ETC CE Report 2026/4

A just transition to a circular economy in Europe: Monitoring jobs, skills and workforce inclusion

Authors:
Wim Van Opstal (VITO), Dani Sangers (VITO), Lize Borms (VITO), Susanna Paleari (IRCrES), Imke Schmidt (Wuppertal Institute), Andrea Van Acker (VITO), Burcu Gözet (Wuppertal Institute)

European Environment Agency
European Topic Centre
Circular economy and resource use

Cover design: EEA
Cover image ©SolStock, licensed
Layout: ETC CE

Publication Date 21 April 2026

EEA activity Circular Economy and Resource Use

ETC CE coordinator: Vlaamse Instelling voor Technologisch Onderzoek (VITO)

ETC CE partners: Banson Editorial and Communications Ltd, česká informační agentura životního prostředí (CENIA), Collaborating Centre on Sustainable Consumption and Production (CSCP), Istituto Di Ricerca Sulla la Crescita Economica Sostenibile, Istituto Superiore per la Protezione e Ricerca Ambiantale, IVL Swedish Environmental Research Institute, Norion Consult, Universita Degli Studi Di Ferrara (SEEDS), German Environment Agency (UBA), Teknologian Tutkimuskeskus VTT oy, Wuppertal Institut für Klima, Umwelt, Energie gGmbH, World Resources Forum Association.

DOI 10.5281/zenodo.19668753

European Topic Centre on
Circular economy and resource use
https://www.eionet.europa.eu/etcs/etc-ce

Contents

Acknowledgements

The ETC task team is grateful for the guidance and support of the EEA task manager Martina Bisello (EEA). The team also thanks Sanna Due (EEA) for her helpful suggestions and feedback. Further appreciation goes to Ioannis Bakas, Valeska Götz, Peder Jensen and Tobias Nielsen (EEA) for valuable input during the preparation of this report. The authors also thank Jorge Cabrita (Eurofound), Stelina Chatzichristou (Cedefop), Oscar Gomez Prieto (Eurostat), Esther Goodwin Brown (Circle Economy) and Casper Edmonds (ILO) for their constructive and insightful feedback. Finally, appreciation goes to Malgorzata Bednarek, Ivana Gudelij and Jens Guenther for their review through the EEA/Eionet focal point network, as well as to participants in the online EEA workshops on *Jobs in a Just Circular Transition* held on 23 September 2025 and 18 November 2025 for their constructive input. The authors also thank all interview respondents for their support throughout the project.

Summary

This report examines the employment implications of the transition to a circular economy in Europe, with a focus on job creation, job quality, and skills within a just transition framework. Policy assessments expect the circular transition to generate around 700,000 additional jobs by 2030 compared to an estimated 4 million circular jobs in 2018. However, the analysis shows that existing evidence remains partial and that current monitoring frameworks provide an incomplete picture of circular labour-market dynamics.

A comprehensive assessment of employment, job quality, and skills indicators shows that monitoring relies mainly on Eurostat's circular economy employment indicator, which captures around 4.4 million full-time equivalent jobs in 2023. Definitional constraints and data limitations lead to a systematic underestimation of reuse, repair, and informal circular work. Data gaps persist regarding disaggregation by gender, age, education, and socio-economic group, as well as the capacity to monitor distributional, procedural, and recognitional justice dimensions.

While circular economy policies in Europe may also generate significant labour impacts beyond Member States through global value chains and trade relations, the analysis focuses on employment implications within Europe. The findings show that circular transitions involve simultaneous job creation and job losses across sectors and regions. Job quality varies strongly across circular activities, with risks related to low wages, instability, and occupational safety concentrated in several core circular sectors. Skills demand shifts towards hybrid technical, organisational, and transversal competences. Significant geographical inequalities emerge between Member States, regions, and urban versus rural areas. Informal and unpaid contributions to circularity remain largely unrecognised despite their relevance. The report concludes that a just circular transition requires improved labour-market monitoring and targeted policy action. Ensuring that firms can attract, retain, and upskill the workforce is essential for social fairness as well as for long-term competitiveness and economic resilience in Europe.

1 Introduction

1.1 Why this report

The transition to a circular economy is gaining political momentum across the European Union (EU) and globally, reflected in the growing number of national circular economy roadmaps and strategies and its integration into industrial, labour, and social policy (UNIDO, 2025). Circular strategies – from eco-design and reuse to remanufacturing and recycling – are promoted as instruments for reducing environmental pressures, enhancing resource efficiency, and supporting the development and uptake of circular innovations. However, there is growing recognition that such transitions are not inherently just. Circular systems do not automatically deliver socially beneficial outcomes (EEA, 2024b; ETC CE, 2025). Ensuring that circularity contributes to social fairness requires embedding justice into the design, governance, and monitoring of circular policies and employment transformations.

European policy frameworks such as the European Green Deal, the Circular Economy Action Plan, and the Clean Industrial Deal emphasise the transformative potential of circularity for achieving sustainability targets. These initiatives are expected to create new employment opportunities in repair, remanufacturing, eco-design, logistics, digital services, and education (European Commission, 2019, 2020a, 2025a). A recent Joint Research Centre study by Foster et al. (2024) identifies twelve categories of socioeconomic impacts linked to circular economy policies and concludes that employment features as the most frequently assessed category across both the scientific and policy literature. Recent international monitoring initiatives further underline this importance. For example, the International Labour Organization and Circle Economy have begun to develop global assessments of circular employment and its potential contribution to decent work, highlighting both the scale of emerging labour-market changes and the need for improved monitoring frameworks (Circle Economy et al., 2025b). At the same time, employment opportunities are not evenly distributed. Circular transitions may reinforce existing inequalities if benefits accrue to already privileged actors or regions, while vulnerable groups face job loss, skills mismatches, or marginalisation. Circular practices in the informal economy, such as community repair, waste picking, and voluntary sharing, remain undervalued despite their ecological contributions and potential social benefits.

Employment transformations linked to circularity must therefore be carefully managed and monitored. This requires an analytical framework for understanding who gains and who loses, who participates in decision-making, and whose contributions are recognised in processes of job creation and destruction, under what working conditions, and with what skills. In particular, three justice dimensions offer a conceptual foundation for this effort: distributional (who gains and who bears the costs), procedural (who participates in shaping transitions), and recognitional (whose perspectives and contributions are valued) (EEA, 2024c; ETC CE, 2025; Kirchherr, 2021).

Much of the debate on a just circular transition contrasts industrialised economies with the Global South, highlighting cross-border inequalities. While this perspective remains essential, justice concerns *within* the EU have received comparatively limited attention. The need for such a framework is particularly relevant given the ambition of the EU to advance a Circular Single Market and to establish a new Circular Economy Act as part of a broader Clean Industrial Deal. These initiatives aim to create market demand for secondary materials, strengthen eco-design requirements, and transform value chains such as construction and consumer goods. The revision of the Construction Products Regulation and new packaging rules are expected to produce far-reaching effects across multiple industries. However, their social implications remain underexplored. A just circular transition must therefore be guided not only by ecological imperatives but also by a commitment to social fairness. The European Parliament has called for a stronger integration of circular economy measures with the European Pillar of Social Rights and gender equality strategies (European Parliament, 2021).

This report responds to these policy imperatives through a structured analysis. Chapter 2 outlines the analytical framework for monitoring job creation in the transition to a circular economy, grounded in justice dimensions. Chapter 3 evaluates existing indicators and suggests improvements for monitoring circular jobs, job quality, and skills. Chapter 4 explores two thematic areas: geographical inequalities and the integration of vulnerable groups. Chapter 5 concludes with methodological and policy reflections. Throughout this report, short case studies on job profiles illustrate the main concepts and issues discussed.

1.2 Methods

This report adopts a mixed-methods approach to develop an analytical framework for monitoring job creation and transformation in the context of a just circular transition. The applied methods combine desk research, policy analysis, stakeholder consultations, indicator assessment, and empirical investigations. Each section of the report draws on a methodological strategy appropriate to its scope.

In Section 2.1, the review of relevant policy initiatives builds on a systematic screening of European industrial policy frameworks, including the Clean Industrial Deal, the Circular Economy Action Plan, and employment and social policy frameworks such as the European Pillar of Social Rights. In addition, the 2022 and 2024 Circular Economy Country Profiles were reviewed to map Member State-level actions regarding skills and jobs in a circular transition. This policy mapping was complemented with desk research to capture emerging initiatives and recent updates. Section 2.2 explores stakeholder perspectives on the labour-market, job quality, and skills dimensions of a just circular transition. This involved a targeted literature review and a stakeholder mapping to identify relevant civil society organisations and representative bodies, including trade unions and business representatives. Semi-structured interviews were conducted with stakeholders across these groups, including representatives of international circular economy organisations, a European SME association, and sustainability and circular economy institutes, with the latter spanning both EU Member States and a non-EU country. The interviews focused on how these respondents perceive employment impacts, opportunities, and justice implications of the circular transition. For Section 2.3, a comprehensive literature review was conducted to assess how concepts such as circular jobs, job creation and destruction, job quality, and skills are addressed in current academic and policy literature. This review serves as the foundation for the analytical framework developed in Section 2.4.

Section 3 focuses on the mapping and assessment of existing indicators on jobs, job quality, and skills. The work began with the formulation of an ideal indicator set, grounded in the Bellagio principles for sustainability indicators and the RACER criteria (Relevant, Accepted, Credible, Easy, Robust) as applied by the European Commission (ISPRA & EEA, 2020). This conceptual foundation guided the mapping of existing indicators from academic sources and major statistical authorities. Two online workshops were organised with representatives from statistical authorities and other relevant organisations. In addition, bilateral expert meetings were held with Eurostat, the International Labour Organization (ILO) and Circle Economy to gain insight into current methodological practices and to identify gaps and potential improvements in measurement.

Section 4 includes two thematic deep dives: on geographical inequalities and on the integration of vulnerable groups. These analyses are informed by a combination of literature review, interviews with regional and social stakeholders, and statistical analyses of available administrative data. Throughout the report, illustrative case studies across selected value chains and circular strategies were developed and integrated in text boxes. These were selected based on diversity in sector, skill level, and employment type. The case studies were constructed using a combination of literature review, secondary case material, and stakeholder interviews to illustrate how circular economy transitions affect job profiles, working conditions, and skills requirements in practice.

2 Towards an analytical framework

This section lays the groundwork for assessing how the circular economy transition affects employment, job quality, and skill development. It begins with a mapping of policy initiatives at the EU and national levels (2.1), focusing on how governments and institutions promote circular employment and skill-building measures. Next, it examines the perspectives of key stakeholders (2.2), including workers, consumers, businesses, financial actors, research and education, highlighting their roles, concerns, and influence in shaping a just circular transition. The third subsection presents a literature review (2.3) synthesising recent insights from academic literature and policy reports on the employment impacts of circular strategies, offering definitions, classifications, and empirical findings. Finally, an analytical framework (2.4) is developed, structured around distributional, procedural, and recognitional justice, to guide the assessment of circular jobs, aggregate employment dynamics, job quality, and skills through a just transition lens.

2.1 Policy initiatives

To inform the analytical framework, we start with an analysis of policy initiatives, addressing both the EU and its Member States (along with other EEA countries). First, we provide a synthetic overview of the most relevant initiatives undertaken by the EU to support skills development and job creation in a circular transition. Secondly, we provide an overview of significant examples of national policy initiatives. This is based on a screening of the 2022 and 2024 CE Country Profiles and scanning of available evidence online.

2.1.1 EU policy initiatives

According to the 2020 Circular Economy Action Plan (European Commission, 2020a), between 2012 and 2018, the number of jobs linked to the circular economy in the EU grew by 5% to reach around 4 million. A further 700,000 new jobs are expected to be created by 2030 (along with a potential increase in EU GDP of 0.5% induced by a circular transition). Circularity, however, can have a positive net effect on job creation only if workers acquire the skills required by the green transition. Therefore, the CEAP lists several instruments in support of education, skills and job creation, including the Skills Agenda, the EU Pact for Skills, the Action Plan on the Social Economy, the European Social Fund Plus, the European Urban Initiative, etc.

We first summarise an overview of the most relevant initiatives undertaken by the EU to promote skill development and job creation in the circular economy. These initiatives are different in terms of nature and objectives (e.g., policy strategies, funding, networking activities, etc.), targeted stakeholders (public authorities at the national, regional, local levels; the private sector; the social economy; etc.), scope, etc. Importantly, only a few of them are exclusively focused on the greening of skills (European Economic and Social Committee, 2023) and even fewer on the circular economy.

EU strategies and skills frameworks

The **European Green Deal** and the **Green Industrial Deal** (EC, 2023d) both emphasize circularity as a core component of their strategies for a sustainable future. The **Clean Industrial Deal** (EC, 2025a) reaffirms the strategic relevance of circularity by identifying it as a key priority for enhancing EU competitiveness and resource sovereignty, and it proposes a **new Circular Economy Act (2026).** It highlights that the circular potential of the European remanufacturing market is expected to expand significantly, increasing in value from EUR 31 billion today to EUR 100 billion by 2030 and generating

around 500,000 new jobs. The Clean Industrial Deal explicitly recognises skills and quality jobs as a key enabler for social fairness and a just transition. Its flagship actions include a Quality Jobs Roadmap (2025), and a Fair Transition Observatory (2026), which will monitor indicators related to employment, reskilling, and job quality in green and circular transitions. The **Quality Jobs Roadmap** (European Commission, 2025c) aims to improve job quality and create future-proof jobs across Europe. To this end, it focuses, *inter alia*, on supporting workers and employers in the green and digital transitions. It recognises that there is a growing need for a skilled workforce in economic activities related to sustainable product design, reuse, remanufacturing and recycling of materials, as well as in cleantech and bioeconomy. It also highlights the role played by the New European Bauhaus Academy in accelerating up and re-skilling across the construction ecosystem.

The **European Skills Agenda**, adopted in 2020 (European Commission, 2020b), is a five-year plan to strengthen inclusive education, training, and labour market resilience across the EU. Among its actions, the Agenda introduced dedicated measures to promote skills for the green transition. These include a taxonomy and monitoring framework for green skills, the development of a core green skills set, and support for integrating environmental and climate dimensions into all levels of education and training. While the focus is broader than circularity, these measures provide tools to identify, support and track circular economy-related professional development.

Building on the Skills Agenda, the **Union of Skills** (EC, 2025c), adopted by the European Commission in March 2025, represents a new overarching strategy organised around four pillars, including the up- and reskilling of workers for the green and digital transition. It explicitly commits to scaling up training in strategic sectors, many of which involve circular business models, resource efficiency, or regenerative processes. The strategy also includes the creation of a Skills Guarantee pilot and enhanced EU Skills Academies to meet emerging skills demands from industry for the green and digital transition and the Clean Industrial Deal.

In order to improve skills in science, technology, engineering, and maths (STEM), a **STEM education strategic plan** was presented by the European Commission (A STEM Education Strategic Plan: Skills for Competitiveness and Innovation, 2025). The plan recognises that advanced STEM skills are crucial, *inter alia*, for climate forecasting and circular economy and provides support for the development of interdisciplinary degrees applying digital technologies to, for example, climate modelling and circular engineering.

A cornerstone of both the Skills Agenda and the Union of Skills is the **EU Pact for Skills** (European Commission, 2020c), which facilitates partnerships among public and private actors to promote upskilling and reskilling. Its scope is economy-wide and the Pact includes Large-Scale Partnerships (LSP) and Regional Skills Partnerships (RSP). In 2022, a LSP for the Proximity and Social Economy Ecosystem was set up to promote upskilling and reskilling of 5% of the workforce (or 1,145,000 workers) each year by 2030 across the ecosystem. In 2024, an estimated 3,200 members of the Pact reported reaching around 2.6 million individuals with upskilling and reskilling efforts. However, capacity limitations remain a key challenge for realising its potential impact (European Commission, 2020c).

The **EU Action Plan on the Social Economy** (EC, 2023b) recognises the role of social enterprises in pioneering circular economy solutions at the local level. It identifies the reuse, repair, and recycling sectors as particularly promising for inclusive job creation, especially for disadvantaged groups. The Action Plan promotes partnerships between social economy actors and mainstream businesses and provides guidance to cities and regions via platforms such as the European Circular Economy Stakeholder Platform and the Circular Cities and Regions Initiative.

The 20 principles of the **European Pillar of Social Rights** express principles and rights essential for fair and well-functioning labour markets and welfare systems in 21st century Europe. The **EU Pillar of Social Rights Action Plan** (The European Pillar of Social Rights Action Plan, 2021) highlights that the CE Action Plan lays the foundations for an industrial policy that stimulates innovative and competitive industrial ecosystems, which are crucial to creating new sustainable job opportunities. The European Parliament has repeatedly called for better integration of circular economy measures with the European Pillar of Social Rights (Resolution of 10 February 2021 on the New Circular Economy Action Plan, 2021; Resolution of 23 November 2023 on Job Creation – the Just Transition and Impact Investments, 2023), underlying the need for a more holistic understanding of sustainability, sustainable jobs and the just transition.

Complementary platforms, sectoral programmes, and observatories

The **European Alliance for Apprenticeships (EAfA)**, a long-standing platform launched in 2013 and renewed in 2020, supports the quality, supply and image of apprenticeships across Europe (EC, 2025b). It has recently expanded to include green and digital transition themes, creating a dedicated community of practice focused on the skills needed for sustainability transitions. Although not exclusive to the circular economy, it provides a complementary instrument for work-based learning aligned with relevant industries for a circular transition.

The **European Circular Economy Stakeholder Platform**, a joint initiative by the European Commission and the European Economic and Social Committee (EC, 2019), serves as a dissemination and engagement hub for circular economy policies, case studies, and learning tools. It is increasingly used to promote educational materials and best practices in skilling, upskilling, and reskilling towards circularity, and facilitates peer learning and policy exchange among stakeholders.

Several sectoral or thematic initiatives further strengthen circular economy-related skills at the local and industry levels. The **New European Bauhaus Academy** (EC, 2022) focuses on reskilling workers in the built environment towards sustainable construction practices, including reuse of materials and regenerative design principles. The **Net-Zero Industry Academies** (EC, 2024), launched under the 2023 Net-Zero Industry Act (Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on Establishing a Framework of Measures for Strengthening Europe's Net-Zero Technology Manufacturing Ecosystem and Amending Regulation (EU) 2018/1724 (Text with EEA Relevance), 2024), aim to train 100,000 workers per Academy in fields including technologies such as biogas, landfill gas, and biotech solutions. The Academies focus on developing skills and training for net-zero technologies, which often involve circular economy principles.

The **European Institute of Innovation and Technology (EIT)** - an independent EU body set up in 2008 to drive Europe's ability to innovate - and its Knowledge and Innovation Communities (KICs) support innovation and skills development for entrepreneurs across multiple sectors. Notably, the EIT has launched the *InnoEnergy Skills Institute* (formerly European Battery Academy) and the *Girls Go Circular* initiative, which deliver large-scale training in circular value chains and digital entrepreneurship. Cross-KIC collaborations have also sought to strengthen circular economy capacity in the Western Balkans (EIT Manufacturing, 2021).

At the regional and urban level, the **Circular Cities and Regions Initiative (CCRI)**, **Intelligent Cities Challenge (ICC)** and **European Urban Initiative (EUI)** promote place-based circular economy experimentation, including job creation and capacity building. These initiatives facilitate interregional cooperation and support local governments in identifying circular economy opportunities linked to regional economic development, often backed by EU structural funds or Horizon Europe (EC, n.d.) (EUI, n.d.; ICC, 2025).

In addition, the **European Fair Transition Observatory**, led by the Directorate-General for Employment, Social Affairs and Inclusion (DG EMPL) and announced as a flagship initiative under the Clean Industrial Deal, aims to facilitate the monitoring and implementation of fairness transition policies across the EU. Its envisaged functions include the collection and provision of data on fairness aspects of transition policies, the identification of good practices, and the facilitation of stakeholder engagement across governance levels. The Observatory is expected to be established in the coming period and will represent an important future instrument for integrating social fairness considerations into industrial, climate, and labour-market policy monitoring at EU level (ECNO, 2025).

The **Cedefop Green Observatory**, operated by the EU agency Cedefop, provides labour market intelligence on the impact of green transitions on skills demand across sectors and occupations in the EU. While most of its work is general to the green transition, select policy briefs focus explicitly on circularity (e.g. reuse and eco-design), making it a useful resource for monitoring circular economy job trends (Cedefop, 2026a). Furthermore, the Union of Skills governance will be informed by the forthcoming **European Skills Intelligence Observatory**. The observatory will provide data and foresight regarding skills and allow for early warning alerts regarding skills shortages in critical or strategic sectors.

EU funding mechanisms

Finally, a wide range of **EU funding instruments** supports investments in skills and human capital that are relevant for the CE transition (ETC CE, 2024b; European Commission, 2021a)

- The **Recovery and Resilience Facility (RRF)** and **React-EU** provide post-pandemic investments, some of which target circular economy activities and related jobs and skills, as part of the green transition (EC, 2021b).
- The **European Social Fund Plus (ESF+)** is the EU's main vehicle for skills and social investment, with €5.8 billion earmarked for green skills and jobs, including in the circular economy (EC, 2021a).
- **Erasmus+** also funds circular economy-relevant education and training projects, as illustrated in Table 1 (EC+, n.d.).
- Additional support is available via the **European Global Adjustment Fund (EGF)**, which assists workers displaced by low-carbon restructuring[1]; the **Just Transition Fund (JTF)**, which supports region and communities impacted by the transition to climate neutrality, by promoting economic diversification and creating new opportunities, including in the circular economy[2]; and the **European Regional Development Fund (ERDF)**, which is designated to strengthen economic, social and territorial cohesion in Europe, including by supporting investments for green and circular initiatives, and skills development[3].
- **InvestEU**, the **Modernisation Fund**, and the **Technical Support Instrument (TSI)** further enable investment and capacity building for the green transition across Member States.

[1] https://employment-social-affairs.ec.europa.eu/policies-and-activities/funding/european-globalisation-adjustment-fund-displaced-workers-egf_en
[2] https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes/just-transition-fund_en
[3] https://ec.europa.eu/regional_policy/funding/erdf_en

Table 1 – Examples of Erasmus+ initiatives related to a circular economy

Acronym	Full title	Objectives/results	Duration	Involved countries
FOOD-Y EU		Promote CE and food waste management among NEET (Not in Employment, Education, or Training) youth	2022-2024	SE, TU, RO, EL, IT
Climacy		The project has facilitated the development of skills in creative writing and workshop development among educators and youth workers so as to promote sustainability (including circularity)	2022-2024	DE, IT, BG
Think CircEco	Promoting CE thinking and opportunities among NEETs and low-skilled adults	Support NEETs in using the potential of the CE by equipping them with the necessary skills and tools, thus facilitating their entry into the labour market	2022 (start)	ES, RO, AT, EL, IT
CERES	Circular Innovation Ecosystem REdesigning Skills	Introduce the topic 'CE' in higher and professional education. A CE Digital Innovation Hub will be created, i.e. a digital platform where users and SMEs can find a space for discussion on issues of ecological transition, courses and information materials on circularity.	2023-2026	CY, BG, DK, FR, IT, UK
CIRC	CIRcular City Project	Train adult educators in CE methodologies while empowering marginalized adults by imparting essential skills and competencies.	2023-2025	DE, SK, IT, PL, CY, NL
INSIGHT	Fostering Industrial Symbiosis through the development of a novel and innovative training approach	Provide training for a new professional profile: the industrial symbiosis facilitator. An e-learning platform gives access to the training course which has been created.	2019-2022	BE, SI, ES, IT, RO
Furn 360	Circular Business Training for the Furniture and Woodworking Sectors	Create a training curriculum to facilitate the implementation of circular business models in the furniture sector. The FURN360 training course was developed by the consortium.	2017-2020	DE, BE, ES, FI
CICLO		Upgrade and multiply the opportunities for upskilling and reskilling of long term unemployed and low-skilled workers, in the field of evolving CE market, via innovative VET tools and pedagogies, accompanied by skills acquisition assessment, recognition and validation methods.	2019-2021	SK, CY, ES, EL, IT, PT, IE
PackAlliance		Foster Academia-Industry collaboration for the development of new skills and competence building for innovation towards the transition of the plastics packaging industry to a CE model.	2020-2022	FI, IT, PL, ES

Sources: own elaboration of projects websites[4]

2.1.2 National policy initiatives

Now, we provide an overview of the policy initiatives by EU Member States and EEA countries supporting education, training, skill development, and job creation in a circular transition. A comprehensive, but non-exhaustive inventory of significant initiatives undertaken at the country level by public and private actors and by social enterprises has been prepared, based on the screening of the 2022/2024 CE Country Profiles[5] and of the Education and Training Monitor's country reports,[6] as

[4] https://foodyproject.eu/about/; https://climacy.myerasmus.net/; https://www.thinkcireco.net/; https://www.circularceres.net/; https://circ-city-project.eu/; https://www.insight-erasmus.eu/; https://www.furn360.eu/; https://ciclo-project.eu/; https://erasmus-plus.ec.europa.eu/projects/search/details/612212-EPP-1-2019-1-ES-EPPKA2-KA

[5] https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-reports-2022-5-circular-economy-country-profiles-a-set-of-30-country-profiles-that-summarise-policies-and-initiatives-in-the-area-of-circular-economy; https://www.eionet.europa.eu/etcs/etc-ce/products/country-profiles-on-circular-economy-in-europe

[6] https://op.europa.eu/webpub/eac/education-and-training-monitor/en/index.html (the country reports contain a section on 'learning for sustainability').

well as on the CESP 'education and training' toolbox and online desk-research (see supplementary materials). As of March 2025, about 130 recent/ongoing policy initiatives have been recorded for 25 EU Member States and nine EEA countries (both members and cooperating countries).[7]

Integration of skills and jobs in circular economy strategies

A growing number of Member States have adopted dedicated circular economy strategies or action plans, with countries such as Czechia, Cyprus, Estonia, Portugal and Italy explicitly identifying skill development and employment generation as strategic priorities. Wallonia's *Circular Wallonia* initiative aims to increase circular employment by 20% between 2017 and 2025, while Hungary's forthcoming circular economy strategy sets a 30% increase target in circular jobs by 2040. These targets reflect a growing awareness of the employment potential of circularity when paired with proactive policy.

In addition to circular economy-specific frameworks, many countries have embedded circular economy considerations into broader skills and labour market strategies. Greece's 2023 Skills Strategy prioritises circular skills; Latvia's National Education Guidelines (2021–2027) promote green competencies across vocational education and training (VET); and Portugal's National Ocean Strategy and Marine Litter Action Plan link circular principles to blue economy employment and eco-design training. Similarly, spatial planning policies in Portugal now include circularity-related job creation in areas such as servitisation, reuse, and remanufacturing.

Public initiatives and national programmes

Public authorities have developed a wide range of concrete initiatives beyond policy declarations. For example, the Circular Economy Finland programme serves as a national hub connecting circular economy solution seekers and providers, while its Circular Design Programme delivers training for corporate designers and R&D professionals. In Portugal, the CIRCO Hub supported 95 companies and 50 designers in applying circular design principles, and Ireland's Rediscovery Centre has evolved into a national circular economy hub, combining social enterprise development with sectoral reuse initiatives.

Other notable efforts include Lithuania's small business support programme, which promotes green and circular economy employment for vulnerable groups, and Austria's Open4Innovation platform, which earmarks €92 million to support circular economy projects that increase employment, with a focus on gender inclusion. Multiple Member States - such as Croatia, Estonia, Cyprus and Bulgaria - have included skill training relevant for the circular economy in their national recovery plans or cohesion programmes. France's Ecological Transition Contracts and Portugal's InC2 initiative provide frameworks for municipal-level engagement with circular economy actions, including workforce development and training.

Partnerships between public, private, and social economy actors

Partnerships between public authorities, private enterprises, and social economy actors are increasingly central to circular employment and skills initiatives. The Dutch CIRCO programme, backed by the Ministry of Infrastructure and Water Management, has supported over 1,000 companies in implementing circular design, while Austria's BauKarussell consortium enables deconstruction projects that employ disadvantaged workers through social enterprises. Ireland's Circular Economy Innovation Grant Scheme, Romania's incentive schemes, and Switzerland's new 2024 programme to

[7] No information was found about Iceland, Malta, North Macedonia, and Sweden.

fund circular training and platform development also illustrate how financial incentives are being deployed to drive employment outcomes.

Notable EU Interreg-funded projects highlight regional and transnational cooperation. The *WE.Circular* project addresses the underrepresentation of women in circular economy sectors, *Crescento* is developing a joint master's programme in circular economy, and *Circular Spaces* supports eco-design skills among maker communities. These projects reflect a growing emphasis on lifelong learning and inclusion in circular economy workforce development.

Role of research institutes, universities and NGOs

Academic institutions and non-profit organisations also play a prominent role in advancing circular economy education and training. In Slovenia, the ReBuilt initiative integrates circularity and digital tools into construction sector curricula, while in Ireland, the Galway-Mayo Institute of Technology offers a postgraduate diploma and MSc in circular economy leadership. KU Leuven has launched interdisciplinary postgraduate circular economy programmes for professionals, and universities in France and Italy have introduced dedicated degrees in areas such as sustainable chemistry.

In Germany, the Fraunhofer Institute's Reman-Lab provides practical, industry-linked circular economy training in remanufacturing, while in Luxembourg, the NGO Digital Inclusion trains displaced persons in digital repair. Spain's AERESS collaborates with appliance manufacturers to create second-hand value chains that combine circular principles with social employment.

Monitoring Skills and Employment in the Circular Transition

Finally, several national authorities are actively developing monitoring systems to capture the employment effects of the circular economy. Statistics Finland tracks circular economy jobs and pay levels; Poland's *oto-GOZ* project developed regional and national circular economy indicators, including job-related metrics; and Spain's public employment service (SEPE) produces prospective sectoral studies with data feeding into national circular economy action plans. In Flanders, the Circular Economy Policy Research Centre has produced dedicated employment studies, while localised analyses have also been undertaken in cities like Paris and Amsterdam.

2.2 Stakeholder perspectives

In this section, we examine stakeholder perspectives to broaden our understanding of the key considerations in defining policies for a just circular transition. These insights inform our analytical framework by introducing perspectives and metrics that may otherwise be overlooked or taken for granted, thereby contributing to a more inclusive and comprehensive approach. This stakeholder analysis builds on a two-dimensional understanding of stakeholders. On the one hand, it considers groups that are directly affected by circular economy policies related to jobs and skills, and who therefore have a vested interest in their outcomes. On the other hand, it includes actors who hold the capacity to influence the success or failure of such policies. These two dimensions are not mutually exclusive and may overlap.

A literature review formed the basis for identifying stakeholder groups or categories and individual representatives of these groups. For the stakeholder groups, the impact of the topic on the actors belonging to this group was of interest. For the individual stakeholders, their interest in the issue and the potential influence on it, as well as the question whether they were already mobilised, was analysed. Additionally, sectoral and regional particularities were identified. Five expert interviews

from research and practice were conducted to refine the understanding of stakeholder perspectives and fill potential literature gaps.

2.2.1 Workers

The largest affected group regarding labour market and skill developments are workers themselves. For them, the transition to a circular economy may cause significant disruptions, both positive and negative (Alessio et al., 2021; Multani et al., 2024). Some labour-intensive sectors, such as services, repair, and waste management, may see job growth, while material-intensive, resource-extracting industries may face job losses (Alessio et al., 2021). Regardless of whether it is a 'winning' or 'losing' sector, new competences and skills are needed in order to master the tasks of a circular economy (Bianchi, 2020). High-quality circular jobs, especially those in management, design, and innovation, often demand advanced qualifications and transversal competences such as systems thinking (Cedefop, 2023b). In contrast, many core circular jobs in waste collection, sorting, or repair require manual skills and low formal qualifications, raising concerns about job quality and long-term career perspectives. Hence, alongside net employment effects, close attention must be paid to reskilling and upskilling trajectories to ensure inclusive participation in the circular transition (Bianchi, 2020; ILO, 2022).

Vulnerable groups in the labour market – such as migrants, people with disabilities, and rural populations – face specific challenges in a circular transition, as they are often concentrated in informal, low-paid, or precarious jobs (CISL, 2023). Gender inequalities also persist, as women remain underrepresented in technical sectors and overrepresented in lower-paid service roles. These dynamics particularly hold for sectors like textiles, waste processing, and domestic repair, where informal employment remains prevalent, especially in Eastern and Southern Europe (Gittins & Letenyei, 2024; Gusheva et al., 2022; Irvine, 2023; Rendon et al., 2021). Formal workers are typically represented by unions that can influence labour policy and workplace conditions, but informal workers – often women and migrants – lack collective representation and are at risk of further marginalisation. Especially mothers with children perform most unpaid household work in the EU (Román & Ophir, 2024), which shows how informal labour extends into the private sphere. This matters for the circular economy, as key activities like sorting waste, maintenance and cleaning, take place at home, requiring time and effort. At the same time, the circular economy holds potential for inclusive job creation through local, manual-intensive activities, particularly where regionally embedded loops support reshoring and decentralised production. Work Integration Social Enterprises (WISEs) can play a strategic role in capturing this potential (Van Opstal et al., 2024).

Trade unions play a key role in a just circular transition by advocating for decent working conditions and participatory governance structures. At the European level, organisations such as the European Trade Union Confederation (ETUC), the European Trade Union Institute (ETUI), industriAll Europe, and the European Federation of Public Service Unions (EPSU) have engaged with circular economy policies (ETUI, 2020; industriAll, 2022; Weghmann, 2017), although their general interest and influence in this field remain moderate.

Given the decline of fossil fuel industries and other energy-intensive sectors, and the associated risk of job losses, trade unions have primarily focused their just transition efforts on decarbonisation policies, with comparatively less emphasis on the circular economy (Galgóczi, 2024). Trade union representatives in regional studies on the circular transition stress the importance of social dialogue and worker participation to prevent a technocratic and top-down implementation of circular solutions (Van Opstal & Borms, 2024). Despite its relevance, however, a just circular transition remains a peripheral concern for many trade unions.

Meanwhile, other civil society organisations are increasingly engaging with formal and informal labour market aspects of a circular economy. Networks such as RREUSE, ENSIE, and the Euclid network promote the role of social enterprises in providing circular jobs to disadvantaged populations and advocate for supportive policy frameworks at EU and national levels (RREUSE, 2022). While small in number across the EU, their influence regarding their target groups should not be underestimated (CISL, 2023). Regarding the broader labour market, however, this influence in policymaking is still considered modest. More broadly, organisations such as the European Women's Lobby (EWL), the European Institute for Gender Equality (EIGE), or the European Disability Forum represent the interests of vulnerable workers. While they acknowledge the under-recognition of household and informal labour, they do not seem to be mobilized regarding circular economy policies (Van Opstal et al., 2026). A notable exception is a publication by the EIGE on gender considerations in relation to circular economy objectives when formulating interventions and policies at MS level (EIGE, n.d.).

2.2.2 Consumers

Taking the perspective of consumers, several important concerns emerge in the context of a just circular transition. A *first* major issue is affordability: while circular products and services may align with environmental and social values, they may be more expensive or exert higher upfront costs which limits accessibility for lower-income households, potentially reinforcing socio-economic inequalities (Grafström & Aasma, 2021).

Secondly, circular consumption frequently demands new forms of labour from consumers, referred to as 'consumption work', such as maintaining, repairing, returning, or sharing products, which can be time-intensive and may conflict with people's working lives and household obligations. This holds especially for those with precarious jobs or time poverty (Hobson et al., 2021; Jaeger-Erben, Frick, et al., 2021).

Thirdly, this involves 'behavioural switch costs' - both cognitive and practical - requiring not only consumer motivation but also time, skills, and often digital access and literacy, all of which are unevenly distributed. In this context, convenience-oriented circular solutions such as product-as-a-service models may offer relief by reducing consumer responsibility for maintenance and end-of-life handling, but they often come at a premium price and challenge deeply embedded ownership norms. Moreover, customer acceptance of these business models requires high trust levels, which are distributed unequally across socio-demographic groups (Van Opstal & Manshoven, 2024).

Finally, there is limited consumer awareness of the social injustices embedded in linear production systems, such as exploitative labour practices in global supply chains (Toussaint et al., 2021). Initiatives like true pricing aim to inform consumers on these issues and influence purchasing decisions, but evidence suggests that the willingness to act of consumers on social concerns is mediated by affordability, information overload, and habits (Abasli & Mukhtarov, 2024).

Consumers are represented by the European Consumer Centres Network (ECC-Net) and the Bureau Européen des Unions de Consommateurs (BEUC). Their interest and influence in circular economy policies might be comparable to those of the major trade unions. BEUC has been instrumental in advocating for stronger consumer rights within the EU, notably contributing to the adoption of the Right to Repair Directive (Directive (EU) 2024/1799 of the European Parliament and of the Council of 13 June 2024 on Common Rules Promoting the Repair of Goods and Amending Regulation (EU) 2017/2394, 2024). This directive mandates that manufacturers provide access to spare parts and repair information, extends the legal guarantee by one year for repaired goods, and requires Member States to implement measures promoting repair, such as repair vouchers or information campaigns. Right to Repair Europe, a coalition of more than 130 organisations, has also played a pivotal role in

this legislative progress. Their advocacy has led to the inclusion of repairability requirements in the Ecodesign for Sustainable Products Regulation and the establishment of repairability scores for products such as smartphones and tablets (EC, 2023a). While these organisations have a strong interest in the issue, their influence on job-related considerations in a just circular transition remains limited.

2.2.3 Employers and financial institutions

Businesses have a keen interest in the development and concrete design of circular economy policies, as these tend to have a major impact on business models, production processes and supply chain management (CISL, 2023). Businesses will therefore need workers equipped with circular economy-related skills, although the specific demand will vary across regions and sectors (Alessio et al., 2021). Also, an inclusive circular economy policy benefits companies by providing a stable, healthy, and productive workforce (Bassi & Guidolin, 2021; CISL, 2023). Regarding the influence of companies, they play a key role in ensuring good working conditions and supporting worker development through training. In sectors such as waste management, the growing demand for higher-level skills, such as technical, logistical, and data analysis skills, poses a challenge. These sectors are sometimes perceived as unattractive, making it difficult to attract qualified workers, and educational curricula currently fail to address these skill needs (Weghmann, 2017). In addition, public sector employers also require circular economy-proof skills. Re- and up-skilling is also particularly relevant for them. For example, employees in administrations may need to acquire basic knowledge of the circular economy in order to organise public procurement according to relevant criteria. Zero waste policies at the city level also require new, often high-level circular economy skills (Circle Economy, 2023).

