International Journal of Product Lifecycle Management

ISSN online: 1743-5129 - ISSN print: 1743-5110
https://www.inderscience.com/ijplm

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Adriana Hofmann Trevisan, Federica Acerbi, Irene Pellucchi, Iskra Dukovska-Popovska, Giorgio Mossa, Sergio Terzi, Claudio Sassanelli

DOI: 10.1504/IJPLM.2026.10078239

Article History:

Received:	21 October 2025
Last revised:	23 January 2026
Accepted:	27 January 2026
Published online:	19 June 2026

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Adriana Hofmann Trevisan

Department of Management, Economics and Industrial Engineering,
Politecnico Di Milano,
Via Lambruschini, 4/B, 20156 Milan, Italy
Email: adriana.hofmann@polimi.it
and
School of Public Health,
University of São Paulo,
01246904 São Paulo, Brazil
Email: adrianatrevisan@alumni.usp.br

Federica Acerbi

Department of Management, Economics and Industrial Engineering,
Politecnico Di Milano,
Via Lambruschini, 4/B, 20156 Milan, Italy
Email: federica.acerbi@polimi.it

Irene Pellucchi

Erion Compliance Organization Scarl,
Via Messina 38, 20154 Milan, Italy
Email: irene.pellucchi@erion.it

Iskra Dukovska-Popovska

Department of Materials and Production,
Aalborg University,
9220 Aalborg, Denmark
Email: iskra@mp.aau.dk

Giorgio Mossa

Department of Mechanics, Mathematics and Management,
Politecnico di Bari,
Via Orabona 4, 70125 Bari, Italy
Email: giorgio.mossa@poliba.it

Sergio Terzi

Department of Management, Economics and Industrial Engineering,
Politecnico Di Milano,
Via Lambruschini, 4/B, 20156 Milan, Italy
Email: sergio.terzi@polimi.it

Claudio Sassanelli*

Department of Mechanics, Mathematics and Management,
Politecnico di Bari, Via Orabona 4, 70125 Bari, Italy
Email: claudio.sassanelli@poliba.it
*Corresponding author

Abstract: The industrial sector requires skilled professionals to implement circular practices. With the advent of digital transformation, this demand for skilled labour is growing. Clear understanding of the real needs of industry is a valuable input to educational institutions to design training programs that effectively meet the skill requirements of organisations in the labour market. Therefore, this study aims to map the industrial and practical requirements related to the skills and job roles essential for advancing the transition to a circular economy (CE). To this end, an online exploratory survey was conducted with 102 experts from firms interested in or engaged in CE-related activities. This article discusses a set of skills required by industry, the main barriers to CE implementation, highlighting the necessity of a skilled workforce, and explores the different educational formats most needed to strengthen professional training for a twin green and digital transition.

Keywords: skills; circular economy; manufacturing; competences; workforce; education; job roles.

Reference to this paper should be made as follows: Trevisan, A.H., Acerbi, F., Pellucchi, I., Dukovska-Popovska, I., Mossa, G., Terzi, S. and Sassanelli, C. (2026) 'A survey on skills and education needs for the industrial circular economy transition', *Int. J. Product Lifecycle Management*, Vol. 16, No. 2, pp.218–251.

Biographical notes: Adriana Hofmann Trevisan is Assistant Professor in the Department of Environmental Health at the School of Public Health, University of São Paulo (USP). From 2024 to 2025, she was a Research Fellow at the School of Management of Politecnico di Milano (POLIMI) and a member of the European consortium Circular Economy Innovation Ecosystems – Redesigning Skills (CERES). She holds a PhD and a Master's degree in Production Engineering from USP (EESC) and a bachelor's degree in Environmental Engineering from State University of Pará (UEPA). Her research focuses on circular economy, digital transformation, reverse logistics, and product-service systems (PSS).

Federica Acerbi is an Assistant Professor in the Manufacturing Group at Politecnico di Milano's Department of Management, Economics and Industrial Engineering. She earned her PhD at the same university, working across academic and industrial contexts with a focus on sustainable operations management in manufacturing. Her research addresses data and information valorisation to support circular economy strategies in industry. She participates in European and national research projects and in consultancy initiatives for

digital transformation. She teaches sustainable manufacturing and operations management at master level and a bachelor course on production systems. She is a member of AIDI and IFIP WG 5.7, co-leading a special interest group on Eco-efficient and Circular Industrial Systems.

Irene Pellucchi is a Senior Researcher (Strategic Development & Innovation Expert) at Erion, Italy's leading Extended Producer Responsibility System. Holding a Master's degree in Development Cooperation Policy and a postgraduate in Sustainability from ALTIS – Graduate School of Sustainable Management, she contributes to EU-funded projects and innovation studies focused on WEEE and WBA. Within the Strategic Development & Innovation team, she leads environmental education and awareness initiatives and fosters collaborations with Associations and Universities.

Iskra Dukovska-Popovska is an Associate Professor at the Department of Materials and Production, Aalborg University. Her research is in the field of sustainable supply chain management and planning, with a particular emphasis on empirical and design science approaches to sustainable operations. Her work spans issues such as sales and operations planning in industrial and retail contexts, information sharing and replenishment planning in fresh food supply chains, and reverse logistics and circular supply chain design for end of life textiles, including collection systems, supply-demand balances and circular economy strategies for textile recycling.

Giorgio Mossa is a Full Professor of Industrial Systems Engineering and former Program Director of the Master of Science (MSc) in Industrial Engineering and Management at the Polytechnic University of Bari (Italy). He is Rector Delegate for Continuing Education, and member of the Board of the PhD Course on 'Management Engineering' at the Polytechnic University of Bari. His main research topics are design and management of industrial systems and supply chains, circular economy in industry, sustainable logistics and human performance modelling.

Sergio Terzi is a Full Professor at Politecnico di Milano's Department of Management, Economics, and Industrial Engineering and Co-founder of Miraitek 4.0, a university spin-off. He served as an Associate Professor at the same department from 2014 to 2022 and has been Visiting Professor at the University of Lyon in 2008 and 2018. Previously, he was a researcher and Assistant Professor at the University of Bergamo (2005–2014), earning his PhD in 2005. He holds an MSc in Economics and Business Administration (2001) and a BSc in Industrial Engineering (1999) from LIUC. Since 2026, he is the Deputy Director of his department at Politecnico Milano.

Claudio Sassanelli is an Associate Professor at Politecnico di Bari and Senior Research Fellow at École des Ponts Business School. He holds a Masters degree in Management and Civil Engineering and a PhD in Management, Economics and Industrial Engineering. His research focuses on circular economy, with particular emphasis on product-service systems, product lifecycle management, design for X, and industry 4.0. He has held visiting positions at Tokyo Metropolitan University (Japan) and Universidade de São Paulo (Brazil), authored around 140 scientific publications, serves as guest editor and editorial board member for several journals, and has over ten years of experience in international research and innovation projects. Within the IFIP W.G. 5.7 community, he is a co-leader of the special interest group on service systems design, engineering and management.

This paper is a revised and expanded version of a paper entitled 'A survey investigating skills, job profiles, and education in Circular Economy: a practice perspective' presented at IFIP 21st International Conference on Product Lifecycle Management, Bangkok, Thailand, 7–10 July 2024.

1 Introduction

In recent years, a growing number of studies have shown that the adoption of digital technologies significantly boosts practices associated with the circular economy (CE) (Findik et al., 2023; Sassanelli et al., 2023). Industry 4.0 technologies [e.g., the internet of things (IoT), big data, artificial intelligence (AI)] enable improvements in both operational processes and organisational strategy (Kristoffersen et al., 2020). Operationally, these technologies contribute to maintenance services (Rusch et al., 2023), and to tracking data and information throughout the circular lifecycle management (Sassanelli et al., 2020a). At the strategic level, the use of data enables more assertive decision-making based on concrete information (Acerbi et al., 2025a). Therefore, the transition to the CE can be driven by the advancement of digital innovation (Rosa et al., 2020; Sassanelli et al., 2023), considering skilled labour and industrial capabilities (Trevisan et al., 2024). In this context, it is essential that professionals in the labour market develop the skills necessary to direct this transformation (Akyazi et al., 2023). Skill can be described as "a particular ability that you develop through training and experience and that is useful in a job" (Cambridge Dictionary, 2025).

Previous scholars (Pinzone and Taisch, 2023; Straub et al., 2023; Vitti et al., 2025) emphasise that a successful transition requires skills that go far beyond technical aspects (such as circular product design and energy management). Social and interpersonal skills are also critical (e.g., negotiation, teamwork, critical thinking) (Akyazi et al., 2022; Ghobakhloo et al., 2023), in addition to digital skills (such as data analysis and programming) (Luo and Qiao, 2023). Hence, the industry requires a workforce with multiple skills, capable of addressing the challenges posed by the simultaneous digital and green transitions and transforming them into opportunities (Akyazi et al., 2022). This intertwined and concurrent green and digital transformation is known as the *twin transition* (Rehman et al., 2023), a concept that has gained prominence since 2020, particularly in light of European Union policy frameworks aimed at driving a sustainable and digital future for the continent (Council of European Union, 2020; European Commission, 2020). The twin transition entails several interrelated challenges, including the need for a strategic business vision that integrates sustainability goals with digitalisation (Llorente, 2024), the alignment of organisational structures and processes to support both transitions simultaneously (Muench et al., 2022), and the development of new competencies combining technical, digital, and resilience skills (Trevisan et al., 2024). In this context, the role of education and training systems becomes central, as they are expected to equip the workforce with the skills and competences required to respond to these emerging challenges.

