Mapping formative and training opportunities to enhance Circular Economy skills: a market analysis

Alessia Boscarato [1*], Federica Acerbi [1], Claudio Sassanelli [2], Sergio Terzi [1]

** Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Piazza Leonardo da Vinci 32, 20133 Milan, Italy (alessia.boscarato@mail.polimi.it, federica.acerbi@polimi.it, sergio.terzi@polimi.it)*

*** Department of Mechanics, Mathematics and Management, Politecnico di Bari, Via Orabona, 4, 70125 Bari, Italy (claudio.sassanelli@poliba.it)*

Abstract: Circular Economy (CE) is becoming increasingly important, as in the near future such a paradigm will become the new standard for manufacturing companies, bringing with it the need to start implementing transition plans towards more circular models. However, the integration of the CE model requires new skills and capabilities, and the demand for new employment opportunities for the so-called "green jobs" is expected to increase. Therefore, this paper has the objective to explore the current opportunities for people in terms of courses available on the market to enhance their circular-oriented skills. This research objective has been addressed by performing a market analysis which focuses on an in-depth study of the current market offer. The analysis explored the courses aimed at developing skills that enable the transition to the CE, also encompassing sustainability and Digital Technologies (DTs) themes, at Higher Education (HE) and Vocational Education & Training (VET) levels. These kinds of courses were deployed through national and international projects or provided by business schools and other teaching entities. Based on their learning objectives and educational modules, these projects and courses at HE and VET levels have been further classified within three main macro categories (i.e., "CE transition", "sustainability transition", and "twin transition") thanks to the application of the SLIP (Sort, Label, Integrate, Priority) method, which is a free form methodology used to Sort, Label, Integrate and Prioritize concepts. In this way, it has been possible to highlight the gaps in the current teaching and training provision. Relevant inputs useful for the development of a new set of topics that will potentially help to improve the educational offer for the transition to the CE in the manufacturing context have been proposed.

Keywords: Circular Economy, Market Analysis, Industry 4.0, skill, competence

1. Introduction

Nowadays, Circular Economy (CE) is gaining importance, becoming a key aspect that will allow manufacturing companies to get competitive advantage and be sustainable in the long term (Akyazi et al., 2022, 2023). Indeed, CE is a solution to one of today's greatest difficulties: the shift from the paradigm of boundless resources and scarce constraints to the knowledge that, instead, resources are limited and subject to restrictive constraints. This implies that manufacturing companies need also highly qualified labor force that have not only technical skills but also socio-behavioral abilities to deal with the complexities arising from the transition (Cannavacciuolo et al., 2023). Many scholars are contributing to the research related to the Circular Manufacturing (CM) domain, starting from the competencies needed, including transversal skills like system thinking, creativity and permanent curiosity (Beducci et al., 2024), to models that can support companies in the CE transition, such as a maturity model developed to understand if an organization is capable of processing and managing data to foster the adoption of CM (Acerbi et al., 2024). However, despite these numerous valuable research contributions, the implementation of CE is still at an early stage and companies still struggle to convert their current traditional processes to circular ones. In this phase, educational institutions play a fundamental role in transmitting both theoretical and practical notions to increasingly support manufacturing companies towards the circular transition. Skills need to be constantly updated (Sumter et al., 2021), especially regarding the adoption of Digital Technologies (DTs) to foster circular practices. Given these circumstances, this paper aims to explore the current learning and training opportunities available on the market to enhance people's circular-oriented skills. Therefore, a market analysis has been performed, focused on an in-depth study of the current market offer, exploring courses aimed at developing skills that enable the CE transition, also encompassing sustainability and DTs themes, at Higher Education (HE) and Vocational Education & Training (VET) levels.

The paper is structured as follows. Section 2 describes the research methodology and the main drivers adopted to analyze courses and categorize them into macro-categories. Section 3 analyzes the results and Section 4 discusses them. Section 5 concludes the paper pointing out suggestions.