The European Roundtable for Industry represents the interests of about 60 large European companies, while SMEunited fulfils this role for European SMEs. The latter advocates actively for broadening instruments in sustainable finance, administrative unburdening and capacity-building for SMEs to make the shift to the circular economy happen (SMEUnited, 2022). Business Europe, the Union of Industrial and Employers' Confederations of Europe, represents companies of all sizes. Interest and influence of these actors are rated medium to medium-high, although activities regarding job and skills developments remain at a low level. In the public sector, the International Council for Local Environmental Initiatives (ICLEI) represents over 2500 local and regional governments worldwide and actively engages in capacity-building, knowledge dissemination and policy advice for sustainable development, with a high focus on circular solutions and the just transition. In a recent policy brief on Circular Cities (Circular Cities Frontrunner group, 2025), ICLEI emphasised the importance of social fairness and the just transition in the circular transformation of cities. For example, they are engaged in initiatives for the integration of social economy actors in many of the support mechanisms and skills roadmaps.

For financial institutions, the case for supporting a just circular transition is not only normative but also strategic. Ensuring that investee firms can attract, retain, and upskill the right workforce is essential for maintaining long-term competitiveness and (financial) resilience. Circular business models often involve shifts from product sales to service provision, requiring new technical, logistical, and digital skills, particularly in sectors such as repair, remanufacturing, and reverse logistics (Fallahi et al., 2023; Kumar et al., 2025). Labour and skills shortages in these areas can constrain the scalability and bankability of circular ventures.

At the same time, financial actors themselves face rising regulatory expectations to align with EU sustainability frameworks, such as the EU Taxonomy. This includes assessing not only the environmental but also the social performance of economic activities (Moneva et al., 2023; Rataj et al., 2025). Moreover, instruments such as results-based finance, sustainability-linked loans, or circular

economy–aligned green bonds can be designed to tie financial returns to social outcomes, including decent work and skills development (Sepetis, 2022).

From a federative perspective, the European Investment Advisory Hub (EIAH) has the purpose to strengthen Europe's investment and business environment through offering advice on financing and investment operations, implementing investment projects and supporting awareness raising and market development activities. Through the InvestEU programme they aim to enhance investments, boost innovation and facilitate job creation. However, few if any EIAH publications addressed the circular economy, indicating a lack of specific attention to it in the context of job creation (European Investment Bank, 2025).

2.2.4 Social partners

As intermediaries between employers and employees, the social partners – trade unions and employer federations – not only have a major interest in the development of the labour market and workers' rights but can also help shape it. For example, they can ensure a targeted exchange of information and facilitate negotiations; on the policy side, they can collaborate to ensure that financial risks are compensated by policies. In addition, they can contribute to needs analyses for new skill profiles and could therefore also work with vocational education and training (VET) institutions to develop qualification and training pathways. Newly emerging sectors and industries including startups may not yet be organised and have no employee representation (Alessio et al., 2021). This challenge is broader, as social dialogue mechanisms are typically structured around established industries and sectors, whereas the circular economy transcends sectoral boundaries and cannot be easily delineated as a distinct sector.

Social partners and governments collaborate in tripartite governance structures that shape labour-market outcomes. At the global level, the International Labour Organization (ILO) brings together representatives of governments, employers, and workers to promote social justice and decent work. Its work on circularity, including the report *Decent Work in the Circular Economy* (Saliba et al., 2023), and more recently *Employment in the circular economy: Leveraging circularity to create decent work* (Circle Economy et al., 2025a), highlights the importance of strong labour standards and social dialogue to foster a just circular transition. Within the European Union, Eurofound – the European Foundation for the Improvement of Living and Working Conditions – operates on a similar tripartite basis, involving governments, employers, and trade unions in the study of employment trends, working conditions, and industrial relations. As a decentralised EU Agency based in Ireland, Eurofound also contributes to EU-level policy debates on green and digital transitions, providing evidence to support fair and sustainable labour-market policies.

Finally, the European Economic and Social Committee (EESC), as the EU's institutional platform for tripartite and civil-society consultation, plays a complementary role by issuing advisory opinions. In its opinion on the revised Circular Economy Monitoring Framework, the EESC calls for an urgent upgrade of labour metrics, disaggregating circular employment figures by gender, age and salary, and recording labour accidents per sector. It also calls for a dedicated skills indicator as a human-capital component to identify gaps, guide training and education, and ensure sufficient capacity in the market (EESC, 2023).

2.2.5 Research and education

The education sector, encompassing primary, secondary, vocational and higher education, contributes to enabling a just circular transition. At school level, integrating circular economy concepts into

curricula can foster environmental literacy, systems thinking and social awareness from an early age. These foundations influence future consumption patterns, household practices, and career aspirations.

Vocational education and training can contribute to upskilling and reskilling, especially when implemented through well-designed and targeted programmes. This applies across all sectors, particularly in industries facing structural change or job losses, where reskilling can create new opportunities (Cedefop, 2023b). Key actions include developing training for sectoral transitions, work-based training, expanding continuing vocational education and training (CVET) to strengthen learning abilities, creating feedback loops between CVET and employer needs, identifying local or regional demands, and supporting employers in offering training to their workers (Cedefop, 2023b). Much can be achieved through skill enhancement and incremental learning, without the need for complete retraining (Alessio et al., 2021).

Universities also have a role to play in the preparation of the future workforce, but this is more likely to be related to the formal, highly educated sector (Bianchi, 2020). At university level, neither the European University Association (EUA) nor the European Universities alliances show a big interest in circular economy jobs and skills. In contrast, agencies working on vocational education and training policy, such as the European agency Cedefop, have been actively analysing circular labour market developments and emerging skills profiles for many years.

From a research perspective, the issues of labour market transition and skills development are of interest to a number of research fields and disciplines. The number of Web of Science-indexed articles addressing the intersection of the labour market and the circular economy has grown substantially, from just 5 new publications in 2015 to 58 in 2020, and 190 in 2024. Research can provide an evidence-base for the specific design of circular economy policies through targeted studies and analyses of needs, potentials, risks, and the impact and monitoring of policies. In the area of jobs and skills, for example, there is still a lack of studies on how sustainability skills can best be learned and acquired, as well as evaluations of existing programmes and the application of skills in real life (CISL, 2023).

Finally, research and education institutions frequently act as key partners in quintuple helix initiatives, such as circular economy hubs, where they contribute to knowledge development, skills formation, and multi-stakeholder collaboration. Such circular hubs may also embed labour market inclusion within circular economy transitions, by explicitly linking circular innovation with the creation of meaningful work for disadvantaged groups, as is the case in Flanders (Van Opstal, Bocken, et al., 2025). These hubs orchestrate collaborations between Work Integration Social Enterprises (WISEs), conventional businesses, local governments, and knowledge partners to develop localised circular economy initiatives. Their activities, such as matchmaking, knowledge sharing, and subsidy support, align closely with the needs of circular frontrunners, especially in addressing barriers such as limited supply chain collaboration and knowledge gaps. Examples of circular hubs in other regions, albeit with no specific focus on social employment, include Circular Valley (Wuppertal, Germany), Circular Berlin, and the Circular Economy Forum Austria.

2.3 Literature review

This section provides an overview of the most relevant literature on labour market impacts associated with the transition towards a circular economy. It synthesises key findings on employment trends, with particular attention to job quality dimensions and evolving skill requirements. In doing so, it highlights how different circular strategies may affect employment across sectors and occupations. The section also offers a comprehensive review of existing definitions and classification systems for

circular economy jobs, job quality, and skills, identifying the conceptual and methodological foundations underpinning various monitoring approaches.

2.3.1 Jobs in a circular economy

Narratives on circular jobs

Over the past decade, the relationship between the circular economy and employment has gained increasing prominence in both academic literature and policy discourse (Foster et al., 2024). Several scholars argue that circular strategies have the potential to create employment through labour-intensive processes (Burger et al., 2019; Llorente-González & Vence, 2020). These jobs are frequently embedded in local economies and may contribute to regional resilience, especially where circular practices shorten value chains and generate employment at the point of consumption (Clube, 2022). At the same time, caution is warranted against overly optimistic claims: many employment estimates remain hypothetical, and limited empirical attention has focused on the nature and distribution of these jobs (Clube & Tennant, 2022). Insights from the stakeholder interviews reinforce this point by indicating that expectations of large-scale job growth in repair and waste management tend to inflate projections, while actual employment in industrial circular activities appears far smaller and more difficult to capture through existing measurement approaches.

Box 1 – Emerging high-skill job profiles

The Ecodesign for Sustainable Products Regulation (ESPR) forms the cornerstone of the European Commission's approach to more sustainable and circular products (EC, 2023a). The regulation introduces design requirements that affect how products are designed, manufactured, repaired, remanufactured, reused, and recycled across a wide range of sectors. As a result, the ESPR has far-reaching implications for value chains, labour demand, and skills profiles, particularly by increasing the importance of design, technical, and service-oriented activities across product life cycles.

Within this broader regulatory framework, the EU Strategy for Sustainable and Circular Textiles sets the ambition that by 2030 all textile products placed on the EU market will be durable, repairable, and recyclable (EC, 2022). Successful implementation of these requirements will depend on sustainable product design, positioning designers in a pivotal role as they respond to more complex criteria related to material durability, reparability, and recyclability (Circle Economy et al., 2023). This will also require the development of new skill sets focused on designing for repair, reuse, and recycling. Emerging circular jobs in the textile sector may arise in service-oriented activities such as second-hand resale platforms, rental services and repair shops. These developments also create opportunities for new roles in platform development and maintenance, including software developers and digital service providers, particularly in higher-income countries (industriAll, 2024). At the same time, the ILO cautions that a shift towards a more service-based textile economy may disrupt established industries with strong trade union representation, posing a risk of moving workers into more precarious forms of employment (International Labour Organization, 2025).

Similar dynamics emerge in the electronics sector. EU legislation on sustainability, repairability, and recyclability under the ESPR framework is likely to increase demand for technical professionals, including engineers specialised in automation and robotics, as well as R&D professionals working on disassembly, sorting, recycling, and remanufacturing processes (Nikoloudakis & Rangoussi, 2024). A stronger regulatory emphasis on during-use circular economy activities is also likely to shift EU employment away from low-value assembly and export-oriented roles towards high-value, technically skilled, and service-oriented positions. At the same time, this shift can generate additional local, labour-intensive employment in repair, refurbishment, and reuse activities (Multani et al., 2025).

Recent research has moved beyond sectoral estimates to examine the evolving labour dynamics across different circular strategies and discursive framings. In their discourse analysis, Multani and Bachus (2024) identify three narratives that shape expectations about labour in a circular economy. The first narrative associates circularity with economic competitiveness and resource security, envisioning high-skilled innovation and technical job growth. The second frames circularity as a systemic societal transformation, fostering local craft jobs and strengthening links to the social economy. The third emphasises the transformative role of digitalisation and innovation, placing STEM and design skills at the centre of future labour markets.

Complementing these discursive narratives, Beducci et al. (2024) provide a more granular understanding of the "human dimension" of the circular economy through a systematic literature review of skills and job profiles in circular manufacturing. They present a set of indicative job profiles, such as industrial symbiosis facilitators, reverse logistics operators, circular procurement officers, and recovery operation managers, each combining several skills.

Definitions and classifications of circular jobs

Many scholars include circular jobs under the label of green jobs, a concept for which there is no agreed definition yet, making comparing existing research findings difficult (Valero et al., 2021). The ILO defines green jobs as *"decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency."* (ILO, 2008, 2025). The U.S. Bureau of Labor Statistics defines green jobs as (1) *"Jobs in businesses that produce goods and provide services that benefit the environment or conserve natural resources"* and (2) "*Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.*" (U.S. Bureau of Labor Statistics, 2013).

Drawing on this foundation, Burger et al. (2019) define circular employment as "*the number of jobs that contribute directly to the circular economy*". This includes both "core" circular activities – such as preserving existing products, using waste as a resource, and rethinking business models – and "enabling" activities that support the transition, such as ecodesign, digital integration, and collaborative business practices.

Circle Economy (2021a) further refined this distinction by defining a circular job as *any occupation that directly involves or indirectly supports an activity of the circular economy*. This includes:

- *Direct circular jobs*:
  - Core circular jobs are all jobs that ensure the closure of raw material cycles, including jobs in repair, renewable energy, and waste and resource management. They form the core of the circular economy.
  - Enabling circular jobs are jobs that remove barriers to and enable the acceleration and upscaling of core circular activities, including jobs that arise in leasing, education, design and digital technology. They form the supporting shell of the circular economy.
- *Indirectly circular jobs* are jobs that indirectly uphold the circular economy. These jobs occur in other sectors that do not play a direct role in furthering the transition to the circular economy but can still adopt circular strategies. They include jobs that provide services to core circular strategies, including jobs in information services, logistics and the public sector.

A more recent framework developed by Circle Economy and the ILO further distinguishes between employment in fully circular sectors and partially circular sectors. Fully circular sectors comprise economic activities whose primary purpose is circular, such as repair, recycling, remanufacturing, and other activities centred on extending product lifetimes or recovering materials. Partially circular sectors include industries in which only a share of activities contributes to circular outcomes. Examples include manufacturing, construction, and retail, where circular practices such as reuse, refurbishment, or material recovery coexist with linear production processes. In such sectors, the circular share of employment must be estimated using sector-specific circularity coefficients that approximate the proportion of activities aligned with circular economy principles (Circle Economy et al., 2025b)

Another policy-driven approach has been developed in France. The Monitoring and Statistics Directorate (SOeS) uses a circular economy definition provided by ADEME to construct a national circular employment indicator. This approach distinguishes between *core circular activities* and *adjacent circular activities*. Core circular activities include organic agriculture, rental, reuse and second-hand use or repair, recovery and sale of secondary raw materials, waste collection and processing, and recycling and repurposing. Adjacent circular activities have a primary objective other than circularity or resource reduction, but contribute indirectly to circular outcomes. Examples include waste incineration with energy recovery, energy management and transport.

Taken together, these approaches illustrate that no uniform definition of circular jobs exists. Definitions differ in scope, methodological basis and boundary-setting, particularly regarding indirect and enabling activities. In this report, the term “circular jobs” is used as an umbrella concept to refer to employment associated with activities that contribute to a circular economy. Where empirical findings rely on specific operational definitions, this is indicated explicitly.

Laubinger et al. (2020) identify four directions in which the circular economy can affect labour markets: job creation, substitution, destruction, and redefinition. *First*, there can be job creation for the sectors and activities that are stimulated in the transition to a circular economy, for example by developing circular business models or increased resource efficiency. *Second*, jobs can be substituted, which means that some activities will be replaced by others but can be performed by the same people. Examples of this category are activities that move from landfilling and waste incineration to recycling. *Third*, job destruction entails occupations that will disappear without replacement by other jobs, e.g., because of banned activities or discontinued activities such as mining. *Finally*, jobs can be redefined when existing jobs continue but the content of the work changes, which can require a different skillset. Laubinger et al. (2020) expect job substitutions from material-intensive industries to services sectors, as well as job destruction in the material-intensive industries and job creation in the services sector.

Yet, as Borms et al. (2024) show, the circular economy defies conventional sectoral classifications, requiring innovative methodologies to track employment contributions across overlapping activities and hybrid business models. This necessitates more granular definitions and policy instruments that can distinguish between direct and indirect roles, paid and unpaid work, and formal and informal contexts.

Box 2 – Jobs in the informal circular economy

While most research and policy documents focus on circular economy activities in the formal economy, they neglect the existence of many circular economy activities in the informal economy. The informal economy consists of all the productive activities in an economy that are not (directly) measured by national statistics (OECD, 2002). According to the International Labour Organisation (ILO), 60% of workers and 80% of enterprises worldwide operate in this informal economy (ILO, 2018). More than half of all circular economy employment – over 74 million, or 52% – can be considered informal in nature. In Europe , informal circular economy employment is estimated at 13%, with 2.7 million people employed (Circle Economy et al., 2025b).

Most studies on the informal circular economy concentrate on waste recycling practices in the Global South (Saliba et al., 2023). The informal sector in these contexts is typically characterised by small-scale, labour-intensive operations that are largely unregulated and unregistered (Wilson et al., 2006). An estimated 15 to 22 million informal workers in the Global South play a vital role in waste management systems (Z. Liu et al., 2023; Maalouf & Agamuthu, 2023). Informal engagement in circular activities in these regions usually arises from economic necessity (Korsunova et al., 2022) and is often driven by institutional voids, such as underdeveloped labour, product, and financial markets, or the absence of regulatory and contractual enforcement (Derks et al., 2024).

Informal circular economy activities in high-income countries have received comparatively little scholarly attention. Where they are acknowledged, research tends to highlight informal waste collection practices such as collecting scrap metals using vans, retrieving discarded textiles from residential areas, or exploiting bottle deposit systems (Cook et al., 2024). These activities are typically undertaken by migrants or ethnic minorities experiencing social exclusion (Porras Bulla et al., 2021). For example, in Hungary the collection of municipal bulky waste is partially done informally by Roma people, and it has been linked to reduction of waste destined for landfill or incineration, with particularly metallic waste (copper, aluminium, iron) being brought back into market through a transactional supply chain. Despite their contribution to reuse and recycling in Hungary, this group is closely monitored and subject to penalisation bias, as bulky waste is deemed property of the municipality once items are placed at the kerbside (Gittins & Letenyei, 2024, 2025). Furthermore, informal reuse and repair initiatives – such as repair cafés, community workshops, or unregistered trades – are seldom framed as part of the informal circular economy and often taken for granted (Van Opstal, Pals, et al., 2025)

2.3.2 Job expansion and sectoral shifts in a circular transition

Narratives on circular job gains and losses

A prominent narrative in the literature views the circular economy as a net generator of employment. The transition is understood to entail a structural shift from material-intensive to labour-intensive production processes, resulting in new employment opportunities across various service-based activities such as repair, reuse, refurbishment, and remanufacturing (ILO, 2010; Laubinger et al., 2020). In Europe, it is expected that the transition to a circular economy will generate 700,000 additional jobs by 2030 compared to an estimated 4 million jobs in the circular economy in 2018 (Cambridge Econometrics et al., 2018; European Commission, 2020d). ILO (2022) estimates that the transition to a low-carbon, circular, and resource-efficient economy would generate 18 million new jobs worldwide and 1.2 million new jobs in the EU by 2030. More recently, the EU Clean Industrial Deal estimates that the circular economy will create 500,000 new jobs in the remanufacturing sector (EC, 2025a). Aguilar-Hernandez et al. (2021) performed a meta-analysis of over 300 circular economy

scenarios and found that employment increases are likely when multiple circular measures are pursued simultaneously, yielding a median employment gain of 0.9% in 2020 to 4.1% in 2050 under ambitious scenarios. In the moderate scenario however, the median was 0.0%. These projections reinforce a 'win-win' vision wherein resource efficiency, GDP growth, and employment gains align.

A *second* strand in the literature questions simplistic win-win framings by highlighting the uneven and conditional employment effects of circular strategies. Sectoral shifts are central: jobs may decline in extractive, manufacturing, and construction sectors while growing in services, waste, and logistics. Borms et al. (2025) modelled three Circular Economy Action Plan policies and found that job gains and losses vary by sector and occupation. For example, increasing recycled inputs boosts jobs in waste management, services, and construction but reduces them in agriculture and manufacturing. Similarly, enabling high-quality recycling increases jobs in waste management and manufacturing but decreases them in services and construction. A tax on waste exports shifts jobs to construction and market services, with losses in non-market services and waste management sectors. These scenarios emphasise the need for reskilling. Donati et al. (2020) found that measures such as product lifetime extension and resource efficiency mostly *reduce* net employment (0%-4.6%) and added value, largely due to reduced demand for new goods. The finding that reduced product volumes and longer lifespans can decrease aggregate labour input, even as they promote sustainability, complicates the narrative of green job expansion. Moreover, some circular scenarios may suppress labour requirements by design, such as process optimisation or sharing models where fewer transactions occur (Donati et al., 2020). Insights from broader green-transition research strengthen these warnings. Fernández Intriago et al. (2025) comment that the overlap between jobs displaced and jobs created in green sectors is limited. Even where aggregate job creation exceeds losses, new jobs often require different skills and do not emerge in the same regions or timeframes in which workers are displaced. This misalignment generates distributional pressure and political tension.

A *third* narrative critically examines the geographic shifts in employment patterns that circular transitions may induce. Particularly in globalised value chains, job gains in one region may coincide with losses in another. Repp et al. (2021) demonstrate this in the apparel industry, where EU circular economy policies could generate jobs in reuse and recycling in the EU, but displace production jobs in countries such as Bangladesh, India, and Cambodia. Given that such countries often depend heavily on labour-intensive manufacturing for exports and livelihoods, the net global effect may involve significant job reduction, with potential macroeconomic implications (Circle Economy, 2024c).

These findings raise difficult questions about the distributive footprint of a circular transition and stresses the need for a critical analysis of regional asymmetries and interdependencies in global supply chains (Clube, 2022; Luthin et al., 2023).

Measuring employment effects

Quantifying employment changes in a circular transition requires careful consideration of modelling approaches, scenario design, and sectoral boundaries. Input-output (IO) and computable general equilibrium (CGE) models are frequently used to simulate the economy-wide effects of circular economy measures. These tools estimate net employment impacts that arise from shifts in demand, substitution of primary materials, and the reallocation of economic activity. Wiebe et al. (2019) modelled three circular strategies – resource efficiency, recycling, and reuse/repair – and found that overall employment changes were marginal but diverged strongly across sectors. While services and waste sectors saw gains, mining and utilities experienced substantial losses.

Recent macroeconomic evidence reinforces the need for caution when interpreting these results. Walker et al. (2025) argue that existing models tend to capture employment losses more readily than

potential gains because many circular business models and service-oriented constellations do not yet exist in measurable form. Modelled transitions from manufacturing to services therefore rely on simplified assumptions that obscure new forms of work and value creation that may arise as circular markets mature. The choice of circular strategy also strongly influences modelled employment outcomes. Measures linked to reduction or reuse reduce demand for material-intensive production and drive most of the declines in GDP and employment in the scenarios assessed by Walker et al. (2025). In contrast, recycling shifts demand from primary to secondary materials without reducing total output. It increases employment because collection, sorting, and recycling activities require more labour than primary material extraction.

Methodological decisions also shape model outcomes. The inclusion of investment effects, the extent of product lifetime extension, and whether reductions in production volumes are modelled can significantly alter outcomes (Brusselaers et al., 2022; Donati et al., 2020). Some models show net job losses not because of economic decline, but due to reduced production for the same level of utility, indicating a decoupling of material throughput and employment. The methodology used also influences the magnitude of employment impacts: computable general equilibrium (CGE) and input–output (IO) models typically yield lower employment effects than macro-econometric models like E3ME. This may be because E3ME allows for market disequilibrium, including unemployment and sectoral reallocation, thereby capturing short-term dynamics and sectoral shifts more realistically and often resulting in higher estimated employment effects (CISL, 2023). Indicating modelling results relative to a benchmark – such as total employment – and clearly noting possible over- or underestimations due to modelling assumptions or data limitations would enhance comparability across studies. Moreover, some studies, such as Aguilar-Hernandez et al. (2021), demonstrate that more ambitious circular strategies are more likely to lead to positive employment outcomes, especially when accompanied by broader economic transformation. This points to a need for more granular national and regional employment data on circular activities and for closer comparison of top-down model outputs with bottom-up labour market evidence.

Complementary approaches include sectoral employment data tracking and the use of business registers to monitor growth in circular activities. Niang et al. (2024) for example used firm-level data to show that circular economy-related employment in France grew faster than total employment between 2008 and 2015, particularly in metropolitan areas. Adding nuance, Magdalena et al. (2025) analysed financial statement data and found that circular economy enterprises in Spain experienced fewer disadvantages from rural location compared to their linear counterparts. The authors attribute this to the fact that circular businesses often depend less on highly qualified labour and can therefore operate more effectively in areas with lower-skilled labour pools. Still, definitional ambiguities persist: whether to include only core activities such as recycling or also enabling and indirect functions, such as logistics and design, significantly affects estimates (Burger et al., 2019; Circle Economy, 2024b). Harmonised statistical classifications and better sectoral disaggregation are needed to enhance the robustness and comparability of job impact assessments across countries and over time (Borms et al., 2024).

2.3.3 Job quality

Narratives on job quality

Job quality is often referred to as a boundary condition for a just circular transition (Clube, 2022; ETC CE, 2025). While circular economy activities such as reuse, repair, and recycling are often portrayed as labour-intensive and socially beneficial, this does not guarantee good working conditions. Globally, jobs in these sectors are frequently located in low-paid, physically demanding, and informal settings,

particularly in waste separation and secondary materials processing (Llorente-González & Vence, 2020). According to one of our interview respondents, these sectors are "*not very regulated*", so circular jobs do not automatically lead to better social outcomes, and job quality must be actively safeguarded. In their analysis of the circular transition of social enterprises, Van Opstal et al. (2024) report that income streams from circular activities are often insufficient or too uncertain to attract or retain staff, for instance through seasonal fluctuations in waste streams or reliance on short-term projects.

Circular transitions introduce both new risks and opportunities for job quality. On the one hand, certain circular strategies, such as repair, can create locally embedded, meaningful work with reduced commuting and increased social cohesion (Van Opstal et al., 2024). On the other hand, these jobs may become repetitive, physically demanding, or poorly valued. Furthermore, activities in repair and reuse often begin in pilot settings, with few guarantees regarding contractual stability or long-term viability. The rise of automation and smart technologies also brings mixed prospects: while robotics may improve safety by replacing hazardous tasks, e.g., in recycling or remanufacturing, it may also displace low-skilled workers or concentrate quality jobs in tech-oriented roles (Clube, 2022; Ziegler et al., 2023).

While job creation is often cited as a co-benefit of circular policies, qualitative aspects such as health and safety, contractual terms, decent working conditions and workers' rights receive less attention. Padilla-Rivera et al. (2021) found that experts consulted in circular economy assessments did not prioritise employment as the most relevant social indicator, instead stressing occupational health and child labour. Similarly, Manshoven and Van Opstal (2022) found a broad support among value chain actors in the fashion industry for mandatory policy measures to address issues such as child labour and unsafe working conditions, signalling that voluntary approaches are considered insufficient to safeguard job quality in circular transitions.

Box 3 – Job quality in the circular economy

Workers involved in sorting, shredding and recycling textiles are routinely exposed to harmful chemicals such as PFAS, often with limited information about the presence of these chemicals in the heterogeneous mass of collected garments and insufficient protective equipment (EEA, 2024d). These conditions significantly affect the safety and quality of these jobs, a concern that is likely to persist even after new REACH regulations are introduced and PFAS is phased out in textiles where it is not essential for performance. PFAS can remain in textiles already placed on the market and cannot be identified through visual inspection (EEA, 2024d).

Similar job quality concerns arise in the handling and recycling of waste electrical and electronic equipment (WEEE). WEEE can contain hazardous substances such as heavy metals, flame retardants and plasticisers, which creates exposure risks during collection, sorting, dismantling and shredding (EEA, 2025). Evidence from a multi-country European human biomonitoring study shows elevated internal exposure to toxic metals among e-waste recycling workers, with lead identified as a particular concern and exposure patterns consistent with work-related contamination (Leese et al., 2025).

Definitions and classifications of job quality

Job quality is a multidimensional concept that captures the conditions under which people work, including the economic, social, and physical characteristics of their jobs. The OECD defines job quality along three primary dimensions: earnings quality, labour market security, and the quality of the working environment (Cazes et al., 2015). This framework is widely used in international policy assessments.

The Eurofound job quality framework offers a more granular classification. Eurofound developed seven indices representing different dimensions of job quality, based on aspects of work that have an influence on health and well-being. These are the physical environment, work intensity, working time quality, social environment, skills and discretion, prospects, and earnings (Eurofound, 2024). These dimensions can be operationalised using data from the European Working Conditions Survey (EWCS), which is a benchmark tool for monitoring job quality in the European Union and beyond (see Section 3.2.2 for more details). The European Company Survey (ECS) complements this evidence base by examining workplace practices in work organisation, human resource management, and direct and indirect employee participation.

Complementary to these are the UNEP Social Life Cycle Assessment (S-LCA) guidelines (UNEP, 2020) which identify eight impact categories for assessing social impacts on workers: fair salary, working hours, freedom of association, child labour, forced labour, equal opportunities, health and safety, and access to social security. These frameworks offer a foundation for systematically assessing the quality of jobs in the circular transition, both in formal and informal settings.

The European Trade Union Institute (ETUI) developed a Job Quality Index (JQI), which is based on a series of sub-indices (wages, non-standard employment, working conditions, working time and work-life balance, training and interest representation) that attempt to capture different aspects of job quality (ETUI, 2018). Comparisons in terms of job quality between EU countries are possible. The JQI allows comparisons over time since 2005, and an analysis of gender gaps in job quality.

2.3.4 Skills

Narratives on skills

The transition to a circular economy introduces changes to the composition and role of skills within the labour market. Rather than focusing solely on occupational categories, a task-based perspective - well established in labour economics since the early 2000s – offers a more nuanced understanding of the bundles of activities underpinning circular strategies (Fernández-Macías & Bisello, 2022). Studies extend this approach to green and circular transitions, documenting considerable heterogeneity in task demands across reuse, remanufacturing, service-based, and digitally enabled models (Burger et al., 2019). Consequently, the circular economy requires a shift from conventional skill hierarchies (low-, medium-, high-skilled) towards more nuanced interpretations that account for task complexity, interdisciplinary knowledge, and organisational context. As one interviewee put it, developing "*hybrid competency profiles*" demands a blend of hard skills, such as material science, soft skills, such as communication and leadership, and digital skills, such as platform thinking.

Emerging research on skills in a circular economy highlights the organisational embedding and re-contextualisation of general and specialist skills within new circular practices. Straub et al. (2023) argue that many of the competences required in circular business models are not inherently novel but acquire "circular" significance depending on their application within specific organisational systems. For instance, logistics skills are not new but become strategically important when managing reverse flows in product-service systems or remanufacturing processes. Moreover, employees often do not identify their skills as "circular," highlighting the need for clear circular narratives and framing to support skill recognition and development and strengthen their cognitive legitimacy.

Box 4 – Emerging skills in the repair sector

Repair of smartphones, consumer electronics and cars is rapidly evolving into a high-skill, specialised occupation, with emerging competencies in areas such as software diagnostics and digital troubleshooting (Albatayneh, 2024). One interview partner noted that when new technologies such as heat pumps enter the market, repair work often falls to the same technicians who carried out installation. As diffusion increases, this dynamic contributes to a broader shortage of skilled workers in the repair market. Another interview respondent further stressed that repairers need detailed product knowledge, the ability to disassemble and reassemble complex devices, strong analytical skills to diagnose faults, and familiarity with sourcing appropriate spare parts, which makes these clearly complex activities.

The transition also increases the importance of reverse logistics in sectors such as textiles, electronics, and automotive. This shift towards companies taking back their products not only necessitates an increase in jobs in the logistics sector, but also requires skills such as knowledge of material properties and the ability to assess product condition for advanced sorting and recycling (Jabbour et al., 2019). Additionally, this will require warehouse staff, who typically have lower levels of formal education, to acquire additional skills in using digital tools and automation technologies, such as warehouse management systems, Internet of Things sensors and, where relevant, AI, to increase efficiency, improve sorting accuracy, and reduce waste accumulation (Dagiliene et al., 2025).

Finally, the regional embeddedness of skills has emerged as a central theme in recent economic geography literature. In a regional case study from Sweden, Martin (2025a) shows that the skill base of a region, shaped by historic industrial specialisations and mobility within related sectors, can significantly influence its ability to adapt to circular demands. Inter-industry learning, knowledge spillovers, and the adaptability of local institutions such as vocational centres, universities, and policy actors deter
mine whether a region can develop and retain the competences required for implementing circular economy models.

Definitions and classifications of skills in a circular economy

The distinction between skills and tasks is fundamental to understanding how labour markets evolve in response to technological and structural change. As Acemoglu and Autor (2011) explain in the *Handbook of Labour Economics*, "*a task is a unit of work activity that produces output (goods and services). In contrast, a skill is a worker's endowment of capabilities for performing various tasks. Workers apply their skill endowments to tasks in exchange for wages, and skills applied to tasks produce output*." This distinction becomes particularly important when workers with a given skill level perform a variety of tasks and adapt to changing technologies and market conditions.

In defining circular skills, several authors have sought to translate this conceptual distinction into a framework suited to the circular economy. Straub et al. (2023) define circular skills as "*skills that address aspects of cycling, extending, intensifying, and/or dematerialising material and energy loops*." This definition aligns with the core aim of the circular economy: to decouple value creation from resource throughput and to reconfigure production and consumption systems.

Efforts to classify circular skills vary in scope and methodology. Burger et al. (2019) and Straub et al. (2023) draw on the O*NET database[8] to identify six broad categories of skills: basic, complex problem-solving, social, resource management, systems, and technical skills. These categories encompass a total of 35 skills, enabling a structured understanding of task-level competencies relevant to circular transitions. Janssens et al. (2021) distinguish three skill types: technical (e.g., disassembly), valorisation (e.g., business model innovation), and transversal (e.g., systems thinking, collaboration). Similarly, Sumter et al. (2021) propose a nine-skill typology including circular design, life-cycle thinking, and stakeholder engagement. Public Employment Services, such as VDAB in Flanders, have operationalised these insights into nine occupational skill domains – including logistics, IT, and marketing – to guide job matching and policy design (Borms et al., 2023).

Beducci et al. (2024) identify ten circular skills in manufacturing, spanning legal, service, transversal, and logistics competences. Straub et al. (2023), using self-reported data from 2,407 circular start-up employees, develop a six-cluster taxonomy of skills in business innovation, operations, social dimensions, systems, digitisation, and technical issues. Taken together, these studies demonstrate growing consensus that circular skills transcend traditional technical-vocational boundaries, incorporating organisational, and social dimensions of work.

Measuring skills needs in a circular economy

Tracking the evolution of circular skills and skills needs remains methodologically challenging. Conventional labour market monitoring systems, such as those based on standard sectoral and occupational classifications (NACE and ISCO codes[9]), are not designed to capture circular economy-specific activities or skill transformations. Many circular roles are embedded across sectors and value chains rather than confined to distinct occupational categories, which makes them difficult to identify in conventional datasets.

Recent methodological advancements rely on digital vacancy analytics to detect circular activities and skill demands in near real time. Web scraping, machine learning, and natural language processing techniques are increasingly applied to online job postings and company data to identify relevant competences (Borms et al., 2024). These methods enable the detection of emerging trends in green and circular work, offering more timely insight than official labour statistics. Related studies also model future occupational and sectoral shifts under circular economy scenarios by linking them to corresponding skill profiles (Borms et al., 2025). Such models help policymakers anticipate which skills will be required as material loops and business models evolve.

Complementary survey-based and experimental approaches provide deeper contextual understanding of skill needs. Best–worst scaling (Janssens et al., 2021), clustering and synthesis (Straub et al., 2023), and skills-needs surveys (Borms et al., 2023) allow for detailed mapping of how specific circular strategies – such as recycling, remanufacturing, or product redesign – relate to skill

[8] The O*NET database – short for Occupational Information Network – is an open-access system developed by the US department of Labour, to describe the characteristics of occupations and the skills, knowledge, and abilities they require

[9] The Nomenclature of Economic Activities (NACE) is the EU's official statistical classification system for economic activities. It organises industries into a hierarchical structure of sections, divisions, groups and classes, enabling harmonised reporting and comparison of business and employment data across Member States.

The International Standard Classification of Occupations (ISCO) is the global framework developed by the International Labour Organization to classify and compare occupations based on the tasks and duties performed. It provides harmonised 4-digit occupational categories that allow for consistent labour-market analysis across countries and datasets.

demand. An additional data source lies in digital trace analytics, particularly from professional networking platforms. Analyses of LinkedIn profiles and postings provide valuable insights into the self-identification and diffusion of circular competences across sectors. Straub et al. (2023) for example use LinkedIn data to track the emergence of circular job titles and competence clusters, finding that circular roles often evolve within existing occupational frameworks rather than as distinct professions.

One interviewee argued that monitoring needs to cover not only shifts in skill demand but also how education and training systems respond, including the emergence of new training formats and curriculum change linked to circular economy integration. The interviewee highlighted design-related roles as a key example, noting growing emphasis on circular design and design for decomposition and disassembly, and emphasised the value of tracking how curricula adapt in these areas. Linking demand-side evidence with information on training provision and curriculum innovation would thus provide a more comprehensive view of circular skill development.

2.4 Analytical framework

2.4.1 A just circular transition

The circular economy is not inherently socially beneficial merely by virtue of being circular (ETC CE, 2025). A genuinely sustainable transformation requires a more holistic perspective – one that integrates environmental and economic objectives with social considerations and principles of justice. As environmental and social injustices are deeply embedded in past and present economic and industrial trajectories (Steenmans & Lesniewska, 2023), any move towards a circular economy should consider justice in its design and implementation. The concept of a 'circular society' has emerged as a promising framework for broadening the scope of the circular economy by incorporating social dimensions such as power relations, knowledge inclusion, and human-environment interdependence (Calisto Friant et al., 2024; Jaeger-Erben, Jensen, et al., 2021). Within this expanded framing, the traditional focus on resource efficiency is complemented by a critical reflection on structural inequalities and transformative social change.

A just circular transition acknowledges that circularity cannot be considered sustainable if it contributes to the marginalisation of workers, regions, or social groups. The employment dimension therefore requires a monitoring framework that captures not only aggregate employment shifts and the distribution of opportunities and risks across the workforce, but also qualitative aspects of working conditions and skill requirements. Interview insights reinforce this need by emphasising the importance of monitoring how training provision and curricula adapt to circular demands, for example through emerging forms of circular design, disassembly-oriented practices and sector-specific skill developments. These insights indicate that shifts in education and training may serve as early signals of broader labour market adjustments. It is also crucial to examine how workers and communities are represented in these processes, and whether human labour is recognised, valued and respected. One interviewee highlighted that circular activities depend heavily on workers whose roles often remain undervalued, and that improving job attractiveness, decent working conditions and recognition is essential for sustaining circular transitions.