Educational systems need to provide training that is better aligned with evolving market requirements (Boscarato et al., 2024). Recent studies based on interviews with industry professionals have highlighted the need for workforce qualification and upskilling to enable workers to perform the activities currently required by the industry (Acerbi et al., 2024). Complementarily, other studies highlighted a mismatch between

existing educational programs and the skills required by the labour market, pointing to the need for the establishment of training programs that prepare employees to address contemporary requirements, such as the use of digital technologies to support circular practices (Boscarato et al., 2024; Trevisan et al., 2025). This educational gap is directly reflected in the labour market, as employment opportunities in the 'green area' are increasing almost twice as fast as the supply of qualified workers, as highlighted by the World Economic Forum (WEF) based on LinkedIn data (WEF, 2024).

The lack of managerial skills in industry, for example, can increase production costs, as ineffective management compromises the ability to define, monitor, and adjust process according to technically and economically feasible targets (Ada et al., 2023). Empirical evidence shows that improvements in management practices, such as the implementation of lean manufacturing techniques, result in higher product quality and increased operational efficiency, ultimately improving productivity and profitability (Bloom et al., 2013). However, translating these requirements into practice depends on a workforce that is properly equipped, otherwise, insufficient capabilities may become an obstacle to the transition (Lobo et al., 2021). According to the WEF, in its latest Future of Jobs Report 2025, skills gaps are considered the main barriers to a global transformation in industry, leading 85% of employers interested in reskilling their workforce (WEF, 2025). This workforce is composed of heterogeneous roles, ranging from more operational professionals (e.g., reverse logistics operators, maintenance and repair operators) to professionals at the organisational strategic level (e.g., circular business managers) (Beducci et al., 2024).

Indeed, it is becoming increasingly essential that people have the skills and are empowered to access the job opportunities (Vitti et al., 2025). Although the literature on education for CE has been gaining increasing attention (e.g., Marcon and Sehnem, 2024; Renfors, 2024), it remains unclear which competencies are essential from an empirical perspective. Previous research, though a systematic literature review, has identified the most critical skills, such as circular product design, effective communication, circular remanufacturing, collaboration and network-building capabilities, among others (Trevisan et al., 2024). However, a clear understanding of the current state of business practices and organisation needs remains a crucial input for educational institutions when designing training and upskilling programs that effectively address labour market requirements. In particular, gaining insight into companies' awareness of, preferences for, and utilisation of existing education and training opportunities is essential.

Building upon this gap, the following research questions are proposed:

RQ1 Which skills and job roles are required by industry, to support the transition to a CE?

RQ2 What barriers and opportunities influence the development of skills for CE implementation?

RQ3 Which training formats are preferable for building CE skills?

This study aims to map the industrial and practical requirements related to the skills and job roles essential for advancing a circular model. To achieve this aim, an exploratory survey was conducted with CE experts interested in or engaged in CE-related activities. The main contribution of this study is the provision of an empirically grounded set of skills required by industry. It also discusses the main barriers to CE implementation, highlighting their implications for the development of a skilled workforce. Finally, the

study highlights the different educational formats (e.g., online tutorials, formal certification, traditional academic training) that are most needed to strengthen professional training in this context. These research objectives are in line with previous studies (e.g., Beducci et al., 2024; Vitti et al., 2025) that emphasised the need for further research to address skills and educational development in order to advance CE initiatives.

The results presented in this paper are part of the Circular Economy Innovation Ecosystems Redesigning Skills (CERES) project, which aims to empower the next-generation workforce to address the challenges of the twin transition through the development of courses and educational services targeted at higher education (HE) and vocational education and training (VET) levels. Drawing on a literature review, market analysis, interviews, and a survey with companies, the project developed a CE skills framework (Trevisan et al., 2025). The framework identifies the key skills required to support the CE transition from both theoretical and empirical perspectives, while also highlighting skill gaps that require further reinforcement through targeted CE educational programs. Accordingly, this study focuses specifically on the empirical component based on survey that supported the framework's development presented in Trevisan et al. (2025).

This paper is structured as follows. Section 2 presents the research background focused on education for a CE. Section 3 addresses the research method, based on a survey conducted with professionals from organisations involved in CE. Section 4 presents the results. Section 5 discusses the findings and offers theoretical and practical implications. Finally, Section 6 addresses the conclusions, limitations, and opportunities for future studies.

2 Education for a CE

CE is an economic model that replaces the linear system characterised by take-make-dispose to focus on the recirculation of materials (Ellen MacArthur Foundation, 2015). One of the most recognised CE definitions was proposed in 2017 by Kirchherr et al. and revisited in 2023 after an analysis of 221 definitions, which indicated that the model has been gaining maturity over the years. Building on this conceptual consolidation, the CE can be understood as "a regenerative economic system which necessitates a paradigm shift to replace the 'end of life (EoL)' concept with reducing, alternatively reusing, recycling, and recovering materials throughout the supply chain" [Kirchherr et al., (2023), p.7].

Given that the implementation of CE paradigm depends on changes in knowledge, skills, and organisational practices, education for the CE is gaining increasing relevance. This relevance is not only related to stimulating long-term behavioural changes in society (Tiippana-Usvasalo et al., 2023), but also to preparing professionals to address the organisational barriers that arise along the transition journey, including the limited availability and insufficient sharing of information on materials throughout the product life cycle (Panza et al., 2022). In general, these barriers can range from a lack of financial resources to a shortage of skilled labour to implement more sustainable practices (Akyazi et al., 2022). According to Kumar et al. (2021), many companies still struggle to hire professionals who combine technological knowledge with the ability to optimise resources, or to integrate environmental knowledge with digital technology applications (Lobo et al., 2021). This problem may be related to various factors: weaknesses in

educational systems (Cezarino et al., 2019), high demand in the face of a low supply of qualified professionals (WEF, 2024), or even the need for more training programs to prepare workers to deal with the complexities of the transition (Boscarato et al., 2024). The lack of professionals with suitable profiles (Beducci et al., 2024) may further hinder the establishment of partnerships along the supply chain (Taddei et al., 2024), while persistent gaps in know-how continue to limit organisational progress.

Indeed, implementing circular strategies (e.g., reuse, remanufacturing, designing products for durability, and establishing take-back systems) is not a simple effort (Sanches et al., 2022; Spreafico and Landi, 2022), especially when combined with digital technologies that are driving profound changes in industry (Akyazi et al., 2022; Liu et al., 2022). Engaging multiple stakeholders is often essential (Trevisan et al., 2023), particularly to enable the collective coordination of resources, infrastructure, and knowledge across organisations (Del Vecchio et al., 2020; Konietzko et al., 2020). It is recognised that CE requires innovative solutions, process improvements, and skills for a successful transition (Whitehill et al., 2022). It is not possible to consider only time of experience without adequate training (Spreafico and Landi, 2022). Given this context, it is essential that educational institutions adapt and be flexible to market demands (Burger et al., 2019; Whitehill et al., 2022), following the needs of firms and converting these needs into the development of professionals with the right skill sets (Akyazi et al., 2022).

With the advent of digital transformation and the challenges associated with climate change, skilling and upskilling individuals has become even more indispensable. Professionals need appropriate skills to effectively learn and use technologies for the implementation of sustainable practices (e.g. the use of big data to facilitate industrial symbiosis) (Beducci et al., 2024; Pinzone and Taisch, 2023), and also to coordinate all product lifecycle stages (Panza et al., 2022; Sassanelli et al., 2020a). Education is the foundation for preparing future employees regardless of the field (Knudby and Larsen, 2017). In this sense, the role of the teacher is to recognise students' knowledge gaps and reinforce the topics that demand greater attention and exploration (Spreafico and Landi, 2022).

Recent literature has discussed this topic. For example, Renfors (2024) analysed 22 papers on CE-related courses in HE and identified that innovative approaches (e.g., games, real-world experiences) need to be incorporated into educational systems. Similarly, Marcon and Sehnem (2024) explored technology-based teaching methodologies and highlighted that simulations and games can be important enablers for the development of both digital and CE skills. This means that educators can make their classes more dynamic by incorporating digital resources combined with the teaching of circular-related topics. On the other hand, Trevisan et al., (2025) highlighted that, although educational systems promote the development of critical competencies, a gap remains regarding certain skills that need further cultivation. In other words, a more effective alignment between educational practices and labour market needs is still required, which calls for an investigation of these needs in practice.

Despite the growing body of literature on CE education and skills development, existing studies largely focus on conceptual analyses, theoretical frameworks, or evaluations of specific educational programs (Marcon and Sehnem, 2024; Renfors, 2024; Trevisan et al., 2024). While these contributions provide valuable insights into the types of skills and competencies that are considered important, they offer limited evidence on how these skills are prioritised and applied in real-world organisational contexts. This highlights the need for empirical studies to investigate which CE-related skills are most

critical, and what are the real-world industry requirements for job roles and education. In other words, a more effective alignment between educational practices and labour market demands is still required, which calls for an investigation of these needs in practice.

