across the considered countries.

less demand for additional workers, as most positions are already filled. Finally, as already stated, we must consider that the Eurostat data are from 2023, whereas the LinkedIn data are from 2025, and that the LinkedIn data are not limited to specific sectors. Studying the reasons behind the differences between these two indexes is a very interesting direction for future research.

TABLE 5 | The difference between Eurostat and LinkedIn normalized indexes. A large negative number (i.e., −10 or below) indicates a high position in the Eurostat index but a low position in the LinkedIn index, whereas a large positive number (i.e., +10 or above) indicates a low position in the Eurostat index but a high position in the LinkedIn index.

EU country	Position in Eurostat normalized index (Figure 9)	Position in LinkedIn normalized index (Figure 4)	Delta
Cyprus	6	28	−22
Lithuania	2	23	−21
Croatia	4	25	−21
Malta	7	27	−20
Estonia	1	19	−18
Latvia	5	21	−16
Bulgaria	7	22	−15
Czechia	11	26	−15
Slovenia	7	20	−13
Poland	12	24	−12
Luxembourg	2	10	−8
Slovakia	7	14	−7
Romania	12	18	−6
Hungary	12	17	−5
Portugal	12	9	3
Greece	20	16	4
Sweden	20	15	5
France	18	12	6
Italy	16	8	8
Germany	19	11	8
Spain	16	3	13
Ireland	24	7	17
Austria	23	5	18
Denmark	24	6	18
Finland	20	1	19
Netherlands	27	4	23
Belgium	26	2	24

6 | Industry Versus Research

In this section, we investigate the research output per country in the field of CE and compare it with the job market size as reflected by the LinkedIn job positions related to CE in each country.

We used the Scopus database for collecting publications related to CE. Scopus is a scientific abstract and citation database, launched by Elsevier, whose indexed journals are reviewed for sufficient quality each year according to four measures (*h*-index, CiteScore, SJR, and SNIP). We searched Scopus using the query string "circular economy" (inside double quotation marks) and selecting only the fields "article title" and "keywords" using the OR connector. This means that the considered publications contain the term "circular economy" (as it is) either in their title or in their keywords. This ensures that the publications are strongly connected to CE. Then, we only considered the publications of type "Article" to focus on only high-quality full research papers that have been peer-reviewed. Finally, because our LinkedIn analysis was performed in 2025, we only considered the Scopus articles published during the last 2 years (2024 to July 2025). The final number of considered articles is 8380 (4323 articles in 2024 and 4057 articles in 2025).

For each country, we calculated the number of articles in which at least one author has an affiliation in that country. Figure 11a presents the results. Italy ranks first with 908 articles, followed by Spain (786), the United Kingdom (754), the United States (555), Germany (499), the Netherlands (321), and France (309). At the other end, Malta is last with three articles, followed by Luxembourg (14), Bulgaria (19), Estonia (23), and Croatia (24).

If we now normalize by the population of each country, we can obtain a fairer estimation of each country's contribution to CE research. Figure 11b shows the normalized results. We now see that the first country is Finland with 32.8 articles per one million of population, followed by Portugal (28.9), Cyprus (24.5), Norway (24.4), Denmark (22.7), Sweden (22.3), Luxembourg (21.2), and Lithuania (20.3). The United States is now in the last position with 1.6 articles per one million of population, followed by Bulgaria (2.9) and France (4.5).

If we compare these values with the normalized number of CE LinkedIn jobs (cf. Section 4.1, Figure 4), we notice a positive association. First, the top country is Finland in both normalized indexes. This is an indicator that the research and job market in CE are well-connected in Finland. At the other end, the United States is in a bottom position in both normalized indexes, suggesting lower use of the CE framing in research and labor-market activity. There are five countries that are in the top 10 in both lists, indicating high interest in CE across research and industry: Finland, Denmark, Portugal, the Netherlands, and Norway. Similarly, there are five countries that are in the bottom 10 in both lists, indicating low interest in CE across research and industry: the United States, Malta, Bulgaria, Croatia, and Poland. Finally, some countries rank high in one list but low in the other. Specifically, Cyprus, Lithuania, Latvia, and Estonia are among