In particular, three justice dimensions offer a conceptual foundation for this effort: distributional justice (who gains and who bears the costs), procedural justice (who participates in shaping transitions), and recognitional justice (whose perspectives and contributions are valued) (EEA, 2024b; ETC CE, 2025; Kirchherr, 2021). These justice considerations are important to consider in both *before-use* (e.g., refuse, rethink, reduce), *during-use* (e.g., reuse, repair, sharing), and *after-use* (e.g., remanufacture, repurpose, recycle) circular strategies. While much attention has been paid to formal

employment, a circular economy also depends on *informal* (both paid and unpaid) activities such as household repair, community reuse, and voluntary sharing initiatives. These roles are often excluded from official labour statistics but contribute meaningfully to resource circulation.

2.4.2 Distributional justice

From a distributional justice perspective, a transition towards a circular labour market poses both opportunities and risks. Empirical evidence suggests that labour-intensive strategies such as repair and reuse tend to generate low-wage, precarious employment, often in marginal sectors of the economy (Llorente-González & Vence, 2020). At the same time, high-skilled circular jobs linked to digitalisation and eco-design may benefit already privileged groups (Pirciog et al., 2023). Without targeted interventions, this dual structure risks aggravating existing inequalities and generating a "Matthew effect" in labour markets[10]. Inclusive policies must therefore account for who benefits from emerging employment opportunities, ensuring that vulnerable groups are not disproportionately excluded or burdened by the transition.

Distributional justice concerns also arise from the uneven employment impacts of circular transitions across geographies, sectors, and population groups. While repair and reuse activities may generate employment in urban and service-based economies, regions reliant on extractive industries or manufacturing – both within and outside the EU – may experience significant losses (Repp et al., 2021; Wijkman & Skånberg, 2015). Such sectoral reallocation risks aggravate regional disparities unless supported by coordinated industrial and territorial policies. Moreover, the emphasis on labour-intensive service sectors in a circular transition raises questions about which types of jobs are being created, and for whom (Clube, 2022), issues that will be addressed in later sections. Particularly, as circular economy policies are mostly EU-led, the impact on job creation and losses in non-EU countries is largely unknown and can be very divergent, which is aggravated by the data scarcity in many non-EU countries (Circle Economy, 2024b).

Distributional justice also relates to job quality. Interviewees mention concerns that circular employment is often assessed in quantitative terms while qualitative conditions remain overlooked. They note that wages, working hours, social protection and workplace conditions vary widely across circular activities, suggesting that an exclusive focus on job numbers risks masking significant inequities. Empirical studies confirm that sectors such as textile reuse, electronics repair and waste management often offer low pay, irregular hours and limited protection, particularly for women, migrants and informal workers (CISL, 2023; Deutz et al., 2024). In Work Integration Social Enterprises (WISEs), wage levels may be insufficient to avoid unemployment or inactivity traps (Van Opstal et al., 2024), and circular activities may amplify work instability due to seasonal or project-based funding. Globally, child labour remains a serious concern in circular value chains involving textile reuse or e-waste recovery (Awino & Apitz, 2024). Without redistribution mechanisms, circular transitions risk shifting environmental gains to consumers in the Global North while concentrating social costs on marginalised groups elsewhere.

Finally, an important question is who gains access to the skills needed to benefit from new employment opportunities. Interview partners mention how circular companies, particularly in refurbishment, recruit individuals with low formal qualifications and train them internally through structured programmes that lead to full-time employment. These practices show that in-house

[10] The "Matthew effect" refers to a dynamic of cumulative advantage or disadvantage: initial endowments of resources, status, or skills attract disproportionate opportunities and rewards over time, while those with fewer fall further behind (Bonoli & Liechti, 2019; Merton, 1968); in labour markets, this manifests as higher-skilled or better-connected workers capturing a growing share of gains.

training can offer accessible entry routes for groups with limited labour market attachment, even when such training does not lead to formal certification. While enabling circular jobs often require higher education and technical skills (e.g., design, digitalisation), many core circular economy activities, such as repair and reuse, offer opportunities for those with vocational or lower-level formal qualifications (Burger et al., 2019). Therefore, ensuring equitable access to training and skill development is crucial. For example, circular start-ups engaging with WISEs tend to offer opportunities to low-skilled groups (Van Opstal & Borms, 2024), while digital circular strategies are more aligned with highly skilled profiles (Borms et al., 2023).

2.4.3 Procedural justice

Procedural justice considerations draw attention to how workers and communities are included in decision-making processes on creating circular jobs. In many policy frameworks, labour market reforms are designed top-down, with limited input from those whose jobs are most affected. This risks perpetuating technocratic transitions that overlook local knowledge and the lived experiences of workers (Clube, 2022; Multani & Bachus, 2024). Moreover, the dominance of formal institutional actors in circular economy policymaking can sideline alternative models within the social or informal economy. Because circular activities are generally cross-sectoral or interdisciplinary, this complicates the way in which emerging industries and jobs are classified and the legal frameworks that are applicable. As a result, many emerging circular jobs are currently not unionised, which can negatively impact working conditions, wages and job quality.

Social partners are seen as an important lever in the process of transitioning justly to a circular economy because they can strengthen collective bargaining power and represent workers in emerging circular jobs while sectoral divides are still in place (Circle Economy, 2021b). One interviewee stressed the importance of involving unions more directly in deliberations on circular strategies and in the adaptation of training regulations, arguing that this could help ensure recognition of workers in sectors such as waste management and related services.

Current modelling and policy discourses on job gains and losses often overlook the participation of affected stakeholders in circular strategies, particularly workers in sectors facing contraction. As Multani and Bachus (2024) observe, economic and technological framings of the circular economy tend to dominate, leaving limited space for deliberation on social equity and employment transitions. Including a broader range of actors, such as labour unions, social enterprises, and local governments, in circular economy policymaking can help to ensure that strategies reflect the realities of affected workers and can introduce alternative ideas about what a just transition should look like.

Procedural justice is also compromised when workers have limited voice or representation in shaping the working conditions that affect them. Many circular jobs emerge in marginalised or informal settings where freedom of association and collective bargaining are weak or absent (Fairbrother & Banks, 2024). This is the case in some social enterprises, municipal repair programmes, and informal e-waste sectors, where actors are often excluded from regulatory consultations or workplace governance (Deutz et al., 2024; Leclerc & Badami, 2023). Sector-wide social dialogue remains difficult due to the fragmented and cross-sectoral nature of circular economy activities (Van Opstal et al., 2024). Moreover, labour protections are frequently not extended to workers in new circular sectors, particularly when self-employment or temporary contracts are involved.

A further procedural justice concern relates to the processes through which skill needs are identified, training is designed, and workers are supported during transitions. One interviewee suggested that workers are rarely consulted about retraining processes that affect them and that many remain unaware of their rights or existing mechanisms for participation. The same respondent highlighted the

need for bottom-up empowerment and improved awareness of rights as preconditions for meaningful participation in circular labour governance. This aligns with Martin (2025b), who argues that regional actors play an important role in guiding transitions, but require greater institutional capacity and stakeholder involvement to do so effectively. The involvement of WISEs in co-developing work processes with circular start-ups is a good example of inclusive procedural innovation, as they translate complex tasks into accessible roles while fostering mutual learning between entrepreneurs and target group workers (Van Opstal & Borms, 2024).

2.4.4 Recognitional justice

Recognitional justice calls for acknowledging and validating the full range of contributions to circularity, including those of informal, unpaid, and marginalised workers. Activities such as community repair, self-organised reuse initiatives, or unpaid repair and maintenance often fall outside official definitions of circular employment but play a crucial role in slowing material flows and fostering sustainability cultures (Multani & Bachus, 2024; Van Opstal, Pals, et al., 2025). Overlooking these contributions risks narrowing the circular economy to a techno-economic paradigm and reinforcing the invisibility of grassroots and solidaristic practices.

Activities such as repair, reuse, and remanufacturing are mostly ecologically preferable in terms of resource preservation (Blomsma & Tennant, 2020), but also more directly circular than downstream recycling or waste management. Yet these activities are often undervalued, informally organised, absent from mainstream economic statistics and often overlooked in policy and institutional frameworks (Van Opstal, Pals, et al., 2025). A just circular transition requires institutional recognition of these value-preserving roles – not only to ensure their economic viability but also to shift societal perceptions of their legitimacy and importance.

This includes recognising the contribution of the informal circular economy, where large volumes of repair, reuse, and redistribution occur outside formal regulatory and fiscal systems. Mapping the creation and destruction of these activities expands the evidence base for circular policymaking and challenges growth-oriented definitions of the circular economy (Siderius & Zink, 2023). However, this also demands awareness of potential trade-offs: formalising or supporting informal circular economy practices without safeguards may reinforce precarity, displace regulated labour, or lead to unintended rebound effects (Van Opstal & Borms, 2025; Velis et al., 2022).

Regarding working conditions and job quality, it is problematic that many circular jobs remain unacknowledged or stigmatised. This is especially true for informal recyclers, waste pickers, and repairers, who are often portrayed as outside the boundaries of ‘real’ work, despite their ecological contributions (K. Liu, 2025; Thapa et al., 2023). Recognitional justice also applies to the intersection of gender, race, and class in some circular activities, where the work of women in household maintenance is often not accounted for, and the work of immigrants in informal recycling and remanufacturing remains structurally undervalued (Van Opstal, Pals, et al., 2025).

Finally, recognitional justice emphasises the importance of valuing different forms of knowledge and skills. Several sources highlight how informal skills, such as those of waste pickers in the Global South or reuse practitioners in informal networks, remain under-acknowledged despite their relevance to circular systems (Haswell et al., 2024). Similarly, disability and neurodiversity considerations are rarely integrated into skill planning, despite evidence that, for instance, individuals with autism may be trained to bring valuable IT and analytical skills to circular economy-related roles (Van Opstal et al., 2024).

Box 5 – Justice dimensions in informal circular economy work

From a distributional justice perspective, informal circular economy employment often benefits lower-income and marginalised groups, but without adequate protections. In the Global North, initiatives such as makerspaces tend to favour affluent, educated participants, potentially reinforcing inequalities (Premyanov et al., 2024), while informal repairers and collectors risk stigmatisation and legal sanctions (Cook et al., 2024).

Procedural justice challenges emerge where legal and institutional frameworks neglect or exclude informal circular economy actors. For instance, extended producer responsibility (EPR) schemes and intellectual property regulations frequently limit informal repair or reuse practices (Jourdain & Lamah, 2024), while formalisation efforts rarely include meaningful participation from informal workers themselves.

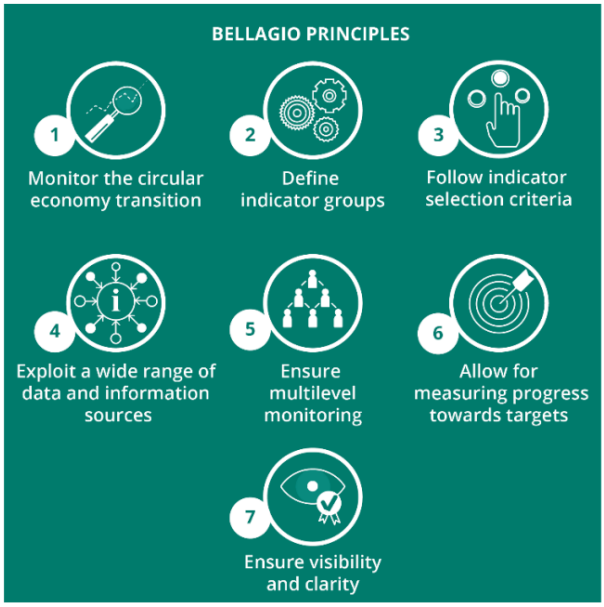
Recognitional justice entails acknowledging the value of informal contributions to circularity. Mapping these activities is essential for legitimising their role in circular transitions and avoiding growth-oriented formal models that neglect alternative pathways to sustainability (Ranta et al., 2018). This includes the challenge for policymakers to develop inclusive models such as partnerships with civil society and social enterprises to integrate or support informal workers while maintaining social safeguards (Valencia et al., 2023; Van Opstal et al., 2026).

3 Mapping and assessment of existing indicators

In this section, we present and discuss indicators for quantifying jobs in the transition to a circular economy, as well as indicators related to job quality and skills. We begin by defining our ideal indicator. Starting with an ideal allows us to clarify what we are aiming to measure and why. It sets a benchmark against which existing data and practical constraints can be evaluated. This approach helps to reveal gaps in current measurement frameworks and enhances conceptual consistency across different types of indicators. It also supports the development of more robust, meaningful, and policy-relevant metrics. An ideal indicator complies with several indicator frameworks and measures what we want to know over several years.

Once we have defined this ideal indicator, we review the indicators that are currently available. For every available indicator, we test whether it complies with the ideal indicator criteria. Furthermore, we provide a synthesis of what all the indicators mean for the labour market in a just circular transition. Finally, we address the limitations of the current indicators and assess what these indicators would need to approximate an ideal indicator. Throughout this process, the **Bellagio principles** are kept in mind, which were established by a collaboration between the EEA and the International Institute for Sustainable Development's Indicators and Performance Reporting group (ISPRA). A high-level meeting was held in Bellagio, Italy, from which the principles take their name. Several European institutions were consulted throughout the process to ensure alignment with the European Green Deal and the Circular Economy Action Plan. These principles can be found in **Error! Reference source not found.**1 and cover the process of monitoring the circular economy using indicators (ISPRA & EEA, 2020).

Figure 1 – Bellagio principles

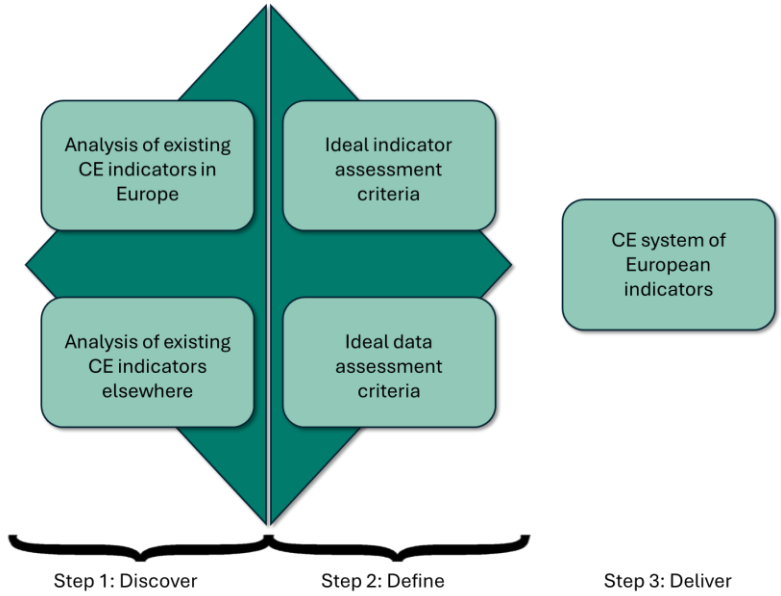


Source: ISPRA & EEA (2020)

In Figure 2, we present a broader roadmap for developing indicators. This visually represents our approach and the structure of the subsections. The chosen visualisation is a "diamond" visualisation, which consists of an expansion in the first step to broaden our view. Typically, this expansion means that we collect all information, including information that might be outside the scope but can be useful to further define the scope. For example, this includes indicators that were developed outside of Europe, or ideas for European indicators that do not have any data yet. In the second step, we will assess all these ideas from step 1 against our criteria for the ideal indicator and the criteria for data.

This will give us an idea of what is feasible and will narrow the scope. The third step represents the end result of such a roadmap.

Figure 2 – A roadmap towards labour market indicators for a just circular transition



Source: own elaboration

3.1 Defining ideal indicators

Indicators, metrics, and frameworks

In this section, we will start off by defining our ideal indicators. We follow the definition of an indicator of Waas et al. (2014) as *"An indicator is the operational representation of an attribute (quality, characteristic, property) of a given system, by a quantitative or qualitative variable (for example numbers, graphics, colours, symbols) (or function of variables), including its value, related to a reference value."* An indicator helps us to specify and simplify complex systems around us by (1) synthesising masses of data, (2) showing the current position, (3) demonstrating progress towards goals and objectives, and (4) communicating the current status (Mitchell et al., 1995).

Instead of indicators, 'metrics' can also be a useful scope for assessing the circular economy. Parchomenko et al. (2019) developed a multi-correspondence analysis for metrics in the circular economy and with metrics, they mean a quantitative measure of a phenomenon. This includes, but is not limited to, indicators. Instead, it is extended with scoreboards, assessment tools, etc.

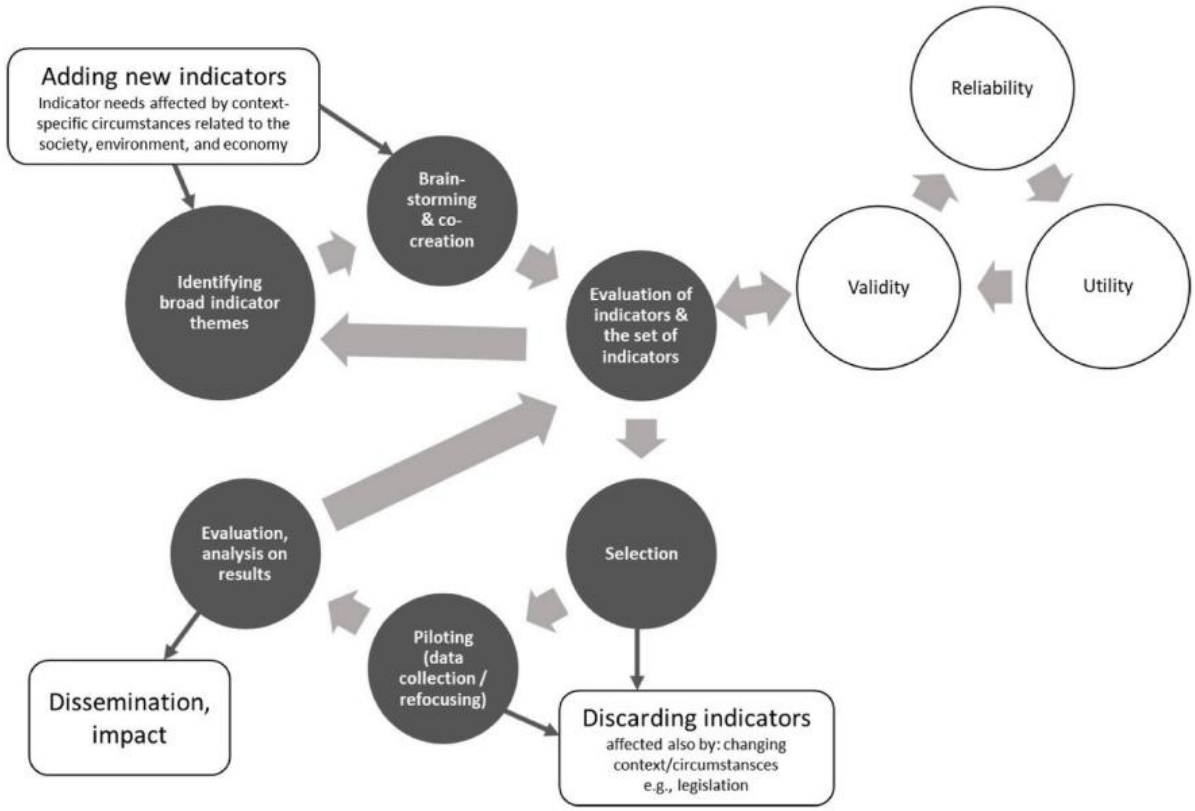
In this report, we consider indicators for quantifying jobs in the circular economy, and some characteristics of those jobs, including gender equality, educational level, informality, etc. But for this we also draw inspiration from indicators that can be found in the form of metrics, for example indicators that are integrated in scoreboards. The literature offers a wide range of methods, frameworks, and roadmaps for constructing indicators for the circular economy, as previously mentioned by Saidani et al. (2019). Already in 2019, a systematic literature review on circular economy indicators found that their development had been conducted in an "inconsistent manner," with each relying on its own methods and scope.

We present two such frameworks from the literature that have been developed to construct indicators. The first one is the framework PICABUE for developing indicators for sustainable development (Mitchell et al., 1995). Their framework consists of the following steps to construct a solid indicator:

1) Stakeholders should reach a consensus on the principles, objectives, and definition of the indicator
2) Identify and select concerns
3) Construct or select indicators following from the concerns
4) Augment the developed indicators according to the principles, definitions, and objectives from step 1. This includes "reference indicator augmentation" or the addition of the reference values and targets
5) Develop uncertainty indicators: express the indicator as a range or a relative value to deal with uncertainties in the data
6) Evaluate and review the final indicators

The second framework is developed by Pitkänen et al. (2023) as an iterative process for social indicators for the circular economy. The visualisation of this process is shown in Figure 3**Source**: Pitkänen et al. (2023)
. While there seem to be quite some differences with the former framework at first sight, many similarities occur. Both processes include a brainstorm with stakeholders, a construction of themes and questions ('identify and select concerns'), a construction of the indicators, followed by a test phase, an evaluation, and a review.

Figure 3 – Iterative process for developing indicators



Source: Pitkänen et al. (2023)

Criteria for an ideal indicator

As a first step in describing our ideal indicator, we outline a set of requirements or criteria derived from a review of the literature. We then summarise these requirements. In the next step, we complement them with additional criteria drawn from established indicator scoring frameworks.

Moraga et al. (2019) summarised three types of circular economy indicators:

- Direct circular economy with specific strategies. These are indicators that relate directly to the circular economy definition and a specific circular strategy (e.g. repair, reuse, or recycling),
- Direct circular economy with non-specific strategies. These are circular economy indicators that relate directly to the circular economy definition but not to a specific circular strategy, such as the number of circular jobs across all sectors.
- Indirect circular economy. These are indicators that do not relate directly to the definition of the circular economy. For example, indicators on sustainability or energy use may give information on the circular economy but are not related to the circular economy definition.

Furthermore, they define three scopes for indicators: (1) scope 0: indicators measure physical properties from the technological cycles but without the lifecycle perspective, (2) scope 1: the indicators measure physical properties from the technological cycles with full or partial lifecycle perspective, (3) scope 2: the indicators measure the effects from technological cycles regarding environmental, economic, and/or social concerns in a cause-and-effect chain modelling.

Next, indicators can measure on a different implementation scale, namely macro, meso, or micro. The macro scale involves measurements as a city, province, region, or nation. The meso scale includes indicators on the level of eco-industrial parks and industrial symbiosis. Finally, the micro scale contains indicators for a single product, company, or consumer (Ghisellini et al., 2016; Kirchherr et al., 2017). Furthermore, indicators should refer to a "reference value that gives meaning to the values the variables take" (Waas et al., 2014). For example, a goal, a target, a norm, a standard, or a benchmark. Therefore, an indicator performs as a measure of distance to target.

Translating these insights into criteria linked to the Bellagio principles, we propose that ideal indicators are "**direct circular economy**" indicators with specific or non-specific strategies (ISPRA & EEA, 2020; Moraga et al., 2019) that cover the macro, micro, and meso levels in a balanced way (Ghisellini et al., 2016; ISPRA & EEA, 2020; Kirchherr et al., 2017). They also act as reference values and as measures of **distance to target**, capturing how the effects of circular transitions evolve over time (ISPRA & EEA, 2020; Waas et al., 2014). These criteria are the first that we will use to qualitatively score the indicators that we find.

Next, we add existing scoring frameworks to these three requirements. We start with the **RACER criteria**, a set of five quality standards developed by the European Commission to assess and design effective performance indicators for policy monitoring and evaluation. The RACER-criteria were considered as the criteria to be used by the Bellagio principles (ISPRA & EEA, 2020). These criteria were used consistently from 2021 onwards in the ETC CE tasks related to the Circularity Metrics Lab. Over the years, the details and the way that we scored were changed. Table shows the most simplified version of the criteria that can be applied to this report. Scoring can be done in multiple ways, varying from a binary 'yes-no' to a more nuanced Likert-scale approach. In this report we continue with a 3-point Likert-scale.

Table 2 – RACER criteria

Criteria	Description	Score
Relevant	Does the indicator relate to/answer a policy question?	1-3
Accepted	Is the indicator used by Eurostat or any national statistical offices, or applied/referred to in a policy context?	1-3
Credible	Are the underlying methodology and data transparently documented and harmonized?	1-3
Easy	Are indicator data easily accessible and is the indicator calculation possible with limited efforts?	1-3
Robust	Are the data and methodology officially reported by 'trusted data sources'?	1-3

Additionally, the **choice of data** is an important part of indicator selection and is included in criteria 3 and 4 of the Bellagio principles. The ideal data would consist of the following criteria, following from a report by EFC and used previously in the EEA project "Lifespan monitoring in the context of CE" (EEA, 2024e): quality, coverage, availability, and timeliness (see Table 3). We argue that if a data stream fulfils all these targets and the data are available at a sufficient level of granularity to identify circular activities in a meaningful way, we can obtain the ideal indicator.

Table 3 – Criteria for the choice of data in indicators

Criteria	Criteria relevant to this report	Explanation
Quality	Circular job creation, job quality, and skills	Does the data reflect **circular jobs** of the EU (employment shifts, job quality, skills)?
Quality	Trustworthiness	How **trustworthy** is the data stream? (Could it be biased because the data stream was aimed to influence decision making (political/strategic));
Coverage	Representativeness	Is the data stream **representing** what it is indicating? (What is the scope: could it cover all EU MS, an entire sector, or does it represent only a "case"?);
Availability	Accessibility	How easy can we **access** the data? (need to purchase, real-time data or only "once in a lifetime"…);
Timeliness	Updatability	How easy can we produce new **updates** over time?

Sources: EFC (2005), EEA (2024b)

Finally, we aim for a combined set of ideal indicators to support the analysis of distributional, procedural, and recognitional justice considerations. We summarise our list of requirements in Box 6.

Box 6 – Requirements for an ideal indicator

- A direct circular economy indicator with specific or non-specific strategies
- EU-27 scope
- The indicator shows the evolution over time and shows the distance to target
- The indicator scores high on the RACER criteria
    - Relevant
    - Accepted
    - Credible
    - Easy
    - Robust
- The indicator scores high on the data criteria
    - Trustworthiness
    - Representativeness
    - Accessibility
    - Updatability
    - If possible, novelty
- The set of indicators jointly allows analysis of distributional, procedural, and recognitional justice considerations

In Box 7, we present an example for this topic.

Box 7 – Towards ideal indicators: an example

An example of an ideal indicator would be the **number of jobs in the circular economy**, calculated with data from **official statistical offices** and available for the **EU-27** between **2010-2025**:

- This is a direct circular economy indicator with a non-specific strategy.
- It is a macro-economic indicator.
- It is a time series on which we can place a target from the Circular Economy Action Plan.
- The indicator is relevant, accepted, credible, easy to understand, and robust.
- The data behind the indicator are trustworthy, representative, accessible, and updatable.
- In combination with other indicators, this indicator helps to analyse distributional justice considerations in a circular transition.

3.2 Assessment of data sources and indicator sets

In this section, we discuss a selection of relevant indicators retrieved from official international statistical authorities, European agencies and observatories, as well as academic and grey literature. We focus on the quantification of the number of circular jobs and data on job quality, education, and skills. This overview was established by a literature and data search, starting from a search for academic papers. Next, we screened references, applying a snowball method to find and add policy reports, data sources, and scientific papers. Apart from existing and established data sources, some promising concepts or indicators suggested by literature that currently lack an available data source will be presented. Finally, we present an overarching assessment of the data sources and indicator sets, using the previously mentioned criteria.

3.2.1 Official international statistics

Eurostat – Labour market statistics

Eurostat reports labour market statistics, including information on earnings, job vacancies, labour cost, and quality of employment. This provides information on the labour supply from individuals, labour demand from businesses, and the resulting labour prices.

An important data source is the **European Labour Force Survey (EU-LFS)**. This survey covers all EU Member States, as well as Iceland, Norway, Switzerland, and the UK and provides quarterly data on people aged 15 and over on labour market participation (Eurostat, 2024). Time series are available from 1983 to the present. The data is collected by the national statistical institutes and forwarded to Eurostat, who publish the data in full. Eurostat reports publicly available EU-LFS based employment data at the NACE 2-digit level[11]. More refined indicators that could enable to disentangle employment figures by sex or age, however, are only publicly available at the NACE 1-digit level, leaving it impossible to capture activities in the circular economy. This also holds for other relevant indicators concerning jobs quality, education, and skills, including:

- Employment by sex, age, and detailed economic activity (lfsa_egan22d)
- Employment by sex, age, time since job started and economic activity (lfsq_egdn2)

[11] https://ec.europa.eu/eurostat/databrowser/view/lfsa_egan22d/default/table?lang=en

- Employment by sex, age, occupation, and economic activity (lfsq_eisn2)
- Over-qualification rates by economic activity (lfsa_eoqgan2)
- Average annual gross earnings by sex and NACE Rev. 2 activity (earn_gr_nace2)
- Gender gap by NACE Rev. 2 activity (earn_gr_gpgr2)
- Temporary employees by sex, age, and economic activity (lfsa_etgan2)
- Self-employment by sex, age and economic activity (lfsq_esgan2)

While ad-hoc data extractions from the EU-LFS can be requested to Eurostat at the NACE 2-digit level, estimating circular employment would require detailed figures at the NACE 4-digit level. However, greater disaggregation at the two-digit level would already make it possible to analyse job quality differences in four circular economy sectors:

- repair of machinery and equipment (NACE33)
- waste management (NACE38)
- rental and leasing (NACE77)
- repair of computers and household goods (NACE95)

Eurostat also reports **Structural Business Statistics (SBS)**, which describe the detailed structure, economic activity, and performance of businesses over time. The SBS data collection has a good coverage in terms of enterprise size classes and economic activity. It covers the so-called business economy, defined as sections B to N, P to R as well as division S95 and S96 of the statistical classification of economic activities (NACE Rev. 2). Thich includes industry, construction, distributive trades, and services, but not all sectors are therefore covered. For the sectors that are included, data are available at the NACE 3-digit level data from 2021 onwards, both at the EU-27 level as the Member State level. Table 4 presents employment data for the four circular economy sectors mentioned earlier, at the 3-digit NACE level.

Table 4 – Employment in selected circular economy sectors in the EU-27

	2021	2022	2023
Repair of fabricated metal products, machinery and equipment	800,000	837,344	857,182
Waste collection	560,000	571,000	577,655
Waste treatment and disposal	263,430	260,000	261,887
Materials recovery	(na)	(na)	234,000
Renting and leasing of motor vehicles	180,000	199,727	209,329
Renting and leasing of personal and household goods	143,202	155,167	149,847
Renting and leasing of other machinery, equipment and tangible goods	326,740	338,925	(na)
Repair of computers and communication equipment	116,409	117,000	(na)
Repair of personal and household goods	224,869	220,000	220,000

Source: own elaboration of Eurostat SBS-data (SBS_SC_OVW)

Finally, the **Labour Cost survey (LCS)**[12], collected every four years, provides detailed information on the level and structure of labour cost data, hours worked and hours paid in different sectors of economic activity in the European Union, EFTA countries, candidate and potential candidate countries transmitting the data to Eurostat. The data are collected by the National Statistical Institutes in most cases on the basis of stratified random samples of enterprises or local units, restricted in most countries to units with at least 10 employees. The application of this data will be discussed in Section 4.1.

[12] https://doi.org/10.2908/LC_RCOST_R2

Eurostat – Circular Economy Monitoring Framework

In 2018, the European Commission introduced the Circular Economy Monitoring Framework (CEMF) to track EU-level progress and inform policy on the circular transition. Eurostat maintains and disseminates the indicators. The framework was revised in 2023 and now comprises 11 indicator sets grouped into five domains: production and consumption, waste management, secondary raw materials, competitiveness and innovation, and global sustainability and resilience (Eurostat, 2025c). Examples include recycling rates (municipal and packaging waste), resource productivity, circular material use, trade in recyclable raw materials, and private investment/value added in circular sectors.

The only labour market indicator in the CEMF is employment in the circular economy measured in full-time equivalent (FTE) for the EU-27, with a time series starting from 2005. The scope of the circular economy is defined through selected economic activities (NACE Rev. 2 at the 4-digit level) and specific products (CPA[13] at the six-digit level or PRODCOM[14]). Employment for these activities and products is then retrieved from official statistics, primarily Structural Business Statistics. Where data gaps occur, for example due to confidentiality or missing recent years, supplementary sources such as PRODCOM, national accounts and the Labour Force Survey are used. NACE sectors were classified as either fully included or fully excluded (see the Annex for the full list), which created a bias towards sectors traditionally associated with the circular economy, such as waste management (NACE 38). A revised version of the indicator is therefore under development, with planned estimates based on inclusion shares, including additional NACE sectors (European Commission, 2025d).

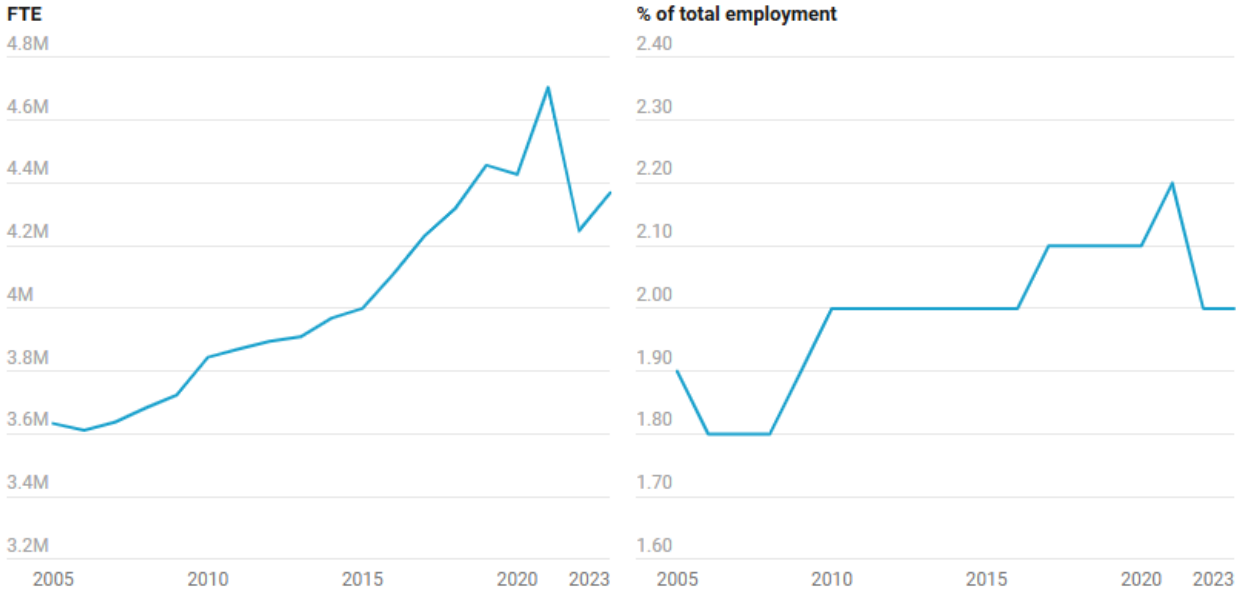
An overview of the activities classified as circular economy sectors is provided in the Annex. Results are publicly available for the EU and its Member States, but they are not disaggregated by individual economic activity. The data originates from Eurostat and is therefore reliable, easily accessible, and updatable. It represents the EU-27 over a consistent time period. However, the sectors which are tagged as circular by Eurostat, only represent a subset of where circular employment takes place. The impact of the circular economy in other sectors is more difficult to isolate, and therefore, Eurostat uses recycling, repair, and reuse as proxies for the circular economy.

Figure 4 shows the time series of circular economy in the EU-27, both in absolute FTE as in relative shares in total employment. Details at the Member State level will be discussed in Section 4.1. The results indicate a minor increase in the share of employment in the circular economy between 2006 and 2021 from 1.8% to 2.2%, which is followed by a small decrease in 2022 and 2023 to 2%. In absolute figures, the increase amounted from 3.3 million FTE in 2005 to 4,7 million in 2021 and almost 4.4 million in 2023. As the Circular Economy Action Plan referred to an additional 700,000 jobs to be created between 2015 and 2030, this metric shows that between 2015 and 2021, already 420,724 jobs were created.

[13] The Classification of Products by Activity (CPA) is the EU statistical classification for goods and services linked to the economic activity that produces them. It provides a harmonised system for measuring production, trade and consumption across Member States.

[14] PRODCOM is the EU's annual survey of industrial production. It collects detailed product-level data from manufacturing firms, using a classification aligned with CPA and NACE to measure volumes and values of goods produced within the EU.

Figure 4 – Employment in the circular economy (in FTE) in the EU-27



Source: own elaboration of (Eurostat, 2025c)

Several comparable analyses are available on the country or regional level. For example, the CE Center in Flanders (Belgium) is the Circular Economy Policy Research Center and publishes a dashboard ('CE Monitor') with indicators for Flanders if available, and otherwise for Belgium (CE Center, 2025). The indicator "Employment in the Circular Economy" measures the number of circular jobs. However, there are some differences in the NACE codes applied by Eurostat and the classification developed by the CE Center, following the work of Willeghems & Bachus (2018). Their classification consists of significantly less NACE codes than the one from Eurostat. Spain on the other hand, added NACE codes to the selection to cover more sectors (ETC CE, 2024c). This could explain why they find a significantly higher share of employment in the circular economy than the EU average. Their timeseries is available for 2017-2021.

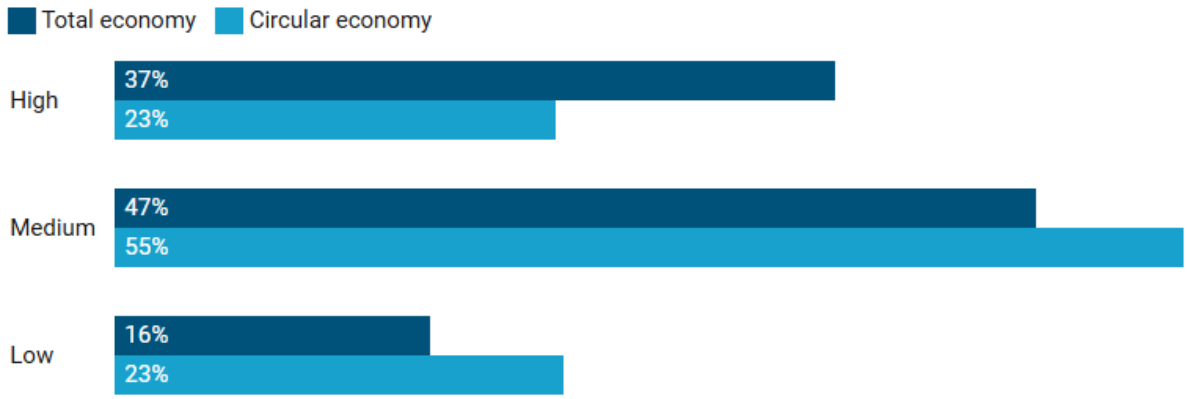
Within the CEMF framework, employment is currently used as an indicator of competitiveness, with no specific attention to social dimensions. In light of two EEA workshops on jobs in a just circular transition, held in September and November 2025, Eurostat shared unofficial and experimental attempts to explore some social aspects of circular employment. These estimates are derived from the Labour Force Survey for the reference year 2021 and relate to the circular economy as defined through aggregated NACE Rev. 2 categories at the 3-digit level. Figure 5 presents employment by gender and indicates that, according to this measurement approach, men account for the majority of circular economy employment.