3 Methodology

With the objective of mapping the industry and practice needs associated with skills and education for the CE, exploratory survey (Forza, 2002) was selected as the primary data collection method because it allows systematic gathering of standardised information from a larger and more diverse sample (Pinsonneault and Kraemer, 1993) than interviews, enabling the identification of industry-wide trends, skill priorities, and gaps. The survey also aimed to capture information about the barriers and opportunities faced, training formats requirements and expectations regarding the development of key competencies to support the circular transition.

Unit of analysis was the organisations in/with which the respondents work and their perceptions of the topics of this study, covering both conceptual understanding and practical relevance aspects. The targeted respondents comprised actors who are interested in, engaged with, or involved in organisational transformation toward the CE, either through their employing organisation or through academic or consultancy projects and collaborations with organisations pursuing CE initiatives. This includes respondents at different levels of experience. In this way, the survey was directed at collecting industrial skill needs, perceived difficulties, immediate requirements, and prospective views on the CE implementation.

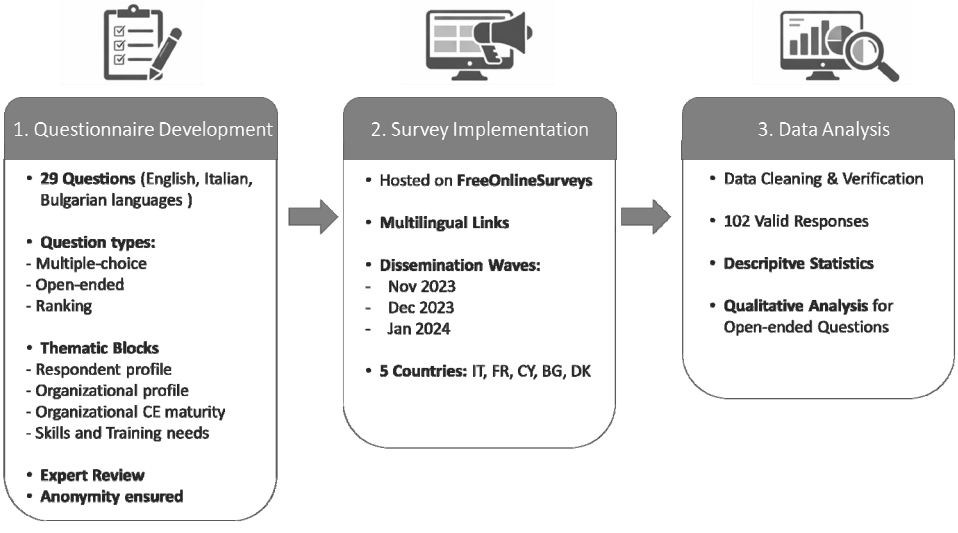
The research methodology was structured into three main stages (Figure 1):

1 questionnaire development

2 survey implementation

3 data analysis, which are described in the following sub-sections.

Figure 1 Methodological procedure



3.1 Questionnaire development

The survey contained 29 questions in English, designed to address different dimensions of this study (see Appendix). To ensure accessibility and linguistic inclusivity, the questionnaire was also translated into Italian and Bulgarian (reflecting the CERES project partners network), thus engaging audiences from diverse cultural and geographical contexts. The questions were structured in three main formats (multiple-choice, open-ended, and ranking). The estimated response time was approximately 15 minutes. The questions were divided into four thematic blocks:

- Block 1 (questions 1–9): respondent profile including institutional affiliation, position, level of involvement in CE-related activities, and main areas of responsibility.
- Block 2 (questions 10–13): organisational profile, covering sector of activity, company size, and territorial scope of operations.
- Block 3 (questions 14–17): evaluating organisational maturity in CE adoption as a basis for comprehending expertise gaps and needs, identifying the main barriers in establishing CE, and pointing out key CE priorities and related regulations and strategies applicable to the business.
- Block 4 (questions 18–29): identification of organisational needs in terms of skills and their relation to different product life stage (beginning, middle and end-or-life), exploring potential requirements for new job profiles, exploring awareness of availability and requirements of training modalities, and strategic stakeholders to support the transition.

To ensure that the responses provided in the closed-ended questions are exhaustive and mutually exclusive (Jain, 2021) CE experts from the CERES project were involved in reviewing the questions. These experts were academic partners, some of them with a PhD in the CE area, as well as partners from Producer Responsibility Organisations.

The respondents were assured anonymity in the publication of the research.

3.2 Survey implementation

The actual data collection was carried out by hosting the questionnaire on the professional survey platform *FreeOnlineSurveys*, with separate links provided for each language version. The questionnaire was translated into Italian and Bulgarian in order to reach a broader audience. The English version was launched in the first week of November 2023, followed by the Italian and Bulgarian versions in the following week. The dissemination strategy took place in three main waves (November 2023, December 2023, and January 2024) and relied on multiple channels: the CERES project website and LinkedIn page (590 followers), the individual LinkedIn profiles of CERES partners (with an estimated combined reach of approximately 6,000 followers), partners' social networks (both public and private), e-mail marketing, and institutional newsletters. For instance, the link was included in Erion's newsletter (Italian version), and the English version was directly promoted by REPIC and Politecnico di Bari, partners of the CERES project, who shared invitations with corporate contacts. Similar activities were conducted by all CERES project partners in the five countries of the project consortium (Italy,

France, Cyprus, Bulgaria and Denmark). The response collection was closed at the beginning of February 2024. All data were compiled into a unified database and translated into English to enable analysis.

3.3 Data analysis

Prior to data analysis, a rigorous data verification process was undertaken. During this process, responses were examined for completeness and internal consistency, leading to exclusion of 50 incomplete English responses and 24 incomplete Italian responses, resulting in a final dataset of 102 valid responses. While the sample is not statistically representative, this is consistent with the exploratory nature of this study (Jain, 2021), which aims to identify initial patterns and insights. Closed-ended questions were analysed through descriptive statistics, while open-ended ones were examined qualitatively, with similar responses grouped together and patterns, thematic categories, and discursive recurrences identified.

4 Results

This section presents the survey results, organised according to the sequence of question blocks in the questionnaire. Whenever appropriate, graphs are included to provide a more detailed visualisation of the data, along with the corresponding response percentages. The number of responses may differ from the total sample (102), which takes into account both respondents who completed the entire questionnaire and those who provided information by answering specific selected open-ended or multiple-choice questions. This section is structured into the following subsections: 4.1 respondents' profiles and organisational characteristics (corresponding to blocks 1 and 2 of the questionnaire); 4.2 organisational barriers, progress in CE, and regulations (corresponding to block 3); and 4.3 skills, training, and workforce in CE (covering block 4).

4.1 Respondents' profiles and organisational characteristics

The initial block of the survey (questions 1 to 9) focused on collecting participants' profile information. In the first four questions, respondents were asked to provide basic data such as name, e-mail, and affiliated institution. These details were used solely to characterise the sample and will not be disclosed in order to guarantee respondents' anonymity. In question five, participants were asked to indicate their role within the organisation. Most participants selected 'other' (48%), indicating that predefined categories did not fully capture their roles, while the remaining responses were mainly distributed among industry, consultant, and academic positions. Only 2% of the respondents identified as policymakers.

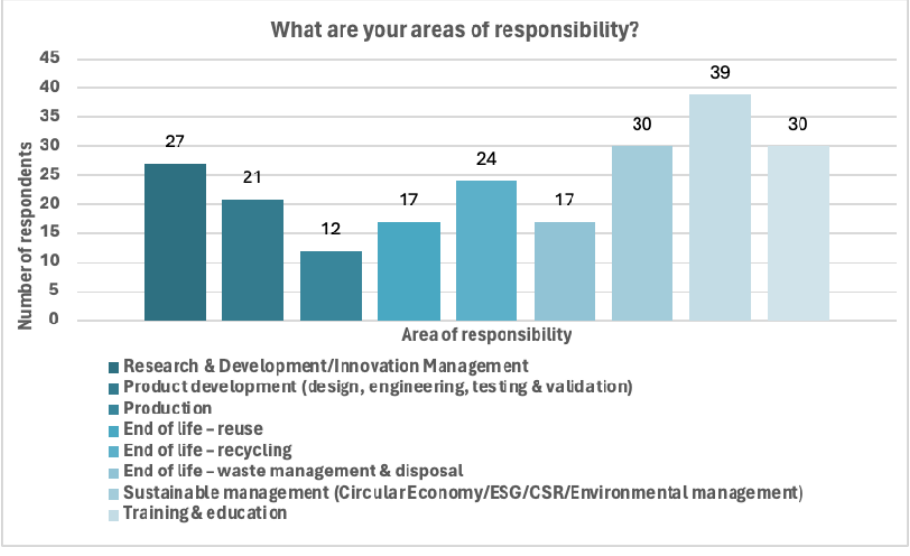
Question 6, an open-ended one, sought to further detail respondents' profiles by requesting them to indicate their job titles. This question reflected the participation of employees from different functional areas and hierarchical levels. For example, several participants mentioned the role of manager, with emphasis on sustainability manager and project manager. Other reported positions included engineer, officer, director, professor, auditor, business professional, sales, and IT representative. This highlights the diversity of positions represented in the sample, covering employees from diverse areas of activity.