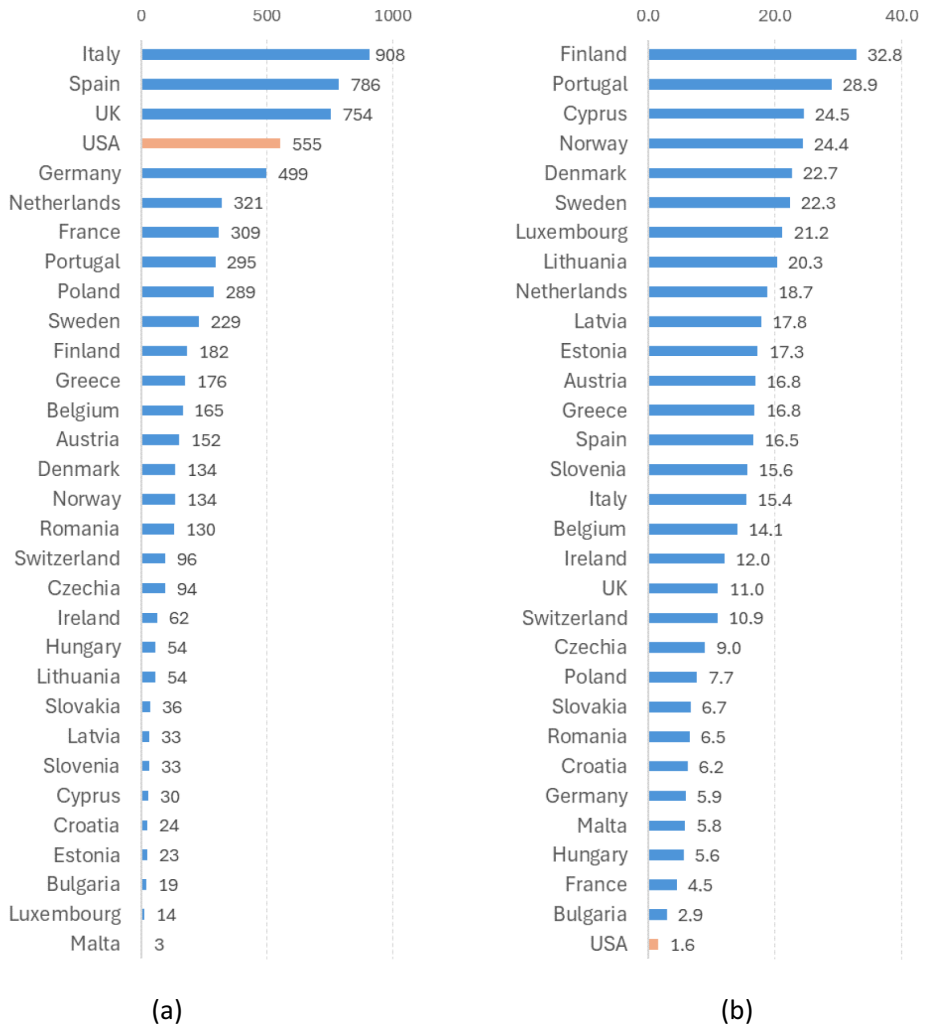

FIGURE 11 | Number of (a) country articles during 2024–2025. (b) Country articles per 1 million of population during 2024–2025.

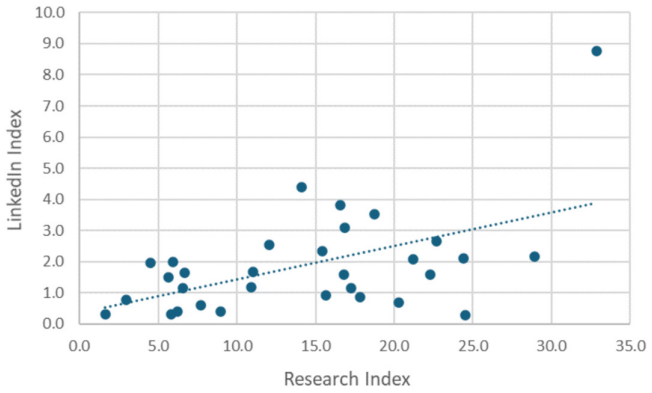

FIGURE 12 | Relationship between CE research outcome and CE LinkedIn job demand across the considered countries.

the top performers in CE research output but show low numbers in CE LinkedIn jobs, whereas Belgium, Ireland, and Spain score high in CE LinkedIn jobs but relatively low in CE research output. These differences suggest that in the first group of countries, universities and research institutes invest significantly in CE research, but the CE job market has not yet developed to the same extent. In contrast, in the second group, the private sector is more active in implementing CE practices and creating jobs, whereas CE research output remains relatively limited.