2. Research methodology

The market research was carried out within the CERES European project (Sassanelli et al., 2023) to map the formative and training opportunities already available in the educational scenario related to the CE domain. The analysis

started in September 2023 and was structured into 3 main steps: *1*. Research of learning and training courses offered on the market and data collection, *2*. Analysis of the information gathered, *3*. Critical discussion of the results obtained. The first step has been conducted classifying the courses by educational levels (i.e., HE and VET). Therefore, dedicated queries were performed on the web browser for gathering information related to the extant courses at HE level ("course circular economy" and "master degree course Circular Economy"), and at VET level ("course on circular economy for vocational and training education VET"). Thanks to this research, 113 courses were found out in total (27 at VET level (mostly related to specific projects dedicated to their development) and 86 at HE level). Going into detail, each course was then analyzed according to 25 drivers, split according to three primary goals: to gather the information describing the sample of courses detected and selected (e.g., provider/teaching institution, language of the course); to analyze the content of courses and of their modules (e.g., methodological approach of teaching, course delivery methods); and, based on this analysis, to classify the selected courses into macro-categories (e.g., keywords, main topics). The classification of courses into macro-categories was done through the SLIP (Sort, Label, Integrate, Priority) method (Maeda, 2006): after identifying the keywords for each educational program, and considering courses' main topics and learning objectives, 3 main macro-categories linked to CE, sustainability and digital transition were detected. These macro-categories are detailed in sub-section 3.2.

3. Results

This section reports the results of the market analysis. In sub-section 3.1, the information describing the sample of courses has been gathered. In sub-section 3.2, the results of the content analysis, which led to the definition of the three macro-categories of courses, are reported.

3.1 Descriptive analysis

HE and VET levels were analyzed separately, being different samples in terms of characteristics (Table 1).

The analysis of the HE sample showed that almost all courses are provided by universities or business schools, which often rely on online course platforms. These teaching institutions are mostly concentrated in Europe, where the United Kingdom (UK), Italy and The Netherlands are the first providers in terms of the number of teaching courses offered. The courses' teaching modules were then examined in detail following the same drivers used for the VET sample.

Concerning VET, the market analysis started with the classification of the educational programs by typology and provider/teaching institutions. Considering the reference sample, 61.5% are projects, 15.5% are teaching courses, 11.5% training courses and the remaining 11.5% is split between workshop, webinar and pilot courses. It turns out that most of them are Erasmus+ funded projects (70.4%), while 29.6% are courses provided by universities (i.e., Lahti University of Applied Sciences, University of Gävle, University of Latvia, Itmo University), non-profit organization (e.g., Circle Economy Foundation), online education platforms (Circulab Academy), and consortium (EIT Raw Materials). It emerged that the most contributing country is Germany, followed by Italy and Spain.

Table 1. Drivers considered for the descriptive analysis

Driver	HE	VET
Teaching approach	*a.* 9.4% of the courses adopts only theory-based approaches; *b.* 15.6% adopts also application-base approaches, case study, simulation; *c.* 3.1% includes analytical application in addition to the previous; *d.* 3.1% integrates all the approaches considered in the analysis (i.e., theory, application-base, case study, analytical approach, simulation, serious game); *e.* 68.8% alternate theory concepts with case studies.	Theory-based approach adopted by all courses. Among them 25.5% also uses practical case studies, 11.8% gamification, 5.9% simulation, 3.9% application-based approach.
Course delivery method	Online delivery method is the most used due to its ease of implementation. Hybrid approach (i.e., online and offline lessons) is practiced by 22.2% of the educational programs, and 18.5% of them are completely provided in presence (offline).	Most of the courses are delivered through online platforms (MOOC). Only 14.8% adopts a hybrid approach, and one course is held in presence (offline).
Required proficiency level	39% does not require specific competencies; 50% require intermediate proficiency levels (i.e., students should already have studied fundamental concepts related to CE); 11% of courses (designed for candidates with relevant experience in the CE field or in areas like R&D) require an expert level.	All the courses require a beginner proficiency level (i.e., they provide teachings that start from the basic concepts and then possibly delve deeper into certain areas, so that they can be accessible to as many people as possible).
Prerequisite	Bachelor's degree or its equivalent are required; in other cases, minimum work experience is required.	No prerequisites needed, excluding only a few cases in which there are constraints in terms of age (e.g., 18+), or English proficiency level (at least B1).