Figure 5 – Employment by gender in the circular economy in the EU-27, 2021

Source: own elaboration of unpublished, experimental results from Eurostat (European Commission, 2025d), based on Labour Force Survey data

In Figure 6, Eurostat uses educational attainment as a proxy for skill level. The results indicate that circular economy employment is concentrated mainly among workers with low and medium levels of education, with a much smaller share among those with high (tertiary) education.

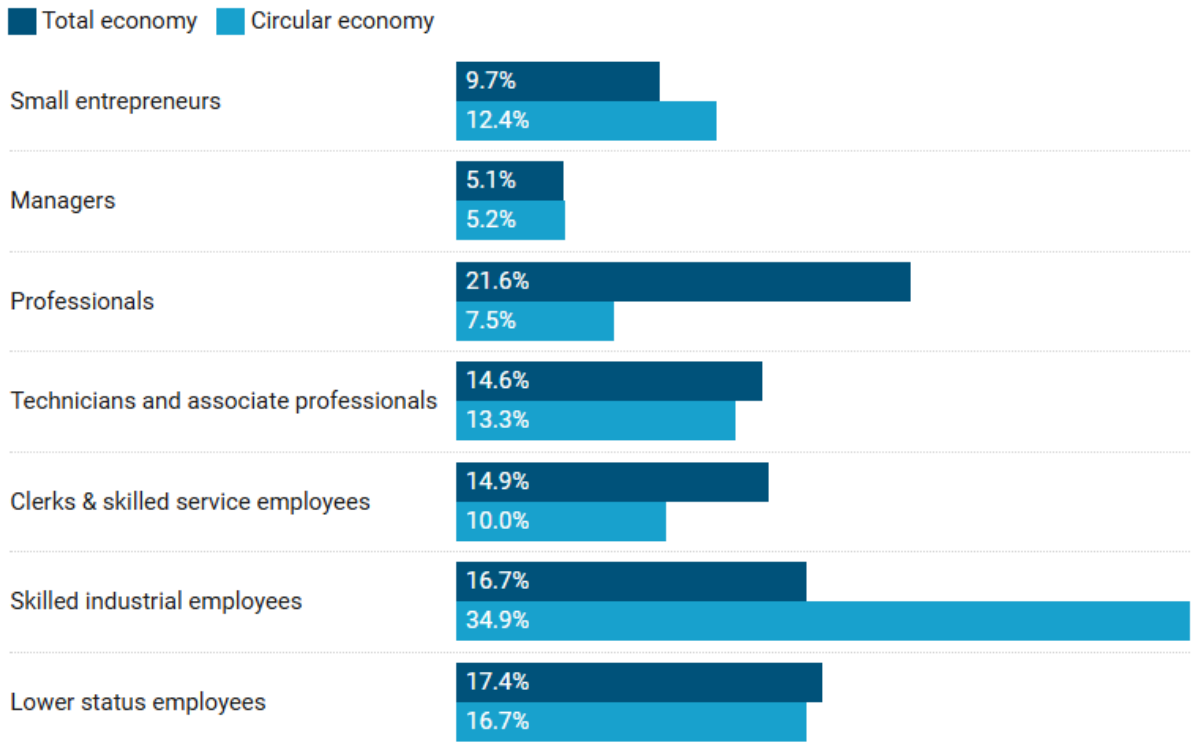
Figure 6 – Employment by educational level in the EU-27, 2021



Source: own elaboration of unpublished, experimental results from Eurostat (European Commission, 2025d), based on Labour Force Survey data

Figure 7 shows circular employment by socio-economic group and indicates that it employs skilled industrial workers at roughly twice the share observed in the total economy. These results should, however, be interpreted with caution, as they reflect only a very early attempt to capture the social effects of circular employment.

Figure 7 – Employment by socio-economic group in the EU-27, 2021



Source: own elaboration of unpublished, experimental results from Eurostat (European Commission, 2025d), based on Labour Force Survey data

Eurostat – Social Scoreboard

Eurostat publishes several scoreboards, which are indicator dashboards, among which a Social Scoreboard (Eurostat, n.d.). The Social Scoreboard[15] supports the European Pillar of Social Rights and serves as a reference framework to monitor societal progress. It tracks progress across the three chapters of the Pillar: equal opportunities, fair working conditions, and social protection and inclusion. It publishes headline indicators, endorsed by the European Council, and secondary indicators which are currently under review. Indicators are mainly compiled from EU-LFS and EU-SILC (the Survey on Income and Living Conditions).

Interesting indicators for the purposes of this report include the gender employment gap, the disability employment gap, and household income. These metrics are not tailored to circular economy dynamics, but they provide the reference social context against which circular policies and labour-market impacts can be assessed.

UN

At the level of the United Nations, a first key initiative is the **global indicator framework for the Sustainable Development Goals**, developed by the Inter Agency and Expert Group on SDG Indicators (IAEG SDGs) in 2017. The framework is refined annually and complemented by regional and national indicators developed by Member States. At present, the SDG Global Indicator Framework contains 234 unique indicators covering the goals and targets. In Table 5, an overview is presented of indicators linked to SDG 8 that are relevant for the EU 27 labour market. This dataset does not allow differences

[15] https://ec.europa.eu/eurostat/cache/dashboard/social-scoreboard/

between circular and other jobs to be identified, but it can provide important contextual information on job quality within Member States.

Table 5 – SDG indicators on job quality

Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	
8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services	8.3.1 Proportion of informal employment in total employment, by sector and sex
8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value	8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities
	8.5.2 Unemployment rate, by sex, age and persons with disabilities
8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training	8.6.1 Proportion of youth (aged 15–24 years) not in education, employment or training
8.7 Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms	8.7.1 Proportion and number of children aged 5–17 years engaged in child labour, by sex and age
8.8 Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment	8.8.1 Fatal and non-fatal occupational injuries per 100,000 workers, by sex and migrant status
	8.8.2 Level of national compliance with labour rights based on International Labour Organization (ILO) textual sources and national legislation, by sex and migrant status

Source: https://unstats.un.org/sdgs/

The United Nations Economic Commission for Europe (UNECE) has developed a **Quality of Employment Framework**. In 2015, the Conference of European Statisticians endorsed a statistical framework prepared by the Expert Group on Measuring Quality of Employment. This framework provides a conceptual basis and detailed practical guidance for countries that wish to compile statistics on the quality of employment. It offers a conceptual approach that captures multiple facets of employment quality from the perspective of the employed person, and defines 67 indicators across seven dimensions (presented in Figure 8), some of which are further divided into sub dimensions. As with the SDG indicator framework, however, these data do not provide specific insights into circular economy transitions or allow circular jobs to be distinguished from other forms of employment.

Figure 8 – Dimensions of the Quality of Employment Framework (UNECE)

Source: https://unece.org/statistics/quality-employment-framework

ILO

The International Labour Organization (LIO) provides a comprehensive statistical and conceptual foundation for monitoring employment, job quality and labour market conditions across countries. Through its ILOSTAT database, the organisation maintains internationally harmonised indicators that cover employment levels, labour underutilisation, working time, wages, skills, and demographic characteristics of the workforce. A core element of this work is the ILO **Decent Work framework**, which brings together indicators on employment opportunities, adequate earnings, job security, working conditions, equality of opportunity, and social protection. The ILO also plays a central role in defining and measuring informality. The indicator framework distinguishes employment in the informal economy and employment in informal jobs, allowing analysts to assess the prevalence of unregulated work, limited social protection and insecurity in labour markets worldwide. In parallel, the ILO maintains extensive statistics on social dialogue and industrial relations, including trade union density, collective bargaining coverage, and data on strikes and lockouts across sectors.

More recently, the ILO joined forces with the World Bank Group and Circle Economy in the **Jobs in the Circular Economy** initiative. It aims to create evidence and tools to unlock the potential of the circular economy for promoting innovation, sustainable enterprise, and ensuring decent work for all. The partners aim to measure, model and monitor jobs in the circular economy, support ex-ante impact assessments so that circular solutions are just and fair, and increase political support and implementation capacity for people-centred circular policies. It uses a building-block approach in which economic activities in ISIC Rev. 4 are classified as fully circular or partially circular (Circle Economy et al., 2025b).

Fully circular sectors include repair, waste management, second-hand retail, material recovery and related services. All employment in these sectors is counted as circular. In partially circular sectors, such as agriculture, mining, manufacturing and construction, ISIC data do not allow for the disaggregation of circular activities within these sectors. Therefore, circularity in these sectors is estimated through coefficients based on economic and material circularity:

- Economic circularity: Employment is proxied by the sector's contribution to the recycling sector (domestic and exports). This is the case for mining and partially for manufacturing and construction.
- Material circularity: Employment is proxied by estimating the percentage of secondary inputs over total inputs into the sector. This is partially the case for manufacturing and construction.

Several economic activities fall outside the scope of their study because existing classification systems and datasets do not allow circular practices to be identified reliably. In addition, some activities are not considered to be part of the circular economy or are considered to be addressed more adequately in other studies (Circle Economy et al., 2025b).

Their global baseline covers 177 of 187 ILO Member States and draws on ILOSTAT employment data at the 4-digit ISIC level where possible, disaggregated by gender and informality, and aligned with recent Eora multi-regional input–output tables[16]. The headline baseline estimate suggests 121 to 142 million people in circular economy employment across 177 countries, or about 5.0 to 5.8 per cent of total employment covered in the study. The estimate excludes agricultural employment from the headline baseline, and most circular employment appears in fully circular sectors rather than partially circular sectors (Circle Economy et al., 2025a). An extension study to add circular economy employment in agriculture as an additional building block to this methodology and global study will take place in 2026.

Excluding agriculture, circular economy employment represents 6.4 per cent of total employment in the Americas, 5.8 per cent in Asia and the Pacific, 5.6 per cent in Africa, 5.4 per cent in Europe and Central Asia, and 4.9 per cent in the Arab States. In absolute terms, Asia and the Pacific account for more than half of global circular employment (77.6 million people), followed by the Americas (27.5 million), Europe and Central Asia (20.8 million), Africa (12.9 million), and the Arab States (2.7 million) (Circle Economy et al., 2025b).

This work acknowledges that statistical systems designed around linear production structures and formal enterprises often obscure informal and hybrid circular activities. For these reasons, their figures are presented as indicative and likely to underestimate circular employment, especially in informal, repair-oriented and service-based activities. Nevertheless, they provide an important first step towards internationally comparable measurement of jobs in a circular transition.

OECD

The Organisation for Economic Co-operation and Development (OECD) developed the **Job Quality Framework** in the mid-2010s as part of a broader agenda on well-being and labour market performance (Cazes et al., 2015). The framework defines job quality through three core dimensions.

- Earnings quality captures the extent to which earnings contribute to material wellbeing, in terms of both average wage levels and their distribution across workers.
- Labour market security reflects the risk of job loss and the extent to which unemployment benefits and related transfers protect workers against income loss.
- The quality of the working environment covers non-monetary aspects of work, including physical health risk factors, job strain arising from high demands and low resources, working time arrangements, autonomy, learning opportunities and career prospects.

[16] Eora is a global multi-regional input–output (MRIO) database that provides harmonised national accounts, trade flows and environmental extensions for almost every country in the world. It is widely used for analysing global value chains and environmental footprints because it offers detailed inter-country linkages and time series data.

Data for these three dimensions and their underlying indicators are available in the OECD Job Quality Database[17]. This framework underpins ongoing analysis in OECD Employment Outlook reports. Nevertheless, no specific link can be made with the circular economy. Furthermore, the OECD/AIAS database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) provides comprehensive and comparable information on the evolving nature and scope of collective bargaining in OECD and EU countries[18].

Yet the OECD publishes data on resource efficiency and the circular economy[19] and has a programme on the Circular Economy in Cities and Regions[20], supporting cities and regions in their transition towards a circular economy. Moreover, it publishes reports on circular economy policies and country studies[21]. These initiatives, however, do no specifically relate to circular jobs.

3.2.2 European Union agency approaches to indicators and monitoring

At the EU-level, several agencies collect data that produce thematic indicators, scoreboards, and monitoring frameworks.

EEA – Circular Metrics Lab (CML)

The EEA Circularity Monitoring Lab (CML) is the European Environment Agency's analytical platform for tracking progress towards a more circular economy across the EU. It brings together existing statistical indicators and develops new analytical tools to monitor how material use, product lifecycles, waste generation, and circular business practices evolve over time (EEA, 2024a). With regard to circular employment, the CML currently draws on Eurostat's circular jobs indicator, as integrated in the CEMF. The EEA plans to expand the monitoring framework with indicators that capture just transition dimensions, including labour market related outcomes.

Eurofound – European Working Conditions Survey

Eurofound, the European Foundation for the Improvement of Living and Working Conditions, is a decentralised EU Agency based in Ireland. While it is not a statistical authority, it is a data provider and a recognised research entity by Eurostat. It conducted the European Working Conditions Survey (EWCS) in 1991, 2005, 2010, 2015, 2021, and 2024 (Eurofound, n.d.), aimed at monitoring working conditions of the EU Member States. Each wave is accompanied by full methodological documentation and a micro-dataset accessible upon application. A public data-visualisation tool is also available, which allows users to explore descriptive statistics without downloading the microdata[22].

The EWCS contains a rich set of variables that could be used to construct indicators relevant for monitoring job quality in circular and green employment. The EWCS covers a broad range of dimensions, including:

[17] https://www.oecd.org/en/topics/job-quality.html
[18] https://www.oecd.org/en/data/datasets/oecdaias-ictwss-database.html
[19] https://www.oecd.org/en/topics/resource-efficiency-and-circular-economy.html
[20] https://www.oecd.org/en/topics/circular-economy-in-cities-and-regions.html
[21] https://www.oecd.org/en/topics/circular-economy-policies-and-country-studies.html
[22] https://www.eurofound.europa.eu/en/data-catalogue/european-working-conditions-survey

- Work organisation
- Working time and work–life balance
- Employment status and contracts
- Work intensity and autonomy
- Skills and training
- Health and safety risks
- Violence, harassment and discrimination
- Representation and social dialogue
- Digitalisation
- Well-being and job security

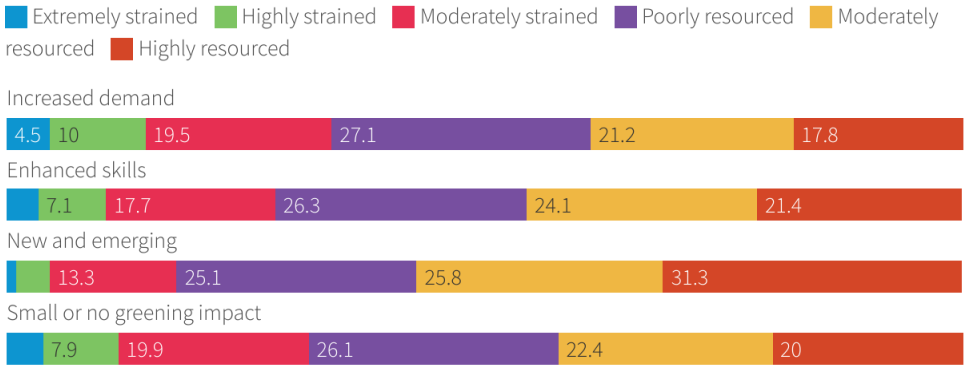
This broad set of dimensions highlights the potential of the EWCS to inform a more comprehensive approach to circular labour-market monitoring, including unpaid work and health- and safety-related risks that may be particularly relevant in sectors such as repair, recycling and waste management.

From a technical perspective, the EWCS includes NACE Rev. 2 at the 3-digit level and ISCO at the 4-digit level. The EWCS microdata could therefore support the development of job quality indicators for selected circular sectors. A further meaningful extension for circular economy monitoring could involve including additional survey questions capturing circular tasks and responsibilities across occupations and sectors.

Eurofound's **Job Quality Framework** provides a conceptual basis for analysing job quality using EWCS data. Rather than producing a single composite index, the framework measures job quality across seven dimensions: working time quality, earnings, career prospects, skills and discretion, work intensity, social environment, and physical environment. Each dimension is captured through a composite indicator based on several sub-indicators and survey variables.

Figure 9 presents an application of this approach, showing job quality across occupational groups clustered by their degree of "greenness", based on an O*NET-derived classification. The analysis compares four types of occupations: those with minimal greening impact; new and emerging green occupations; existing occupations requiring enhanced skills; and existing occupations in increased demand due to the green transition. These indicators do not measure circular economy employment specifically. However, the EWCS provides a structured basis for analysing job quality through the seven dimensions of the Job Quality Framework. With access to the microdata and sufficient sectoral detail, similar analyses could be adapted to examine job quality in circular economy-related occupations.

Figure 9 – Job quality index by greening occupational group, EU-27, 2021 (%)



Note: The job quality index shown in the figure is based on a more limited framework developed for the 2021 EWCS telephone survey, which had a reduced capacity to collect information compared with the face-to-face EWCS waves conducted in 2015 and 2024. As a result, the index relies on a smaller set of variables than the full Job Quality Framework.
Source: Eurofound (2021)

ETUI

The European Trade Union Institute (ETUI) – the research and training centre of the European Trade Union Confederation (ETUC) – began developing the European Job Quality Index (JQI) in 2008 in response to the lack of robust indicators on job quality at the European level. Drawing on a range of data sources, the ETUI created a multidimensional, quantitative indicator that captures the quality of work rather than employment quantity alone. The JQI enables comparisons of job quality across EU-27 countries and is structured around six main dimensions: income quality; forms of employment and job security; working time and work–life balance; working conditions; skills and career development; and collective interest representation. These sub-indices together provide a comprehensive picture of job quality across sectors and countries. Nonetheless, the dataset does not provide the level of detail needed to distinguish circular jobs from other types of employment.

EIGE

The European Institute for Gender Equality (EIGE) is the EU agency responsible for producing data, analysis and tools to support gender-equality policies across Member States. In its Online Panel Survey on Gender Gaps in Unpaid Care, Individual and Social Activities (EIGE, 2023), EIGE outlines the methodological foundations of a dedicated survey examining gender differences in unpaid care work, personal activities and social participation. The indicators collected through the survey are documented in EIGE's Gender Statistics Database, which provides a harmonised framework for monitoring gender gaps across the EU. However, the dataset does not contain information specific to circular economy activities.

CEDEFOP

Cedefop, the European Centre for the Development of Vocational Training, is an agency of the European Union. It provides research, analysis, and data on vocational education and training (VET), skills, jobs and qualifications. Cedefop has developed a freely accessible online skills intelligence tool[23] that offers a range of indicators on skills needs and demands, which can be disaggregated by occupation, country, age group, qualification level, gender and skill, depending on the indicator.

[23] https://www.cedefop.europa.eu/en/blog-articles/welcome-skills-intelligence-online-tool

Although the circular economy is not a dedicated focus area, Cedefop has addressed related issues in its work on green skills.

The Cedefop Green Observatory presents analysis on how the green transition affects jobs and skills across sectors and occupations in the EU. It includes a dedicated site for studies and reports, some of which concentrate specifically on the circular economy, such as the policy briefs "*Too good to waste: Tapping the potential of vocational education and training in the waste management sector*" (Cedefop, 2022) and "*From linear thinking to green growth mindsets: Vocational education and training and skills as springboards for the circular economy*" (Cedefop, 2026a).

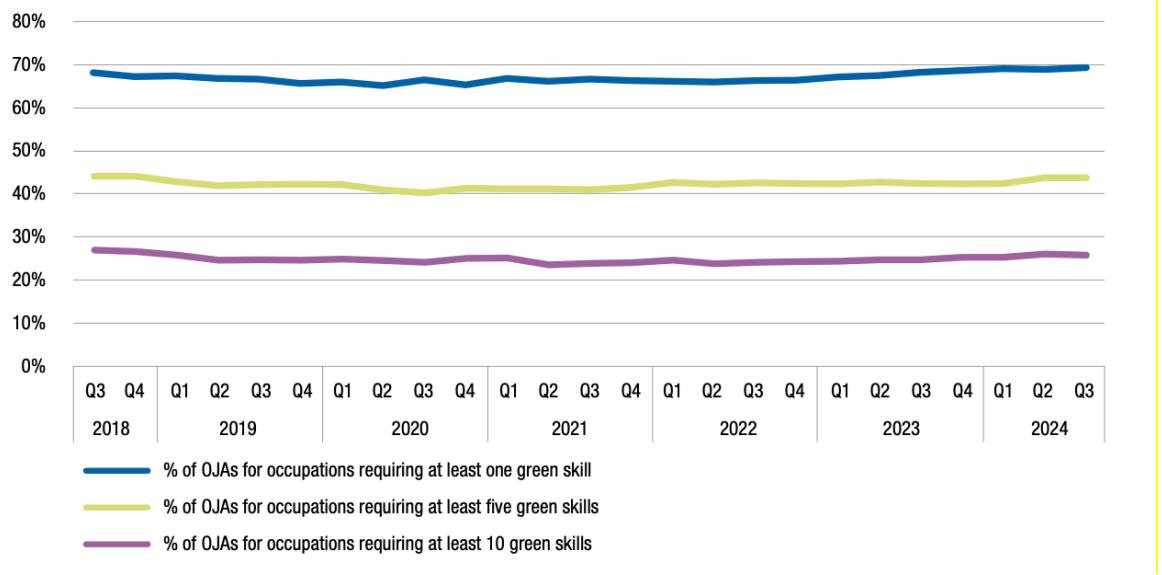
Cedefop notes that it is difficult to analyse green or circular transitions in the labour market using traditional quantitative data sources (Cedefop, 2025). Eurostat's indicator on persons employed in circular economy sectors and the EU-LFS both rely on NACE codes, which do not capture circular activities in sufficient detail. Cedefop therefore uses big data from online job advertisements (OJAs), which provide near real-time insight and can reveal changing skill demand related to the green and digital transitions.

Figure 10 presents such an analysis based on the European Skills, Competences, Qualifications and Occupations classification (ESCO). ESCO provides a structured taxonomy of occupations and skills used to analyse labour-market demand in OJAs. Within this framework, skills are grouped into three categories:

- Brown skills: knowledge and skills that increase the environmental impact of human activity
- White skills: knowledge and skills that neither increase nor reduce this impact
- Green skills: knowledge and skills that reduce this impact

In total, 571 ESCO skills and knowledge concepts were labelled as green. The identification of these skills combined a list of green-related keywords with natural language processing applied to a dataset of six million online job advertisements in the United Kingdom, which was used to identify and validate relevant skill concepts. Figure 10 illustrates how the measurement of green skills demand varies depending on the definition applied. It shows the share of online job advertisements that contain at least one, at least five or at least ten green skills between 2018 and 2024. The comparison highlights that estimates of green demand change substantially depending on the threshold used to classify an advertisement as green.

Figure 10 – Share of online job advertisements corresponding to occupations that require (at least) a minimum number of ESCO 'green skills' (2018-2024)



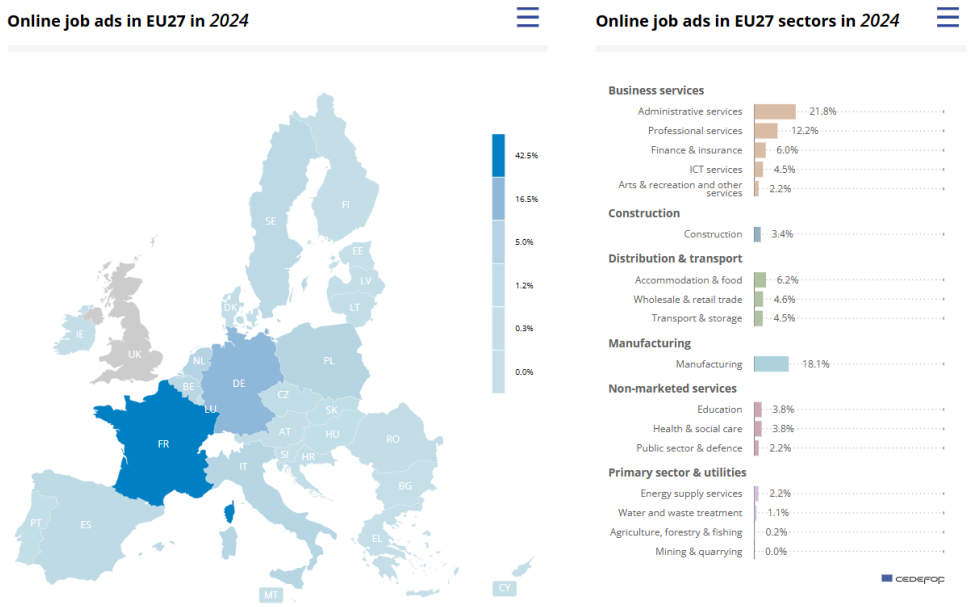
Source: Cedefop (2025)

Cedefop has also built an online platform[24] that reports the number of online job advertisements by year, occupation, skill (ESCO classification), sector (NACE Rev. 2 at the 1-digit level) and region (NUTS2[25]). This set of dashboards allows users to explore interactively how demand for different skills has evolved in EU-27 countries over recent years, and an example is shown in Figure 11. At present, however, the dashboard does not yet include an explicit tagging of circular skills. In addition to this specific dataset, Cedefop publishes indicators on unemployment rates, gender employment gaps, qualification and educational attainment, labour shortage indices and related labour market metrics, drawing on the Eurostat indicators discussed above.

[24] https://www.cedefop.europa.eu/en/tools/skills-intelligence/trend-focus/skills-online-job-advertisements?country=EU27_2020&year=2024#1

[25] The Nomenclature of Territorial Units for Statistics (NUTS) is the EU's official system for dividing territory into comparable statistical units.

Figure 11 – A snippet of the dashboard "Skills in online job advertisements"



Source: Cedefop (2026b)

3.2.3 Academic and grey literature

In 2019, Parchomenko et al. (2019) published a study on 63 metrics and 24 features relevant for the circular economy. None of these metrics appeared to relate to the labour market or to social justice considerations. In the last few years, however, research on the social aspects of the circular economy is emerging. In an assessment of the social life cycle impacts of the circular economy, Luthin et al. (2023) identified 113 social circularity indicators. Job creation and employment was the most addressed (55%) indicator, followed by training and education (for employees) (39%).

In this section we provide a chronological overview of studies that developed indicators, including peer-reviewed academic research and grey literature. The latter group includes reports from think tanks, NGOs, industry associations, consultancies, and foundations producing indicator sets, often in close collaboration with, or commissioned by, international agencies and governments.

Ecorys (2012) – Jobs in eco-industries in the EU

Already in 2012, a study commissioned by the DG Employment of the European Commission (Ecorys, 2012) calculated the number of jobs dependent on the environment and resource efficiency improvements in the EU. This calculation was performed in 2000, 2008, and 2010 for all EU-27 countries. Ten sectors were defined in their previous study as eco-industries: (1) air pollution control, (2) waste water management, (3) solid waste management, (4) soil and groundwater remediation, (5) noise and vibration control, (6) biodiversity & landscape, (7) water supply (8) recycled materials, (9) renewable energy production, (10), other (e.g. general public administration and private environmental management).

The employment is calculated for these sectors as the following equation:

$$Employment = \frac{EPE * Labour\ Compensation\ Factor}{wage\ per\ year}$$

With:

- EPE = Environmental Protection Expenditures (Eurostat)
- Labour Compensation Factor (based on previous calculations by Ecorys and IDEA Consult). The Labour Compensation Factor is the Total Labour Compensation (Eurostat) divided by Total (gross) output of the relevant NACE subsectors in Eurostat
- Average wage per year in different environmental sectors/domains (Eurostat)

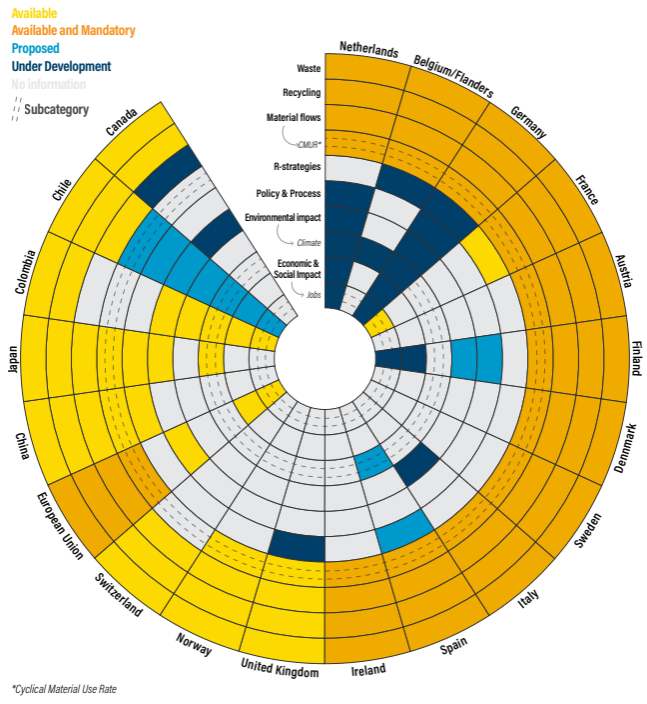
Following this approach, they estimated employment in eco-industries across the EU-27 at 3.4 million jobs in 2010, up from 3.1 million in 2008 and 2.5 million in 2000. This is an increase in employment between 2000 and 2010 of almost 37%.

Overall, a time series is available but needs to be updated. Moreover, the study focusses on eco-industries (as listed supra) and not on the circular economy, resulting in a neglect of e.g., repair activities or employment in reuse and sharing activities. From the ten eco-industries defined above, we can assume that the following sectors can be considered as circular economy sectors: wastewater management, solid waste management, and recycled materials.

PACE (2021) – Circular economy indicators

The Platform for Accelerating the Circular Economy (PACE), a public-private collaboration initiative launched by the World Economic Forum in 2018, published in 2021 an analysis of existing indicators on the circular economy (PACE, 2021). An overview of these indicators, referring to several countries worldwide but with a focus on the EU, are visually represented in Figure 12.

Figure 12 – Overview of circular economy indicators available, proposed, or under development



Source: PACE (2021)

As discussed, indicators for jobs in at the EU-level are available through Eurostat, but at the Member State level, this information is scarce. Although these indicators have been published, they remain under restricted access and are not publicly available. At the time of the PACE publication, metrics for the Netherlands, Germany, and Finland were still under development. Meanwhile, the indicator for

employment in the circular economy in the Netherlands is available with data between 2001-2020 and disaggregated per R-strategy: rethink, reduce, reuse, repair or recycle (CBS, 2022). In Finland, a shortlist of indicators was eventually established in 2020 and updated in 2022 by Statistics Finland, but did not include an indicator on circular jobs (Statistics Finland, 2023). For Germany, no indicators are available on employment in the circular economy (ETC CE, 2024a).

Tsironis et al. (2022) – LinkedIn-data

Tsironis et al. (2022) use a new data source by scraping LinkedIn to identify all EU companies with the term "circular economy" in the profile description, and then sum reported employee counts to estimate total circular employment. Using data from 2021, the estimate equals 124,306 employees in the EU-28. The approach yields an experimental indicator, but reproducibility is limited because large-scale LinkedIn data are not openly accessible and repeated extraction would be required to build a time series. Moreover, coverage on LinkedIn is not representative of the wider economy, and keyword-based identification omits firms that do not use the term or applies it inconsistently, which introduces selection bias (Fabo et al., 2022).

Pitkänen et al. (2023) – Measuring social sustainability of the circular economy

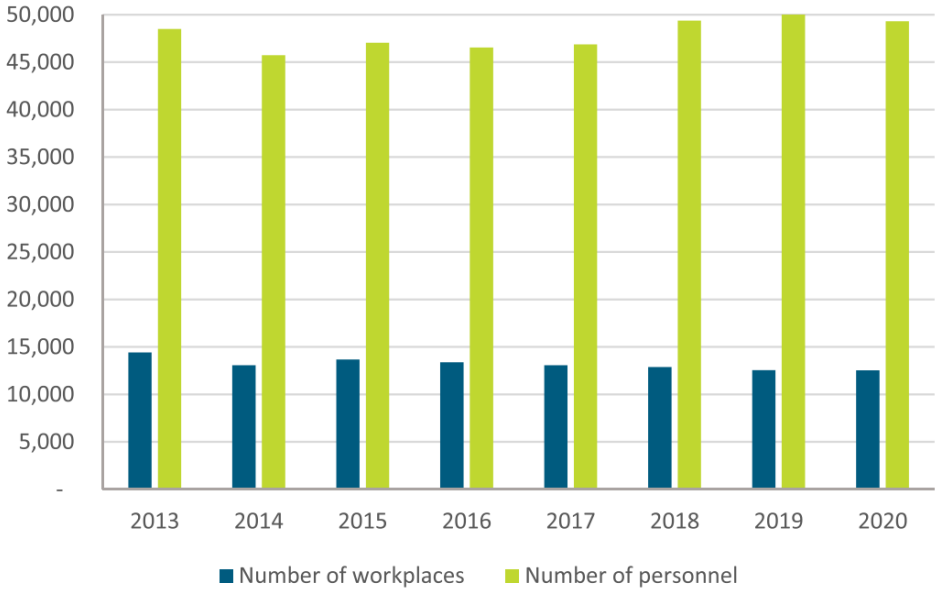
In a study on the social sustainability of the circular economy, Pitkänen (2023) developed the following indicators related to circular employment for Finland:

- Number of workplaces and their personnel in the circular economy industries
    - Data source: annual statistics of businesses and financial statements, structural business and financial statement statistics
    - Timeseries: 2013-2020
    - Calculation method: sum of workplaces (circular economy industries) and sum of personnel (circular economy industries)
- The pay level in circular economy industries (euro per month)
    - Data source: Annual statistics of the structure of earnings in the circular economy-related branches
    - Timeseries: 2010-2020
    - Calculation method: median (monthly pay) of recycling, repair, reuse, and renting and leasing compared to the median pay of all industries, only full-time employees
- The educational background of persons employed in the circular economy industries
    - Data source: Annual statistics on transition from school to further education and work in circular economy industries
    - Time series: 2010-2020
    - Calculation method: sum employed from vocational school, sum employed from university of applied sciences, sum of employed from upper secondary schools, and sum of employed from university
- Recycling jobs in subsidised employment of vulnerable groups
    - Data source: employment service statistics
    - Time series: 2016, 2019-2020
    - Calculation method: sum of refuse sorters / sum of all subsidised employment

Error! Reference source not found. 13 presents the number of workplaces in the circular economy in Finland and the number of personnel. The authors mention that in 2020 there were 12,500 circular economy workplaces with almost 50,000 personnel, which is respectively 3.73% of all workplaces and 0.08% of all personnel in Finland. This result is higher than the 44,169 people employed in the circular economy according to Eurostat, which can be explained by differences in the sectoral classifications between this study and the CEMF. Whereas the CEMF applies a granular approach at the NACE 4-digit

level (Annex), this study applies a less granular approach by covering employment in recycling, repair, reuse, renting, and leasing.

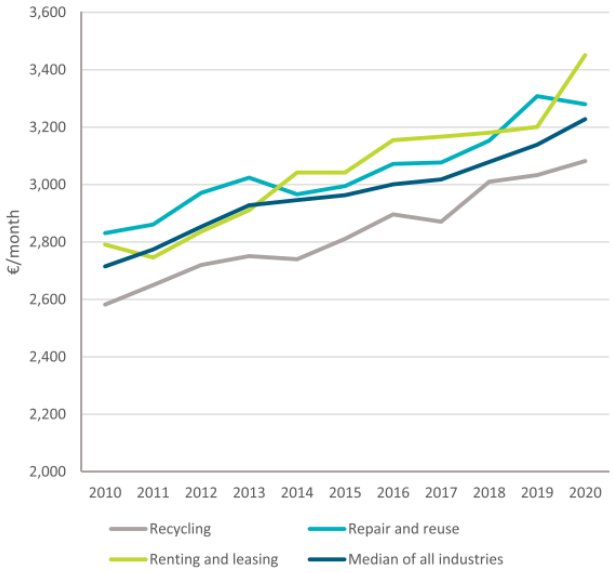
Figure 13 – Employment in the circular economy by number of workplaces and personnel



Source: Pitkänen et al. (2023), based on data from Statistics Finland, covering employment in recycling, repair, reuse, renting, and leasing.

As reported in Figure 14, the median pay was 3,200 euro per month in 2020 in all industries while it was 3,300 euro per month for renting and leasing industries and 3,450 euro per month in the renting and leasing industry. Furthermore, the median pay in circular industries was increasing more rapidly than in other sectors.