Figure 12 shows a scatter plot confirming the observed positive association. We also conducted a statistical analysis to examine the significance of this association. Pearson's correlation coefficient ($r_p = 0.52$, $p = 0.0027$) indicates a statistically significant linear relationship, suggesting that countries with more CE research activity per capita also tend to have more CE LinkedIn jobs. Spearman's rank correlation coefficient ($r_s = 0.41$, $p = 0.0217$) likewise reveals a statistically significant monotonic association, confirming that the relationship holds when considering ranked values rather than raw magnitudes. Taken together, these results provide evidence that research activity and labor market presence in CE are positively related. However, as with the previous analysis, this association should be interpreted as indicative of co-occurring patterns rather than as evidence of a direct or causal relationship.

7 | Discussion

The present work provides a data extraction approach from LinkedIn, which includes region selection and application of a series of filters, allowing for a comprehensive extraction of relevant data. The inclusion of various filters, ranging from job operation mode and job type to job experience level and job function, provides an exploration of job postings related to the CE. Through this approach, we shed light on the CE country and the global job market.

7.1 | Discussion of Findings

Today, LinkedIn is regarded by many as an essential influencing platform for professionals seeking employment (Dhanasekar et al. 2025). Findings reveal certain CE job trends across locations and other job attributes, with key findings highlighting the prominence of certain countries, job characteristics, and emerging patterns within the CE employment.

The dominance of certain European countries in absolute numbers, particularly Germany, France, the Netherlands, and the United Kingdom, in contributing to the global CE job market, highlights their presence as leaders in sustainable practices and green initiatives. This occurrence may be attributed to specific environmental regulations, government initiatives, and commitment to sustainability, paving the way for policymakers and businesses to adopt CE practices. This finding complements results reported by Tsironis et al. (2022) who find that Germany, the United Kingdom, and France share the three top places of employees associated with companies related to CE among the EU-28 countries on LinkedIn. The latter for Germany is also supported by Knäble and Tsagarakis (2023), who report CE-related companies doubling every 3 years on LinkedIn. Nevertheless, when we normalize by the total number of LinkedIn job postings, smaller European countries, in particular Finland and Belgium, emerge as leaders in CE employment. From a sustainability transitions perspective, these results reflect heterogeneous national trajectories of CE adoption rather than a simple size effect. Countries combining strong CE regulatory environments, high public investment in green innovation, and active institutional support for circular business models appear to generate disproportionately more CE-labeled labor demand relative to their overall LinkedIn presence. This is consistent with institutional complementarities arguments: firms in high-regulation, high-support environments are more likely to explicitly frame their hiring as CE-oriented, because CE alignment carries organizational legitimacy and regulatory value in those contexts (Markard et al. 2012; Bauwens 2021). By contrast, countries with lower normalized indicators may have firms that adopt circular practices without explicitly labeling them, or that have not yet fully integrated CE as an organizational framework in their recruitment communications.

A comparison between the European Union and the United States reveals distinct job characteristics: hybrid work arrangements are significantly more common in the EU (28%) than in the United States (13%), whereas the share of full-time positions is higher in the United States (93% vs. 84%). Moreover, CE jobs in the United States tend to target more senior professionals (46% vs. 35% in the EU). Differences also appear in job functions: In the EU, information technology leads, followed by engineering and manufacturing, whereas in the United States, manufacturing dominates, followed by management and information technology. These structural differences carry important theoretical implications. The EU pattern, dominated by information technology, engineering, and business development, with a relatively high share of hybrid work arrangements and junior-level positions, is consistent with a transition-phase labor market: organizations are adapting and expanding existing professional roles to incorporate CE principles, building circular human capital progressively across hierarchical levels. This aligns with recent findings showing that demand for green and circular skills is growing fastest in mainstream functions such as technology, finance, and operations, rather than in narrowly defined green occupations (LinkedIn 2024). The US pattern, concentrated in Manufacturing and Management, at more senior levels, suggests a more operationally focused, scaling-phase approach: implementing established circular practices within

existing production systems rather than broadly embedding CE across organizational functions. These contrasts are consistent with broader evidence that CE employment effects vary significantly by sector and geography (Repp et al. 2021), with reuse and recycling-oriented roles expanding in regulatory-forward contexts while upstream, labour-intensive activities face contraction.