Looking within an organisation, in most cases there was a single-role respondents (around 81%), and only few organisations had multiple-role respondents (around 19%). This is a common situation, when the unit of analysis is an organisation, rather than a smaller unit, as well as it is an exploratory study (Pinsonneault and Kraemer, 1993).

Questions 7 and 8 focused on the topic of CE. Question 7 asked whether participants had already been involved in activities related to the theme and, if so, Question 8 sought to identify for how long. The majority of respondents (approximately 73%) reported having experience in the field, while 27% stated they had no prior experience with CE. Regarding question 8, among the 73% of respondents involved in circular activities, 15% reported less than one year of experience, 50% between 1 and 4 years, and approximately 35% more than 4 years. These results indicate that most respondents have been engaged with CE for several years, with only a small share entering the field recently. This trend aligns with the period in which the European Union intensified its environmental agenda through regulations and initiatives such as the European Green Deal (European Commission, 2019), which appears to have stimulated growing interest in CE-related topics.

Regarding respondents' areas of responsibility (question 9), 14 options were provided, and several participants selected multiple categories. As shown in Figure 2, sustainable management was the most frequently selected area (39 responses), followed by training and education and waste management/end-of-life activities (30 responses each). Research and development related to innovation also emerged as a relevant area (27 responses). Other areas, such as logistics, human resources, remanufacturing, and after-sales services, received fewer than 10 responses.

Figure 2 Respondents' professional areas (see online version for colours)



In terms of organisational characteristics (second block of the survey), four different questions were asked. These questions addressed the industry in which the organisation operates (question 10), its main activities (question 11), organisational size (question 12), and geographic scope (question 13). Regarding industry (question 10), most respondents

selected 'other' and specified sectors such as certification and standardisation, civil engineering, consultancy, food and beverages, healthcare, and research and education. Among the predefined options, electrical and electronic equipment (EEE) was the most represented sector, with 22 organisations. Other sectors, including trade associations, IT disposition and asset management, textiles, wind turbines, and automotive, each accounted for fewer than 10 responses (Figure 3).

Figure 3 Respondents' industry sectors (see online version for colours)

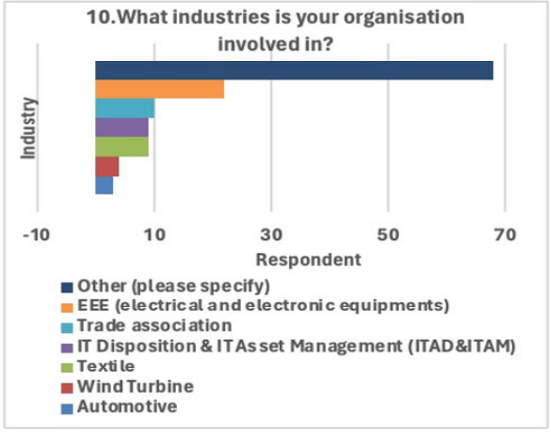
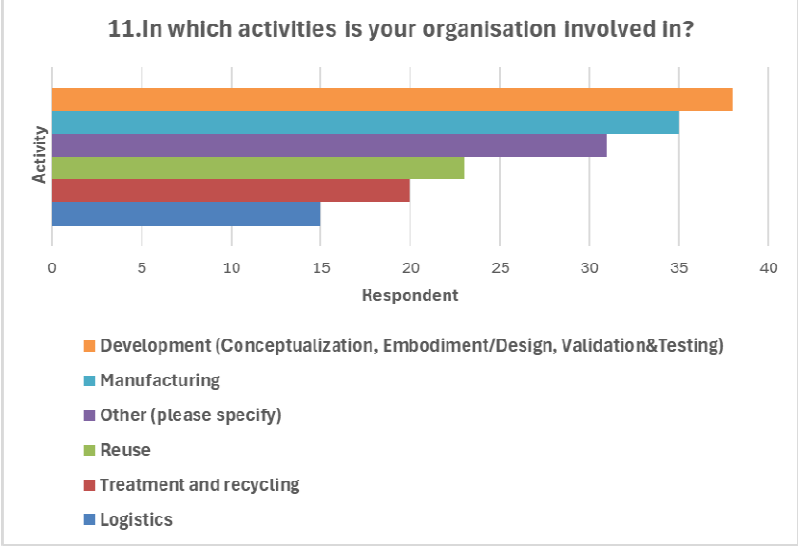


Figure 4 Core activities reported by organisations (see online version for colours)



In question 11, as shown in Figure 4, development and manufacturing were the most frequently selected activities (38 and 35 responses, respectively). Other activities, such as reuse and treatment, also received 20 or more responses. The 'other' option was selected by 31 respondents, who reported a wide range of activities including maintenance, certification, retail, education, auditing, standardisation, conservation, policy

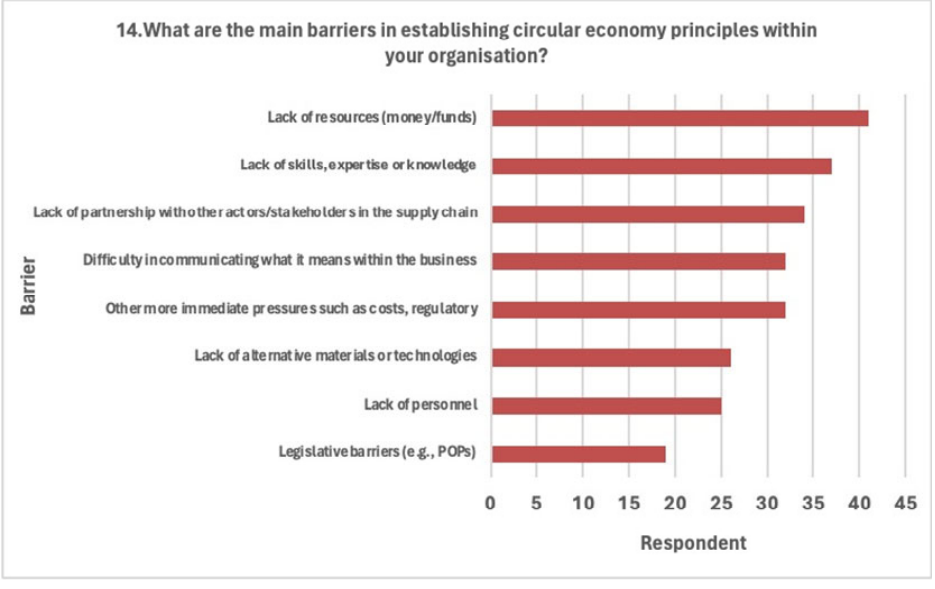
development, and accounting, indicating a diverse sample. Regarding company size (question 12), three categories were adopted according to Commission Recommendation 2003/361: large organisations, SMEs, and micro enterprises (European Union, 2025). All three options accounted for approximately 30% of respondents, although SMEs accounted for a bit higher proportion (35%). Once again, this result highlights the diversity of organisations that took part in the sample, even considering that 5% of the 102 respondents did not answer this item.

Finally, question 13 addressed the geographical scope of the organisations. Respondents could select international, national, or regional/local. Most organisations operated at the national and international levels, with 50 responses each, while 24 operated at the regional or local level. Overall, the sample included companies with diverse geographical scopes.

4.2 Organisational barriers, progress in CE, and regulations

This subsection explored the third block of the questionnaire (questions 14–17), which aimed to understand the main barriers to adopt CE, the organisational maturity in terms of circular practices, and the potential regulations that are fundamental within the companies' scope of activities. Regarding the barriers (Figure 5), question 14, the most prominent was the lack of financial resources, followed by the lack of skills, expertise, or knowledge among professionals in the field, as well as the lack of partners for establishing collaborations. Another relevant barrier was the difficulty in establishing effective communication to explain CE principles within organisational boundaries. Indeed, implementing CE requires internal communication and knowledge exchange across different departments. It also depends on having professionals with the right skills to apply circular practices, identify potential areas for improvement, and guide the company's strategic planning.

Figure 5 CE barriers faced by companies (see online version for colours)



In terms of CE maturity level and progress in applying CE practices, participants were asked in question 15 about their organisation. For this, six different levels were made available that could be selected by them. The levels ranged from level 0, referring to a lack of practices, up to level 6 in accordance with the maturity model developed by Acerbi et al. (2025a), which would be a full adoption of circular practices as defined by Acerbi and Taisch (2020). Of the 102 participants in the survey, 6% abstained from answering this question. Of the remaining respondents, 4% highlighted that they had no knowledge about CE practices. 30% mentioned that they are familiar with the topic and are starting the journey in the implementation of practices; in addition, a second group of respondents, with approximately 30%, highlighted that their activities are centred on CE, being the core of their business. This result shows that although many organisations have already started the transition, a significant portion has already structured all their business aligned with the principles of this economic model.