Target groups	Primarily managers, industry leaders, policymakers, business professionals, executives, students specialized in sustainability and CE matters, designers and engineers.	VET students and teachers are the main target groups, although in other cases the targets are technical professionists (e.g., electricians, plumbers), designers, entrepreneurs and managers.
Modules number and their duration	Average number of modules: 5.9; Duration: at least 1 day (in general, there was no precise info about the duration of the modules).	Average number of modules: 5.5 Duration: from 1 hour to 30 hours (74% of courses reports quite detailed information on it).
Final assessment	Many courses disclose information about the presence or absence of final assessments (70.4%). Of these, more than half have final assessments.	48.2% of courses has final assessments, 33.3% of them doesn't had it, and in 18.5% of cases, information on final assessment was not available.
Language	English is the main language used. 9 courses are also provided in other languages besides it (e.g., Norwegian, Spanish, French, Italian); in a few cases, some programs are fully taught in Italian (3) or Spanish (1).	59.3% of courses is taught primarily in English. 40.7% of these courses allow students to follow lectures, in addition to English, also in additional languages (such as Italian, Spanish, Swedish).
Price	17% of courses are free access; 7.9% are free courses but require a fee to obtain the final certification (average price: €121.5), 5.3% require a tuition fee (e.g., universities). The average price of the remaining educational programs is €1,863.48 (min: €13.38 - max: €13,000).	Most of the educational programs are free since they receive funding by the European Commission or other organizations (one course is funded by the Emilia-Romagna region in Italy, for example). Only one course in the sample requires to be paid for ($280,00).
Referring industry	The concepts presented are often not industry-specific (87.7%). Nonetheless, some courses focus on plastic, renewable energy, agri-food, built environment and metal industries.	The courses teach topics transversal to all industries; some are specialized in a specific one (e.g., agri-food), or offer a set of modules specifically focused on a particular sector.

3.2 Content analysis

The SLIP method (Maeda, 2006) allowed the classification of courses within the 3 macro-categories identified (CE transition, Sustainable transition, Twin transition), both at HE and VET levels. Considering that the objective of the analysis is to investigate the teaching and training offer in the CE domain, the "CE transition" macro-category is explored in detail, while, due to the limited space, for the other macro-categories tables are reported to summarize the main topics and sub-topics addressed by the courses.

3.2.1 HE: Macro-Categories

Almost all courses in the HE sample were classified into the "CE transition" macro category, and a very few into the other ones. These are explained in detail below.

3.2.1.1 CE transition at HE level

The category 'CE transition' for HE includes all those HE courses in the sample that aim to provide teaching intended to develop knowledge and skills related to the CE. Considering these conditions, 75 HE courses were identified as part of this category. Through the SLIP method (Maeda, 2006), the data gathered from the analysis was sorted, labeled, integrated, and prioritized according to 7 principal topics, which are: Introduction to CE, Strategy & Marketing, Circular Value Chain, Circular Eco-design, Policies & European Union (EU) regulations, Assessing & Monitoring, and Introduction to Advanced Technologies (ATs) enabling CE implementation (although this is not the core focus of these courses as in the case of the "twin transition" category). These are described in detail below.

Introduction to CE: all the HE courses introduce their teaching offer starting from the basis of the CE, explained following. **1. *Definitions and principles of CE***: the main frameworks and paradigms (e.g., the 3R - Reduce, Reuse, Recycle) are explained, including the advantages CE can bring in addressing global challenges; in some cases, these concepts are described referring to specific industries - e.g., both the Delft University of Technology and the Oxford Management Center offer a course called "*Circular Economy for a Sustainable Built Environment*", which introduces CE theories by linking them to the built environment. **2. *Sustainability***: some courses introduce the CE concepts, remarking the relationship with sustainability. For instance, the course "*A Circular Economy of Metals: Towards a Sustainable Societal Metabolism Sustainability*" introduces metals with reference to the pursuit of circular economy in complying with Sustainable Development Goals (SDGs) standards. **3. *Circular business models***: almost all courses include notions on traditional business models and how we can move towards a circular one; diverse typologies of business models are explained, such as the product-as-a-service model or the sharing platform one. **4. *Benefits and obstacles***: general benefits that CE can bring to the environment, to society (new job opportunities) and companies (e.g., cost savings, energy efficiency, waste reduction) are explained; some courses also discuss the potential obstacles in implementing CE (e.g., these topics

are covered in the courses "*Circular Economy Specialist*" and "*Circular Economy Instructor*" by the Circular Economy Institute).