The distribution of job operation modes, job types, experience levels, and functions demonstrates that the nature of CE employment is diverse, whereas the dominance of full-time positions in almost all countries indicates stable career opportunities within the CE sector. On the other hand, the dominance of jobs in functions such as information technology and sales highlights the multifaceted nature of circularity, including some alternative functions beyond traditional ones. The diversity and interdisciplinary nature of CE-related jobs are further evidenced by the study conducted by Tsironis et al. (2024), which analyzed 7533 companies on LinkedIn with CE interest and revealed a wide range of industries in which these companies operate.

The regional analysis shows a variation in job counts and job characteristics across different countries, suggesting the presence of unique socioeconomic contexts and policy priorities. This pattern is consistent with subnational evidence from France, where CE employment growth and spatial concentration are closely linked to regional public policies and institutional support (Niang et al. 2024). Specifically, countries such as Finland, Belgium, Spain, and the Netherlands demonstrate more CE-related jobs based on their total job market in LinkedIn, indicating strong government support and private sector engagement, whereas countries with a lower ratio, such as Cyprus, the United States, Malta, Czechia, Croatia, and Poland, may benefit from policies, investments, and capacity-building initiatives that can stimulate CE employment and innovation. The dominance of specific job experience levels within each country provides information regarding workforce development needs and educational priorities, as countries with a high demand for entry-level positions, such as Germany and Italy, may benefit from targeted training programs and education initiatives to provide individuals with the necessary skills for CE careers. Similarly, certain countries like Latvia and Croatia have a relatively high demand for senior-level positions (midsenior, director, and executive) and may therefore need investment in advanced training, leadership development, and talent acquisition strategies. This trend may be due to unique socioeconomic dynamics; cultural and organizational factors, such as lifetime employment traditions; and slow adoption of CE concepts in traditional industries, which may have delayed the development of CE-specific leadership expertise. Moreover, the distribution of CE jobs across functions shows that each country demonstrates certain specialization within the global market. For example, France focuses on information technology, engineering, and manufacturing, whereas Spain focuses on business development, Italy on human resources, and Estonia on consulting.

When comparing LinkedIn-based indicators with indicators from other sources, notable discrepancies and associations emerge. First, the Eurostat indicator, which concerns employment in three CE sectors, shows substantial divergence from the normalized LinkedIn indicator. Specifically, a majority of EU countries (63%) rank inconsistently across the two measures (being high in one index and low in the other or vice versa). Statistical analysis confirms a negative association between these indicators, suggesting that the level of circularity in employment measured by Eurostat does not necessarily align with current job market activity. From a theoretical standpoint, this negative association should not be interpreted as a contradiction or a measurement inconsistency, but rather as evidence that the two indicators capture complementary phases and dimensions of CE employment. Eurostat data document the accumulated stock of workers in institutionally recognized CE sectors: recycling, repair, and leasing, where the workforce is already largely in place, and recruitment demand is consequently lower. LinkedIn job postings capture the flow of new CE-labeled demand: active recruitment in roles where CE alignment is being explicitly communicated by employers, which tends to be most intense in countries at earlier or more dynamic phases of CE adoption. This interpretation is consistent with sustainability transitions theory, which distinguishes between the stabilization of established niche practices and the emergence of new sociotechnical configurations (Geels 2002). Countries can therefore be simultaneously mature in terms of established CE sector employment and highly active in terms of new CE-labeled hiring or vice versa. The implication is that neither indicator alone provides a complete picture of CE labor market dynamics and that combining demand-side (job postings) and supply-side (employment stocks) data is necessary for a comprehensive monitoring framework (Olekanma et al. 2024; Sulich and Sołoducho-Pelc 2022).

Second, an examination of the relationship between LinkedIn data and national research output reveals a monotonic positive association, indicating that countries with stronger research engagement in the CE also tend to offer more CE-related job opportunities. Finland stands out as the leading country in both, showing a strong link between research activity and job market demand. Nevertheless, some countries exhibit clear divergences, pointing to potential gaps between knowledge production and labor market application in the CE. At a broader level, these findings are consistent with macrolevel evidence from panel data models showing that higher CE adoption across European countries is associated with lower unemployment rates, particularly where private investment in circular sectors and trade in recyclable raw materials are strong (Nademi and Sedaghat Kalmarzi 2025). This suggests that the demand-side labor market signals captured through LinkedIn job postings are aligned with the wider macroeconomic dynamics of the CE transition.