Question 16 was developed as an extension of question 15, asking companies with higher maturity in CE to detail the gaps identified and the solutions adopted to overcome them. Approximately 47% of participants showed a good level of CE adoption and answered this question. Among these respondents, 16.67% highlighted that they did not face any significant challenge related to the lack of expertise in the field, neither at the present time nor at the beginning of the first steps of the journey. On the other hand, the remaining participants mentioned that they faced several challenges. One of them was the difficulty of engaging clients in the long term to commit to the implementation of more circular practices, which even represented resistance to change. The lack of qualified professionals and expertise was also a highlighted point. In general, obtaining data for environmental assessments is a process that requires time and expertise. In this context, a company in the civil construction sector from our sample mentioned that there was an effort to develop specialised technical skills in the sector, so that they could comply with environmental regulations and requirements.

A recurring point in the survey was the concentration of technical and regulatory knowledge in a few individuals, which required efforts to disseminate it more widely within organisations. To address this challenge, many companies relied on their internal talents, encouraging employee engagement and ensuring support at the leadership level. In this case, sustainability managers played a central role, acting as coordination agents of the transition. Some companies implement simple practices, such as prevention and reuse actions in the workplace, with the aim of raising employee awareness and promoting cultural and behavioural changes. Training and employee capacity building, as well as effective communication, were also highlighted as key factors in strengthening knowledge about CE and in the more successful adoption of circular practices. In particular, 25% of respondents mentioned that external training is also a good strategy for gaining knowledge in the field.

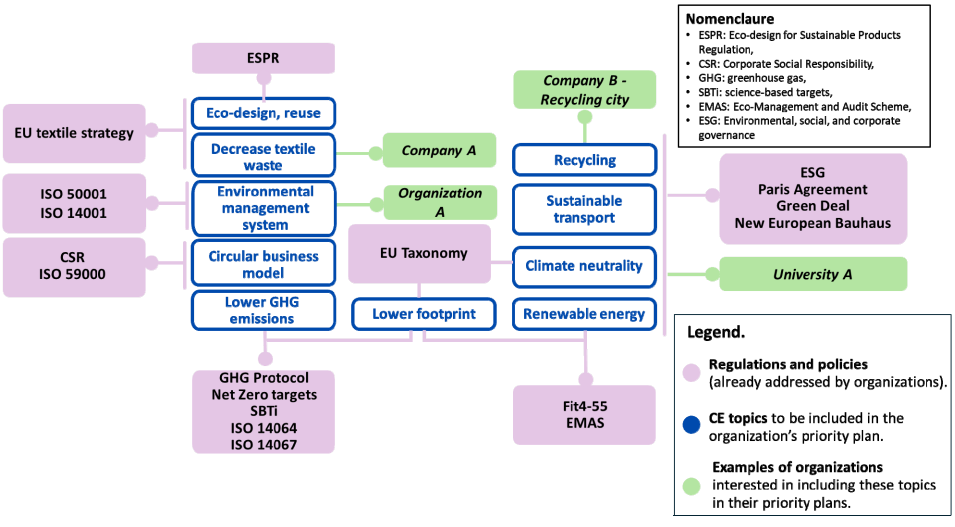
In cases where the organisation did not have professionals in the field and needed to adopt faster actions, companies resorted to hiring external professionals (e.g., sustainability experts), as well as involving specialised consultants to provide recommendations and support the transition. This aspect reinforces the importance not only of internal employee training, but also of seeking intellectual resources that add value to organisational activities and drive the team to improve more broadly. In addition, collaboration with different supply chain actors, market analysis of best practices, network building, and active search for funding are highlighted as fundamental elements.

Technical standards and certifications, such as ISO 14001, were also emphasised as guiding, since some organisations in the sample pursued certification.

With regard to the regulations or guidelines that are used by organisations to guide their actions and strategies, question 17 was formulated for this purpose. It was observed that, given the thematic umbrella and the interconnectivity of concepts involving CE, it can be present in numerous regulations. The issue related to reducing the environmental footprint, for example, in addition to being a fundamental aspect for achieving a more sustainable society, is also directly related to more circular practices. In this sense, different regulations and guidelines, such as ISO 14064 and 14067 standards, the Eco-Management and Audit Scheme (EMAS), Fit4-55, Science-Based Targets (SBTi), EU Taxonomy, Net Zero targets, and the Greenhouse Gas (GHG) Protocol highlight this aspect.

Figure 6 was created to synthesise the different regulations and guidelines mentioned by respondents, as well as to highlight some cases from our sample that served as examples of the implementation and sharing of sustainable actions. For example, Company A is an organisation based in Denmark that, according to its reports, uses 10% of recycled material in the manufacturing of textile products. Company B, in turn, played an important role in the creation of Recycling City, being considered the most eco-friendly scrapyard in Europe. The cases of Organisation A and University A, located in Cyprus and Bulgaria respectively, were also highlighted, as they directed their actions toward reducing environmental impacts and, consequently, fostering climate neutrality.

Figure 6 Linkages among regulations and CE topics, supported by illustrative case examples (see online version for colours)



Given the emphasis on recycling activities, the green deal was mentioned by 20% of participants as a prominent regulation. Several objectives established through the Green Deal encouraged numerous sectors, such as civil construction, e-waste, and the textile industry, to engage in more environmentally actions. In addition, recycling was not the only key issue raised by respondents. In the case of organisations in the textile and electronic sectors, product reuse was also cited as being of critical importance. In order of

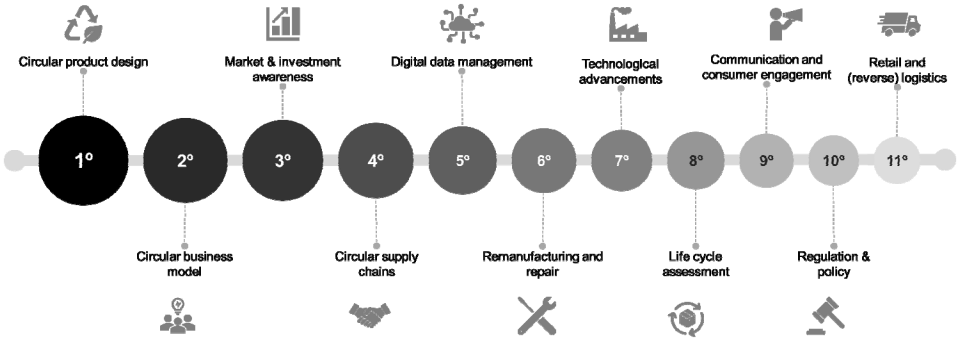
priority, reuse is considered a strategy with greater potential than recycling, since less energy and effort are required for the product to return to use (Potting et al., 2017). Finally, another political initiative mentioned was the New European Bauhaus, which is an innovative and creative way to enhance the Green Deal in the development of more sustainable living environments and spaces.

In terms of ISO certification, as already mentioned, some organisations engaged in the process to improve their management systems, reduce environmental impacts, and at the same time promote more circular approaches. ISO was mentioned by 29% of participants as a guideline of great importance. Several standards in this context were mentioned, such as ISO 50001 (focused on energy management), ISO 14001 (related to environmental management systems), ISO 59000 (specifically focused on CE), ISO 14064 (related to the quantification and reporting of greenhouse gas emissions and removals), and ISO 14067 (focused on the carbon footprint of products). Overall, an organisation that holds certification, in addition to improving its activities, also gains greater legitimacy in its actions and achieves broader recognition from other stakeholders regarding its compliance with current standards, regulations, and environmental practices.

4.3 Skills, training, and workforce in CE

This sub-section explore the fourth block of the survey (questions 18–29) related to skills and capacity building for the circular transition. In question 18, participants were asked to rank, in order of priority, the skills they considered most important for their organisations to advance in CE practices. Among the 11 skills presented, three ranked highest: circular product design (first), circular business models (second), and market and investment awareness (third). On the other hand, skills related to regulation and policy and retail and reverse logistics were perceived as lower priorities. Figure 7 presents the complete ranking of skills according to the participants' answers.

Figure 7 Ranking of skills for advancing CE in participants' organisations



In question 19, participants were asked to indicate which skills should be further strengthened to support the transition to the CE in a broad sense. Figure 8 presents the resulting priority ranking. The results show that cross-cutting skills (e.g., entrepreneurship, business model innovation) were considered the most relevant, followed by soft skills (e.g., leadership, teamwork, communication) and digital skills (e.g., knowledge of AI, IoT, digital platforms, data analysis). These findings highlight the growing demand for professionals who not only possess technical knowledge but also

develop interpersonal competencies that foster a more collaborative and innovative work environment. This also requires mastery of technologies popularised by Industry 4.0 and the ability to apply them in support of circular strategies.