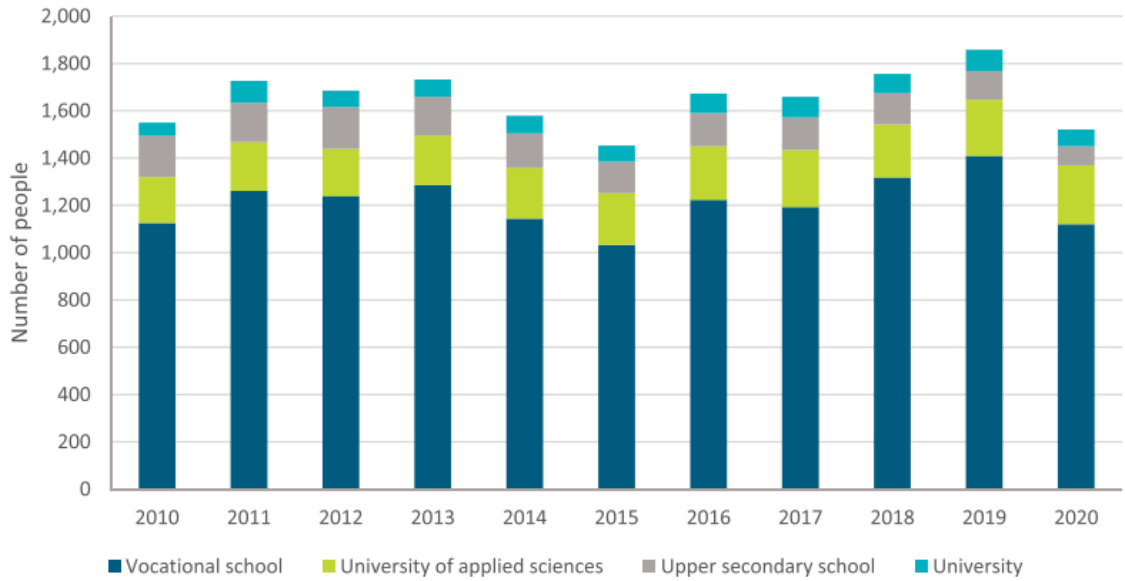
Figure 14 – Median pay in different circular economy sectors and in all industries



Source: Pitkänen et al. (2023), based on data from Statistics Finland, covering employment in recycling, repair, reuse, renting, and leasing.

Figure 15 shows that the number of people employed in circular economy sectors as their first job ranges between 1,500 and 1,900 with an increase in the years before the COVID-pandemic. Most employees in circular economy sectors have a vocational education background. The number of people with a higher educational degree entering circular jobs remained rather constant over the years.

Figure 15 – Education of people employed in the circular jobs within one year of graduation

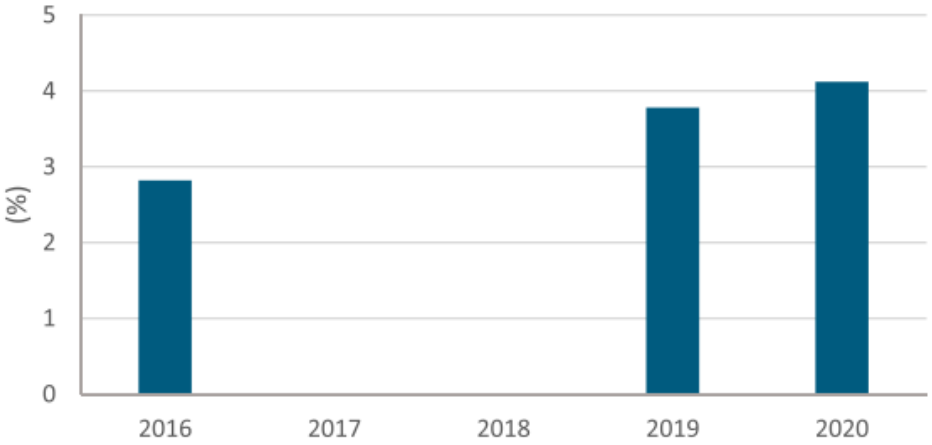


Source: Pitkänen et al. (2023), based on data from Statistics Finland, covering employment in recycling, repair, reuse, renting, and leasing.

Figure 16 shows an increase in the share of jobs in recycling in subsidised employment in Finland. In 2020, there are slightly more than 4% of people in work trials and wage subsidies who worked as refuse sorters. In absolute numbers, this is slightly more than 3,000 people. In total, the number of

people employed with subsidies employment in 2021 was around 74,000 people (Pitkänen et al., 2023).

Figure 16 – Share of refuse sorters of all subsidised workers in Finland



Source: Pitkänen et al. (2023)

This study provides a useful example of capturing just transition considerations at a Member State level. A key limitation is that the indicators presented are based on a less granular approach than adopted by the CEMF. The approach is, however, feasible, with lighter NACE-level data requirements. A further strength lies in the use of reliable, validated data suited to continuous monitoring.

Borms et al. (2024) – Web scraping data to monitor circular activities and employment

Borms et al. (2024) used web-scraped data, obtained in collaboration with the Brussels-based data company Inoopa, covering all Belgian companies to identify which companies engage in circular activities and how many people they employ. The dataset is linked to annual business statistics on total employment.

First, a *baseline* measure counts employment in NACE activities classified as circular according to Willeghems & Bachus (2019), using annual business statistics. This indicator is already applied in the Flemish CE Monitor. Second, an algorithm reassigns a five-digit NACE code to each company on the basis of keywords found on company websites and social media pages. Employment is then summed for companies with a circular first NACE code according to the algorithm. Third, a weighted circular employment measure accounts for circular main and side activities by using the first, second, and third NACE codes. The algorithm assigns an activity share between 0 and 1, which is used to apportion employment.

Table 6 reports the results of this approach. The total number of employed people allows to calculate the share of circular employment. Over the years, this share remained relatively constant at 1.5% for baseline circular jobs and 3% for weighted circular employment.

Table 6: Circular economy employment in Belgium

	2015	2016	2017	2018	2019	2020	2021
Total number of employed people	4,617,700	4,675,400	4,748,200	4,818,200	4,895,100	4,898,300	4,989,300
Circular jobs	63,253	66,382	68,422	70,947	74,296	78,182	77,162
Weighted circular employment	136,670	138,122	140,947	142,927	146,250	144,947	145,718

Source: Borms et al. (2024)

This approach makes interesting use of web scraped data. However, the data is only available for Belgium, and a repetition of the exercise would require (non-free) updates of the data. Moreover, the study did not discuss how to perform robustness checks with using circular economy related keywords in different languages, which would challenge the implementation of this approach at the EU level.

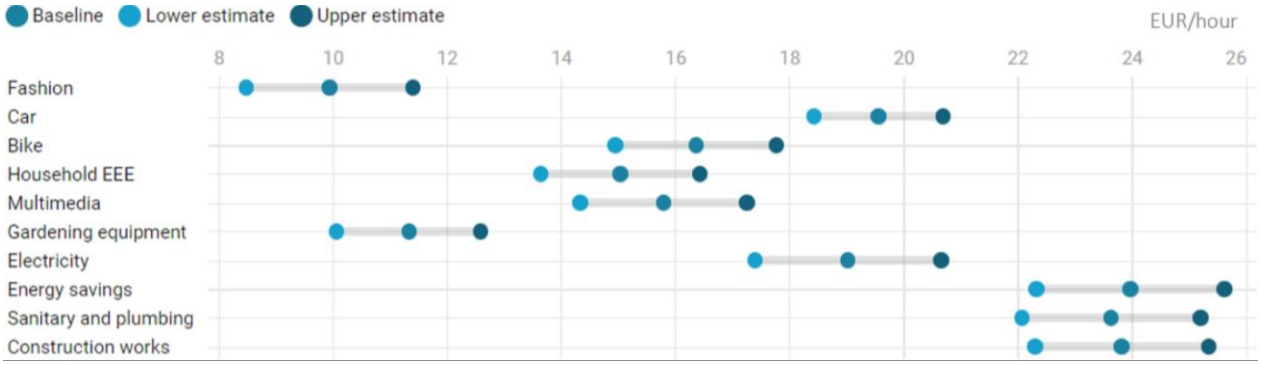
Van Opstal et al. (2025) – Mapping informal circular jobs

Van Opstal et al. (2025) developed a systematic attempt to map the prevalence and economic weight of informal employment in the circular economy within an industrialised context. Focusing on Flanders, Belgium, the authors focus on repair, reuse, sharing, and refurbishing. To overcome the limitations of existing macroeconomic and survey data – they designed a dedicated, population-weighted survey (n = 820) that captures both paid and unpaid informal circular economy work across multiple product categories (e.g., household electronics, textiles, cars, bikes, etc.). Through post-stratification techniques, they correct for demographic and attitudinal sampling biases.

This results in an estimate of *informal paid* employment in repair and refurbishing activities accounting between 31,000 and 41,000 full-time equivalent (FTE) jobs in 2023, which is equivalent to 1.5-2.0% of total employment. These figures exclude *unpaid informal* work, suggesting that the overall contribution of the informal circular economy to employment is likely much higher.

Regarding job quality, the authors use the willingness-to-pay for informal circular economy activities as a proxy to capture potential income statistics for informal paid work. More specifically, they retrieved data for Flanders on the willingness-to-pay for repair and refurbishment activities on different product groups, as reported in Figure 17. This willingness-to-pay increases with the complexity of the task, involving more specific skills sets, and with the value of the underlying goods. The authors did not ask for the willingness-to-pay on an hourly base for reuse and sharing activities, since the focus of these circular economy activities is on acquiring (access to) goods. Conversely, informal repair and refurbishing expenditures expressed in willingness-to-pay per hour normally reflect labour costs.

Figure 17 – Willingness-to-pay for paid informal repair and refurbishing activities (hourly wages in EUR)



Source: Van Opstal et al. (2025)

This approach may result in relevant, credible, and robust indicators, measuring circular jobs with trustworthy, representative, and novel data. However, even for online surveys, data collection and analysis are time-consuming and expensive to replicate, resulting in limitations regarding accessibility and updatability.

3.3 Towards monitoring job creation from a just circular transition perspective

3.3.1 Distributional justice

Preliminary lessons

Existing data only offer a very partial picture of the distributional impacts of circular employment. Circular employment statistics, as reported by Eurostat and included in the Circular Metrics Lab, suggest modest job growth across the EU. The Circular Economy Action Plan does not set a target on the number of jobs which should results from the transition to a circular economy, but it is expected 700,000 additional jobs to be created between 2015 and 2030 (European Commission, 2020a). According to this metric, 368,600 were created between 2015 and 2023. Note, however, that the relative share of circular employment remained at 2.0% in both years. Similarly, country-specific studies show a similar (relative) evolution.

Such aggregate figures mask major sectoral, regional, and socio-economic disparities. The breakdown of employment by circular economy value chain phase – before use (reduce, rethink), during use (repair, reuse), and after use (recycling, recover) – is not made explicit, which could be partially resolved by publishing more granular reporting of the CEMF employment data at the activity level. Likewise, these data omit socio-demographic variables including gender, migration background, or educational attainment, to study distributional justice considerations.

Exceptions can be partially found in academic and grey literature. Pitkänen et al. (2023) report a high share of vocational education graduates entering circular economy employment, while wages in repair, reuse, and renting and leasing activities exceed the national median across all industries. In contrast, wages in recycling occupations remain below average. Their study also observes a growing, though still limited, role for social employment in circular sectors, which aligns with the objectives of the Social Economy Action Plan (SEAP) (European Commission, 2021b). Other statistics reveal findings that can be related to distributive injustices, such as differences in the willingness-to-pay for informal paid labour. Van Opstal et al. (2025) demonstrate that households exhibit a higher willingness-to-pay

for male-dominated activities, such as car repair and refurbishment in housing, compared to female-dominated tasks such as fashion repair.

Finally, employment data do not yet reflect the redistribution of labour across global supply chains, where job creation in the EU (e.g., in reuse and recycling) can come at the cost of job losses in manufacturing hubs in the Global South (Repp et al., 2021). For a deeper analysis of regional differences and vulnerable groups, we refer to Section 4.

Future measurement and indicator improvements

To improve the distributional justice assessment, circular economy employment indicators should be sufficiently granular to be disaggregated by sector, region, socio-demographic group, and value chain phase. This requires integrating circular economy-relevant classifications (e.g., as presented in the Annex) with highly disaggregated labour market data such as those from national employment services, labour force surveys, or business registers (Borms et al., 2023, 2024). Indicators should also capture net employment effects across phases – design, use, and end-of-life – distinguishing between job creation, substitution, destruction, and redefinition (Laubinger et al., 2020).

In addition, social indicators capturing more qualitative aspects, such as job stability, wages, health and safety, should be mainstreamed into circular economy employment monitoring, enabling a nuanced view of job quality across socio-economic groups. Moreover, household and firm-level surveys could supplement administrative data to better capture informal employment, self-employment, and unpaid labour. The online survey on gender gaps in unpaid care, individual and social activities, could serve as an inspirational example (EIGE, 2023). Finally, longitudinal data at this level would enable to track whether circular transitions widen or narrow gaps in income, employment security, and access to vocational training.

3.3.2 Procedural justice

Preliminary lessons

Procedural justice remains largely absent from current circular economy monitoring frameworks. Existing indicators concentrate on outputs, such as the number of circular jobs created, or on inputs, such as private investments in circular activities. These indicators do not capture how decisions are made, whose voices influence employment pathways, or how workers participate in shaping transitions. There is little systematic evidence on the governance of circular economy job creation, on the role of worker representation, or on negotiation processes during workplace change.

Future measurement and indicator improvements

Future monitoring of circular employment could draw on established indicators of social dialogue and worker participation. The ILO provides internationally harmonised statistics on industrial relations, including trade union density, collective bargaining coverage, and data on strikes and lockouts, which can support assessment of workers' voice in circular transitions.

The OECD ICTWSS database offers further detail on wage-setting institutions, state involvement in labour relations and the stability of social pacts, which can help to understand how employment decisions are negotiated within different governance regimes. In addition, the European Working Conditions Survey contains questions on worker representation and consultation practices that can shed light on participatory processes at organisational level. Qualitative evidence from case studies

can complement these indicators by showing how procedural justice unfolds across the “before use”, “during use” and “after use” phases of circular value chains, where inclusion challenges and opportunities vary widely.

3.3.3 Recognitional justice

Preliminary lessons

Recognitional justice remains significantly underrepresented in circular economy monitoring. Existing labour market datasets and circularity indicators rarely account for lived experiences, embodied knowledge and the value created through informal, unpaid, or marginalised labour. Activities such as community repair, informal textile repair, or waste collection by migrants are largely invisible in employment statistics, despite their importance in extending product lifetimes and reducing waste. These activities are undertaken by diverse socio-demographic groups whose contributions and skills are not captured by current labour market classifications. The same applies to circular roles embedded in home care, education and civil society organisations. These forms of labour are seldom framed as circular, although they support resource reduction and product longevity in direct and indirect ways.

Current statistical systems also constrain recognition. NACE codes were designed around linear production and consumption models, with the result that many formal circular economy activities remain unmeasured or undercounted. Hybrid and cross-cutting circular functions often fall between categories or appear only as unidentifiable components of broader sectors. This structural underestimation limits formal recognition of circular workers and distorts the visibility of sectors where circularity is already taking hold. Evidence from the Global South further shows that informal and non-standard workers, particularly women and racialised minorities, often carry out undervalued or stigmatised circular tasks (K. Liu, 2025). Formalisation efforts tend to privilege technical or digital skills, overlooking lived experience and embodied knowledge.

Future measurement and indicator improvements

To advance recognitional justice, circular economy monitoring should broaden the scope of recognised work and make visible the full range of circular contributions. This can begin with qualitative mapping of informal and community-based circular activities in both domestic and non-domestic contexts. Inclusion of self-declared occupations and skills, even if not captured in formal registries, can reveal hidden circular contributions (Korsunova et al., 2021, 2022). Early survey-based attempts to quantify such contributions at the macro-level appear to be feasible, but not straightforward to replicate over time and geographies (Van Opstal, Pals, et al., 2025). Webscraping self-declared data from social media profiles could be more feasible to implement (Tsironis et al., 2022), but would not capture activities from groups that participate less at social media platforms, or do not identify their activities as circular. Furthermore, it should be noted that certain activities sometimes associated with biological circularity, such as organic agriculture, are not included in the core circular employment indicators used by Eurostat and in the ILO headline baseline estimates.

Training and skill indicators should also track whose knowledge is validated through certification, funding, or media visibility. Disaggregating participation in circular training programmes by gender, socio-economic background, and immigration status can help assess the equity of upskilling strategies. Additional proxies, such as cultural representation in circular economy campaigns, or mentions in public policy, can serve as indicators of recognitional legitimacy (Haswell et al., 2024). Combining statistical indicators with narratives from excluded groups may further enrich policy-relevant insights.

4 Thematic investigations

4.1 Geographical inequalities

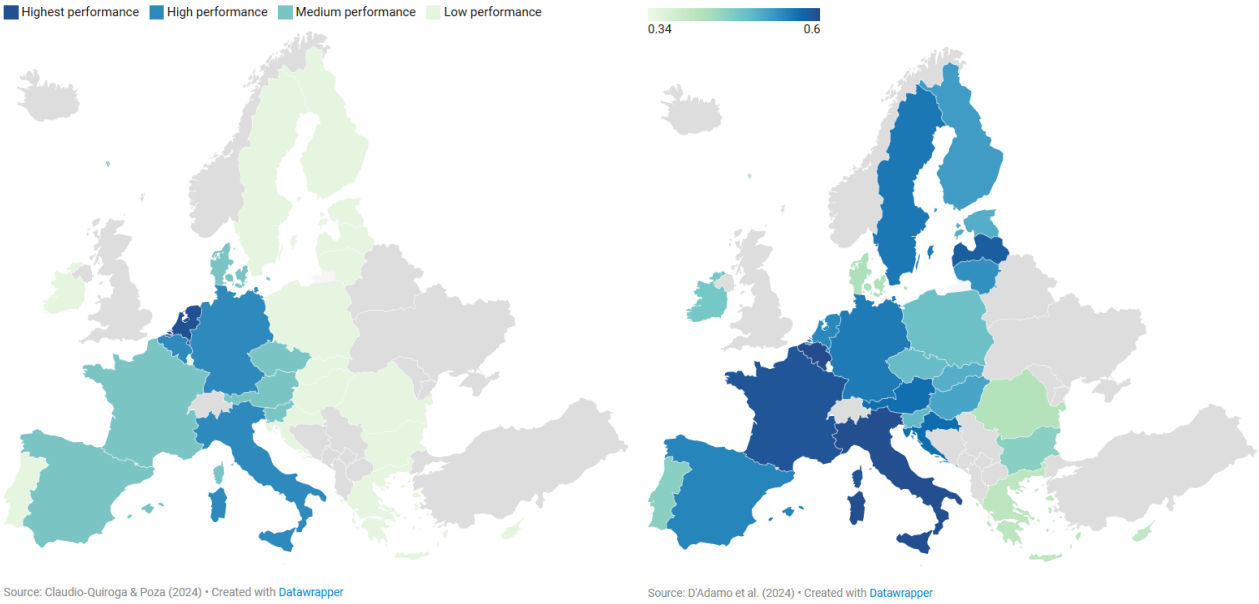
This section provides a thematic deep dive into geographic inequalities within the EU and their implications for monitoring just and circular jobs. It begins with an analysis of differences between Member States, comparing circular economy performance and employment indicators. It then turns to regional disparities, examining how circular jobs and wages vary across territories with distinct industrial legacies, skills bases, and innovation capacities. Next, it explores contrasts between cities and rural areas, highlighting how density, infrastructure, and governance conditions shape circular opportunities and constraints at the local level. The final subsection discusses monitoring priorities across the dimensions of distributional, procedural, and recognitional justice.

4.1.1 Differences between Member States

The Circular Economy Monitoring Framework (CEMF) comprises 10 indicator sets grouped into five domains: production and consumption, waste management, secondary raw materials, competitiveness and innovation, and global sustainability and resilience (Eurostat, 2025c). Examples include recycling rates for municipal and packaging waste, resource productivity, circular material use, trade in recyclable raw materials, and private investment and value added in circular sectors. Other national level studies and indicator sets, reviewed above, could also be used to compare circular economy progress across Member States, but this subsection focuses on harmonised Eurostat CEMF indicators because they offer consistent definitions, coverage and time series that enable robust cross-country comparison. Two recent studies, Claudio-Quiroga & Poza (2024) and D'Adamo et al. (2024), use these CEMF indicators to compare national circular economy performance.

Claudio-Quiroga and Poza classify countries into four performance groups – depicted left in Map 1. They place the Netherlands alone in the highest performance group, followed by Germany, Italy and Belgium in the next tier. D'Adamo et al. (2024) – shown in the right panel of Map 1 – rank Belgium first, followed by Italy and France. The divergence between the two studies largely reflects how the indices are weighted. D'Adamo et al. apply expert weights, giving most influence to competitiveness and innovation and to global sustainability and resilience. This favours countries strong in innovation and emissions reduction. Claudio-Quiroga and Poza (2024) derive weights from the data itself, using a principal components analysis, which gives more influence to waste management and to production and consumption, areas where the Netherlands, Germany, Belgium, and Italy perform well.

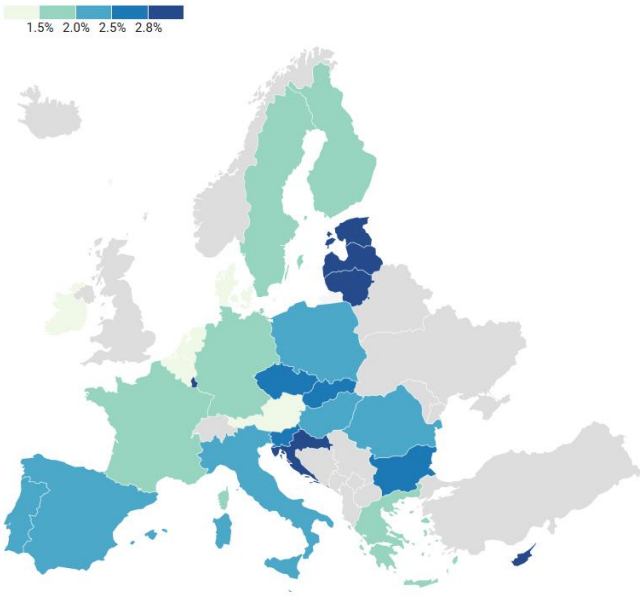
Map 1 – Circular Economy performance of EU Member States



Sources: Claudio-Quiroga & Poza (2024) (left) and D'Adamo et al. (2024) (right)

Jobs in the circular economy are also one of the indicators included in the CEMF. A detailed overview of the NACE codes involved is reported in the Annex. Map 2 shows differences between Member States regarding the relative share of employment in the circular economy. Interestingly, we see the highest shares in the Baltics (up to 7.9% for Estonia) and low shares in Belgium (1.2%) and the Netherlands (1.1%), which at first sight contradicts the circular economy performance indicators reported in Map 1. In other words, a strong circular economy performance does not automatically translate into circular economy employment. A simple correlation analysis between the circular jobs indicator and the other CEMF indicators confirms this picture, as correlations remain weak or largely driven by a small number of outlying Member States.

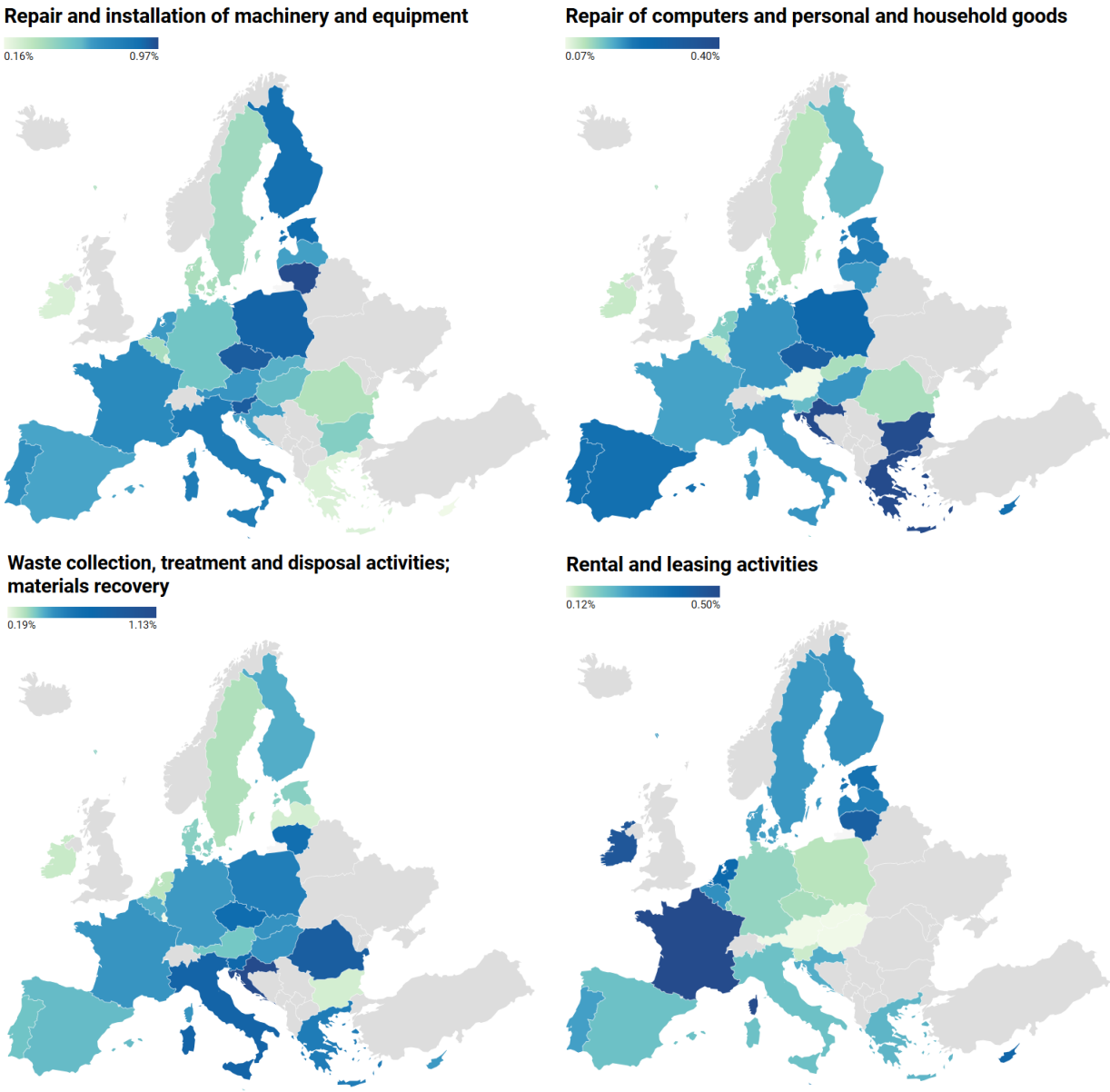
Map 2 – Relative share of circular jobs in 2023



Source: (Eurostat, 2025c)

While Eurostat currently calculates the number of circular jobs using NACE 4-digit level data (Annex), publicly available Eurostat data do not always allow for a sectoral breakdown at the Member State level. For four sectors that are considered highly circular, however, a comparison between countries is possible because employment data for the entire NACE two-digit division are publicly available: repair of machinery and equipment (NACE33), repair of computers and household goods (NACE95), waste management (NACE38), and rental and leasing (NACE77). As reported in Map 3 and Table 7, the data show nuanced divergence across Member States.

Map 3 – Sectoral breakdown of persons employed in the circular economy, as a percentage of total employment, in 2023



Note: Data unavailabilities for 2023 were resolved by taking the latest year data was reported for. For NACE 77, no data was available for Romania and Bulgaria. For NACE 95 no data was available for Luxembourg.
Source: (Eurostat, 2025c)

Table 7 – Sectoral breakdown of persons employed in the circular economy, as a percentage of total employment, in 2023

	Repair and installation of machinery and equipment (NACE 33)	Repair of computers and personal and household goods (NACE 95)	Waste collection, treatment and disposal activities; materials recovery (NACE 38)	Rental and leasing activities (NACE 77)
EU 27	0.62%	0.19%	0.50%	0.25%
Belgium	0.37%	0.09%	0.42%	0.30%
Bulgaria	0.46%	0.39%	0.24%	na
Czechia	0.92%	0.30%	0.67%	0.16%
Denmark	0.36%	0.12%	0.35%	0.27%
Germany	0.51%	0.19%	0.45%	0.18%
Estonia	0.87%	0.21%	0.35%	0.37%
Ireland	0.23%	0.10%	0.26%	0.46%
Greece	0.22%	0.40%	0.57%	0.24%
Spain	0.60%	0.22%	0.40%	0.22%
France	0.70%	0.18%	0.46%	0.50%
Croatia	0.61%	0.40%	1.13%	0.25%
Italy	0.79%	0.19%	0.79%	0.22%
Cyprus	0.16%	0.22%	0.45%	0.41%
Latvia	0.61%	0.21%	0.24%	0.34%
Lithuania	0.97%	0.19%	0.64%	0.43%
Luxembourg	0.22%	na	0.19%	0.19%
Hungary	0.55%	0.19%	0.47%	0.12%
Malta	0.88%	0.15%	0.40%	0.34%
Netherlands	0.62%	0.14%	0.28%	0.40%
Austria	0.63%	0.07%	0.37%	0.12%
Poland	0.90%	0.26%	0.56%	0.15%
Portugal	0.67%	0.22%	0.38%	0.27%
Romania	0.34%	0.12%	0.87%	na
Slovenia	0.92%	0.16%	0.74%	0.14%
Slovakia	0.58%	0.12%	0.47%	0.12%
Finland	0.86%	0.16%	0.42%	0.29%
Sweden	0.39%	0.11%	0.30%	0.28%

Note: Data unavailabilities for 2023 were resolved by taking the latest year data was reported for. For NACE 77, no data was available for Romania and Bulgaria. For NACE 95 no data was available for Luxembourg.
Source: (Eurostat, 2025c)

Some countries with strong industrial manufacturing and engineering bases, such as Czechia, Slovenia, Italy and Poland, report high relative employment in repair and installation of machinery and equipment (NACE 33). However, historical industrialisation does not fully explain cross-country variation, as relatively high shares also appear in less industrialised economies. For waste collection, treatment, disposal and materials recovery (NACE 38) most employment shares cluster around 0.35 to 0.50%. Only a few Member States fall well outside this range. Croatia, Romania, Slovenia, Italy, Lithuania and Poland have markedly higher shares, which may point to a combination of extensive recycling and recovery infrastructure and labour-intensive waste systems.

Repair of computers, personal goods and household items (NACE 95) remains a relatively minor employer in most Member States. The EU-27 average is only 0.19% and most countries cluster

between 0.10 and 0.22%. Even where the values are higher, such as in Bulgaria, Greece, Croatia and Czechia, the shares remain modest.

Rental and leasing activities (NACE 77) show a very heterogeneous pattern across Europe. Some countries, notably France, Ireland, Cyprus, Lithuania, the Netherlands and Estonia, report comparatively high employment shares, often close to or above 0.40%, whereas others remain near or below 0.20%. This variation suggests uneven development of access based and product as a service models and points to diverse national approaches to equipment, vehicle and consumer goods leasing.

Overall, the EU-27 averages for all four categories fall between 0.19 and 0.62%, but almost every category contains Member States with values two to four times higher than others. The variation highlights significant differences in industrial composition, labour market structures and policy environments across the Union. For comparative analysis or monitoring, national context remains essential, because simple benchmarking against EU means risks obscuring these structural differences in how circular economy activities contribute to employment.

A blind spot in cross-country comparisons of circular employment is the lack of data on informal work. The ILO publishes informal employment statistics at the global level, including data at the ISIC level 2, covering activities such as waste management and recycling. However, that dataset does not include figures from EU Member States. Another dataset reported by the ILO covers the proportion of informal employment in total employment. For EU Member States, data are retrieved from the EU Statistics on Income and Living Conditions (EU-SILC). According to these statistics, informal employment, as a percentage of total employment, varies from less than 1% (Malta) to over 8% (Poland). The median value is 2.2% (Romania). However, these data do not identify circular economy jobs.

Evidence from Flanders estimates that 17–37% of paid informal economic activity relates to circular practices in repair and refurbishment, while unpaid informal activity in these areas is equivalent to roughly 1.5–2.0% of total employment in Flanders (Van Opstal, Pals, et al., 2025). Strong municipal collection systems also mean that informal waste picking is largely absent in Flanders. By contrast, informal waste management is documented in Catalonia (Irvine, 2023; Rendon et al., 2021), Hungary (Gittins & Letenyei, 2024, 2025), Albania (EEA, 2022), and North Macedonia (Gusheva et al., 2022), where inconsistent or incomplete municipal waste systems create space for informal collection, often conducted by vulnerable groups such as refugees and ethnic minorities.

4.1.2 Differences between regions

The regional level is a better lens of analysis because labour markets, skills systems and industrial structures are shaped by local conditions rather than evenly distributed across a country. National averages can therefore hide large territorial differences in capacity and exposure.

Two concerns recur in the literature. First, circular activity tends to build on existing industrial and institutional strengths rather than start from a blank slate. Evidence from France and Sweden, for example, shows circular firms and jobs concentrating in metropolitan areas where markets are dense, logistics are short, and policy capacity is higher, which points to territorial embeddedness of circular growth (Martin, 2025a; Niang et al., 2024). Second, circular practices can map onto pre-existing inequalities, with gains accruing mostly to affluent areas with a dense support ecosystem, and lower income or peripheral regions bearing more waste and pollution (Garg et al., 2025). Research on justice within circular transitions shows that the energy and materials shift is already reconfiguring who gains access to jobs across regions, and argues that regional disparities must be addressed to make outcomes both effective and equitable (McCauley, 2025). Case work in Hull illustrates how reuse and

repair systems can be embedded in disadvantaged contexts and why place-based governance is needed to turn local attachment into more inclusive redistribution (Deutz et al., 2024).

The analysis relies on the Nomenclature of Territorial Units for Statistics (NUTS), which is the EU's official system for dividing territory into comparable statistical units and aligns directly with Eurostat data used in this report. At the same time, the OECD Territorial Levels (TL2 and TL3) provide an internationally comparable framework for subnational analysis and may offer additional insights into regional disparities. Publicly available Eurostat data allow to monitor employment and average wages at the NUTS1-level in four circular economy activities. NUTS1 represents the largest subnational scale in this system, covering either entire small countries or major regions within larger countries.

Table 8 reports a set of inequality measures for relative employment – measured as the share of total employment in each NACE code – and for average wages and salaries of workers in these NACE codes across NUTS1 regions in the EU-27, focusing on four circular economy activities. The table presents percentile ratios, Gini coefficients and Theil T indices, together with a decomposition of the Theil measure into within-country and between-country components[26]. These indicators summarise how unevenly relative employment and average wages are distributed across large European regions. The percentile ratios (the decile ratio and the interquartile ratio) capture how much higher values are in regions at the top of the distribution compared with those at the bottom. The Gini and Theil measures provide an aggregate view of dispersion.

Table 8 – Inequality of relative employment and average wages across NUTS1 regions in the EU-27, 2020

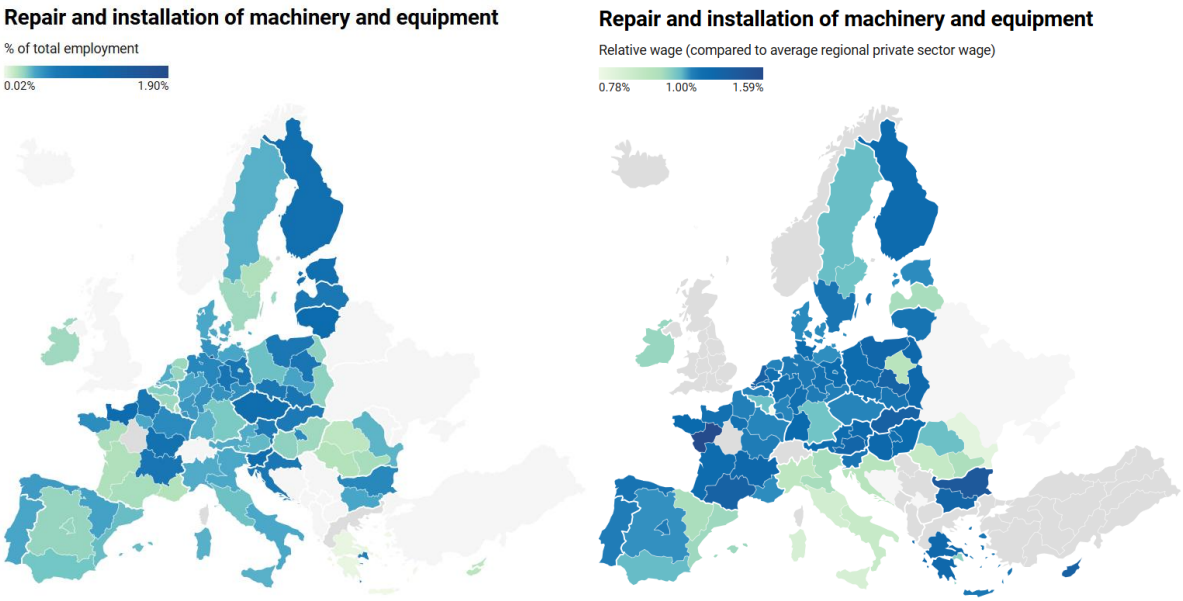
Relative employment	p90/p10	p75/p25	Gini	Theil T	% within-country	% between-country
NACE 33 (repair of machinery)	4.45	2.32	0.31	0.17	52%	48%
NACE 95 (repair of household goods)	18.32	4.05	0.52	0.46	31%	69%
NACE 38 (waste management)	3.05	1.52	0.24	0.10	33%	67%
NACE 77 (rental and leasing)	6.46	2.77	0.35	0.20	47%	53%
Average wages and salaries	**p90/p10**	**p75/p25**	**Gini**	**Theil T**	**% within-country**	**% between-country**
NACE 33 (repair of machinery)	3.76	2.57	0.26	0.11	6%	94%
NACE 95 (repair of household goods)	3.92	2.02	0.25	0.10	11%	89%
NACE 38 (waste management)	3.62	2.68	0.25	0.11	4%	96%
NACE 77 (rental and leasing)	3.82	2.36	0.27	0.11	8%	92%

Source: own elaboration of Eurostat (2025c), online data codes: lc_rnum1_r2 (number of employees) and lc_rcost_r2 (wages and salaries)

When looking at the percentile ratios and the Gini index, inequalities in terms of relative employment are the highest in the repair of household goods sector (NACE 95), while in terms of average wages and salaries cross-sectoral differences are much less pronounced. In all the sectors considered, relative employment varies both between and within countries, although to a different extent. For instance, repair of household goods (NACE 95) and waste management (NACE 38) exhibit higher inequality between countries. Likewise, and as expected, differences in average wages and salaries, arise mainly from variation between countries rather than from regional disparities within them. The right panel of Map 4 shows that, with a few regional exceptions, wages in NACE 33 are higher on average than in the rest of the economy.

[26] The Theil T index is a statistical measure of inequality, which has the key advantage to be decomposed into two parts: one that captures inequality *within* countries (and therefore between different regions within countries) and the second that measures inequalities *between* countries. This index is related to, but not to be confused with, the Theil L index, which is the mean log deviation.