In conclusion, this study provides a comprehensive understanding of the CE job market, unveiling characteristics, regional disparities, and potential areas for further exploration. The insights derived contribute to both academic discourse and practical considerations for job seekers and policymakers in the sustainable employment sector.

7.2 | Implications for the CE Labor Market

Apart from descriptive patterns, the results provide insights into how CE strategies are currently translated into labor market demand. The strong cross-country differences observed, particularly between absolute and normalized indicators, suggest that

CE-related employment is not only a function of economic size but reflects differences in policy orientation, institutional support, and organizational readiness. Countries that rank highly in normalized CE jobs may reflect a more proactive integration of circular practices into business activities.

The analysis of job characteristics shows that the CE labor market is mainly shaped by professional and technical roles, particularly in engineering, information technology, management, and business development. This suggests that CE adoption relies less on the creation of narrowly defined "green jobs" and more on adapting existing roles. For the labor market, this implies that the CE transition is driven mainly by changes in skills and capabilities and less by the emergence of entirely new occupations. In addition, we have noticed a relatively high share of hybrid work in several European countries, which may indicate greater organizational flexibility (or experimentation) in implementing CE initiatives. Last, the high number of midsenior level positions suggests that firms tend to rely on experienced professionals, whereas in countries with more entry-level and internship positions (such as Germany and Italy), firms may be aiming to build long-term CE-related human capital.

When we compare our findings with official employment statistics, we notice that traditional indicators may not fully reflect current organizational needs. This highlights the value of complementing official data with more timely labor market data. In a similar way, the positive association between CE research output and CE-related job demand points to a link between knowledge production and labor market opportunities, whereas differences between these two indicators in some countries may suggest possible gaps between research activity, policy support, and labor market outcomes. Nevertheless, we should interpret these relationships as descriptive associations between indicators and not as evidence of direct or causal links.

As an additional reference, we can relate the LinkedIn-based CE job market indicator to other measures of CE performance, such as the circular material use rate (CMR) reported by Eurostat (Eurostat 2024). The CMR captures the share of secondary materials reintroduced into the economy and reflects progress in material circularity. If we compare these two indicators, we notice that high CE-related job demand does not necessarily mean high levels of material circularity. For example, Finland ranks highly in CE-related job demand but remains among the lowest ranked countries in terms of CMR. Ireland and Portugal show similar differences. On the contrary, the Netherlands, Belgium, and Italy appear in high positions across both indicators. This may also suggest that, in some countries like Finland, lower performance in material circularity coincides with increased efforts to strengthen circular practices through workforce development. Overall, these observations show that different CE indicators capture distinct aspects of the transition and should be interpreted as complementary.

These interpretations are also supported by policy-related analyses at the European level, which emphasize the role of coordinated regulatory and policy frameworks for advancing the CE transition. The European Commission's Circular Economy Action Plan highlights the need to align regulation, industrial strategy, and workforce development in order to support the implementation of CE activities in the member states (European Commission 2020). Building on this, subsequent EU monitoring reports show that progress in CE implementation varies considerably across countries (European Commission 2023). This reflects differences in national policy priorities, industrial structures, and labor market readiness.

An important aspect of the findings concerns the observed differences in the number of CE job positions across countries. This variation is likely linked to differences in CE strategies, institutional frameworks, and labor market structures or hiring practices. This means that, for countries with more established sustainability policies, stronger innovation systems, and higher levels of firm engagement in CE-related activities, we may observe clearer labor market signals. From a methodological perspective, we should interpret with caution the results for countries with a relatively small number of CE job postings. In these cases, observations may be more sensitive to short-term changes in hiring behavior or to the posting practices of a limited number of firms. The normalization approach that we adopted helps mitigate the differences in overall platform usage across countries. Also, our repeated data collection helps reduce sensitivity to short-term fluctuations. However, neither approach fully eliminates the problem of small sample sizes and, for this reason, we should interpret findings for countries with low CE job counts in terms of broader patterns and relative positions.

Taken together, these findings show that CE-related employment plays an important role in implementing circular strategies. Monitoring job demand and job characteristics can therefore help us better understand how the CE transition is progressing.