Figure 8 Ranking of skills to support the overall advancement of CE

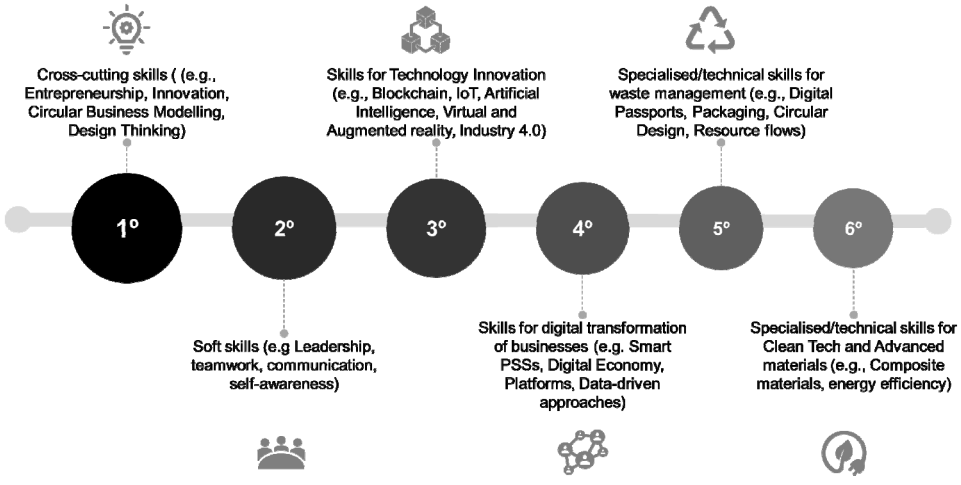
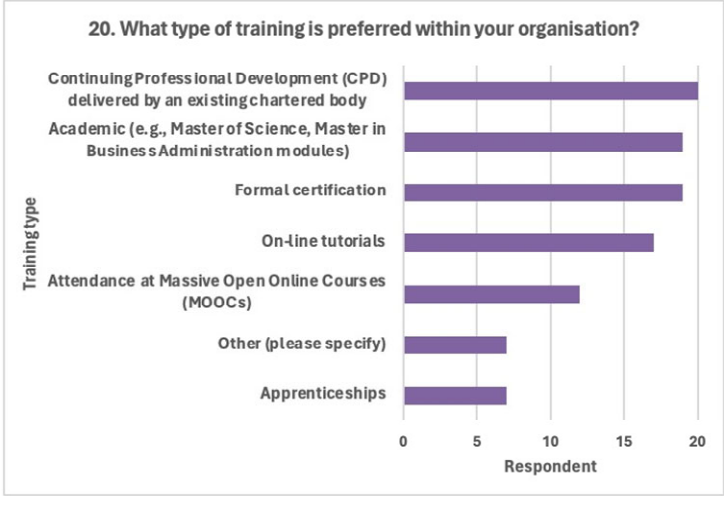


Figure 9 Preferred educational training options (see online version for colours)



Question 20 investigated the educational training options desired by respondents for skill enhancement and the acquisition of new competences. Among the available options (Figure 9), four received more than 15 responses each, in the following order of preference: continuing professional development (CPD) granted by an accredited professional body, academic courses (such as a master's in business), formal certification, and online tutorials. Another training format highlighted by participants was massive open online courses (MOOCs). Other types, such as seminars and business associations, were also mentioned by respondents, while apprenticeships ranked in the last position.

Regarding the necessary skills from a circular life cycle perspective, questions 21, 22, and 23 were formulated. In particular, each question focused on a specific stage of the product life cycle, namely beginning of life (BoL), middle of life (MoL), and EoL. In question 21, focused on BoL, the majority of respondents (38%) identified circular product design as the most demanded skill. According to the survey participants, this skill involves the ability to select materials that reduce resource consumption and to apply Design for X approaches, such as design for disassembly, assembly, manufacturability, and recycling, which are essential for enabling circularity throughout the product lifecycle. In this phase, production management systems, along with business models, must be developed to support the transition to CE. Additionally, life cycle assessment (LCA) was highlighted as a key method for assessing circularity and quantifying carbon footprints and environmental impacts. This methodology was also emphasised as essential for assessing the sustainability of industrial processes. Other cross-cutting and behavioural skills were also highlighted, among them the ability to develop effective communication, systems thinking, and also skills associated with entrepreneurship. Some skills that influence the organisation's strategic capacity also deserve attention, such as stakeholder engagement for acquiring, sharing, and exchanging knowledge, identifying business opportunities to transform linear models into circular ones, as well as understanding the entire product life cycle.

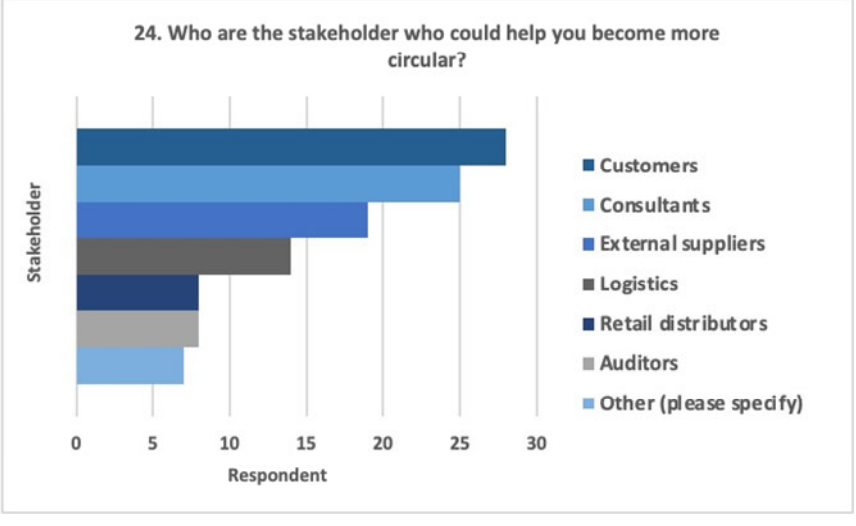
Regarding the skills required at the MoL stage (question 22), knowledge of product durability and reparability was considered essential for advancing circular practices. To support this, planning periodic maintenance and repair activities was seen as a key factor in extending product lifespan. In this context, familiarity with the European regulations provided valuable guidance, particularly for implementing tack-back systems. Skills to create innovative approaches to raise awareness among consumers and producers during the usage phase were also mentioned. In terms of delivering both products and services, digital competencies emerged as critical. One respondent even suggested creating a centralised database where manufacturers could offer spare parts for sale and provide step-by-step repair manuals for their products.

Finally, considering the EoL (question 23), the ability to assess the physical condition of the product at the end of use was considered one of the most relevant skills. Participants mentioned that it is essential to recognise when a product has reached its EoL and which strategy should be directed towards repairing or not repairing the product. In addition, identifying which actors can support and work during this disposal or repairability process is also important. In this regard, the development of competencies in multi-material recycling technologies as well as in cleaning techniques for post-use and post-consumer products was highlighted. Respondents also emphasised the importance of data sharing and standardised labelling of materials to improve communication among stakeholders. Among the suggestions provided, participants mentioned incentives for the creation of specialised factories for material recovery and the promotion of reuse within the same sector of origin, such as the use of demolition waste aggregates in the construction sector. Finally, the role of consumers in a CE was also mentioned. For instance, sustainable behavioural design was pointed out as an important skill, as it allows for the development of strategies to understand users and encourage them to properly dispose of their products.

With the aim of identifying potential stakeholders who support the achievement of a CE (Figure 10) and who can be critical agents in providing advice for the transition, question 24 was designed with this focus. With 26% of the votes, customers were

considered one of the most important actors according to the organisations in our sample. In fact, this type of actor exerts a strong influence in the market, since their purchasing choices for more eco-friendly products can encourage organisations to change the way they manufacture their products. Another highly relevant actor mentioned were consultants (23%) and external suppliers (17%). Consultants, because they possess skills, provide knowledge, tips, and insights that can support the implementation of circular strategies. External suppliers, in turn, are considered key stakeholders not only because they put pressure on their partners to adopt more environmentally responsible actions, but also because they contribute to the creation of organisational legitimacy, strengthening the image and credibility of companies that engage in circular practices.

Figure 10 Critical stakeholders to support the CE transition (see online version for colours)



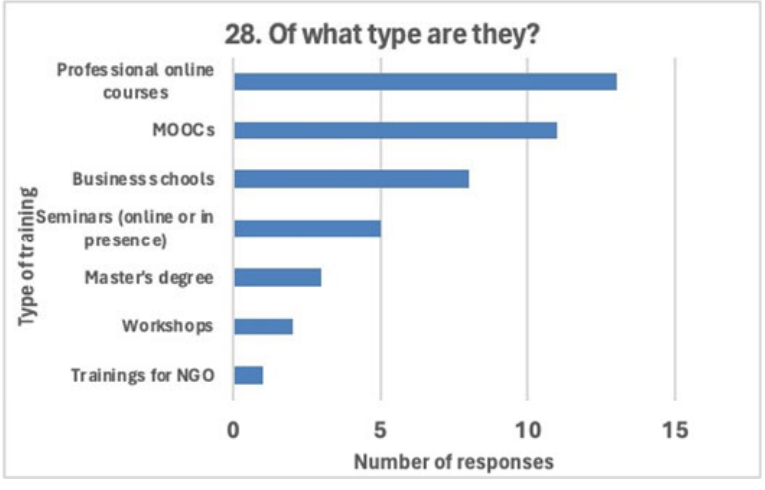
Question 25 focused on understanding which job profiles are most in demand for a circular model (with a 39% response rate from participants). Among those who answered, almost all (90%) emphasised that CE requires specific professional profiles with skills oriented toward the transition. In particular, experts in the implementation of circular business models, as well as in financial management to evaluate circular practices, were highlighted. Once again, the role of sustainability and circularity managers was mentioned as essential, since these professionals generally possess a broader and, at the same time, integrative view of the various actors involved, and the activities carried out. Finally, operational professionals, such as engineers and repair technicians, were considered important to enable circular manufacturing operations, whether through the implementation of remanufacturing/recycling processes or the use of second-raw materials.