Strategy & Marketing. Deeper aspects of CE are then outlined in detail, regarding both business strategy aspects and marketing, as reported in Table 2.

Table 2. Strategy & Marketing: Topics, Sub-topics

Topic	Sub-topics
Business resilience	- Business transformation - Learning to be resilient
Value creation cycles	Mapping circular opportunities & initiative
Marketing strategies	Marketing tools to tell circular product/service features
Ecosystems & Partnerships	- Identify key stakeholders in the CE ecosystem, stakeholders' management - Managing strategic partnership (Open Innovation)

Circular value chain: a recurring subject concerns the study of the value chain processes and how to make them shift to a 'virtuous cycle', according to CE principles. Table 3 reports the main aspects taught.

Table 3. Circular value chain (HE): Topics, Sub-topics

Topic	Sub-topics
Procurement	- Raw materials - Sustainable alternative materials
Operations	- Waste management - Energy management

Circular eco-design. Design for reuse, repair, recycling, remanufacturing and de-manufacturing are the most frequently discussed approaches and, in some cases, these are explained with reference to a specific industry (e.g., the course "*Circular Economy for sustainable built environment*" by Oxford Management Center is specialized for the built environment).

Policies and EU regulations. Many HE courses have modules specifically dedicated to policies and EU legislations to make companies aware of the environmental laws to be respected, and also consider possible incentives that EU gives to companies which pursue CE practices.

Assessing & Monitoring. Developing the ability to assess both environmental and economic impacts through Key Performance Indicators (KPIs) is one of the objectives of the courses analyzed. For measuring economic impacts, circular and sustainable finance concepts are given, in addition to notions on budgeting, project financing, and how to predict future scenarios. In terms of environmental impacts, some courses teach how to conduct the Life Cycle Assessment (LCA) and assess the SDGs impacts.

Introduction to advanced technologies (ATs) enabling CE implementation. The implementation of the CE in current processes is being made easier by the development of new ATs, which enable the transition to Circular Industry 4.0. Some examples of technologies introduced by some HE courses (e.g., "*Master in Circular Economy*" by Politecnico di Bari, "*Circular Economy Masterclass*" by University of Exeter Business School) are: blockchain, digital platforms, additive manufacturing, cyber-physical systems, ATs for recycling and recovering (e.g., chemical recycling, energy recovery), advanced waste sorting and separation technologies (e.g., automated sorting, robotics, and artificial intelligence), data-sharing solutions for material tracking and waste management. In these courses, the technologies are simply tackled as complementary to ease the circular transition, but they do not represent the core of the course as in the twin transition part.

3.2.1.2 Sustainability transition at HE level

The "sustainability transition" macro-category includes HE courses that concentrate on gaining expertise enabling the transition towards sustainable practices, on the social, economic and environmental sides. What mainly characterizes these courses is a strong focus on the Environmental, Social and Governance (ESG) standards, also known to be linked with the Triple Bottom Line (TBL) and SDGs. Table 4 shows the primary subjects addressed.

Table 4. Sustainability transition (HE): Topics, Sub-topics

Topics	Sub-topics
Introduction to sustainability	- Principles & relation with CE - SDGs & ESG standards - Sustainability vision
Sustainability management	- Sustainable business models - Leadership skills - Organizational change & design - Marketing strategies
Assessing & Monitoring	- KPIs linked to TBL & ESG - Sustainable finance

3.2.1.3 Twin transition at HE level

Only one HE course within the sample was identified as part of the "twin transition" macro-category, namely the category that includes those courses that consider the green/circular and digital transitions at the same degree of importance, and hence develop skills for enabling both transitions, through the support of ATs. The developed competencies are reported in Table 5.