Building on this overall interpretation, the next subsections discuss the theoretical and practical implications of our findings.

7.3 | Theoretical Implications

An important contribution of this study lies in its engagement with the CE literature, particularly the frameworks of sustainability transitions and green job markets, with the results extending current theories. The presence of regional disparities in CE job postings stresses the assumption of uniform global transitions toward sustainability, and the differences evidenced across regions suggest that the role of local economic and policy environments in shaping CE job markets is underestimated. This finding necessitates a more localized–regional approach in theoretical models of sustainability transitions, emphasizing the need for region-specific analysis in assessing the proliferation of CE principles. Our results complement the findings of Tsironis et al. (2022), who also argue for the critical role of local economic and policy environments in shaping CE labor markets, whereas Prosman and Cagliano (2022) also show that a localized and region-specific approach in theoretical models of sustainability transitions is important in promoting CE adoption.

Furthermore, theoretical approaches linking CE adoption to firm-level innovation should account for regional policy frameworks and incentives, with uneven distribution of CE roles

implying that innovation alone may not be sufficient to drive the transition, underscoring the importance of policy mechanisms and public sector engagement in promoting CE growth. This finding is consistent with the work of Bauwens (2021) and with subnational empirical evidence showing that the spatial concentration of CE activities in metropolitan areas is strongly shaped by local and regional public policies (Niang et al. 2024). Specifically, this is more evident in regions with uneven CE job distributions, which suggests that regional policy frameworks, public sector incentives, and supportive institutional environments are very important. For example, innovation can lead to technological advances or new business models, but without complementary policies, such as tax incentives, subsidies, or public–private partnerships, firms may lack the motivation or resources to merit from these innovations. In addition, the uneven distribution of CE roles highlights this gap, because regions with better policy support demonstrate more CE jobs compared to regions where innovation occurs less frequently, thus showing the interconnectedness of policy mechanisms, public sector engagement, and CE growth.

A further theoretical contribution concerns the reconceptualization of CE employment beyond narrow, sector-based categories. The dominance of information technology, engineering, business development, and management in CE job postings suggests that the CE transition is driven not primarily by the emergence of new, exclusively CE-specific occupational categories, such as recycling specialists or repair technicians, but by the greening and circularization of mainstream professional roles across a wide range of industries and functions (Acerbi et al. 2024; LinkedIn 2024). This finding echoes emerging arguments in the green jobs literature that the skills required for a CE are largely complementary to, rather than distinct from, existing professional competencies (Olekanma et al. 2024). For theoretical models of sustainability transitions, this implies that labor market readiness for the CE should be measured not only by the supply of specialized CE workers but by the extent to which CE-relevant competencies, design for circularity, resource efficiency analysis, and circular business modeling are embedded and diffused across the general professional workforce.

7.4 | Practical Implications

From a managerial and policy perspective, the study offers insights into the CE job market and its implications for workforce development. For regions where CE job postings are limited, policymakers may consider developing targeted incentives to promote CE adoption and address possible disparities in employment opportunities. At the same time, governments and organizations can examine regions that show strong CE job growth as reference cases for policy interventions and regulatory frameworks in other areas. As the representation of employment activity on professional networking platforms increases, cross-country comparisons become more informative, as potential data biases or measurement errors can be considered proportionally distributed (Tsagarakis et al. 2024).

For firms and managers, the findings offer specific signals rather than general guidance. The dominance of information technology and engineering in EU CE job postings suggests that digital and technical competencies are increasingly central to CE implementation; organizations lagging in these capabilities may face growing challenges as the CE transition progresses. Countries with high proportions of junior-level CE positions (such as Germany and Italy) suggest firms that are actively building long-term CE human capital pipelines; firms in these markets may benefit from graduate recruitment partnerships with universities active in CE research, which our findings show are positively correlated with labor market activity. Conversely, the high prevalence of midsenior CE jobs in countries like Latvia and Croatia may indicate a need for experienced professionals or workforce transitions, calling for targeted reskilling programs (Alaql et al. 2023). In particular, for job functions that currently lag in CE adoption, managers may benefit from reassessing existing practices and identifying opportunities to integrate circular principles into business models and operational processes. Because sectors with low CE job growth may face increasing challenges as sustainability considerations become more central to competitive advantage, proactive investment in CE-related capabilities may help mitigate future risks (Daglis et al. 2023).