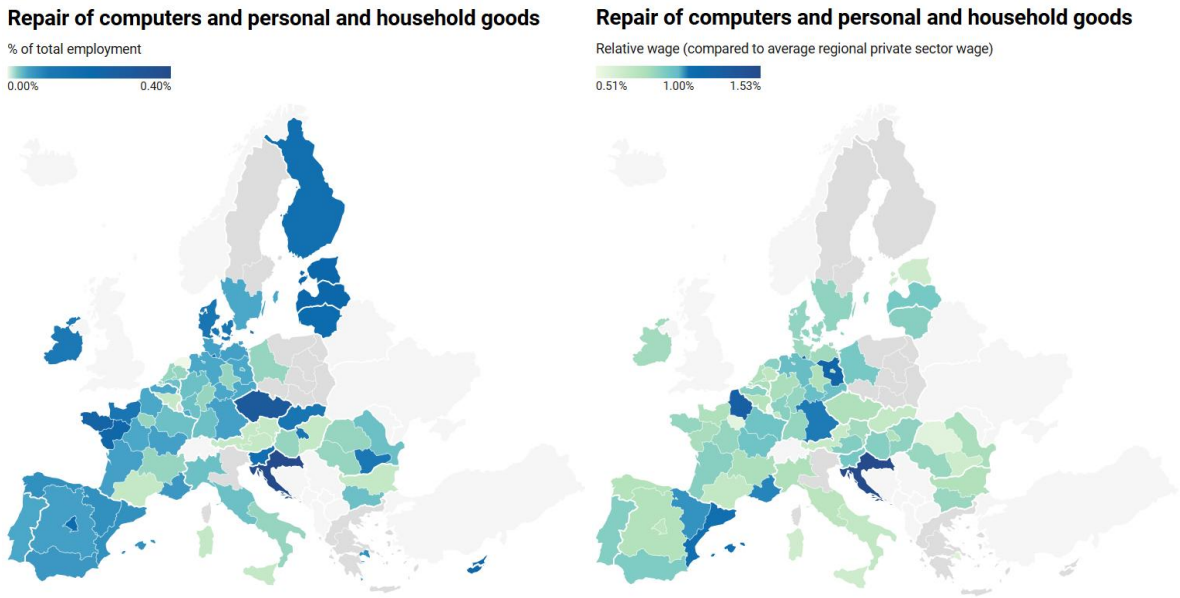
Map 4 – Regional (NUTS1) breakdown of relative employment and wages in repair and installation of machinery and equipment, 2020



Source: (Eurostat, 2025c)

Repair of computers and personal and household goods (NACE 95) shows the strongest regional concentration in relative employment. Many regions record very small or near-zero values, while a set of countries and regions display much higher levels. Several countries also contain one or several standout regions, as seen in Germany, Spain, and France. This combination of a large group of low-employment regions and a smaller group of more specialised ones produces the high inequality values reported in Table 8, with most of the variation arising between countries, as visible in the left panel of Map 5. Average wages in NACE 95, by contrast, show a much narrower spread. Most regions fall between EUR 20,000 and EUR 45,000, with only a limited number of high-wage regions. As shown in Map 5, this activity mostly generates lower than average wages, with exceptions including Croatia, Hauts-de-France, Brandenburg, Bavaria, and Catalonia. An important methodological note is that these data originate from the Labour Cost Survey, which covers companies with ten or more employees. Much of the sector, however, consists of micro-enterprises and sole traders who fall outside the survey frame.

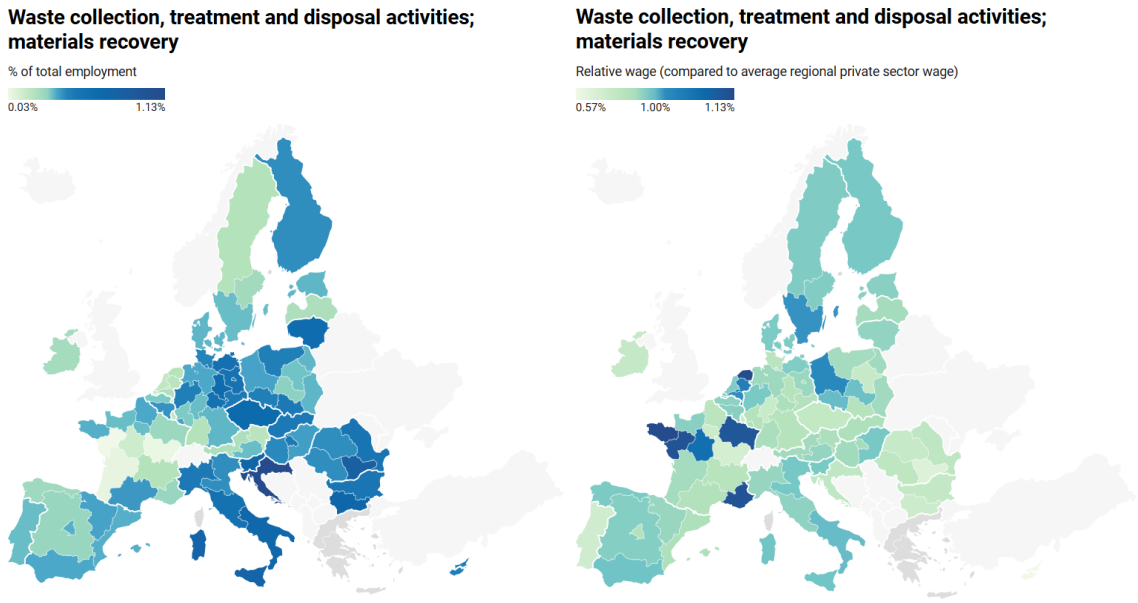
Map 5 – Regional (NUTS1) breakdown of 2020 employment and wages in repair of computers and personal and household goods



Source: (Eurostat, 2025c)

Relative employment in waste collection, treatment and disposal activities; materials recovery (NACE 38) displays a clear cross-country gradient. Higher values occur in Croatia, Slovenia, Lithuania, parts of Italy, Bulgaria and Romania, while several Western and Northern European regions, including Pays de la Loire and parts of the Netherlands, record noticeably lower levels. As reported in Table 8, the variation across countries is more pronounced than the variation within them. Average wages in NACE 38 show a relatively compressed distribution, with most regions positioned in a broad mid-range and only a limited number of outliers. In relative terms, wages in this sector are notably higher than regional averages in parts of France, the northern Netherlands, western Poland and southern Sweden, as shown in Map 6. By contrast, several metropolitan regions – including those surrounding Madrid, Berlin, Hamburg, Bremen, Bucharest and Paris – display lower relative wages in waste collection and treatment.

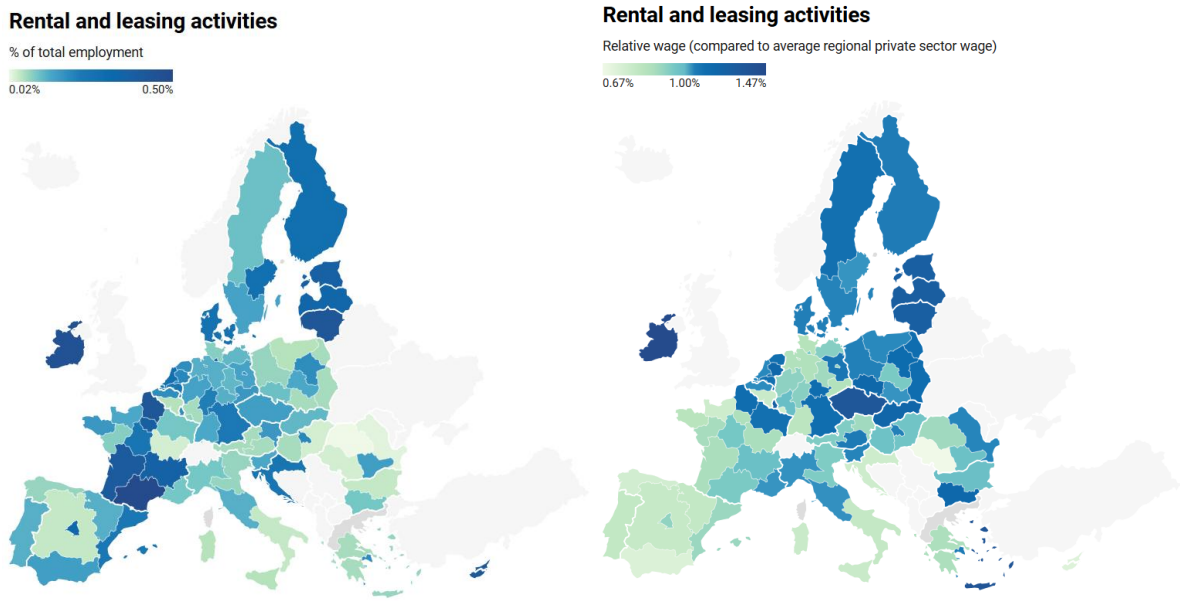
Map 6 – Regional (NUTS1) breakdown of 2020 employment and wages in waste collection, treatment and disposal activities; materials recovery



Source: (Eurostat, 2025c)

Employment in rental and leasing (NACE 77) shows stronger regional concentration than in NACE 33 and NACE 38. Rental and leasing activities tend to cluster in and around metropolitan regions such as Paris, Madrid, Budapest, Bucharest, Berlin, Stockholm and Luxembourg, where they account for a higher share of jobs than in rural regions. This spatial concentration does not, however, systematically translate into higher relative wages in these metropolitan regions, as depicted in Map 7. On average, relative wages in rental and leasing are higher in Eastern Europe, the Nordic countries, the Netherlands and Ireland.

Map 7 – Regional (NUTS1) breakdown of 2020 employment and wages in rental and leasing activities

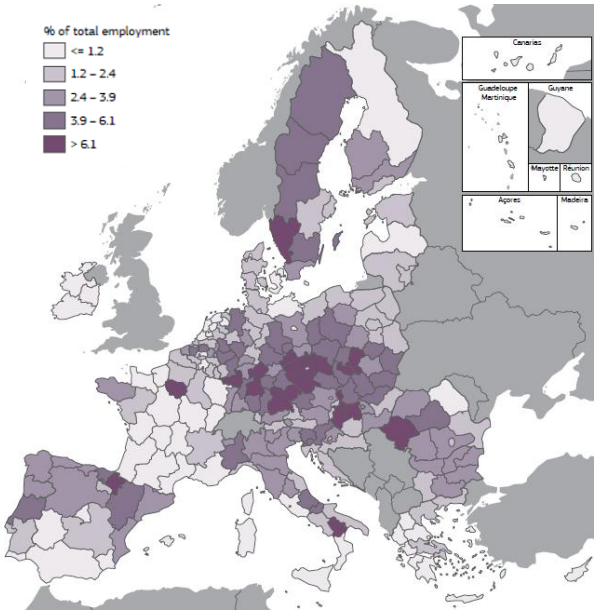


Source: (Eurostat, 2025c)

The identification of other forms of circular employment is constrained by a limited availability of publicly available data at more granular NACE levels. A robust identification of circular activities at the regional level – aligning with the CEMF methodology would require 4-digit NACE data at this level. Furthermore, job quality and skills data specific to circular work are not publicly available at this level of granularity.

A further disaggregation at the NUTS2 level would help to refine the analysis between urban and rural regions. NUTS2 covers provinces or groups of provinces within larger countries. In small countries it may coincide with the national territory. A report by the European Commission (2024) on the economic, social, and territorial cohesion of regions within Europe shows employment differences in carbon-intensive manufacturing at NUTS2 level, as shown in Map 8. Empirical studies at the regional level indicate that carbon-intensive legacies in coal and heavy-industry belts emerge as transition hotspots, where vulnerability is heightened unless circular measures are explicitly aligned with local labour markets. By contrast, metropolitan regions with stronger institutions attract more of the observed circular job growth (Niang et al., 2024).

Map 8 – Employment in carbon-intensive manufacturing in 2020



Note: Direct employment in paper and pulp (NACE17), coke and refined petroleum products (NACE19), chemicals (NACE20), non-metallic minerals (NACE23), basic metals (NACE24) and motor vehicles (NACE29).
Source: (European Commission, 2024)

This is relevant, as regional labour markets are path dependent: circular skill needs tend to grow out of existing industrial specialisations rather than replace them. Circular capabilities of firms tend to grow out of existing specialisations, as shown in a study on West Gothland where circular practice aligns with the regional manufacturing history and incumbent skills (Martin, 2025a). Workers tend to move within technologically related industries, so reconfiguration builds on what is already present. Where the regional skills base is misaligned, transitions often stall without deliberate investment in vocational education and training (VET) and strong employer–provider coordination. Weak innovation activity can also limit the shift, which Cedefop flags as a risk for parts of the EU and which is echoed in work highlighting the role of R&D effort and related institutional signals for circular readiness (Cedefop, 2023a; Dumitrescu-Popa et al., 2024).

Meanwhile, circular transitions can be fostered by digital capacity building. Regions with stronger high-digital-intensive footprints cluster in ways associated with resilience and eco-innovation (Pirciog

et al., 2023). These capabilities can facilitate data-rich circular practices (e.g., repair marketplaces or product-tracking). Monitoring should therefore enrich baseline indicators of the existing skill and industry mix with enablers such as VET provision, R&D intensity, and household internet access, to distinguish regions that can build on existing strengths versus those that need targeted capability building. Evidence on skills mismatches and potential brain drain reinforce the need for place-based reskilling aligned with circular needs, rather than generic upskilling offers that favour already strong regions (Circle Economy, 2024a).

Box 8 – Reviving old industrial hubs in the circular economy

Old industrial hubs across Europe offer potential to support a just circular transition. In the SEPAR8 project, funded through the Just Transition Fund, an innovative, eco-friendly and safe method for battery recycling is being developed to recover critical and strategic metals, with potential for upscaling across the Hauts-de-France region and more broadly in Europe. This creates an opportunity to address regional discrepancies in circular job opportunities (Eiselein & Langenus, 2025). At the same time, the onset of the Green Deal has led to an increase in innovative, high-tech recycling facilities for specific waste streams, such as plastics and textiles.

Battolyser Systems provides a second example from the Groot-Rijnmond region in the Netherlands, which includes Rotterdam and neighbouring municipalities. The case illustrates how legacy industrial hubs can support regional renewal through circular and low-carbon innovation. The region hosts the EU's largest seaport and a major petrochemical cluster, yet it also faces persistent labour market challenges, including above-average unemployment. The Territorial Just Transition Plan therefore prioritises structural transformation of the port-based industrial ecosystem. Battolyser Systems combines a battery and an electrolyser in a single device, uses recyclable materials, and avoids reliance on critical raw materials. The project budget reaches around EUR 8 million, with EUR 2 million from the Just Transition Fund to scale production via a pilot facility, expecting to create 150 high-quality jobs (European Commission, 2025b).

A third example comes from the Horizon Europe Innovation Action Sustainable Circular Economy Transition: *from Industrial Symbiosis to Hubs for Circularity (IS2H4C)*, coordinated by the University of Twente. The project brings together 35 organisations from across Europe to establish four industrial hubs for circularity in the Netherlands, Türkiye, the Basque Country, and Germany, testing how industrial symbiosis can drive systemic change in established industrial areas. The hubs integrate technologies such as carbon capture and electrolysis to link resource efficiency, renewable energy generation, waste prevention, and stronger connections between industry, cities, and surrounding regions. In the Izmir–Manisa hub, for example, firms plan an integrated chain that combines green hydrogen production with captured CO_2 to produce e-methanol and to enable isocyanate-free polyurethane as an alternative to conventional polyurethane. The project aims to set a replicable model for regional industrial renewal, including attention to scaling technologies, embedding them in existing industrial sites, and mobilising investment through innovative financing and social innovation approaches (*Industrie-Hubs der Circular Economy - Fraunhofer UMSICHT*, 2024).

4.1.3 Cities versus rural areas

Within regions, differences between cities and rural municipalities matter because density, market proximity, waste flows, logistics and institutional capacity may differ sharply across space. According to the empirical literature, circular activity concentrates in cities while rural areas face structural disadvantages to implement and scale circular strategies (Niang et al., 2024). Rural settings contend with longer distances, thinner supply chains, and fewer specialised services, which raises coordination

costs and narrows viable circular strategies (Pansera et al., 2024). Rural perspectives from Scotland describe weak infrastructure, a lack of tailored governance, and uneven access to services that limit participation in circular practices, which underlines the need for place-specific support rather than generic national instruments (Malcolm et al., 2024). At the same time, a recent Spain-wide study finds that rural circular companies often survive longer and achieve higher profitability despite their slower growth. This suggests business models grounded in local resources, thinner competition and community ties can be financially sustainable, even if scale is limited (Magdalena et al., 2025).

Cities concentrate both formal and informal activities. In France, metropolitan areas host the bulk of repair, refurbishing, rental and secondary-material markets and attract informal actors around dense, steady waste flows, reinforcing observed clustering of circular firms and jobs in urban settings (Niang et al., 2024). Comparable urban–rural asymmetries appear elsewhere in Europe, where opportunities in higher-value segments tend to concentrate in cities, while peripheral areas risk attracting lower-paid or more hazardous tasks (Pansera et al., 2024).

Building capacity outside major cities depends on collaborative governance. Multi-stakeholder platforms that convene firms, public bodies, knowledge institutions, and civil society can spread capabilities beyond metropolitan hubs. However, smaller municipalities often lack the resources to participate on equal terms, which calls for supportive regional policy and targeted resourcing (Eiselein & Langenus, 2025). Evidence on civic initiatives is mixed but instructive. Community repair shows a distinct geography, with participation higher in both rural municipalities and large city centres than in smaller cities, while community reuse concentrates in central cities, and social sharing is more common in rural areas (Van Opstal et al., 2026). Empirical evidence from Flanders has found a negative association between city residence and self-directed learning of repair skills, which may reflect easier access to commercial repair options in urban settings and fewer incentives to acquire do-it-yourself capabilities (Van Opstal & Borms, 2025).

Job quality and inclusion remain central concerns. Urban circular labour markets span both higher value roles in design and advanced remanufacturing and lower paid service work in repair and reuse, whereas rural activity often concentrates in collection, basic sorting, and seasonal reuse with thinner employer bases and weaker representation, which heightens vulnerability to low pay and limited progression (Pansera et al., 2024). Without planned, worker-centred transition arrangements, new circular models do not automatically deliver secure and well-paid jobs or inclusive participation. Alliance-based governance is needed to protect standards and voice across places (Fairbrother & Banks, 2024). Grassroots repair initiatives in deprived neighbourhoods illustrate this point: they deliver social and environmental value under conditions of fiscal austerity, precarious premises, and limited institutional support, revealing how local conditions constrain community-led circularity (Purvis et al., 2025).

4.1.4 Overarching analysis

Distributional justice

Geographical inequalities in the circular labour market reveal clear distributional imbalances across Member States, regions, and urban-rural contexts. The uneven geography of circular employment means that opportunities and burdens in the transition are not spatially neutral. High-performing countries in circular economy indices, such as the Netherlands, Belgium, and Germany, tend to concentrate innovation and investment capacity, yet they record comparatively low shares of circular employment. Geographical patterns mirror wider disparities in industrial structures and wage levels and highlight that aggregate circular performance does not automatically equate to equitable labour

outcomes. This is important for monitoring, as indicators of circular job growth may obscure qualitative differences in wages, working conditions, and skill levels across space. Complementing quantitative monitoring with indicators of job quality and pay parity at the regional level would make these patterns more visible. Yet, data at this level of granularity are not publicly unavailable. Moreover, the analysis presented reveals that monitoring frameworks must move beyond national averages and incorporate place-sensitive indicators that capture these differences.

From a distributional justice perspective, geographical inequalities in a circular transition depend not only on regional economic structures but also on access to technology and the allocation of environmental burdens. Technology sharing, open innovation platforms and interregional cooperation can lower entry barriers for regions with limited industrial capacity or financial resources. Without such mechanisms, technologically advanced regions may consolidate advantages in high-value circular activities such as advanced recycling, digital platforms or remanufacturing, while less-developed regions remain confined to lower-value segments. Furthermore, international waste shipments – both within and beyond the EU – illustrate how environmental and labour burdens may be externalised to lower-income countries. Although EU regulations aim to restrict the export of problematic waste streams, differences in enforcement capacity and economic dependency create uneven exposure to environmental and occupational risks.

Procedural justice

Procedural justice concerns arise from the unequal capacity of local and regional actors to influence or benefit from circular transition processes. Decision-making power over funding, data, and policy instruments often resides at the national or EU level, while implementation occurs locally, where institutional capacity varies markedly. Metropolitan areas benefit from greater administrative resources and access to multi-stakeholder networks, which facilitate the coordination of circular labour strategies. Smaller municipalities and rural regions, by contrast, frequently lack the means to engage in such governance processes on equal terms. Nonetheless, the capacity to adapt circular strategies to regional realities, rather than apply uniform measures, is central to procedural fairness. Procedural justice in this context implies the inclusion of diverse territorial voices in transition planning and monitoring. Indicators that track not only employment outcomes but also participation in governance structures, access to regional funding programmes, and representation in transition partnerships or communities of practice could help reveal procedural asymmetries.

Recognitional justice

Official statistics capture formal employment in identifiable circular sectors such as repair, waste management, and leasing. Circular economy activities in other sectors remain obscured for statistical reasons. Examples include remanufacturing in automotive and machinery, circular procurement and maintenance work in construction, reuse and upcycling in the fashion sector, and digital platform intermediation for reuse and sharing. These activities contribute to circularity by extending product lifetimes, reducing material demand, and improving utilisation rates, yet they are embedded within broader sectoral classifications and therefore remain difficult to distinguish in standard labour statistics.

Informal and community-based work also remain largely unrecorded. Failure to recognise these contributions distorts both the social and geographical picture of the circular transition. Monitoring instruments that rely exclusively on formal data risk misrepresenting where circular practices actually take place and who participates in them. Recognitional justice therefore requires integrating qualitative and community-based data into official monitoring, for example through complementary

surveys or case studies that capture informal, unpaid, or civil-society-based contributions to circularity.

Recognition also extends to spatial hierarchies between urban and rural areas. Urban centres dominate both formal and informal circular activities, while rural areas face structural disadvantages related to distance, thin supply chains, and limited governance capacity (Pansera et al., 2024). In addition, the lived experiences and place-based knowledge of workers and local communities – in particular in rural areas – may remain invisible in monitoring frameworks. Research indicates that rural circular enterprises can achieve stable, long-term viability through local resource anchoring and community ties (Magdalena et al., 2025). Recognising these different models of circularity is important to avoid imposing performance metrics that inadvertently favour urban density or high-tech innovation. Monitoring frameworks should address this by further refining types of circular employment at the NUTS2 level.

4.2 Vulnerable groups

This section offers a second thematic investigation, focusing on labour market related vulnerabilities within the circular transition. We discuss four groups: gender, age, migrants and ethnic minorities, and people living with disability, chronic illness, or neurodivergence. We treat these categories separately to surface specific risks and opportunities, which is important to clarify what should be monitored, and why. The categories are treated separately for analytical clarity, yet many workers belong to more than one group, and their disadvantages can compound. The closing subsection returns to this intersectional lens and frames priorities for monitoring through the linked dimensions of distributional, procedural, and recognitional justice.

4.2.1 Gender-related vulnerabilities

Gendered divisions of labour shape who bears risks, who accesses new opportunities, and whose work remains visible as economies move toward circularity. Across EU value chains, women are often concentrated in end-of-pipe activities and in unpaid community roles. Men are over-represented in hazardous, technical, and logistics work. This subsection begins with general labour-market patterns because these inequalities may structure how circular transitions unfold. It then identifies they key issues that arise specifically within a circular transition.

Persistent gender inequalities

Looking at the broader EU labour market, women have lower average pay and lower labour force participation than men. In 2023 the average EU gender pay gap was 12% in enterprises with ten or more employees, with variation across countries from near zero in Luxembourg and Belgium to 19% in Latvia (Eurostat, 2025f). Labour market activity also differs: among 20–64 year-olds, 70.8% of women are active in the labour market compared with 80.8% of men (Eurostat, 2025g). Conversely, men face most recorded workplace injuries because they are concentrated in higher-risk occupations and sectors: they account for 94% of fatal and 68% of non-fatal occupational accidents across the EU (Eurostat, 2025a). In other fields, labour market outcomes are similar for men and women; for example, participation in learning activities is broadly comparable at about 42% for both women and men (Eurostat, 2025b).

Within circular economy contexts, these structural differences take specific forms. Women remain more present in lower value and informal activities but less present in higher value roles such as circular product design or advanced remanufacturing (Pansera et al., 2024). Much of the labour that

sustains circularity in communities is unpaid and framed as volunteering, which further depresses its visibility in measurement systems and policy discourse (Rogers et al., 2021).

Transformative pathways and opportunities

Interview insights and preliminary Eurostat findings reported in Section 3.2.1 indicate that circular roles remain male-dominated and that awareness of career opportunities in circular fields is still limited, reinforcing path dependencies that preclude the entry of women into technical and vocational pathways linked to circular activities. There is clear scope for rebalancing when institutions prioritise inclusive skill development and improved job design. A nationally representative Finnish survey finds that gender does not predict the willingness to develop repair skills. Women and men express similar openness to learning, even though they currently repair different product categories. The willingness to upskill correlates with education, self-assessed competence, prior repair experience, frugality, and environmental concern. It declines with age, which signals a need for tailored adult learning offers and product designs that lower skill thresholds for all users (Lundberg et al., 2024).

On the entrepreneurship side, female founders in circular ventures have been found to show a markedly higher propensity to hire vulnerable groups at the labour market, which can accelerate inclusive hiring in collaboration with Work Integration Social Enterprises (WISEs) across a broad set of circular strategies (Van Opstal & Borms, 2024). Results from macro-economic modelling suggest that a shift from extraction and heavy manufacturing toward services and renewables can raise opportunities in occupations that already have higher female participation. This effect is not automatic and requires planned reskilling to avoid losses for low- and medium-skilled workers who are currently concentrated in male-dominated sectors (Wiebe et al., 2019). Finally, conceptual work on a just circular economy argues that gender justice requires more than parity measures. It requires a revaluation of reproductive and care work as circular labour and the correction of metrics that ignore community contributions to repair and reuse. Without such recognition, circular transitions risk reproducing the very inequalities that undermine both social justice and environmental goals (Pansera et al., 2024).

4.2.2 Age-related vulnerabilities

Older and younger workers face distinct but interconnected risks in the transition to a circular economy. While older workers may struggle to adapt to new technologies, digitalisation, or green skill requirements, younger people experience difficulties accessing stable and meaningful employment. Both groups, however, also hold unique potential to contribute to a just circular transition when intergenerational learning, inclusive training, and adaptive employment policies are in place.

Older workers: adaptation challenges and lost opportunities

In 2024, the activity rate of those between 55 and 64 years was 65.2%, compared to 82.5% for those between 25 and 54 years (Eurostat, 2025e). Older workers often encounter barriers when attempting to re-enter the labour market after job loss or structural transitions. In circular sectors, digitalisation and innovation are prominent, yet older entrepreneurs tend to rely on existing networks and accumulated experience rather than developing new technological capabilities (Borms et al., 2023). This may limit engagement with emerging circular practices that depend on digital tools, data management, and advanced design. More experienced managers display weaker ambitions to integrate vulnerable groups into circular work structures (Van Opstal & Borms, 2024). Behavioural inertia, or a “status quo bias”, may cause experienced professionals to fall back on familiar routines and established networks instead of exploring new collaborative or inclusive business models.

These patterns suggest that older workers and entrepreneurs risk exclusion not because of a lack of expertise, but because organisational arrangements and skill expectations are evolving. Without targeted re- and upskilling programmes, this group may be pushed into early retirement or informal work. At the same time, experience in craftsmanship, production processes and management remains relevant for circular innovation, particularly in repair, remanufacturing and product-life extension. This potential, however, depends on technological and institutional conditions. Increasing product complexity, including software integration and advanced material composition, modifies the competence profile required for repair. Repair of contemporary electronics, heat pumps or electric vehicles often requires diagnostic software literacy and specialised technical training. Collaborative arrangements that combine experience-based knowledge with digital competences from younger workers can support adaptation while retaining practical expertise. Age-related labour-market inclusion in circular activities therefore depends not only on individual skill development, but also on regulatory frameworks and product design standards that make repair technically feasible.

Young people: potential drivers but also precarious entrants

In 2024, 9.2% of those between 15 and 24 years old are not in employment, education, or training (NEET) (Eurostat, 2025i). For younger generations, the circular transition opens possibilities but may also intensify precarity. Although policy analyses highlight the circular economy, digitalisation, and the green transition as promising growth sectors for youth employment, the realisation of this potential depends on resilient active labour market policies and high-quality education. Integrating circular economy principles into STEM education, as proposed by Nguyen (2023), provides an effective pathway toward “circular citizenship”, equipping youth with problem-solving, collaboration, and sustainability competences that align with new job profiles.

In the corporate context, younger professionals often drive circular innovation from within. Case study evidence from Italy (Re et al., 2024) illustrates how recruiting young talent can overcome internal resistance to change. Young employees’ stronger commitment to environmental and social issues make them valuable catalysts for organisational transformation toward circular business models. In addition, regional studies such as Fytili and Zabaniotou (2022) demonstrate how youth engagement in low-carbon and circular economies can contribute to economic regeneration in crisis-affected regions, linking sustainability transitions with employment creation.

Intergenerational exchange and mutual learning

Despite differences in skills and opportunities, both younger and older generations possess assets that are essential to a circular transition. Research on circular practices among Finnish young adults (Korsunova et al., 2021) identifies emerging roles such as upcycler, thrifter, and expert-learner, yet also calls attention to the need for intergenerational knowledge exchange. Older generations often retain practical skills in repair and maintenance, while younger people bring expertise in digital platforms and sharing models. Cities and community initiatives could serve as intermediaries that facilitate this exchange, fostering social cohesion and mutual recognition across age groups.

Community repair projects illustrate this potential vividly. In a deprived neighbourhood, Purvis et al. (2025) observed that older individuals and volunteers with health limitations found renewed social purpose and well-being through repair activities. These intergenerational and inclusive initiatives demonstrate that circularity can support not only environmental goals but also social participation and dignity for individuals otherwise marginalised in formal labour markets.

Box 9 – Age and community repair

Repair Cafés, a primary example of community repair based on volunteer engagement, are not only spaces to fix items and support the circular economy at local scale. They also function as places to share repair knowledge and skills and to bring neighbours together, thereby contributing to local resilience (Luukkonen & van den Broek, 2024). A global Repair Café survey conducted in 2014 (Charter & Keiller, 2014) found that the most common age range for volunteers was between 55 and 65 years. In line with literature that highlights civic engagement as a cornerstone of elder-friendly communities (Emlet & Moceri, 2012), volunteers in Repair Cafés indicate that the service they provide helps them feel valuable and useful to the community (Charter & Keiller, 2016).

A follow-up survey in 2020 indicated that attracting young volunteers and young visitors is a moderate to serious difficulty for 59-66% of Repair Cafés (Spekkink et al., 2020). At the same time, several studies show that young people under 35 are more likely than the 35-55 age group to repair items themselves, to involve family and friends in repair, or to make use of professional repair services (Van Opstal et al., 2026).

4.2.3 Migrants, refugees, and ethnic minorities

Migrants and ethnic minorities play a crucial yet often unrecognised role in Europe's circular transition. They occupy both formal and informal segments of circular value chains, often taking on low-paid or precarious work that native workers are unwilling to perform. At the same time, migrants and refugees contribute entrepreneurial dynamism and community-based innovation that can broaden the social reach of circularity.

Concentration in low-paid and precarious circular work

Across the EU, migrant workers are disproportionately represented in low-skilled circular activities such as waste collection, sorting, recycling, and material recovery. In Germany, for example, the waste management sector relies heavily on migrant labour, particularly from Eastern Europe, due to low interest among native workers (CISL, 2023). These jobs are often characterised by insecure contracts, low wages, and limited access to collective representation. Workers face heightened exposure to occupational hazards, including contact with toxic or contaminated materials, and women in these roles may experience additional risks such as harassment (CISL, 2023).

While most research on informal waste management focuses on the Global South, studies also highlight the prevalence of informal waste picking, metal collection, and textile retrieval by migrants in European cities, activities that remain largely invisible in employment and circularity statistics (Cook et al., 2024; Porras Bulla et al., 2021). While such work provides livelihoods for groups excluded from formal labour markets, it is marked by social marginalisation, lack of recognition, and legal insecurity. Moreover, these activities are mostly not integrated into official circular economy frameworks despite their environmental and social value.

Barriers to inclusion and skill recognition

In 2024, EU unemployment rates were on average 10.7% for workers born in a foreign country, compared to 5.5% for those born in the reporting country (Eurostat, 2025h). Migrants and refugees frequently face systemic barriers when entering the formal economy. These include language obstacles, non-recognition of foreign qualifications, and difficulties translating prior experience into

new job contexts. Across Europe, earnings are lower for non-native workers (Barrenechea-Méndez & Martinez-de-Morentin, 2025).

For WISEs, integrating refugees and newly arrived migrants introduces specific challenges but also opens new opportunities. The lack of a shared working language and limited credential recognition can initially constrain performance, yet these enterprises often succeed in building pathways into work precisely for people excluded from mainstream employment (Van Opstal et al., 2024). Moreover, migrants and refugees may possess craft skills that have become scarce in European labour markets, providing them an advantage in repair, refurbishment, and recycling activities (Van Opstal & Borms, 2023).

Start-up ecosystems show similar patterns. Survey data reveal a relatively high share of entrepreneurs with a migrant background among respondents expressing a willingness to employ vulnerable groups (Van Opstal & Borms, 2024). These findings suggest that migrant entrepreneurs can act as bridges between formal and informal economies, linking community networks with emerging circular opportunities. Their personal experiences of exclusion may heighten awareness of social purpose and inclusion in enterprise design, echoing findings on "necessity entrepreneurship" (Noorbakhsh & Teixeira, 2023).

Informality and recognition

From a justice perspective, the contributions of migrants and minorities to circularity remain under-acknowledged in both research and policy. Labour market monitoring rarely captures informal or unpaid forms of circular work, rendering these contributions statistically invisible. This lack of recognition extends to value frameworks that privilege formal production while ignoring maintenance activities as well as care and household work. As a result, large segments of circular work – including informal recycling, textile repair, and small-scale reuse – remain excluded from assessments of circular performance. The same blind spot applies to the many migrant-run repair and reuse shops operating as micro-enterprises or sole traders: these are often instances of necessity or survival entrepreneurship rather than high-growth ventures, positioned in thin markets with low margins and limited social protection (Borrero & Yousafzai, 2025).

Yet this invisibility also masks resilience and agency. Informal and necessity-driven circular activities frequently emerge as livelihood strategies that provide a degree of economic autonomy, foster community ties, and reduce waste simultaneously. They reveal how social exclusion and environmental contribution can coexist. Recognising these dynamics calls for a broader understanding of value and work within circular transitions – one that does not merely measure efficiency but also acknowledges the human and social foundations of circularity.

Box 10 – Migrants and ethnic minorities in waste collection and recycling

Across the world an estimated 15 million people earn their livelihood through informal waste work (Irvine, 2023). In Europe alone, up to one million informal workers, many of them migrants excluded from formal labour markets, collect waste and scrap materials for reuse and recycling. This is estimated to be twice the number of formal recycling workers. Interview respondents noted that ethnic minorities, including Roma communities, have long engaged in informal waste collection and recycling out of economic necessity. In many cases the methods used remain rudimentary, resembling practices more commonly associated with informal recycling in the Global South. Although vocational training programmes exist to help these workers transition into the formal labour market, respondents stressed that such initiatives often fail to account for the specific needs and constraints of these groups and may therefore unintentionally exclude them.

Moreover, growing evidence indicates that a significant share of the labour underpinning recycling activities across Northern Europe is carried out by workers from Eastern European countries, who are often employed on lower wages, temporary contracts and under weaker safety protocols (Gregson et al., 2016; Nuti, 2018). This dynamic reinforces existing hierarchies and stereotypes between workers from Western and Eastern Europe. An illustrative example is found in the Dutch ship recycling sector, where work is organised through chains of subcontractors. During periods of high processing demand, additional workers from Poland and Czechia were hired at less than one third of the wages earned by Dutch workers performing the same tasks on the same site (Gregson et al., 2016).

4.2.4 Disability, chronic illness, and neurodiversity

Workers with disabilities, chronic illnesses, or neurodivergence remain underrepresented in discussions about the circular economy. Yet their inclusion is fundamental to a genuinely just transition. These groups experience structural disadvantages in access to education, employment, and workplace adaptation. In 2024, the disability employment gap in the EU was on average 24% (20.4% for females and 27.2% for males) (Eurostat, 2025d). At the same time, many possess skills and perspectives highly relevant to circular practices, including precision, analytical thinking, and long-term reliability.

Work integration and the social economy as entry points to inclusion

The social and circular economies intersect most visibly in the creation of inclusive employment opportunities for people with disabilities. Sheltered workshops and, more broadly, WISEs play a pivotal role in this domain, offering tailored employment, training, and social support within circular value chains. Empirical studies show that WISEs often employ people with disabilities or psychosocial challenges in repair, recycling, and upcycling activities (Van Opstal et al., 2024). By combining social and environmental objectives, WISEs illustrate how circular production systems can be designed to accommodate diverse forms of ability and contribution. Research on Romania's emerging social economy identifies hybrid models that merge circular and social principles. Examples include waste recovery and upcycling with inclusive employment, thereby offering accessible jobs to individuals who face physical or social barriers to conventional work (Barna et al., 2023). These examples highlight the potential of circular activities – often labour-intensive and community-based – to provide flexible and meaningful employment for people excluded from mainstream labour markets.

Eiselein and Langenus (2025) emphasise the role of social circular hubs and partnerships in enabling WISEs to participate in circular initiatives. These partnerships can provide adapted workplaces, financial support, and technical platforms for experimentation. When designed inclusively, they

demonstrate how circular transitions can strengthen social resilience alongside ecological regeneration.