The last questions of the questionnaire (questions 26 to 29) focused on understanding whether participants had access to or were aware about commercially available training courses related to the CE. The majority of respondents answered positively (61%) in question 26, while in question 27, 74% pointed out that these courses are easily accessible. These findings indicate that although there are options available on the market and they are readily accessible, there is still a challenge in training professionals in

specific skills, such as design of electronic components in a circular way or knowledge of business strategies oriented towards CE in the textile sector.

In question 28, participants were asked which types of CE courses and training available on the market they had access to (Figure 11). Virtual courses received the highest responses, including professional online courses and MOOCs. Considering the convenience of access, enrolment, and flexibility of these courses, since they are usually recorded and can be attended at the most convenient time for the student, these options generally show high adherence. This is further confirmed by question 29, where 68% of participants stated that they made use of these courses for training on topics related to CE.

Figure 11 Types of training courses (see online version for colours)



5 Discussion

The CE has expanded rapidly within industry. The results show that a significant share of respondents (35%) have been involved in circular initiatives for more than four years, while 50% have been working on the topic for between one and four years. These findings indicate that initiatives such as the European Green Deal have played an important role in further popularising the adoption of the CE. In addition, this observation is consistent with publications by the The Ellen MacArthur Foundation (2020), which emphasise that the COVID-19 pandemic also accelerated the transition, as organisations were forced to restructure, rethink their business models, and become more resilient. Moreover, the pandemic also influenced the demand side, as consumers showed increased positive attitudes and inclinations toward purchasing green products (Le, 2023), further reinforcing the acceleration of the transition.

Regarding the barriers, the lack of financial resources was the most prominent, followed by the lack of skills and expertise in CE. The lack of skills is directly associated with the fourth barrier pointed out, which refers to the difficulty in communicating and sharing CE principles among organisational members and business partners. Such

barriers have already been documented in previous studies, which highlight that firms often face a lack of know-how in circular product design, for instance (Sassanelli et al., 2020b). Besides, the literature on product lifecycle management suggests the need for capabilities, including technological and intellectual resources, to manage and integrate information across the product lifecycle (Ghnaya et al., 2024; Panza et al., 2022). Indeed, know-how is critical, as its absence prevents companies from advancing and increasing their CE maturity level, limiting the development of projects with external stakeholders (Uhrenholt et al., 2022).

Regulatory pressures and legislative barriers have also been identified as obstacles to the CE implementation. The literature emphasises the central role of governments in advancing the CE agenda (Keskes et al., 2022; Lobo et al., 2021). Without the support and encouragement of governments, for example, many companies end up limiting themselves to simply complying with current environmental legislation, instead of seeking more sustainable innovations to close the life cycle of their products (Ormazabal et al., 2018). Although the CE offers several opportunities, such as capacity building, strategic use of regulations/certifications, and interorganisational collaboration, overcoming the barriers is fundamental for the advancement of the circular model.

In terms of skills, circular product design and the design of circular business models were ranked by respondents as the most relevant. This result is fully aligned with the skills identified by scholars as critical for the twin transition, encompassing both CE and digital transformation scope (Trevisan et al., 2024). The findings also indicate that soft skills, such as leadership, teamwork, and communication, are highly valued. These soft skills are closely interconnected with product and business model design capabilities, as designers need to communicate effectively and collaborate with diverse stakeholders to ensure successful design processes (Chen, 2022).

Another set of skills that, although not ranked as the most relevant by the survey participants, deserves special attention is technological innovation skills for the CE. With the progress of digital transformation, skills related to data management and the application of technologies such as AI, the IoT, and blockchain are increasingly being adopted to enable the implementation of circular practices (Acerbi et al., 2022; Kadel et al., 2022). For example, IoT combined with big data and analytics can be used to collect information on product usage conditions, which can subsequently be employed to support more sustainable product design (Bressanelli et al., 2018). AI, for instance, can be applied to predict charging and refuelling points for electric vehicles, thereby optimising system performance (Ellen MacArthur Foundation, 2019). Blockchain, in turn, can enable decentralised, transparent, and secure storage and sharing of information regarding product material composition (Narayan and Tidström, 2020). These technologies, also referred to as Industry 4.0 technologies, can be applied to improve several aspects, such as product lifecycle management (Panza et al., 2022), waste management, and emissions reduction (Kadel et al., 2022).

However, no single professional role can encompass the full set of required skills. Instead, these skills are distributed across different professional roles demanded by industry, as reflected in the areas of responsibility identified in this study. The findings indicate that industry has a strong demand for circular design capabilities, which calls for the presence of circular designers. In addition, organisations require circular business managers who possess not only technical know-how but also the ability to engage partners. As the twin transition becomes more prominent within organisational contexts,

there is also increasing demand for roles such as reverse logistics operators and circular production operators (Beducci et al., 2024).

To qualify these professionals, different educational formats are available. According to the survey results, CPD programs granted by accredited professional bodies were ranked as the most relevant. However, when examining the types of training currently undertaken by professionals, MOOCs stand out. In fact, 68% of respondents indicated that they use this format for professional development, which may be partly explained by the flexibility it offers in terms of time and accessibility. Previous studies have highlighted the potential of MOOCs to support long-term learning and human education for the CE (Hajdukiewicz and Pera, 2020), which reinforce the need to develop training aligned with industrial expectations and demands.

5.1 Theoretical and practical implications

This study extends the literature by providing a structured set of skills for the CE and ranking them according to industry needs. Indeed, it reveals the key skills, workforce profiles, and types of training that are essential for fostering new educational and training programs in the CE domain. These findings directly respond to recent calls in the literature to better align education and professional training with market demands, emphasising that educational initiatives should also taking into account the skills demanded from a practical perspective (Acerbi et al., 2024; Boscarato et al., 2024). Another important contribution of this study lies in the identification of barriers and practical gaps in the implementation of the CE. Although previous studies have already highlighted several bottlenecks that hinder CE adoption (i.e., Lobo et al., 2021; Ormazabal et al., 2018), this survey sheds light on how the lack of knowledge and expertise among professionals can actively limit organisations' ability to achieve higher levels of maturity in CE practices. This finding is particularly relevant because, while organisations often struggle to access appropriate funding mechanisms and usually perceive CE as a costly business strategy (Grafström and Aasma, 2021), the presence of adequately trained professionals, particularly those with managerial skills, can enhance organisational effectiveness and productivity (Ada et al., 2023; Bloom et al., 2013).

This study also contributes to the literature on product lifecycle management. While previous research provides theoretical advancements in terms of product development challenges and features (Panza et al., 2022; Sassanelli et al., 2020a), this study discussed skills related to each stage of the product development lifecycle (BoL, MoL, and EoL). The findings show that companies need professionals with knowledge of circular product design (especially in BoL), knowledge of product durability and reparability in the MoL, and the ability to assess the physical condition of the product at the end of use (EoL). This study also highlights interpersonal skills such as effective communication and teamwork (Pinzone and Taisch, 2023), as well as digital skills that are becoming increasingly essential in this area (Akyazi et al., 2022; Trevisan et al., 2024). This is particularly relevant considering the current changes occurring in the industry with the advent of the Twin Transition. It is recognised that digital technologies can effectively influence all stages of the product lifecycle, from gathering information to design more sustainable products, to tracking products at the end of their life (Rusch et al., 2023). In this sense, the study contributes to recent literature (e.g., Serodes, 2025; Trevisan et al., 2024), which emphasises that professionals should be increasingly prepared for a green and digital transition (i.e., the Twin Transition).

This study also offers practical contributions. From an empirical perspective, the identification of the skills most demanded by industry could guide the design of targeted training and capacity-building programs for future workers. Previous studies adopting a theoretical perspective (i.e., a review of the scientific literature) had already identified the most critical skills highlighted by scholars (Trevisan et al., 2024). This survey highlighted the skills considering the industrial needs. Other studies, such as Acerbi et al. (2024), also contributed to identifying critical skills through interviews with experts. Together, these studies, including this survey, were combined to construct a framework that reveals which skills are already being addressed by existing CE-courses and which skills still need to be addressed through new training programs (see Trevisan et al., 2025).

The framework developed by Trevisan et al. (2025), which also builds upon the findings of this study (specifically the most relevant skills), was used as the theoretical basis for the design and development of training programs within the CERES project. In total, six courses were developed, addressing different themes related to CE and fostering a diverse set of skills. For instance, the course entitled "Digital Transition and Transformation" focuses on the development of skills related to data management and the application of Industry 4.0 digital technologies (Acerbi et al., 2025b), which are considered critical both in the scientific literature (Trevisan et al., 2024) and according to the findings of this survey. Another course developed within the CERES project is the "Circular Lifecycle Management" course, which focuses on content aimed at developing skills related to circular product design, LCA, systems thinking, circular remanufacturing, among others (Trevisan et al., 2026). All the six courses are available through the new Circular Economy Digital Innovation Hub (CE-DIH). Within this hub, participants have access not only to the courses but also to hackathons, learning materials, discussion forums, and a wide range of educational support services.