Additionally, we have observed variations across job functions and countries, which underscore the role of education and training in supporting the circular transition. This is further supported by firm-level evidence from outside the EU, where a lack of skills and experience has been identified as a statistically significant barrier to CE adoption, alongside financial and demand-side constraints (Rexhepi Mahmutaj et al. 2025). Targeted training and reskilling programs can help equip workers with the competencies required for positions and roles in sectors showing high CE-related job demand. This, in turn, can facilitate a smoother transition toward more sustainable business practices (Baruffaldi et al. 2017).

7.5 | Social Networks as a Data Source for Research

Social networks have become extremely popular and widely used platforms in today's digital age, playing a major role in the fabric of modern societies. With billions of active users sharing content and information, these platforms are not only essential tools for communication and interaction but also significant sources of abundant data. The vast amount of data generated on social networks provides a rich resource for analysis, offering valuable insights into various aspects of contemporary life, including social trends, public opinion, and market behavior (Ghani et al. 2019). Consequently, leveraging social network data can reveal important patterns and dynamics that shape today's society.

As noted, LinkedIn's global scale makes it a uniquely informative source for cross-country employment analysis (LinkedIn 2026). In our study, we have observed that systematic data collection on CE-related jobs and their attributes, by leveraging the platform's diverse search filters, can yield significant insights into the status and dynamics of the market across various regions and sectors, if properly interpreted. These insights can be beneficial to several stakeholders, including policymakers, entrepreneurs, and educational institutions.

7.6 | Suggestions for Further Research

Future considerations could benefit from incorporating data from additional professional networking platforms, providing a multidimensional aspect of the CE job market, whereas diversifying sources could deal with potential biases inherent in relying solely on LinkedIn data. In addition to broadening data sources, future research could integrate the present demand-side LinkedIn indicators with supply-side approaches that quantify CE employment from input–output tables at the regional or city level (Muñoz H. et al. 2022), enabling a more complete picture of how CE transitions are reflected across both existing employment stocks and active labor demand. Tracking changes in job postings and regional dynamics over time could contribute to a more thorough understanding of the sector's evolution while aiming to share best practices, promote knowledge exchange, and create a global network that could accelerate the growth of sustainable employment opportunities.

Another important direction for future work is the gathering and analysis of the skills, competencies, and qualifications required by the job posts and how those vary across countries and functions, for example, as done by Bals et al. (2019) in the domain of Purchasing and Supply Chain Management, thus applying a more qualitative analysis on the LinkedIn jobs and complementing the quantitative analysis of the present work. Finally, extending or contrasting the descriptive statistics of this work with inferential statistics, for example, by analyzing the relationship between variables or by estimating values of parameters, is another very interesting direction for future work. Important further insights can be gained by content analysis of the job posts or the use of language models, for example, as shown by the methods applied by Toetzke et al. (2024).

7.7 | Limitations

We have recognized several limitations. First, not all countries make equal use of LinkedIn, which means that considering only absolute values per country can provide misleading results. The normalized measure we introduce, "average number of CE LinkedIn jobs per 1000 country jobs," considers each country's overall level of LinkedIn activity and thus provides a more reliable basis for cross-country comparison. However, the results are relative to platform usage and do not necessarily represent absolute employment levels.

A second limitation concerns the representativeness of LinkedIn as a data source. LinkedIn tends to overrepresent jobs that are more likely to be advertised through online platforms but underrepresent small firms, local enterprises, and positions typically advertised through informal channels or public employment services. This means that CE-related vacancies published outside LinkedIn are not captured in the analysis.