Table 5. Twin transition (HE): Topics, Sub-topics

Topic	Sub-topics
Sustainability & CE	- Introduction to sustainability & CE basic concepts
Energy management	- Renewable energies - Energy efficiency - Energy certifications
Green technologies	- Energy storage technologies - Renewable heat technologies - Variable renewable energy technologies

3.2.2 VET: Macro-Categories

The majority of courses in the VET sample were classified into the "CE transition" category, followed by "twin transition" and "sustainability transition".

3.2.2.1 CE transition at VET level

The "CE transition" macro-category includes VET courses and related projects (13 in total) aiming to develop knowledge and capabilities enabling the transition from a linear to a circular model. After an in-depth analysis, six relevant topics were detected through the SLIP method (Maeda, 2006), set out and further explained below.

Introduction to CE. All the courses belonging to the VET sample offer specific modules dedicated to the introduction to the principles of CE. These principles mainly regard the definition of CE and its frameworks (e.g., 4R - Reduce, Reuse, Repair, Recycle); the relationship between CE and sustainability; the advantages and main obstacles to CE implementation; the future opportunities and needs in the labor market expected by 2030 (*circular jobs*). In one course (i.e., '*Education for Zero Waste and Circular Economy*'), these principles are also explained by referring to a specific industry (i.e., the construction industry).

Circular business models. It's a topic addressed by the majority of the courses in the sample. The primary knowledge addressed regards the definition of business models, their principles, and the concept of '*circular business models*', that is based on moving from the current linear approach to a circular one, where waste can again become a resource. For many companies, especially if they have a traditional business model, it may be difficult to make this transition. Thus, it is necessary to also provide knowledge on how to implement a circular model, proposing possible strategies of innovation. For instance, the course '*FURN360*' explains these competencies specifically for the furniture industry, supported by business model case studies and circular model strategies in that industry.

Business Management in the CE. Few courses offer modules dedicated to increasing the capabilities of how to create, organize, manage, and make decisions when applying circular models. Indeed, it is important teaching how to evaluate both the commercial and environmental impacts, alongside the development of entrepreneurial skills (e.g., this is done in the '*Circular Skills'* project).

Circular value chain. It also emerged that many courses teach innovative approaches on how to make circular the value chain's stages (Table 6).

Table 6. Circular value chain (VET): Topics, Sub-topics

Topic	Sub-topics
Procurement	- Raw materials - Sustainable alternative materials - Green procurement
Operations	- Waste management and audit - EU legislations
Marketing & Sales	- Greenwashing - Communication strategies

Circular design. At least eight projects/courses offer teaching on circular design, which relates to the Design for X (DfX) approaches. Insights on design for reuse, recycling, remanufacture, repair, upcycling, sharing, and testing are proposed. These approaches are explained by integrating *design thinking* (an approach to innovation that can help companies in solving complex problems), and EU regulations, which set limits to be respected.

ATs to support CE implementation. This topic is addressed only by one VET project and two training courses (i.e., '*FURN360*', '*Design for a Circular Economy*', and '*Circular Economy: Increasing Resource Efficiency and Designing Out Waste*'). They propose new technologies that can support CE, such as Augmented Reality (AR), 3D printing and scanning, digital collaborative platforms, and tracking systems.

3.2.2.2 Sustainability Transition at VET level

Within the sample, five projects were identified as part of the macro-category called "sustainability transition", defined following the criteria used for the same macro-category at HE level. Through the SLIP method, four topics of relevance were identified (Table 7).

Table 7. Sustainability transition (VET): Topics, Sub-topics

Topic	Sub-topics
Climate change	- Definition of climate change - Main challenges
Social circular economy	- Definition of social CE - Circular business models - Innovation ESG strategies
Entrepreneurship	- Social & sustainable entrepreneurship - Eco-entrepreneurship
Monitoring & Assessing KPIs	- LCA - Definition of relevant KPIs - Circular tools

3.2.2.3 Twin transition at VET level

Among the projects/courses analyzed, nine were classified as part of this macro trend (defined following the same criteria adopted at HE level). The analysis of their objectives and modules made it possible to identify 5 topics that characterize this macro-category (Table 8).