Skills and recognition

While the circular economy depends increasingly on technical, analytical, and creative competencies, discussions on skills rarely consider neurodiversity or disability. Yet there is growing recognition that individuals with certain forms of neurodivergence, such as autism, may bring distinctive abilities suited to roles in quality control, repair diagnostics, and data-driven resource management. Van Opstal et al. (2024) note that neurodiversity considerations are largely absent from European skills planning, despite evidence of these potential synergies. The gap highlights normative assumptions about capability embedded in HR and innovation policy, which restrict employability to narrowly defined functional profiles. Inclusive circular systems could embrace the diversity of cognitive and physical capabilities as a resource for innovation. For example, precision-oriented tasks in disassembly, material sorting, or repair diagnostics may align well with certain neurodiverse skill profiles, while community-oriented reuse or social enterprise work can offer supportive environments for people managing chronic illnesses.

Inclusion in the circular economy extends beyond formal employment. Many people with disabilities or chronic illnesses engage in informal repair, reuse, or volunteer activities that support circular goals while also fostering well-being and social connectedness. These contributions often remain unrecorded in labour statistics and circularity indicators, reinforcing their invisibility.

Barriers and missed opportunities

Despite these promising examples, the structural challenges remain considerable. Many circular start-ups and mainstream firms recognise the potential of working with WISEs but lack mechanisms for collaboration and awareness of how to integrate diverse workers effectively (Van Opstal, Bocken, et al., 2025; Van Opstal & Borms, 2024). Similarly, the broader policy discourse – while acknowledging "vulnerable groups" – rarely specifies disability or neurodiversity in its frameworks for circular skills and jobs. Without explicit recognition, these workers risk being confined to peripheral or low-value-added roles, repeating the marginalisation seen in earlier phases of the green transition. Addressing these gaps requires more than employment quotas or access programmes. It involves embedding inclusivity into the design of circular business models, technology, and governance systems.

4.2.5 Overarching analysis

This overarching analysis of vulnerable groups links justice concepts directly to what should be monitored related to jobs in a just circular transition. Across distributional, procedural, and recognitional justice, monitoring should enable the disaggregation of data by intersecting characteristics (e.g., sex × age × migrant background × disability) and cover both formal and informal spheres of work.

Distributional justice

The evidence across gender, age, ethnicity, and disability demonstrates that circular economy developments do not automatically lead to fairer labour markets or broader social participation. Instead, they tend to mirror existing inequalities.

Labour market vulnerabilities intersect in complex ways. A migrant woman employed in waste sorting, for example, faces gendered division of labour, ethnic marginalisation, and occupational risk simultaneously. An older man with a chronic illness may experience exclusion both from reskilling schemes and from workplaces that lack adaptive arrangements. Workers in carbon-intensive industries, such as coal mining and energy-intensive manufacturing, illustrate another form of compounded vulnerability. These workers are often concentrated in specific regions with limited economic diversification. In such cases, occupational exposure intersects with regional dependency. Furthermore, technological developments, including artificial intelligence, may compound existing labour-market vulnerabilities. AI-driven automation, predictive maintenance systems and data-based optimisation may increase productivity in recycling, logistics and remanufacturing, but may also alter task composition and skill requirements. Workers already facing disadvantages – such as older employees, low-skilled workers or those with limited access to training – may encounter additional barriers if digital competences become a prerequisite for participation in circular activities.

These intersections multiply disadvantage, creating compounded barriers to a stable income and occupational mobility. At the same time, some intersections reveal underexplored opportunities: migrant entrepreneurs demonstrate a strong inclination to employ target groups in circular start-ups, and women-led circular ventures often show higher inclusion ambitions. Recognising these dynamics demands that analysing distributional justice extends beyond counting jobs – it must consider who benefits from subsidies, who bears risks, and how intersecting forms of exclusion or privilege influence access to circular value creation.

Procedural justice

Procedural justice requires that all groups meaningfully participate in decision-making and benefit from transparent, inclusive governance. Yet, across studies, procedural inequalities remain striking. Vulnerable groups often lack voice in formal policy arenas or sectoral organisations. Migrant and minority workers, for example, have limited representation through unions or professional associations, particularly in subcontracted or informal employment where collective bargaining power is weak (Fairbrother & Banks, 2024).

Procedural asymmetries also arise through institutional design. Regulations around intellectual property, product warranties, and reverse logistics typically exclude informal repair and reuse, while corporatisation of waste and material streams restricts access for community initiatives (Van Opstal, Pals, et al., 2025). These mechanisms structurally prioritise actors with capital, legal expertise, and organisational capacity, sidelining smaller or socially oriented participants. Place-based research highlights that even where civic networks and attachment to locality create dialogue opportunities, participation alone does not guarantee influence; stakeholder input must translate into policy change to maintain trust (Deutz et al., 2024).

When vulnerabilities intersect, procedural exclusion deepens. A refugee woman working informally in reuse, for instance, may face gendered expectations, language barriers, and lack of documentation – all of which inhibit participation in formal consultation processes. Similarly, an older worker with declining health may be nominally represented by labour unions but practically excluded from retraining schemes organised for younger cohorts. Addressing such compounded disadvantages requires governance that not only invites participation but also adapts procedures to participants' circumstances – for example, by supporting translation, offering accessible meeting formats, or partnering with community organisations that act as intermediaries.

Recognitional justice

Recognitional justice concerns whether social groups and their contributions are valued within prevailing economic and policy frameworks. In the circular economy, invisibility remains a pervasive form of injustice. Activities central to sustaining circularity – from household repair to volunteer-driven reuse networks – are rarely acknowledged in statistics or performance indicators. Women's care-based repair, migrants' informal recycling, and community work by elder volunteers often fall outside what counts as "employment" or "innovation". This lack of recognition reinforces policy blindness and perpetuates stigma, especially where informal or voluntary work is viewed as marginal rather than essential.

Intersecting vulnerabilities make recognition particularly urgent. A young neurodivergent worker may possess specialised analytical strengths relevant to repair diagnostics but be excluded by narrow hiring norms. Without frameworks that acknowledge overlapping identities, recognition risks becoming selective – celebrating some forms of diversity while it silences others.

5 Conclusions

The aim of this report has been to develop an analytical basis for monitoring job creation in Europe within a just circular transition, linking distributional, procedural, and recognitional justice to labour-market indicators. The approach combined policy analysis, stakeholder perspectives, literature review, mapping of indicator systems, and thematic investigations of geographical inequalities and vulnerable groups. The report demonstrates that a just circular transition demands a detailed understanding of how employment changes unfold across sectors and regions, how job quality evolves in circular activities, how skills requirements shift, and how informal and unpaid work contribute to circularity yet remain unacknowledged. The analyses presented throughout the report therefore inform a set of integrated conclusions that bring together the main insights and clarify what is needed for socially fair circular labour-market transformations.

Key takeaways

First, the evidence shows that circular employment in the EU has increased over time, but the identification of circular jobs is limited by current statistical classifications, which only capture a narrow subset of relevant activities. Existing datasets underestimate enabling roles, hybrid job profiles, and informal or unpaid circular work. As a result, the full scale of employment in the circular economy remains difficult to assess, and policy debates often depend on partial or incomplete labour-market evidence.

Second, the transition is characterised by simultaneous job creation and losses, sectoral shifts, and redefinition of job profiles. Labour-intensive activities in repair, reuse, refurbishment, and reverse logistics generate new employment opportunities, while material-intensive and extractive sectors experience contraction. These changes occur across global value chains, with implications that extend beyond the EU. Employment restructuring therefore raises complex distributional issues, as local gains may be offset by job losses elsewhere, and regions dependent on linear production models face particular challenges.

Third, the quality of circular jobs varies considerably. Repair, sorting, and recycling roles frequently involve low wages, repetitive work, limited training, and safety risks. High-skilled roles in design, innovation, and digital services tend to benefit already advantaged groups, while workers entering or remaining in low-quality circular occupations often face instability linked to fluctuating waste streams or short-term project funding. Job quality therefore emerges as a central dimension of a just circular transition. Without targeted interventions, the transition risks reinforcing existing labour-market inequalities rather than reducing them.

Fourth, emerging circular activities require a shift in the distribution of skills across the labour force. Circular transitions depend on hybrid skills that combine technical competences, organisational abilities, and transversal capabilities such as collaboration and systems thinking. However, VET systems, higher education, and regional training centres do not always succeed to respond at the necessary pace, and disadvantaged groups face persistent barriers to accessing training.

Fifth, circular employment displays geographical inequalities, with higher relative employment shares in Northern and Western Member States and lower shares in many Southern and Eastern countries. Within countries, regional disparities are equally significant. Circular employment tends to concentrate in metropolitan and economically stronger regions, where service-based circular activities, innovation ecosystems, and specialised skills are more developed. Rural and peripheral regions are more strongly associated with waste collection and treatment. These spatial patterns

indicate that a circular transition may reinforce existing territorial labour-market inequalities unless accompanied by cohesion policies explicitly targeting lagging regions.

Finally, vulnerable groups risk exclusion unless the transition is guided by explicit justice considerations. Many circular consumption practices require unpaid labour in households, which places additional burdens on individuals with limited time or resources. Procedurally, the perspectives of vulnerable groups are insufficiently reflected in policy design. From a recognitional justice perspective, informal contributions to circularity remain largely invisible in official metrics.

Methodological reflections

First, the development of improved and more inclusive classifications of circular activities is required. This involves the upcoming Eurostat circular employment indicator through broader inclusion criteria across relevant NACE codes and through the systematic incorporation of enabling and hybrid circular activities. Such classifications need alignment across Member States in order to support comparability and to reduce inconsistencies between national methodologies.

Second, labour-force and working-conditions surveys require the integration of circular-task modules. The EU-LFS and the EWCS, for instance, could include questions capturing circular activities across sectors, exposure to specific risks, opportunities for training, and contractual arrangements. The inclusion of circular-task identifiers would allow for direct linkage between job quality metrics and circular activities.

Third, monitoring systems require the inclusion of informal and unpaid circular work. Survey instruments, administrative proxies, and targeted sampling strategies are required to measure informal repair, community reuse, self-organised refurbishment, and other unregulated activities that contribute significantly to circularity. These data complement official statistics and broaden the analytical scope needed for justice-sensitive assessments. Fourth, indicator development requires explicit integration of justice dimensions. The construction of indicators should allow for disaggregation by gender, age, migration status, household income group, contract type, and region. Monitoring can support more meaningfully a just transition when labour-market information is connected to distributional, procedural, and recognitional justice dimensions.

Policy reflections

First, circular transition policies require the systematic embedding of just transition principles. Circular policies would therefore benefit from ex-ante social impact assessments that identify potential job gains, losses, and redefinitions, as well as regional and sectoral vulnerabilities. Moreover, policies need to safeguard job quality in circular sectors. This involves enhanced enforcement of safety regulations, clarification of labour standards, and support for stable employment relationships in repair, reuse, and recycling. Sector-specific agreements and social dialogue mechanisms can support the development of collective standards in fragmented circular labour markets. These measures require involvement of unions, employer organisations, and local authorities.

Second, inclusive and accessible reskilling pathways are essential. VET systems need to deliver modular circular skills programmes that support individuals with low or medium levels of formal qualification. Regional training centres require resources to work with employers, WISEs, and municipal authorities in order to support circular innovation and local labour-market resilience. Work-based learning and short-cycle training can support transitions for workers in declining sectors.

Third, informal circular workers and community initiatives require recognition and structured engagement. Policy design needs to include informal repairers, community reuse organisations, and migrant refurbishers in consultation processes. Semi-formalisation pathways can be developed through micro-enterprise support, access to training vouchers, and inclusion in local procurement schemes. The aim is not to replace informal ecosystems but to strengthen their contributions while ensuring safe and fair working conditions.

Finally, local and regional authorities require stronger roles in governing circular labour transitions. Cities and regions are well placed to integrate circular labour-market needs into waste strategies, industrial policy, and spatial planning. Local living labs and circular hubs can support inclusive experimentation, foster cross-sector collaboration, and create embedded opportunities for marginalised groups.

List of abbreviations

Abbreviation	Name
ADEME	Agence de la Transition Écologique
CCRI	Circular Cities and Regions Initiative
CEAP	Circular Economy Action Plan
CEMF	Circular Economy Monitoring Framework
CGE	Computable General Equilibrium
EEA	European Environment Agency
EIGE	European Institute for Gender Equality
ESCO	European Skills, Competences, Qualifications and Occupations
ESF	European Social Fund
ETUC	European Trade Union Confederation
ETUI	European Trade Union Institute
EWCS	European Working Conditions Survey
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
ILO	International Labour Organization
ISCO	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification of All Economic Activities
JQI	Job Quality Index
JTF	Just Transition Fund
LFS	Labour Force Survey
NACE	Nomenclature of Economic Activities
NEET	Not in Education, Employment, or Training
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
SILC	Statistics on Income and Living Conditions
STEM	Science, Technology, Engineering and Mathematics
UNECE	United Nations Economic Commission for Europe
UNEP	United Nations Environment Programme
VET	Vocational Education and Training

References

A STEM Education Strategic Plan: Skills for Competitiveness and Innovation, COM(2025)89 final (2025). https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52025DC0089

Abasli, I., & Mukhtarov, F. (2024). Old Habits Die Hard: How Narratives on Social Aspects of Circular Economy (Re)Produce Global Inequalities. *Circular Economy and Sustainability*. https://doi.org/10.1007/s43615-024-00470-7

Acemoglu, D., & Autor, D. (2011). Skills, Tasks and Technologies: Implications for Employment and Earnings*. In D. Card & O. Ashenfelter (Eds), *Handbook of Labor Economics* (Vol. 4, pp. 1043–1171). Elsevier. https://doi.org/10.1016/S0169-7218(11)02410-5

Aguilar-Hernandez, G. A., Dias Rodrigues, J. F., & Tukker, A. (2021). Macroeconomic, social and environmental impacts of a circular economy up to 2050: A meta-analysis of prospective studies. *Journal of Cleaner Production*, *278*, 123421. https://doi.org/10.1016/j.jclepro.2020.123421

Albatayneh, A. (2024). The electric cars era transforming the car repairs and services landscape. *Advances in Mechanical Engineering*, *16*(7), 16878132241266536. https://doi.org/10.1177/16878132241266536

Alessio, C., Goodwin Brown, E., & Sosa, L. (2021). *The implications of the circular economy for the labour market. A briefing for social partners*.

Awino, F. B., & Apitz, S. E. (2024). Solid waste management in the context of the waste hierarchy and circular economy frameworks: An international critical review. *Integrated Environmental Assessment and Management*, *20*(1), 9–35. https://doi.org/10.1002/ieam.4774

Barna, C., Zbuchea, A., & Stănescu, S. M. (2023). Social economy enterprises contributing to the circular economy and the green transition in Romania. *CIRIEC-España, Revista de Economía Pública, Social y Cooperativa*, (107), 47–69. https://doi.org/10.7203/CIRIEC-E.107.21738

Barrenechea-Méndez, M. A., & Martinez-de-Morentin, S. (2025). Profit Sharing, Teams, and Earnings. *Industrial Relations: A Journal of Economy and Society*, *n/a*(n/a). https://doi.org/10.1111/irel.70014

Bassi, F., & Guidolin, M. (2021). Resource Efficiency and Circular Economy in European SMEs: Investigating the Role of Green Jobs and Skills. *Sustainability*, *13*(21), Article 21. https://doi.org/10.3390/su132112136

Beducci, E., Acerbi, F., Pinzone, M., & Taisch, M. (2024). Unleashing the role of skills and job profiles in circular manufacturing. *Journal of Cleaner Production*, *449*, 141456. https://doi.org/10.1016/j.jclepro.2024.141456

Bianchi, G. (2020). *Sustainability competences*. JRC Publications Repository. https://doi.org/10.2760/200956

Blomsma, F., & Tennant, M. (2020). Circular economy: Preserving materials or products? Introducing the Resource States framework. *Resources, Conservation and Recycling*, *156*, 104698. https://doi.org/10.1016/j.resconrec.2020.104698

Bonoli, G., & Liechti, F. (2019). Good intentions and Matthew effects: Access biases in participation in active labour market policies. In *The Future of the Social Investment State*. Routledge.

Borms, L., Multani, M., Bachus, K., Dams, Y., Brusselaers, J., & Van Passel, S. (2024). Using Natural Language Processing to monitor circular activities and employment. *Sustainable Production and Consumption*, *46*, 42–53. https://doi.org/10.1016/j.spc.2024.02.007

Borms, L., Pals, E., Dams, Y., Brusselaers, J., & Van Passel, S. (2025). *Occupations and skills in the circular economy: Modelling the recycling and waste sectors using a general equilibrium model.* [Working paper].

Borms, L., Van Opstal, W., Brusselaers, J., & Van Passel, S. (2023). The working future: An analysis of skills needed by circular startups. *Journal of Cleaner Production*, *409*, 137261. https://doi.org/10.1016/j.jclepro.2023.137261

Borrero, J. D., & Yousafzai, S. (2025). Spinning the circle: Unravelling the "why?" behind social motivations in circular economy entrepreneurship. *Journal of Enterprising Communities: People and Places in the Global Economy*. https://doi.org/10.1108/JEC-01-2024-0003

Brusselaers, J., Breemersch, K., Geerken, T., Christis, M., Lahcen, B., & Dams, Y. (2022). Macroeconomic and environmental consequences of circular economy measures in a small open economy. *The Annals of Regional Science*, *68*, 283–306. https://doi.org/10.1007/s00168-021-01079-6

Burger, M., Stavropoulos, S., Ramkumar, S., Dufourmont, J., & van Oort, F. (2019). The heterogeneous skill-base of circular economy employment. *Research Policy*, *48*(1), 248–261. https://doi.org/10.1016/j.respol.2018.08.015

Calisto Friant, M., Vermeulen, W. J. V., & Salomone, R. (2024). Transition to a Sustainable Circular Society: More than Just Resource Efficiency. *Circular Economy and Sustainability*, *4*(1), 23–42. https://doi.org/10.1007/s43615-023-00272-3

Cambridge Econometrics, DG Environment (European Commission), ICF, & Trinomics. (2018). *Impacts of circular economy policies on the labour market: Final report and annexes*. Publications Office of the European Union. https://data.europa.eu/doi/10.2779/574719

Cazes, S., Hijzen, A., & Saint-Martin, A. (2015). *Measuring and Assessing Job Quality: The OECD Job Quality Framework*. OECD. https://doi.org/10.1787/5jrp02kjw1mr-en

CBS. (2022, November 9). *Economische indicatoren circulaire economie, 2001-2020*. https://www.cbs.nl/nl-nl/maatwerk/2022/45/economische-indicatoren-circulaire-economie-2001-2020

CE Center. (2025). *Employment in the circular economy – CE monitor*. https://cemonitor.be/en/indicator/effects/socio-economic/employment-in-the-circular-economy/

Cedefop. (2022). *Too good to waste: Tapping the potential of vocational education and training in the waste management sector*.

Cedefop. (2023a). *From linear thinking to green growth mindsets: Vocational education and training (VET) and skills as springboards for the circular economy* (Policy Brief No. 9184). https://www.cedefop.europa.eu/en/publications/9184

Cedefop. (2023b). *Skills in transitions: The way to 2035.* European Centre for the Development of Vocational Training. https://data.europa.eu/doi/10.2801/438491

Cedefop. (2025). *Meeting skill needs for the green transition | CEDEFOP*. https://www.cedefop.europa.eu/en/publications/4220

Cedefop. (2026a). *Cedefop green observatory (web page)*. https://www.cedefop.europa.eu/en/themes/green-observatory

Cedefop. (2026b). *Skills in online job advertisements (web page)*. https://www.cedefop.europa.eu/en/projects/skills-online-job-advertisements

Charter, M., & Keiller. (2014). *Grassroots Innovation and the Circular Economy: A Global Survey of Repair Cafés and Hackerspaces* (p. 19).

Charter, M., & Keiller, S. (2016). *The second global survey of repair cafés: A summary of findings* [Summary Report]. The Centre for Sustainable Design. http://cfsd.org.uk/site-

pdfs/The%20Second%20Global%20Survey%20of%20Repair%20Cafes%20-%20A%20Summary%20of%20Findings.pdf

Circle Economy. (2021a). *Circular Jobs Methodology*. https://legacy.circle-economy.com/resources/circular-jobs-methodology

Circle Economy. (2021b). *How social partners can ensure a just transition to a circular economy*. Circle Economy.

Circle Economy. (2023). *Circular Jobs in City Governments. People driving the circular transition of urban governance.* https://legacy.circle-economy.com/resources/circular-jobs-in-city-governments

Circle Economy. (2024a). *Circular Jobs can boost a Just Transition in Europe*. Deloitte. https://cdn.prod.website-files.com/5d26d80e8836af2d12ed1269/6617a99a2ff86ec0e3022b5b_20240325%20-%20CGR%202024%20-%20Policy%20briefs%20-%20Jobs.pdf

Circle Economy. (2024b). *Circular Jobs Definitions and Methods: Technical Review*. Circle Economy, ILO, World Bank Group.

Circle Economy. (2024c). *Socioeconomic Impacts of European Union Circular Textiles Policies on Trading Partners*. https://legacy.circle-economy.com/resources/socioeconomic-impacts-of-european-union-circular-textiles-policies-on-trading-partners

Circle Economy, ILO, & S4YE. (2023). *Jobs in the circular economy*. S4YE.

Circle Economy, ILO, & World Bank Group. (2025a). *Employment in the circular economy: Leveraging circularity to create decent work.* Circle Economy.

Circle Economy, ILO, & World Bank Group. (2025b). *Employment in the circular economy: Leveraging circularity to create decent work. Technical annexe*. Circle Economy.

Circular Cities Frontrunner group. (2025). *Policy brief on accelerating the circular economy for a prosperous and competitive Europe*. https://circulars.iclei.org/wp-content/uploads/2025/07/final4_edited_policy_paper_ciruclar_cities_frontrunnersgroup_published-685884535.pdf

CISL. (2023). *Inclusive Circularity: Creating decent and fair jobs in the EU*. CLG Europe.

Claudio-Quiroga, G., & Poza, C. (2024). Measuring the circular economy in Europe: Big differences among countries, great opportunities to converge. *Sustainable Development*, *n/a*(n/a). https://doi.org/10.1002/sd.2925

Clube, R. (2022). Is job creation a legitimate social benefit of the circular economy? *Resources, Conservation and Recycling*, *181*, 106220. https://doi.org/10.1016/j.resconrec.2022.106220

Clube, R., & Tennant, M. (2022). Social inclusion and the circular economy: The case of a fashion textiles manufacturer in Vietnam. *Business Strategy & Development*, *5*(1), 4–16. https://doi.org/10.1002/bsd2.179

Cook, E., Silva de Souza Lima Cano, N., & Velis, C. A. (2024). Informal recycling sector contribution to plastic pollution mitigation: A systematic scoping review and quantitative analysis of prevalence and productivity. *Resources, Conservation and Recycling*, *206*, 107588. https://doi.org/10.1016/j.resconrec.2024.107588

D'Adamo, I., Favari, D., Gastaldi, M., & Kirchherr, J. (2024). Towards circular economy indicators: Evidence from the European Union. *Waste Management & Research*, *42*(8), 670–680. https://doi.org/10.1177/0734242X241237171

Dagiliene, L., Varaniute, V., & Sutiene, K. (2025). Impact of organisational capabilities on the implementation of circularity-oriented activities. *Business Strategy and the Environment*, *34*(2), 1607–1624. https://doi.org/10.1002/bse.4044

Derks, M., Bidmon, C., & Ciulli, F. (2024). Circular e-waste ecosystems in necessity-driven contexts: The impact of formal institutional voids. *Business Strategy and the Environment*, *33*(4), 3733–3747. https://doi.org/10.1002/bse.3652

Deutz, P., Jonas, A. E. G., Newsholme, A., Pusz, M., Rogers, H. A., Affolderbach, J., Baumgartner, R. J., & Ramos, T. B. (2024). The role of place in the development of a circular economy: A critical analysis of potential for social redistribution in Hull, UK. *Cambridge Journal of Regions, Economy and Society*, *17*(3), 551–564. https://doi.org/10.1093/cjres/rsae002

Directive (EU) 2024/1275 of the European Parliament and of the Council on the Energy Performance of Buildings (Recast) (2024). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024L1275

Directive (EU) 2024/1799 of the European Parliament and of the Council of 13 June 2024 on Common Rules Promoting the Repair of Goods and Amending Regulation (EU) 2017/2394, 2024/1799 (2024). http://data.europa.eu/eli/dir/2024/1799/oj/eng

Donati, F., Aguilar-Hernandez, G. A., Sigüenza-Sánchez, C. P., de Koning, A., Rodrigues, J. F. D., & Tukker, A. (2020). Modeling the circular economy in environmentally extended input-output tables: Methods, software and case study. *Resources, Conservation and Recycling*, *152*, 104508. https://doi.org/10.1016/j.resconrec.2019.104508

Dumitrescu-Popa, I., Chita, E., Craciun, A., & Panait, M. (2024). Challenges of the Circular Economy: Inequality and Economic Behavior. *Proceedings of the International Conference on Business Excellence*, *18*(1), 798–810. https://doi.org/10.2478/picbe-2024-0070

EC+. (n.d.). *Capacity-building in higher education*. Retrieved https://erasmus-plus.ec.europa.eu/programme-guide/part-b/key-action-2/capacity-building-higher-education

EC. (n.d.). *Circular Cities and Regions Initiative*. Retrieved https://circular-cities-and-regions.ec.europa.eu/

EC. (2019). *European Circular Economy Stakeholder Platform*. https://circulareconomy.europa.eu/platform/en

EC. (2021a). *European Social Fund Plus*. https://european-social-fund-plus.ec.europa.eu/en

EC. (2021b). *Recovery and Resilience Facility*. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en#:~:text=The%20Recovery%20and%20Resilience%20Facility%20%28RRF%29%20is%20a,stronger%20and%20more%20resilient%20from%20the%20current%20crisis.

EC. (2022). *EU Strategy for Sustainable and Circular Textiles*. https://environment.ec.europa.eu/document/download/74126c90-5cbf-46d0-ab6b-60878644b395_en?filename=COM_2022_141_1_EN_ACT_part1_v8.pdf

EC. (2023a). *Ecodesign for Sustainable Products Regulation*. https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en)

EC. (2023b). *EU Action Plan Social Economy*. https://social-economy-gateway.ec.europa.eu/eu-initiatives/seap_en

EC. (2023c). EU Pact for Skills. https://pact-for-skills.ec.europa.eu/index_en

EC. (2023d, February 1). *A Green Deal Industrial Plan for the Net-Zero Age*. European Commission. https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:52023DC0062

EC. (2024, March 20). *Net-zero Industries Academies*. https://ec.europa.eu/newsroom/growth/items/823315/en

EC. (2025a). *COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS The Clean Industrial Deal: A joint roadmap for competitiveness and decarbonisation* (COM(2025) 85 final).

EC. (2025b). *European Alliance for Apprenticeships*. https://employment-social-affairs.ec.europa.eu/policies-and-activities/skills-and-qualifications/working-together/european-alliance-apprenticeships/about-eafa_en

EC. (2025c). *Union of skills: Investing in people for a competitive European Union*. https://commission.europa.eu/topics/eu-competitiveness/union-skills_en

ECNO. (2025). *2025 Flagship Report: State of EU progress to climate neutrality*.

Ecorys. (2012). *The number of Jobs dependent on the Environment and Resource Efficiency improvements* (Final report). Commissioned by DG Environment.

EEA. (2022). *Municipal waste management in the Western Balkan countries* (Briefing No. 06/2022). https://www.eea.europa.eu/publications/municipal-waste-management-in-western/municipal-waste-management-in-the

EEA. (2024a). *About CML*. https://www.eea.europa.eu/en/circularity/about-the-cml

EEA. (2024b). *Delivering justice in sustainability transitions* [Briefing]. https://www.eea.europa.eu/publications/delivering-justice-in-sustainability-transitions

EEA. (2024c). *Just sustainability transitions—From concept to practice*. https://www.eea.europa.eu/en/analysis/publications/just-sustainability-transitions

EEA. (2024d). *PFAS in textiles in Europe's circular economy*. https://www.eea.europa.eu/en/analysis/publications/pfas-in-textiles-in-europes-circular-economy

EEA. (2024e, December 17). *Product lifespans—Monitoring trends in Europe*. https://www.eea.europa.eu/en/analysis/publications/product-lifespans-monitoring-trends

EEA. (2025). *Occupational exposure in recycling facilities (Signal)*. https://www.eea.europa.eu/en/european-zero-pollution-dashboards/indicators/occupational-exposure-in-recycling-facilities-1

EESC. (2023). *Revised monitoring framework for the circular economy*. https://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/revised-monitoring-framework-circular-economy

EIGE. (n.d.). *Specific objective vi. Promoting the transition to a circular economy and resource efficient economy*. Retrieved https://eige.europa.eu/gender-mainstreaming/toolkits/gender-responsive-evaluation-greena/tool-8/step-1/specific-objective-vi

EIGE. (2023). *Online panel survey on gender gaps in unpaid care, individual and social activities—Technical report | European Institute for Gender Equality*. https://eige.europa.eu/publications-resources/publications/online-panel-survey-gender-gaps-unpaid-care-individual-and-social-activities-technical-report?language_content_entity=en

Eiselein, P., & Langenus, M. (2025). Towards a just circular transition: Fostering principles and stakeholder roles in sustainable partnerships. *Journal of Cleaner Production*, *486*, 144450. https://doi.org/10.1016/j.jclepro.2024.144450

EIT Manufacturing. (2021). *Circular Regenerative Economy in Western Balkans*. https://www.eitmanufacturing.eu/news-events/activities/circular-regenerative-economy-in-western-balkans/

Emlet, C. A., & Moceri, J. T. (2012). The Importance of Social Connectedness in Building Age-Friendly Communities. *Journal of Aging Research*, *2012*, 1–9. https://doi.org/10.1155/2012/173247

ETC CE. (2024a). *Germany 2024 circular economy country profile*. https://www.eea.europa.eu/en/topics/in-depth/circular-economy/country-profiles-on-circular-economy/circular-economy-country-profiles-2024/germany_2024-ce-country-profile_final.pdf

ETC CE. (2024b). *Investment needs and gaps for the sustainability transition in Europe: Rethinking the European Green Deal as an EU industrial strategy* (No. 2024/8). https://www.eionet.europa.eu/etcs/etc-ce/products/etc-ce-report-2024-8-investment-needs-and-gaps-for-the-sustainability-transition-in-europe-rethinking-the-european-green-deal-as-an-eu-industrial-strategy

ETC CE. (2024c). *Spain 2024 circular economy country profile*. https://www.eea.europa.eu/en/topics/in-depth/circular-economy/country-profiles-on-circular-economy/circular-economy-country-profiles-2024/spain_2024-ce-country-profile_final.pdf

ETC CE. (2025). *A Just Transition to Circular Economy—Exploring current and potential social implications exemplary for the value chains batteries, plastics, and textiles (ETC CE Report 8/2025)* (ETC CE Report 8/2025). European Topic Centre on Circular Economy and resource use. https://doi.org/10.5281/ZENODO.15494624

ETUI. (2018). *Job quality index (JQI) | etui*. https://www.etui.org/topics/labour-market-employment-social-policy/job-quality-index-jqi

ETUI. (2020, July 17). *The circular economy and 'Green jobs': A new space for social dialogue?* https://www.etui.org/news/circular-economy-and-green-jobs-new-space-social-dialogue

EUI. (n.d.). *European Urban Initiative*. Retrieved 2025

Eurofound. (n.d.). *European Working Conditions Surveys (EWCS) | European Foundation for the Improvement of Living and Working Conditions*. Retrieved 3 July 2025, from https://www.eurofound.europa.eu/en/surveys/european-working-conditions-surveys-ewcs

Eurofound. (2021). *European Working Conditions Telephone survey*. Eurofound. https://www.eurofound.europa.eu/en/surveys-and-data/surveys/european-working-conditions-survey/ewcts-2021/

Eurofound. (2024). *Job quality side of climate change*. https://www.eurofound.europa.eu/en/publications/2024/job-quality-side-climate-change#:~:text=The%20direct%20impact%20of%20climate,services%20are%20particularly%20at%20risk

European Commission. (2019). *The European Green Deal, European Commission, Brussels, Belgium*. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1596443911913&uri=CELEX:52019DC0640#document2

European Commission. (2020a). *A Circular Economy Action Plan (CEAP)*. European Commission. https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

European Commission. (2020b). *European Skills Agenda for sustainable competitiveness, social fairness and resilience*. https://ec.europa.eu/social/main.jsp?langId=en&catId=89&furtherNews=yes&newsId=9723

European Commission. (2020c). *Pact for Skills*. https://pact-for-skills.ec.europa.eu/index_en

European Commission. (2020d, October 4). *COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. Chemicals Strategy for Sustainability Towards a Toxic-Free Environment.* https://circabc.europa.eu/ui/group/8ee3c69a-bccb-4f22-89ca-277e35de7c63/library/dd074f3d-0cc9-4df2-b056-dabcacfc99b6/details?download=true

European Commission. (2021a). *EU funding programmes*. https://commission.europa.eu/funding-tenders/find-funding/eu-funding-programmes_en

European Commission. (2021b). *Social Economy Action Plan*. https://ec.europa.eu/social/main.jsp?catId=1537&langId=en

European Commission. (2024). *Ninth report on economic, social and territorial cohesion*. European Commission. https://doi.org/10.2776/264833

European Commission. (2025a). *Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and The Committee of the Regions The Clean Industrial Deal—A joint roadmap for competitiveness and decarbonisation*. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52025DC0085&qid=1742805523127

European Commission. (2025b). *Learnings: SMEs in the green and circular economy JTP Groundwork in Baranya*. Just Transition Platform.

European Commission. (2025c). *Quality Jobs Roadmap*. https://employment-social-affairs.ec.europa.eu/document/download/82975aa7-bdd6-4a64-b3e3-82433901f8f7_en?filename=Quality-Jobs-Roadmap_Communication_2025.pdf

European Commission. (2025d, November 18). *Jobs in circular economy*. EEA workshop 'Jobs in a Just Circular Transition'.

European Economic and Social Committee. (2023). *Europe's Circular Economy and its Pact for Skills: Working together for an inclusive and job-rich transition?* https://www.eesc.europa.eu/en/our-work/publications-other-work/publications/europes-circular-economy-and-its-pact-skills-working-together-inclusive-and-job-rich-transition

European Investment Bank. (2025). *The InvestEU Advisory Hub*. https://advisory.eib.org/about/the-hub

European Parliament. (2021). *New Circular Economy Action Plan—European Parliament resolution of 10 February 2021 on the New Circular Economy Action Plan (2020/2077(INI))* (P9_TA-PROV(2021)0040). https://www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.pdf

Eurostat. (n.d.). *Social scoreboard*. Social Scoreboard. Retrieved 4 July 2025, from https://ec.europa.eu/eurostat/cache/dashboard/social-scoreboard

Eurostat. (2024). *EU - Labour Force Survey microdata 1983-2023, release 2024* [Data set]. Eurostat. https://doi.org/10.2907/LFS1983-2023

Eurostat. (2025a). *Accidents at work statistics*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Accidents_at_work_statistics

Eurostat. (2025b). *Adult learning—Participants*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Adult_learning_-_participants

Eurostat. (2025c). *Circular economy monitoring framework*. https://ec.europa.eu/eurostat/cache/scoreboards/circular-economy/

Eurostat. (2025d). *Disability employment gap by level of activity limitation and sex (source EU-SILC)* [Data set]. Eurostat. https://doi.org/10.2908/HLTH_DLM200

Eurostat. (2025e). *Employment and activity by sex and age—Annual data ([lfsi_emp_a])*. https://ec.europa.eu/eurostat/databrowser/view/lfsi_emp_a__custom_18405243/default/table

Eurostat. (2025f). *Gender pay gap statistics*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Gender_pay_gap_statistics

Eurostat. (2025g). *Persons employed in circular economy sectors* [Data set]. Eurostat. https://doi.org/10.2908/CEI_CIE011

Eurostat. (2025h). *Unemployment rates by migration status, citizenship and educational attainment level [lfsa_urganedm]*. https://ec.europa.eu/eurostat/databrowser/view/lfsa_urganedm__custom_18406461/default/table?page=time:2024

Eurostat. (2025i). *Young persons neither in employment nor in education and training by labour status (NEET rates)*.

Fabo, B., Kurekova, L. M., & ILO. (2022). *Methodological issues related to the use of online labour market data*. ILO. https://doi.org/10.54394/zzbc8484

Fairbrother, P., & Banks, M. (2024). A Just Transition for Labour: The Challenges of Moves to a Circular Economy. *Relations Industrielles / Industrial Relations*, *78*(2). https://doi.org/10.7202/1109482ar

Fallahi, S., Mellquist, A.-C., Mogren, O., Listo Zec, E., Algurén, P., & Hallquist, L. (2023). Financing solutions for circular business models: Exploring the role of business ecosystems and artificial intelligence. *Business Strategy and the Environment*, *32*(6), 3233–3248. https://doi.org/10.1002/bse.3297

Fernández Intriago, L., Burrow, S., Chakraborty, S., Daniels, R., Finkelstein Shapiro, A., Garcia, H., Heffron, R., Jakob, M., Janser, M., Kerr, S., Leining, C., Maré, D., Pucheta, M., Raimi, D., Rambharos, M., Richardson, E., Tarazona, M., & Terzi, A. (2025). Overcoming five key challenges to make the energy transition a just labor transition. *Nature Communications*, *16*(1), 7541. https://doi.org/10.1038/s41467-025-62905-5

Fernández-Macías, E., & Bisello, M. (2022). A Comprehensive Taxonomy of Tasks for Assessing the Impact of New Technologies on Work. *Social Indicators Research*, *159*(2), 821–841. https://doi.org/10.1007/s11205-021-02768-7

Foster, G., Marschinski, Calisto Friant, M., Leiputé, B., King, T., Fischer, Gausas, S., Svedkauskiene, A., & Langham. (2024). *Socioeconomic impacts of the Circular Economy*. Publications Office of the European Union.