A third limitation concerns the definition of CE-related jobs adopted in this study. Job postings were identified based on the explicit presence of the term "circular economy" in LinkedIn search results. Although this approach ensures consistency and transparency across all countries considered, it implies a conservative identification of the CE labor market and may systematically underestimate its full extent. Positions that align with CE principles, such as roles in eco-design, repair and reuse, resource efficiency management, or industrial symbiosis, are not captured if their postings do not explicitly use the CE label. This is a recognized constraint of keyword-based job posting research: The relationship between job titles, job descriptions, and the actual content of work is imperfect, and evolving or sector-specific terminology may not yet have converged on a single label (Alzghaibi 2023; Faliagka et al. 2014). Furthermore, the degree of underestimation may vary across countries and industries. In contexts where CE is strongly embedded in regulatory and organizational discourse, as in some Northern and Western European countries, the CE label may appear more consistently in job postings, yielding a more representative indicator. In contexts where circular practices are prevalent but described through sector-specific or technical language without CE labeling, the approach may more significantly undercount actual CE-related employment. Similarly, the approach may be less representative of small firms, local enterprises, and positions typically filled through informal channels or public employment services, which are known to be underrepresented on LinkedIn relative to larger, internationally networked organizations (Buettner 2017; Kwok and Muniz 2021). These potential biases should be considered when interpreting and comparing the country-level results. The normalization procedure adopted in this study (CE jobs per 1000 total LinkedIn jobs) partially mitigates differences in overall platform usage across countries but does not eliminate these representativeness concerns. At the same time, the use of "circular economy" as the primary search term was deliberate: the concept has achieved a high level of standardization and institutional recognition across policy, industry, and academic contexts (Kirchherr et al. 2023; European Commission 2020), and its use as a search query enables replicable, comparable data collection at scale.

A fourth limitation concerns the degree of relevance of some lower ranked results to the CE, as the term may appear in job descriptions ranging from a general orientation toward circularity to roles fully dedicated to CE activities. However, we expect this effect not to differ significantly across countries. In addition, disabling personalization of search results helps ensure that unrelated jobs matching the user profile do not appear in the retrieved lists, thereby improving consistency across searches.

8 | Conclusion

In this work, we have explored the CE job market using LinkedIn data, providing an overview of the current status and focusing on regional disparities, job characteristics, and comparisons with indicators from other sources. This analysis offers an indicative picture of how CE-related employment is reflected in online job postings across countries.

Specifically, our analysis highlights notable geographical patterns and differences in the CE job market, especially when comparing absolute numbers with a normalized indicator. For example, the United States ranks first in absolute numbers but second to last in the normalized index. A comparison between the European Union and the United States reveals distinct job characteristics in terms of work arrangement (hybrid jobs are

more common in the EU), job type (full-time jobs are more common in the United States), job experience level (CE jobs in the United States tend to target more senior professionals), and job functions (information technology leads in the EU, whereas in the United States, manufacturing ranks first). These findings point to heterogeneity in how CE-related employment demand is expressed across labor markets.

When comparing the LinkedIn-based indicator with an official Eurostat indicator, we notice important discrepancies. Specifically, most EU countries (63%) rank inconsistently across the two measures, and statistical analysis confirms this negative association. In addition, an examination of the relationship between employment and research output in CE reveals a monotonic positive association, indicating that countries with stronger research engagement in CE also tend to offer more CE-related job opportunities, with Finland standing out as the leading country in both. These findings should be interpreted as indicative associations rather than as evidence of direct or causal relationships.

Overall, we can consider the insights derived from this analysis as a benchmarking tool for understanding the emerging field of sustainable employment. They may inform policymakers, industry stakeholders, researchers, and job seekers by illustrating how CE principles are reflected in the labor markets of different countries, highlighting areas where further coordination between policy, research, and labor market actors may be beneficial.

Through these findings, we point to several concrete directions for future research. First, longitudinal analyses that track CE-related job postings over time will allow researchers to examine the dynamics of labor market adjustment, identify emerging occupations and roles, and assess whether observed disparities across countries persist over time. Second, future studies can expand the data by considering multiple data sources, such as other professional networking platforms or national vacancy databases, aiming at reducing platform-specific biases. This would help validate and refine indicators of CE-related employment demand. Third, further research can focus on the skills, competencies, and qualifications required for CE-related jobs. By combining the quantitative analysis of this work with a qualitative analysis (such as content analysis of job descriptions), we can provide deeper insights into workforce requirements and reskilling needs. Last, we could examine more explicitly the interaction between policy frameworks, research activity, and the labor market by connecting the employment indicators with policy interventions and institutional contexts. In this context, comparative studies at the subnational, regional, or sectoral level will be particularly valuable for understanding how different CE strategies affect employment under different socioeconomic and regulatory conditions.

Author Contributions

Pavlos Fafalios: conceptualization, methodology, software, data curation, investigation, validation, formal analysis, visualization, writing – original draft, writing – review and editing. **Theodoros Daglis:** writing – original draft, writing – review and editing. **Konstantinos P. Tsagarakis:** conceptualization, methodology, data curation, investigation, validation, supervision, visualization, project administration, writing – original draft, writing – review and editing.

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