Table 8. Twin transition (VET): Topics, Sub-topics

Topic	Sub-topics
Sustainability & CE	- Definitions of CE and sustainability - Advantages & Obstacles - Circular business models - Frameworks useful to implement sustainable circular practices & SDGs - EU policies
Digital Tools	- Digital tools, advantages & obstacles -Automation, Artificial Intelligence, Internet of Things, visualization platforms, quantum computing & blockchain - Digital Twin
Robotics	- Principles of Robotics - Collaborative Robotics - Lean Robotics
DfX	- Design for robotic cells, recycling, etc. - Design for waste management - Design for energy efficiency

	- EU legislations
Monitoring & Assessing	- LCA - Definition and choice of relevant KPIs - Circular tools

4. Discussion

The above-mentioned analysis can provide valuable insights into the current opportunities for individuals and organizations at both HE and VET levels. Below, some considerations in terms of courses available on the market to enhance circular-oriented skills are highlighted and discussed. The first consideration regards the difference in type of topics and degree of depth (or level of granularity) for courses at VET and HE levels. For what concerns the projects and courses at VET level, in general the teaching approach is mainly based on practical aspects rather than theoretical ones. This is consistent with the type of audience addressed. Most of these courses have been developed through projects funded by the EU with the aim of creating training courses for the CE transition, many of which are still ongoing. This insight unveils that some teaching providers are starting to implement a transition towards an educational offer that integrates CE and sustainability themes, but still at a mostly experimental level. Moreover, by analyzing the topics addressed by the courses belonging to the VET sample, specific related gaps have been identified. In particular, in the "CE transition" macro-category, the courses are mainly focused on providing knowledge about basic CE principles, circular business models, and circular design, but only few of them offer teachings that provide students with the basics of financial aspects, fundamental metrics useful in measuring environmental, economic, social impacts, LCA, identification and monitoring KPIs necessary to achieve the optimization of process flows. These elements are essential in implementing circular models. On the contrary, the courses in the "sustainability transition" and "twin transition" macro-categories deepen these topics and provide practical examples of their implementation to improve the learning process. Except for the "twin transition" macro-category, another gap is the lack of teaching modules that delve into those ATs and tools which are already present on the market and could be potentially implemented by manufacturing companies to facilitate the circular and sustainable transition. This could be linked also to the type of macro-categories considered that have a limited attention over DTs. Only a few courses in the "CE transition" macro-category deal with relevant practices and aspects useful for making the shift towards circular supply chains, and these topics are not addressed in the educational programs in the other macro-categories. Moreover, entrepreneurial skills are developed mainly by those courses belonging to the "sustainability transition" macro-category and very few in the CE one.

Looking at those courses addressed at HE level, most of them have been clustered inside the "CE transition" macro-category. This result, in fact, was expected considering the initial queries used (i.e., "course circular economy" and "master degree course Circular Economy") and the objective of this market analysis, which focused on deepening the educational offering linked to the CE. At HE level, many topics - such as circular business models - are considered as prerequisites that students should learn during the introduction of teaching modules, while other topics, like policies and EU regulations, are considered an important section that needs to be explored in depth in dedicated modules. However, after a careful analysis of the courses' learning objectives and teaching modules, it was possible to understand that most of them deal with many aspects relating to CE but in a fairly generic way, and only a few courses address the topics at an advanced level.