Fytili, D., & Zabaniotou, A. (2022). Organizational, societal, knowledge and skills capacity for a low carbon energy transition in a Circular Waste Bioeconomy (CWBE): Observational evidence of the Thessaly region in Greece. *Science of The Total Environment*, *813*, 151870. https://doi.org/10.1016/j.scitotenv.2021.151870

Galgóczi, B. (2024, April). *Industrial Policy for quality jobs and a Just transition*. https://www.etui.org/sites/default/files/2024-06/Industrial%20policy%20for%20quality%20jobs%20and%20a%20just%20transition-2024.pdf

Garg, A., Raut, R. D., Kumar, M., Zhang, C., & Gokhale, R. S. (2025). Does the circular economy transition aid to carbon neutrality? Examining net-zero policy and stakeholder impact from the environmental justice viewpoint. *Journal of Cleaner Production*, *491*, 144851. https://doi.org/10.1016/j.jclepro.2025.144851

Ghisellini, P., Cialani, C., & Ulgiati, S. (2016). A review on circular economy: The expected transition to a balanced interplay of environmental and economic systems. *Journal of Cleaner Production*, *114*, 11–32. https://doi.org/10.1016/j.jclepro.2015.09.007

Gittins, T., & Letenyei, L. (2024). Informal entrepreneurship and the circular economy in Hungary: Entrepreneurial practices of informal Roma municipal waste collectors. *Eastern Journal of European Studies*, *14*(2), 131–161. https://doi.org/10.47743/ejes-2023-0206

Gittins, T., & Letenyei, L. (2025). Informal waste collection and municipal waste management in Hungary: A pilot project featuring smartphones to estimate the extent of informally retrieved bulky waste. *Waste Management*, *200*, 114757. https://doi.org/10.1016/j.wasman.2025.114757

Grafström, J., & Aasma, S. (2021). Breaking circular economy barriers. *Journal of Cleaner Production*, *292*, 126002. https://doi.org/10.1016/j.jclepro.2021.126002

Gregson, N., Crang, M., Botticello, J., Calestani, M., & Krzywoszynska, A. (2016). Doing the 'dirty work' of the green economy: Resource recovery and migrant labour in the EU. *European Urban and Regional Studies*, *23*(4), 541–555. https://doi.org/10.1177/0969776414554489

Gusheva, E., Gjorgievski, V., Grncarovska, T. O., & Markovska, N. (2022). How do waste climate policies contribute to sustainable development? A case study of North Macedonia. *Journal of Cleaner Production*, *354*, 131572. https://doi.org/10.1016/j.jclepro.2022.131572

Haswell, F., Edelenbosch, O. Y., Piscicelli, L., & van Vuuren, D. P. (2024). The geography of circularity missions: A cross-country comparison of circular economy policy approaches in the Global North and Global South. *Environmental Innovation and Societal Transitions*, *52*, 100883. https://doi.org/10.1016/j.eist.2024.100883

Hobson, K., Holmes, H., Welch, D., Wheeler, K., & Wieser, H. (2021). Consumption Work in the circular economy: A research agenda. *Journal of Cleaner Production*, *321*, 128969. https://doi.org/10.1016/j.jclepro.2021.128969

ICC. (2025). *Intelligent Cities Challenge*. https://www.intelligentcitieschallenge.eu/

ILO. (2008). *Green jobs: Towards decent work in a sustainable, low-carbon world*. Worldwatch Institute. http://www.unep.org/PDF/UNEPGreenjobs_report08.pdf

ILO. (2010). *Global Employment Trends For Youth* (pp. 1–87).

ILO. (2018). *World Employment and Social Outlook: Trends 2018* [Report]. International Labour Organization. http://www.ilo.org/global/research/global-reports/weso/2018/WCMS_615594/lang--en/index.htm

ILO. (2022). *Inclusion of persons with disabilities in the digital and green economy*.

ILO. (2025, June 2). *What is a green job? | International Labour Organization*. https://www.ilo.org/topics-and-sectors/just-transition-towards-environmentally-sustainable-economies-and-societies/what-green-job

industriAll. (2022). *More and fair circular economy: Towards strategic autonomy for industrial jobs and a cleaner environment*. https://news.industriall-europe.eu/documents/upload/2022/12/638055883130940811_Adopted_-_More_and_fair_circular_economy_-_towards_strategic_autonomy_for_industrial_jobs_and_a_cleaner_environment_-_EN.pdf

industriAll. (2024, June 20). *On the path for a just transition for textile and garment workers*. https://www.industriall-union.org/on-the-path-for-a-just-transition-for-textile-and-garment-workers

Industrie-Hubs der Circular Economy—Fraunhofer UMSICHT. (2024, February 15). Fraunhofer-Institut für Umwelt-, Sicherheits- und Energietechnik UMSICHT. https://www.umsicht.fraunhofer.de/de/presse-medien/pressemitteilungen/2024/industrie-hubs-der-circular-economy.html

International Labour Organization,. (2025). *Advancing decent work in supply chains: Decent work challenges and opportunities in the textiles and clothing sector*. ILO. https://doi.org/10.54394/PKJM3600

Irvine, B. (2023). Working the Waste Commodity Frontier: Metabolic Value and Informal Waste Work. *Antipode*, *55*(2), 458–479. https://doi.org/10.1111/anti.12902

ISPRA, & EEA. (2020). *Bellagio Declaration. Circular Economy Monitoring Principles Abstract.* https://epanet.eea.europa.eu/reports-letters/reports-and-letters/bellagio-declaration.pdf?utm_source=chatgpt.com

Jabbour, A. B. L. de S., Rojas Luiz, J. V., Luiz, O. R., Jabbour, C. J. C., Ndubisi, N. O., Caldeira de Oliveira, J. H., & Horneaux Junior, F. (2019). Circular economy business models and operations management. *Journal of Cleaner Production*, *235*, 1525–1539. https://doi.org/10.1016/j.jclepro.2019.06.349

Jaeger-Erben, M., Frick, V., & Hipp, T. (2021). Why do users (not) repair their devices? A study of the predictors of repair practices. *Journal of Cleaner Production*, *286*, 125382. https://doi.org/10.1016/j.jclepro.2020.125382

Jaeger-Erben, M., Jensen, C., Hofmann, F., & Zwiers, J. (2021). There is no sustainable circular economy without a circular society. *Resources, Conservation and Recycling*, *168*, 105476. https://doi.org/10.1016/j.resconrec.2021.105476

Janssens, L., Kuppens, T., & Van Schoubroeck, S. (2021). Competences of the professional of the future in the circular economy: Evidence from the case of Limburg, Belgium. *Journal of Cleaner Production*, *281*, 125365. https://doi.org/10.1016/j.jclepro.2020.125365

Jourdain, V., & Lamah, M.-E. (2024). "Fostering and slackening consumption, downstream and upstream: Consumer's roles in French circular economy". *Journal of Cleaner Production*, *467*, 142884. https://doi.org/10.1016/j.jclepro.2024.142884

Kirchherr, J. (2021). Towards circular justice: A proposition. *Resources, Conservation and Recycling*, *173*, 105712. https://doi.org/10.1016/j.resconrec.2021.105712

Kirchherr, J., Reike, D., & Hekkert, M. (2017). Conceptualizing the circular economy: An analysis of 114 definitions. *Resources, Conservation and Recycling*, *127*, 221–232. https://doi.org/10.1016/j.resconrec.2017.09.005

Korsunova, A., Halme, M., Kourula, A., Levänen, J., & Lima-Toivanen, M. (2022). Necessity-driven circular economy in low-income contexts: How informal sector practices retain value for circularity. *Global Environmental Change*, *76*, 102573. https://doi.org/10.1016/j.gloenvcha.2022.102573

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

Kumar, B., Kumar, A., Sassanelli, C., & Kumar, L. (2025). Exploring the role of finance in driving circular economy and sustainable business practices. *Journal of Cleaner Production*, *486*, 144480. https://doi.org/10.1016/j.jclepro.2024.144480

Laubinger, F., Lanzi, E., & Chateau, J. (2020). Labour Market Consequences of a Transition to a Circular Economy: A Review Paper. *International Review of Environmental and Resource Economics*, *14*(4), 381–416. https://doi.org/10.1561/101.00000120

Leclerc, S. H., & Badami, M. G. (2023). Informal E-Waste Flows in Montréal: Implications for Extended Producer Responsibility and Circularity. *Environmental Management*, *72*(5), 1032–1049. https://doi.org/10.1007/s00267-023-01857-2

Leese, E., Verdonck, J., Porras, S. P., Airaksinen, J., Duca, R. C., Galea, K. S., Godderis, L., Janasik, B., Mahiout, S., Martins, C., Mārtiņsone, I., Ani, M. M., van Nieuwenhuyse, A., Scheepers, P. T. J., Silva,

M. J., Viegas, S., & Santonen, T. (2025). HBM4EU e-waste study – Occupational exposure assessment to chromium, cadmium, mercury and lead during e-waste recycling. *Environmental Research*, *283*, 121892. https://doi.org/10.1016/j.envres.2025.121892

Liu, K. (2025). Contested circular economy and mixed social implications from practice: A scoping review. *Sustainable Development*, *33*(2), 2154–2170. https://doi.org/10.1002/sd.3229

Liu, Z., Schraven ,Daan, de Jong ,Martin, & and Hertogh, M. (2023). The societal strength of transition: A critical review of the circular economy through the lens of inclusion. *International Journal of Sustainable Development & World Ecology*, *30*(7), 826–849. https://doi.org/10.1080/13504509.2023.2208547

Llorente-González, L. J., & Vence, X. (2020). How labour-intensive is the circular economy? A policy-orientated structural analysis of the repair, reuse and recycling activities in the European Union. *Resources, Conservation and Recycling*, *162*, 105033. https://doi.org/10.1016/j.resconrec.2020.105033

Lundberg, P., Vainio, A., Viholainen, N., & Korsunova, A. (2024). Consumers and self-repair: What do they repair, what skills do they have and what are they willing to learn? *Resources, Conservation and Recycling*, *206*, 107647. https://doi.org/10.1016/j.resconrec.2024.107647

Luthin, A., Traverso, M., & Crawford, R. H. (2023). Assessing the social life cycle impacts of circular economy. *Journal of Cleaner Production*, *386*, 135725. https://doi.org/10.1016/j.jclepro.2022.135725

Luukkonen, R., & van den Broek, K. L. (2024). Exploring the drivers behind visiting repair cafés: Insights from mental models. *Cleaner Production Letters*, *7*, 100070. https://doi.org/10.1016/j.clpl.2024.100070

Maalouf, A., & Agamuthu, P. (2023). Waste management evolution in the last five decades in developing countries—A review. *Waste Management & Research: The Journal of the International Solid Wastes and Public Cleansing Association, ISWA*, *41*(9), 1420–1434. https://doi.org/10.1177/0734242X231160099

Magdalena, A. S., Fernández, B. C., & Callén, Y. F. (2025). Financial performance of new circular economy companies in rural settings. *Small Business Economics*, *64*(4), 1953–1980. https://doi.org/10.1007/s11187-024-00971-7

Malcolm, Z., Macaulay, B., & Todd, M. (2024). Towards a circular economy and just transition to net-zero in rural Scotland: Resident perspectives on policy and practice. *Journal of Rural Studies*, *108*, 103300. https://doi.org/10.1016/j.jrurstud.2024.103300

Manshoven, S., & Van Opstal, W. (2022). The Carrot or the Stick? Stakeholder Support for Mandatory Regulations towards a Circular Fashion System. *Sustainability*, *14*(22), Article 22. https://doi.org/10.3390/su142214671

Martin, H. (2025a). Skills for a Circular Economy Transformation—A Regional Case Study From Sweden. *International Journal of Training and Development*, *29*(3), 299–308. https://doi.org/10.1111/ijtd.12360

Martin, H. (2025b). Skills for a Circular Economy Transformation—A Regional Case Study From Sweden. *International Journal of Training and Development*, *n/a*(n/a). https://doi.org/10.1111/ijtd.12360

McCauley, D. (2025). Just circularities: Intersecting livelihoods, technology, and justice in just transition and circular economy. *Journal of Cleaner Production*, *500*, 145176. https://doi.org/10.1016/j.jclepro.2025.145176

Merton, R. K. (1968). The Matthew Effect in Science. *Science*, *159*(3810), 56–63. https://doi.org/10.1126/science.159.3810.56

Mitchell, G., May, A., & Mcdonald, A. (1995). PICABUE: A methodological framework for the development of indicators of sustainable development. *The International Journal of Sustainable Development & World Ecology*, *2*, 104–123. https://doi.org/10.1080/13504509509469893

Moneva, J. M., Scarpellini, S., Aranda-Usón, A., & Alvarez Etxeberria, I. (2023). Sustainability reporting in view of the European sustainable finance taxonomy: Is the financial sector ready to disclose circular economy? *Corporate Social Responsibility and Environmental Management*, *30*(3), 1336–1347. https://doi.org/10.1002/csr.2423

Moraga, G., Huysveld, S., Mathieux, F., Blengini, G. A., Alaerts, L., Van Acker, K., de Meester, S., & Dewulf, J. (2019). Circular economy indicators: What do they measure? *Resources, Conservation and Recycling*, *146*, 452–461. https://doi.org/10.1016/j.resconrec.2019.03.045

Multani, M., & Bachus, K. (2024). Which labour for the CE? An exploration of narratives on labour and circularity in Flanders. *Resources, Conservation and Recycling*, *207*, 107690. https://doi.org/10.1016/j.resconrec.2024.107690

Multani, M., Borms, L., & Bachus, K. (2025). The impact of circularity and circular strategies on firm employment. *Journal of Environmental Management*, *393*, 127144. https://doi.org/10.1016/j.jenvman.2025.127144

Multani, M., Borms, L., Pals, E., & Dunne, A. (2024). *Transitioning to a circular economy: Implications for bottleneck jobs and job quality*.

Nguyen, T. P. L. (2023). Integrating circular economy into STEM education: A promising pathway toward circular citizenship development. *Frontiers in Education*, *8*. https://doi.org/10.3389/feduc.2023.1063755

Niang, A., Bourdin, S., & Torre, A. (2024). The geography of circular economy: Job creation, territorial embeddedness and local public policies. *Journal of Environmental Planning and Management*, *67*(12), 2939–2954. https://doi.org/10.1080/09640568.2023.2210749

Nikoloudakis, N., & Rangoussi, M. (2024). Sustainability in (engineering) education through reclaiming and reusing electronic components from e-waste: A last decade research review. *International Journal of Sustainability in Higher Education*, *26*(1), 181–198. https://doi.org/10.1108/IJSHE-09-2023-0405

Noorbakhsh, S., & Teixeira, A. A. C. (2023). Do refugee inflows contribute to the host countries' entrepreneurial rates? A dynamic panel data analysis, 2000–2019. *Journal of Enterprising Communities: People and Places in the Global Economy*, *18*(3), 487–532. https://doi.org/10.1108/JEC-09-2022-0137

Nuti, A. (2018). Temporary Labor Migration within the EU as Structural Injustice. *Ethics & International Affairs*, *32*(2), 203–225. https://doi.org/10.1017/S089267941800031X

OECD. (2002). *OECD conceptual framework for the testing and assessment of endocrine disrupting chemicals*.
http://www.oecd.org/env/chemicalsafetyandbiosafety/testingofchemicals/oecdconceptualframeworkforthetestingandassessmentofendocrinedisruptingchemicals.htm

PACE. (2021). *Circular Indicators for Governments. Accelerating action in the circular economy.*

Padilla-Rivera, A., do Carmo, B. B. T., Arcese, G., & Merveille, N. (2021). Social circular economy indicators: Selection through fuzzy delphi method. *Sustainable Production and Consumption*, *26*, 101–110. https://doi.org/10.1016/j.spc.2020.09.015

Pansera, M., Barca, S., Martinez Alvarez, B., Leonardi, E., D'Alisa, G., Meira, T., & Guillibert, P. (2024). Toward a just circular economy: Conceptualizing environmental labor and gender justice in circularity studies. *Sustainability: Science, Practice and Policy*, *20*(1), 2338592. https://doi.org/10.1080/15487733.2024.2338592

Parchomenko, A., Nelen, D., Gillabel, J., & Rechberger, H. (2019). Measuring the circular economy—A Multiple Correspondence Analysis of 63 metrics. *Journal of Cleaner Production*, *210*, 200–216. https://doi.org/https://doi.org/10.1016/j.jclepro.2018.10.357

Pirciog, S. C., Grigorescu, A., Lincaru, C., Popa, F. M., Lazarczyk Carlson, E., & Sigurdarson, H. T. (2023). Mapping European high-digital intensive sectors—Regional growth accelerator for the circular economy. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.1061128

Pitkänen, K., Karppinen, T. K. M., Kautto, P., Pirtonen, H., Salmenperä, H., Savolahti, H., Schubin, E., & Myllymaa, T. (2023). How to measure the social sustainability of the circular economy? Developing and piloting social circular economy indicators in Finland. *Journal of Cleaner Production*, *392*, 136238. https://doi.org/10.1016/j.jclepro.2023.136238

Porras Bulla, J., Rendon, M., & Espluga Trenc, J. (2021). Policing the stigma in our waste: What we know about informal waste pickers in the global north. *Local Environment*, *26*(10), 1299–1312. https://doi.org/10.1080/13549839.2021.1974368

Premyanov, N., Roma-Athanasiadou, E., Metta, J., Angelidou, M., & Tsolakis, A. (2024). Circular Entrepreneurship via Makerspaces Towards Fostering Sustainable Cities: A Mixed-Method Approach with Case Studies. *Journal of Circular Economy*, *2*(3). https://doi.org/https://doi.org/10.55845/QZUU6387

Purvis, B., Else ,Tim, Genovese ,Andrea, Jimenez ,Andrea, & and Venkataraman Guru, R. (2025). Grassroots initiatives for a bottom-up transition to a circular economy: Exploring community repair. *Local Environment*, *0*(0), 1–17. https://doi.org/10.1080/13549839.2025.2467385

Ranta, V., Aarikka-Stenroos, L., Ritala, P., & Mäkinen, S. J. (2018). Exploring institutional drivers and barriers of the circular economy: A cross-regional comparison of China, the US, and Europe. *Resources, Conservation and Recycling*, *135*(September 2017), 70–82. https://doi.org/10.1016/j.resconrec.2017.08.017

Rataj, O., Alcorta, L., Raes, J., Yilmaz, E., Riccardo, L. E., & Sansini, F. (2025). Sustainability vs profitability: Innovating in circular economy financing practices by European banks. *Sustainable Production and Consumption*, *53*, 1–16. https://doi.org/10.1016/j.spc.2024.11.025

Re, B., Sanguineti, F., & Previtali, P. (2024). Navigating organizational change through a processual perspective on the transition toward the circular economy: Save The Duck case study. *Journal of Organizational Change Management*, *37*(8), 77–93. https://doi.org/10.1108/JOCM-05-2024-0248

Regulation (EU) 2024/1735 of the European Parliament and of the Council of 13 June 2024 on Establishing a Framework of Measures for Strengthening Europe's Net-Zero Technology Manufacturing Ecosystem and Amending Regulation (EU) 2018/1724 (Text with EEA Relevance), OJ L, 2024/1735, 28.6.2024 (2024). http://data.europa.eu/eli/reg/2024/1735/oj/eng

Rendon, M., Espluga-Trenc, J., & Verd, J.-M. (2021). Assessing the functional relationship between the formal and informal waste systems: A case-study in Catalonia (Spain). *Waste Management*, *131*, 483–490. https://doi.org/10.1016/j.wasman.2021.07.006

Repp, L., Hekkert, M., & Kirchherr, J. (2021). Circular economy-induced global employment shifts in apparel value chains: Job reduction in apparel production activities, job growth in reuse and recycling activities. *Elsevier Resources, Conservation and Recycling*, *171*, 105621. https://doi.org/10.1016/j.resconrec.2021.105621

Resolution of 10 February 2021 on the New Circular Economy Action Plan, P9_TA(2021)0040 (2021). https://www.europarl.europa.eu/doceo/document/TA-9-2021-0040_EN.html

Resolution of 23 November 2023 on Job Creation – the Just Transition and Impact Investments, P9_TA(2023)0438 (2023). https://www.europarl.europa.eu/doceo/document/TA-9-2023-0438_EN.html

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

Román, J. G., & Ophir, A. (2024). Housework time and task segregation: Revisiting gender inequality among parents in 15 European countries. *Demographic Research*, *50*, 503–514.

RREUSE. (2022). *A Plan for a Fair and Inclusive Circular Transition led by Social Enterprises. Analysis of the EU Social Economy Action Plan from RREUSE and its members.* RREUSE.

Saidani, M., Yannou, B., Leroy, Y., Cluzel, F., & Kendall, A. (2019). A taxonomy of circular economy indicators. *Journal of Cleaner Production*, *207*, 542–559. https://doi.org/10.1016/j.jclepro.2018.10.014

Saliba, M., Glutting, J. R., & Goodwin Brown, E. (2023). *Decent Work in the Circular Economy: An overview of the existing evidence base*. https://www.ilo.org/sites/default/files/wcmsp5/groups/public/@ed_dialogue/@sector/documents/publication/wcms_881337.pdf

Sepetis, A. (2022). Chapter 13—Sustainable finance and circular economy. In A. Stefanakis & I. Nikolaou (Eds), *Circular Economy and Sustainability* (pp. 207–226). Elsevier. https://doi.org/10.1016/B978-0-12-819817-9.00002-8

Siderius, T., & Zink, T. (2023). Markets and the Future of the Circular Economy. *Circular Economy and Sustainability*, *3*(3), 1569–1595. https://doi.org/10.1007/s43615-022-00196-4

SMEUnited. (2022, November 30). *Circular Economy is successful if SME oriented*. https://www.smeunited.eu/news/circular-economy-is-successful-if-sme-oriented

Spekkink, W., Rödl, M., & Charter, M. (2020). *Third Global Survey on Repair Cafes*. https://research.uca.ac.uk/5588/5/The%20Third%20Global%20Survey_2020.pdf

Statistics Finland. (2023). *Indicators for the circular economy business | Statistics Finland*. https://stat.fi/tup/kiertotalous/kiertotalousliiketoiminnan-indikaattorit_en.html

Steenmans, K., & Lesniewska, F. (2023). *Circular Economy and the Law: Bringing Justice into the Frame* (1st edn). Routledge. https://doi.org/10.4324/9780429355141

Straub, L., Hartley, K., Dyakonov, I., Gupta, H., van Vuuren, D., & Kirchherr, J. (2023). Employee skills for circular business model implementation: A taxonomy. *Journal of Cleaner Production*, *410*, 137027. https://doi.org/10.1016/j.jclepro.2023.137027

Sumter, D., de Koning, J., Bakker, C., & Balkenende, R. (2021). *Key Competencies for Design in a Circular Economy: Exploring Gaps in Design Knowledge and Skills for a Circular Economy*. *13(2)*(776). https://doi.org/https://doi.org/10.3390/su13020776

Thapa, K., Vermeulen, W. J. V., Deutz, P., & Olayide, O. (2023). Ultimate producer responsibility for e-waste management–A proposal for just transition in the circular economy based on the case of used European electronic equipment exported to Nigeria. *Business Strategy & Development*, *6*(1), 33–52. https://doi.org/10.1002/bsd2.222

The European Pillar of Social Rights Action Plan, COM(2021)102 final (2021). https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=COM%3A2021%3A102%3AFIN

Toussaint, M., Cabanelas, P., & González-Alvarado, T. E. (2021). What about the consumer choice? The influence of social sustainability on consumer's purchasing behavior in the Food Value Chain. *European Research on Management and Business Economics*, *27*(1), 100134. https://doi.org/10.1016/j.iedeen.2020.100134

Tsironis, G., Daglis, T., & Tsagarakis, K. P. (2022). Social media and EU companies' engagement in circular economy: A LinkedIn approach. *Sustainable Production and Consumption*, *32*, 802–816. https://doi.org/10.1016/j.spc.2022.06.006

UNEP. (2020). *Guidelines for social life cycle assessment of products and organizations 2020.* United Nations Environment Programme.

UNIDO. (2025). *Global Stocktake of National Circular Economy Roadmaps and Strategies: 2025 Update*. UNIDO.

U.S. Bureau of Labor Statistics. (2013, January 25). *The BLS Green Jobs Definition*. Bureau of Labor Statistics. https://www.bls.gov/green/green_definition.htm

Valencia, M., Solíz, M. F., & Yépez, M. (2023). Waste picking as social provisioning: The case for a fair transition to a circular economy. *Journal of Cleaner Production*, *398*, 136646. https://doi.org/10.1016/j.jclepro.2023.136646

Valero, A., Li, J., Muller, S., Riom, C., Nguyen-Tien, V., & Draca, M. (2021). *Are 'green' jobs good jobs? How lessons from the experience to-date can inform labour market transitions of the future*. Grantham Research Institute on Climate Change and the Environment and Centre for Economic Performance, London School of Economics and Political Science.

Van Opstal, W., Bocken, N., & Brusselaers, J. (2025). Unlocking the social circular economy: Value propositions and organisational design of social circular hubs. *Business Strategy and the Environment*. https://doi.org/https://doi.org/10.1002/bse.70138

Van Opstal, W., Bocken, N., & Brusselaers, J. (2026). The Roles of Civil Society Associations in Organising the Informal Circular Economy. *Sustainable Development*, *34*(S1). https://doi.org/10.1002/sd.70168

Van Opstal, W., & Borms, L. (2023). Startups and circular economy strategies: Profile differences, barriers and enablers. *Journal of Cleaner Production*, *396*, 136510. https://doi.org/10.1016/j.jclepro.2023.136510

Van Opstal, W., & Borms, L. (2024). Work integration ambitions of startups in the circular economy. *Annals of Public and Cooperative Economics*, *95*(2), 477–504. https://doi.org/10.1111/apce.12431

Van Opstal, W., & Borms, L. (2025). Subsidizing repair: Implications for the formal and informal circular economy. *Journal of Cleaner Production*, *518*, 145898. https://doi.org/10.1016/j.jclepro.2025.145898

Van Opstal, W., Borms, L., Brusselaers, J., Bocken, N., Pals, E., & Dams, Y. (2024). Towards sustainable growth paths for work integration social enterprises in the circular economy. *Journal of Cleaner Production*, *470*, 143296. https://doi.org/10.1016/j.jclepro.2024.143296

Van Opstal, W., & Manshoven, S. (2024). From trust to transition: Residential customer acceptance of circular solar business models. *Energy Research & Social Science*, *115*, 103647. https://doi.org/10.1016/j.erss.2024.103647

Van Opstal, W., Pals, E., & Sangers, D. (2025). Mapping the prevalence and size of the informal circular economy in an industrialised region. *Resources, Conservation and Recycling*, *218*, 108268. https://doi.org/10.1016/j.resconrec.2025.108268

Velis, C., Hardesty, B. D., Cottom, J. W., & Wilcox, C. (2022). Enabling the informal recycling sector to prevent plastic pollution and deliver an inclusive circular economy. *Environmental Science & Policy*, *138*, 20–25. https://doi.org/10.1016/j.envsci.2022.09.008

Waas, T., Hugé, J., Block, T., Wright, T., Benitez-Capistros, F., & Verbruggen, A. (2014). Sustainability Assessment and Indicators: Tools in a Decision-Making Strategy for Sustainable Development. *Sustainability*, *6*(9), Article 9. https://doi.org/10.3390/su6095512

Walker, A., Albizzati, P. F., Milios, L., Pinero, M. P., Besler, M., Pedauga, L., Eder, P., & Tonini, D. (2025). *Capturing the Potential of the Circular Economy Transition in Energy-Intensive Industries*. JRC Publications Repository. https://doi.org/10.2760/4604362

Weghmann, V. (2017). *Waste Management in Europe. Good Jobs in the Circular Economy*. EPSU.

Wiebe, K. S., Harsdorff, M., Montt, G., Simas, M. S., & Wood, R. (2019). Global Circular Economy Scenario in a Multiregional Input–Output Framework. *Environmental Science & Technology*, *53*(11), 6362–6373. https://doi.org/10.1021/acs.est.9b01208

Wijkman, A., & Skånberg, K. (2015). *The Circular Economy and Benefits for Society Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency A study pertaining to Finland, France, the Netherlands, Spain and Sweden*. Club of Rome.

Willeghems, G., & Bachus, K. (2018). *Employment impact of the transition to a circular economy: Literature study*.

Willeghems, G., & Bachus, K. (2019). *Modelling job creation in the circular economy in Flanders* (CE Center publication N° 7). CE Center - Circular Economy Policy Research Center. https://ce-center.vlaanderen-circulair.be/en/publications/publication/7-modelling-job-creation-in-the-circular-economy-in-flanders

Wilson, D. C., Velis, C., & Cheeseman, C. R. (2006). Role of Informal Sector Recycling in Waste Management in Developing Countries. *Habitat International*, *30*, 797–808.

Ziegler, R., Bauwens, T., Roy, M. J., Teasdale, S., Fourrier, A., & Raufflet, E. (2023). Embedding circularity: Theorizing the social economy, its potential, and its challenges. *Ecological Economics*, *214*, 107970. https://doi.org/10.1016/j.ecolecon.2023.107970

Annex – Circular jobs in the EU: NACE codes

This annex provides an overview of all sectors classified as circular under Eurostat's circular economy sector classification. The sectors are reported using NACE codes at the four-digit level.

Circular Economy Sector: good or service description	NACE Rev. 2 (2008)	NACE Description
Filter Gravel for water and wastewater filtration	08.12	Operation of gravel and sand pits; mining of clays and kaolin
Collection of waste resulting from the extraction of raw materials;	09	Mining support service activities
Collection of waste resulting from the extraction of raw materials;	09	Mining support service activities
Paper recycling	17.1	Manufacture of pulp, paper and paperboard
Ozone for water desinfection	20.11	Manufacture of industrial gases
Chlorine for water desinfection	20.13	Manufacture of other inorganic basic chemicals
Recyclate from waste plastic	20.16	Manufacture of plastics in primary forms
Activated carbon for water filtering purposes	20.59	Manufacture of other chemical products n.e.c.
Retreading of tyres	22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
Camel-back strips for retreading rubber tyres	22.11	Manufacture of rubber tyres and tubes; retreading and rebuilding of rubber tyres
Manufacture of reclaimed rubber in primary forms or in plates, sheets or strip;	22.19	Manufacture of other rubber products
Sewage infrastructure: sieve/trench drain strainer/Perforated buckets and similar articles used to filter water at the entrance to sewage drains;	22.29	Manufacture of other plastic products
Recycled glass	23.13	Manufacture of hollow glass
Lime for waste water treatment plant; Flue gas desulfurization of thermal treatment plants	23.52	Manufacture of lime and plaster
Concrete sewage pipes	23.61	Manufacture of concrete products for construction purposes
Melting of iron wastes (not in 38.3): Basic iron and steel and ferro-alloys	24.10	Manufacture of basic iron and steel and of ferro-alloys
Material recovery: Production of secondary aluminium by electrorefining from residuals and waste materials (not in 38.3)	24.42	Aluminium production
Material recovery: Production of secondary copper by electro-refining from residuals and waste materials (not in 38.3)	24.44	Copper production
Material recovery: non-FE metals	24.45	Other non-ferrous metal production
Tubes and pipes for sewage system	24.51	Casting of iron
Parts for sewage infrastructure	25.99	Manufacture of other fabricated metal products n.e.c.
Waste water treatment: hydrological analysis appliances	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
Waste water treatment: Appliances for chemical and physical examination of waste water; instruments for waste analysis and treatment	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
Instruments for waste analysis and treatment; Sensors for material efficient production	26.51	Manufacture of instruments and appliances for measuring, testing and navigation
Pumps for use in wastewater treatment	28.13	Manufacture of other pumps and compressors
Parts for pumps for use in wastewater treatment	28.13	Manufacture of other pumps and compressors
Reloading facility, waste conveying system	28.22	Manufacture of lifting and handling equipment
Waste processing: Manufacture of weighing machinery	28.29	Manufacture of other general-purpose machinery n.e.c.
Machinery and apparatus for filtering or purifying water	28.29	Manufacture of other general-purpose machinery n.e.c.
Manufacture of machinery and apparatus for filtering or purifying gases and liquid	28.29	Manufacture of other general-purpose machinery n.e.c.
Machinery for metal recovery: Mechanical engineering product to classify, separate and sort wastes	28.41	Manufacture of metal forming machinery
Metal scrap processing machines	28.41	Manufacture of metal forming machinery
Machinery for metal recovery: Mechanical engineering product to classify, separate and sort wastes	28.49	Manufacture of other machine tools
Reloading facility, waste conveying system	28.91	Manufacture of machinery for metallurgy

Facilities to agglomerate, compress, mix, metal pellet wastes	28.91	Manufacture of machinery for metallurgy
Machines for waste treatment: Mechanical engineering product to classify, separate and sort wastes	28.92	Manufacture of machinery for mining, quarrying and construction
Machinery for retreading pneumatic tyres or plastic recyclate	28.96	Manufacture of plastics and rubber machinery
Machinery for plastic recovery: Mechanical engineering product to classify, separate and sort wastes	28.96	Manufacture of plastics and rubber machinery
Machinery for wood and paper waste	28.99	Manufacture of other special-purpose machinery n.e.c.
Mechanical engineering product for disassembly, waste shredding, screening and classifying	28.99	Manufacture of other special-purpose machinery n.e.c.
Vehicles for wastewater treatment, vehicles for sewer cleaning, trucks for waste collection;Manufacture of vehicles for wastewater treatment, vehicles for sewer cleaning, trucks for waste collection; Refuse collection vehicles, street sweepers and cleaners	29.10	Manufacture of motor vehicles
Heavy-duty vehicle bodywork for refuse collection vehicles	29.10	Manufacture of motor vehicles
Heavy-duty vehicle bodywork for refuse collection vehicles	29.20	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
Conversion and reconstruction of ships, floating platforms and structures;	30.11	Building of ships and floating structures
Reconditioning of railway and tramway locomotives and rolling-stock	30.20	Manufacture of railway locomotives and rolling stock
Reconditioning of aircraft: civilians	30.30	Manufacture of air and spacecraft and related machinery
Reconditioning of civil aircraft engines	30.30	Manufacture of air and spacecraft and related machinery
Reconditioning of civil helicopters	30.30	Manufacture of air and spacecraft and related machinery
Repair of fabricated metal products, machinery and equipment	33.11	Repair of fabricated metal products
Repair of fabricated metal products, machinery and equipment	33.12	Repair services of machinery
Repair of fabricated metal products, machinery and equipment	33.13	Repair services of electronic and optical equipment
Repair of fabricated metal products, machinery and equipment	33.14	Repair services of electrical equipment
Repair of fabricated metal products, machinery and equipment	33.15	Repair and maintenance services of ships and boats
Repair of fabricated metal products, machinery and equipment	33.16	Repair and maintenance services of aircraft and spacecraft
Repair of fabricated metal products, machinery and equipment	33.17	Repair and maintenance services of other transport equipment
Repair of fabricated metal products, machinery and equipment	33.19	Repair services of other equipment
Installation of waste systems and conveyors	33.20	Installation of industrial machinery and equipment
Installation of waste, waste-water systems and conveyors	33.20	Installation of industrial machinery and equipment
Installation of waste systems and conveyors	33.20	Installation of industrial machinery and equipment
Planning and installation of industrial process control equipment; installation services in waste management	33.20	Installation of industrial machinery and equipment
Sewerage services: e.g. collecting, transporting and treating wastewater; operation, maintenance and cleaning of sewer systems;Provision of sewerage services: e.g. collecting, transporting and treating wastewater; operation, maintenance and cleaning of sewer systems; Sewage	37.0	Sewerage
Collection of waste	38.1	Waste collection
Waste treatment (excluding landfill, incineration and nuclear waste treatment) (not otherwise included in 38.3 due to primary allocation)	38.2	Waste treatment and disposal
Materials recovery	38.3	Materials recovery
Remediation activities and other waste management services	39.00	Remediation activities and other waste management services
Maintenance and repair of water networks (utility)	42.21	Construction of utility projects for fluids
Maintenance and repair of water networks (pipelines)	42.21	Construction of utility projects for fluids
Construction work for sewage systems (utility)	42.21	Construction of utility projects for fluids
Construction work for sewage systems (pipelines)	42.21	Construction of utility projects for fluids
Construction work for waste treatment plants	42.21	Construction of utility projects for fluids
Construction work for waste treatment plants	42.99	Construction of other civil engineering projects n.e.c.
Maintenance and repair services for reducing water losses	43.22	Plumbing, heat and air-conditioning installation
Maintenance and repair of motor vehicles	45.20	Maintenance and repair of motor vehicles
Wholesale of waste and scrap	46.77	Wholesale of waste and scrap

Retail sale of second-hand goods in stores (ecl. Antics)	47.79	Retail sale of second-hand goods in stores
Architectural services for wastewater and waste management projects	71.11	Architectural activities
Engineering services for sewerage and drainage projects	71.12	Engineering activities and related technical consultancy
Engineering services for waste management projects;	71.12	Engineering activities and related technical consultancy
Rental and leasing of cars and light motor vehicles	77.11	Rental and leasing of cars and light motor vehicles
Rental and leasing of trucks	77.12	Rental and leasing of trucks
Renting and leasing of recreational and sports goods	77.21	Rental and leasing of recreational and sports goods
Renting of video tapes and disks	77.22	Rental of video tapes and disks
Renting and leasing of other personal and household goods	77.29	Rental and leasing of other personal and household goods
Renting and leasing of agricultural machinery and equipment	77.31	Rental and leasing of agricultural machinery and equipment
Renting and leasing of construction and civil engineering machinery and equipment	77.32	Rental and leasing of construction and civil engineering machinery and equipment
Renting and leasing of office machinery and equiment (including computers)	77.33	Rental and leasing of office machinery and equipment (including computers)
Renting and leasing of water transport equipment	77.34	Rental and leasing of water transport equipment
Renting and leasing of air transport equipment	77.35	Rental and leasing of air transport equipment
Renting and leasing of other machinery, equipment and tangible goods n.e.c.	77.39	Rental and leasing of other machinery, equipment and tangible goods n.e.c.
Library and archive services	91.01	Library and archives activities
Repair of computers and peripheral equipment	95.11	Repair of computers and peripheral equipment
Repair of communication equipment	95.12	Repair of communication equipment
Repair of consumer electronics	95.21	Repair of consumer electronics
Repair of household appliances and home and garden equipment	95.22	Repair of household appliances and home and garden equipment
Repair of footwear and leather goods	95.23	Repair of footwear and leather goods
Repair of furniture and home furnishings	95.24	Repair of furniture and home furnishings
Repair of watches, clocks and jewellery	95.25	Repair of watches, clocks and jewellery
Repair of other personal and household goods	95.29	Repair of other personal and household goods
Washing and (dry-)cleaning of textile and fur products (partially)	96.01	Washing and (dry-)cleaning of textile and fur products

European Topic Centre on
Circular economy and resource use
https://www.eionet.europa.eu/etcs/etc-ce

The European Topic Centre on Circular economy and resource use (ETC CE) is a consortium of European institutes under contract of the European Environment Agency.

European Environment Agency
European Topic Centre
Circular economy and resource use