6 Conclusions

This study aimed to map the industrial and practical requirements related to the skills and job roles essential for advancing the transition to CE. To this end, a survey was conducted with 102 respondents interested in, engaged with, or directly involved in CE-related activities across different sectors. The results contribute to a clearer understanding of the skills most in demand by organisations, the main barriers hindering the implementation of CE practices, and the types of training programs that can support employee capacity building.

The results show that the transition to the CE is not limited only by technological or financial constraints, but also by a significant lack of knowledge, expertise, and adequately trained professionals. In this sense, the study reinforces the critical role of human capital in enabling organisations to advance towards higher levels of CE maturity. In particular, the results highlight the importance of managerial, soft, and digital skills, along with competencies related to circular product design, and product lifecycle management. This evidence reinforces that multiple skills and job roles are necessary for the CE implementation, and also to overcome challenges throughout the entire product lifecycle. Thus, interdisciplinary teams capable of integrating diverse expertise are necessary to address the complexity of the transition.

From a practical perspective, the identification and ranking of industry relevant skills provide valuable insights for educators, and training providers. The results highlight the importance of education and training programs in qualifying both current and future workforce. These findings can support the development of educational and training initiatives that are more closely aligned with labour market needs, particularly within HE and VET systems. Indeed, this alignment is already being conducted through initiatives oriented toward professional development, such as the CERES project, which translated empirical and theoretical evidence on skill needs into structured training programs designed to support the green and digital transition.

Despite the numerous results, this research has limitations that are worth mentioning. First, the number of respondents was limited, restricting the scope of the analysis, making it difficult to construct a fully representative and generalisable view of the state of practice associated with the professional demands for CE implementation. Future research could replicate this survey with a larger audience and with a more granular focus on specific national regulatory frameworks and industrial sectors, in order to capture country- and sector-specific skill requirements and regulatory barriers for the implementation of CE practices. A second limitation concerns the language used in the questionnaires. Although English is a widely used language, potential respondents speaking other languages (e.g., Spanish, Portuguese, German) may not have had access to the survey, reducing the representativeness of the sample. Future studies could consider collecting data in multiple languages to broaden the geographical reach of the research scope.

Acknowledgements

This work was co-funded by the European Education and Culture Executive Agency (EACEA) of the European Union [Circular Economy ecosystems Redesigning Skills (CERES) project (GA 101111684)]. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them. It was also supported by the Italian Ministry of University and Research under the Programme ‘Department of Excellence’ Legge 232/2016 (Grant No. CUP - D93C23000100001). This research was also partially funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.3 - Call for tender No. 341of March 15, 2022 of Italian Ministry of University and Research funded by the European Union #8211; NextGenerationEU. Award Number: PE00000004, Concession Decree No. 1551 of October 11, 2022 adopted by the Italian Ministry of University and Research, CUP D93C22000920001, MICS (Made in Italy - Circular and Sustainable).

Declarations

All authors declare that they have no conflicts of interest.

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Appendix

Survey questions

Survey on skills required by an industrial transition to the circular economy model.

Block 1: Respondents' profiles

1 Name

2 Surname

3 E-mail

4 Organisation name

5 Who are you?

- Consultant
- Industrial
- Academic
- Policymaker
- Other

6 What is your job title?

7 Have you been working on circular economy – related activities?
- Yes
- No

8 If yes, how long have you been working on them? (years)
- <1
- 1–4
- >4

9 What are your areas of responsibility?
- Research & Development/Innovation Management
- Product development (design, engineering, testing & validation)
- Production
- Logistics
- Reverse logistics
- After sales services supporting use phase (maintenance, repair, etc.)
- End of life – reuse
- End of life – recycling
- End of life – remanufacturing
- End of life – waste management & disposal
- Sustainable management (Circular Economy/ESG/CSR/Environmental Management)
- Human resources
- Other (please specify)

Block 2: About your organisation

10 What industries is your organisation involved in?
- EEE (electrical and electronic products)
- Automotive
- IT Disposition (ITAD) & IT Asset Management (ITAM)
- Textile
- Wind turbine
- Trade association
- Other (please specify)

11 In which activities is your organisation involved in?
- Development (conceptualisation, embodiment/design, validation&testing)
- Manufacturing
- Reuse

- Treatment and recycling
- Other (please specify)

12 What size is your organisation?

- Micro (staff headcount<10; turnover<2m)
- SME (staff headcount<250; turnover<50m)
- Large (staff headcount>250; turnover>50m)

13 At what regional level do you operate?

- Regional/local
- National
- International

Block 3: About your company's/organisation's understanding of Circular Economy

14 What are the main barriers in establishing circular economy principles within your organisation?

- Lack of partnership with other actors/stakeholders in the supply chain
- Lack of skills, expertise or knowledge
- Lack of resources (money/funds)
- Lack of personnel
- Other more immediate pressures such as costs, regulatory
- Lack of alternative materials or technologies
- Legislative barriers (e.g., POPs)
- Difficulty in communicating what it means within the business.

15 How much mature would you define your organisation in relation to Circular Economy?

- We don't know anything about it.
- We know about it but don't have the resources or expertise to implement it.
- We understand the concept but don't understand how it is applicable to our business.
- We have a general understanding of it but it is not translated or implemented into company plans or activities.
- We have a good understanding and are starting to adopt some related practices into our business.
- It's at the core of what we do, and we are working across our supply chain to deliver.

16 Where you answered E or F in question N° 15, did you initially encounter gaps in expertise, and how did you address these?

17 Please describe the circular economy priorities for your business, organisation or sector including links to published strategies or plans where available (e.g., Green Deal, ESG, CSR, ISO standard).

Block 4: Circular Economy Skills Needs

18 Thinking about advancing circular economy within your organisation, where do you see the priorities for skills development and training? (put in order of priority)*

- Design of systems, products, and components for durability, reuse, recyclability, and recycled content.
- Design of circular business models to create added value and incentives including different ways of working with supply chains and customers.
- Commercial and market awareness to retain profitability and seek funding and investment for change.
- Procurement and supply chain working to increase closed loop recycling and reuse of components.
- Digital technologies, information systems and machine learning to manage and use data effectively to manage the performance, use and end of life of products and components.
- Remanufacturing, refurbishment and repair of products to extend product life and optimal energy use.
- Technological advancements to improve design, choice of materials and reuse and recycling of materials.
- Life cycle assessment to understand impacts of material choice, production and end of life management of products and materials/whole life costing/net zero.
- Communication and consumer engagement: to create a sharing economy for products that are used infrequently, wider acceptance of leased product and second hand or refurbishment, etc.
- Legislative barriers and opportunities presented by future legislation (e.g., DPP, ESPR).
- Retail and logistics for more efficient distribution of products, parts and takeback/reverse logistics.

19 Which kind of skills need to be enhanced more to support circular economy adoption? (put in order of priority)*

- Resilience Cross-cutting skills (related to Circular Business Innovation) (e.g., Entrepreneurship, Innovation, Circular Business Modeling, Sustainable Competitiveness, Systems, and Design Thinking).
- Resilience Soft skills (related to communication and teamwork) (e.g., Leadership, Flexibility, Responsibility, Team building, Problem-defining and solving, Self-awareness).
- Skills for Technology Innovation in the CE (e.g., development, provision and management of technologies as Blockchain, IoT, Artificial Intelligence, Virtual and Augmented reality, Fourth Industrial revolution).

- Skills for digital transformation of businesses (e.g., Technology Management and Digital Transformation, Smart PSSs, Digital Economy, Platforms in a digital economy, Data-driven approach (GDPR, IPR).
- Specialised/technical skills for waste management (e.g., Digital Passports, Packaging, Circular Design, Resource flows (collection, sorting, reuse, recycling, etc), Supply chain design, feasibility and sustainability.
- Specialised/technical skills for Clean Tech and Advanced materials enabling CE (e.g., Composite materials, zero waste economy, energy efficiency, circular bioeconomy, carbon capture and storage).

20 What type of training is preferred within your organisation?

- Formal certification
- Continuing Professional Development (CPD) delivered by an existing chartered body
- Attendance at Massive Open Online Courses (MOOCs)
- Online tutorials
- Apprenticeships
- Academic (e.g., Master of Science, Master in Business Administration modules)
- Other (please specify)

21 According to your experience, which are the required new technical skills related to the BoL stage (e.g., design, production, internal logistics) from a circular economy perspective?

22 According to your experience, which are the required new technical skills related to the MoL stage (e.g., use, maintenance, repair) from a circular economy perspective?

23 According to your experience, which are the required new technical skills related to the end-of-life stage (e.g., remanufacturing, recycling, disposal) from a circular economy perspective?

24 Who are the stakeholders who could help you become more circular?

- Consultants
- Auditors
- External suppliers
- Customers
- Logistics
- Retail distributors
- Other (please specify)

25 In your opinion, are there new job profiles required to face the economic transition across the value chain?

26 According to your experience, are there already any training courses on the market?

- Yes
- No

27 If yes, are they easily available for your company?

- Yes
- No

28 Of what type are they (e.g., Massive Open Online Course/courses offered by business schools etc.)

29 If you answered YES to question N° 26, have you taken advantage of the training offers on the market?

- Yes
- No

Thank you for completing this survey.