Comparing the educational programs among HE and VET levels, it emerged that HE courses tend to address the topics linked to CE without focusing on a specific industry, unlike VET courses which, in general, explain the main concepts and then go into detail by industry (e.g., agri-food, construction, fashion). Furthermore, unlike VET courses, HE programs provide many theoretical concepts and, in many cases, they deepen the themes of monitoring and assessing relevant KPIs, also offering a broad overview of the main technologies that can support the circular transition. However, they lack practical teaching, thus making it difficult to put the theoretical concepts learned into practice. A gap of concern, common to both HE and VET levels, regards how to handle the problem of greenwashing. Indeed, there are many EU policies and regulations which oblige companies to achieve objectives in line with CE and sustainability. Nevertheless, having to comply with these rules can often lead companies to adopt opportunistic behavior, as many of them tend to embrace practices that apparently respect the environment or social values, but only for facade. Therefore, there is the need to create awareness of this issue to make companies aware of the significance of their actions' effects and impel them to concretely undertake a CE and sustainability transition. Another aspect that emerged concerns the accessibility of these courses: most of HE courses are not for free, and the required cost is on average greater than €1,800, thus representing a limit of accessibility (not all people can afford them); on the other hand, VET courses are almost all available for free. Moreover, many courses (both at HE and VET levels) are only provided in English, which could still be a barrier for some groups of individuals (depending on their age) even if it is the primarily known by the younger generations.

4.1 Contribution and implications

This market analysis contributes to both theory and practice, providing a set of managerial and policy implications. From a theoretical perspective, it provides a systematization of a broad sample of courses at HE and VET levels, clustering them into 3 main macro-categories (i.e., "CE transition", "sustainability transition", "twin transition"), and also detailed into relevant topics and sub-topics addressed by their teaching modules. This systematization can be useful to all the researchers engaged in the field of CE and sustainability, helping them to understand what is the current market offer, and which are the main trends and gaps. At the same time, this research contributes to practice, impacting both course providers

and practitioners (e.g., companies' employees). Indeed, providers (such as universities) can consider the results of this research for understanding how to position their educational offer in the market and how to improve it according to the market needs. On the other hand, practitioners (such as companies) can refer to the main topics and detect which are the most interesting areas useful to improve their transition towards CE, for instance. The research also has managerial implications, since managers can take as a reference the systematization into macro-categories of the courses detected and analyzed to improve the decisions about which topics (and related courses) should be chosen for reskilling/upskilling companies' employees, in line with the CE transition. Finally, the results obtained can also have policy implications. Indeed, even if educational programs in the CE field are increasing, this research raises a relevant gap (i.e., the quite general and theoretical approach used to explain the CE topic, neglecting specific and detailed applications). Therefore, policy makers can use these results as a starting point for developing and formulating new educational funding programs able to fill this gap and help practitioners to acquire more practical-oriented skills and to put into practice what has been learned theoretically.

5. Conclusion

The market analysis was conducted to map the formative and training opportunities already available on the market in the educational scenario related to CE domain. The analysis started with the search of learning and training courses offered on the market, leading to collecting 113 educational programs. These were then examined based on 25 drivers of analysis to gather descriptive information about the courses, explore the content of their modules, and then classify and systematize them into 3 main macro-categories (i.e., "CE transition", "sustainability transition", "twin transition"). Each macro-category was gauged in detail, allowing also to define the relevant topics and sub-topics characterizing each of them. In the end, the research enabled to detect the gaps present in the current market. It is necessary to specify that the results obtained are subject to limits of the research. For instance, the entire sample of teaching and training courses analyzed focuses on providing education exclusively for VET (i.e. courses carried out at upper secondary level and post-secondary level), and HE (i.e., courses provided by universities, business schools, and other teaching institutions for post-secondary education), neglecting other levels of education (e.g., primary schools, middle schools - EQF levels 1,2,3). This is due to the queries used for the initial courses search, which was specific for HE and VET levels. Another limit of the analysis regards the availability of courses' information: indeed, many courses don't disclose complete data about their organization, learning objectives, teaching modules. Thus, conclusions were reached based on the personal interpretation of the data available at the time the analysis was carried out, but it is possible that some courses could have added/changed information in the meanwhile, or they are no longer available on the market. Based on the results and limits of this research, next steps can be suggested to further improve the analysis. First of all, search queries can be extended to cover a wider spectrum of teaching levels (including for example primary schools), to gather relevant data that potentially can support the creation of a new set of educational paths which include CE and sustainability themes, raising public awareness and making them becoming the new standard both for the society and companies. Lastly, another recommendation concerns the potential cooperation among teaching providers of CE courses to fill the current market gap.

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