Education for Zero Waste and Circular Economy

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Abstract

Erasmus+ project on *Education for Zero Waste and Circular Economy* (EduZWaCE) started in October 2018 to fill a gap in Vocational Education and Training on Waste minimization and circular economy, and develop interdisciplinary skills needed for new jobs in the areas. The international consortium of ten partners from nine European countries works to produce an interactive platform, comprising a Knowledge Hub, an Online Course and a Diagnosis Tool. The online course is addressing the training material on zero waste and circular economy focused on two profiles – manager and worker. The EduZWaCE courses respect the European Qualification Framework (EQF) and the European Credit system for Vocational Education and Training (ECVET) rules. Five learning units have been prepared for each profile. The elaborated learning units for managers are: 1) Introduction, 2) Material and resource efficiency, 3) Circular design, 4) Value creation in circular economy and 5) Self-assessment tool. Each unit is citing learning outcomes: knowledge, skills, competences and main action/achievement to be acquired. The contents of the worker's learning units has been concentrated on a qualified worker for reusable construction and demolition materials which targets the highest fraction of waste (36 %) in EU; its contents are: 1) Introduction (including best practice in cities), 2) Construction elements in buildings, 3) Wooden elements, 4) Electric equipment in buildings, and 5) Conduction of an assessment of reusable construction and demolition materials. The training material has been discussed with invited stakeholders at national workshops. The results of the discussion have been included in the final version of the learning units. A training procedure and recognition methodology will be used to pilot the training material developed; the results are expected in early summer and will be reported at the HES2020. The project is expected to have significant impact on individual participants, their organisations, target groups and relevant stakeholders. Dissemination and diffusion of project results will comprise target groups inside and outside the partnership. The outside target audience will be informed at local, regional, national, EU and global levels.

Keywords: education, zero waste, circular economy, online course, Erasmus+KA202

1 Introduction

The climate crisis causes extreme weather events, e.g. in the last year – wildfires in Australia, Amazon, Angola, California, Congo and Siberia, record summer and annual high temperatures in

Western Europe, invasive species growth and migrations through changing of ecosystems, warming up of oceans, melting of ice cover and the first glacier on Iceland, as well as floods, typhoons in Philippines and Japan, cyclone Fani in India, hurricane in the Bahamas. The world's people will face "untold suffering due to the climate crisis" unless there are major transformations to global society, according to a stark warning from more than 11 000 scientists (ScienceAlert, 2019). "We declare clearly and unequivocally that planet Earth is facing a climate emergency," they state. "To secure a sustainable future, we must change how we live. This entails major transformations in the ways our global society functions and interacts with natural ecosystems." Nine components of our climate system called "tipping points" because they are under growing threat of abrupt and irreversible changes points (Amazon rainforest, Arctic sea ice, Atlantic circulation, Boreal forests, Coral reefs, Greenland ice sheet, Permafrost, West Antarctica ice sheet, part of East Antarctica) may increase the risk of crossing others, pushing Earth to the point of no return (WEF, 2019). In December 2019, European Environment Agency (EEA) issued a report on Europe's state of the environment 2020 (EEA, 2019): "change of direction urgently needed to face climate change challenges, reverse degradation and ensure future prosperity".

Primary raw materials, metal ores, minerals and fossil fuels are essential to produce metals, glass, bricks, ceramics, cement, lime, textiles, paper and plastics for manufacturing of basic products for living. They range from buildings, roads and railways, to furniture, household appliances, heating, air conditioning, information and communication equipment, to cars, trains, buses, ships and planes, to machines, engines and devices, to books, clothes, packaging and wrapping, etc. We need energy, water, air and food for living and producing. Only few of the resources are renewable like sunshine, water, wood, food and feed. The supply is limited while their use is growing exponentially. Therefore, some of them are already scarce, and EU has declared 27 of them as *critical raw materials* (EC, 2020a). To remain competitive and to preserve our environment, natural resources should be used efficiently and without depleting the planet's resources. This can be achieved only by recycling of all waste materials as secondary raw materials. The global economy is consuming 100 Gt/a (billion tonnes per year) of material but just 8.6 % are cycled back (CGP, 2020). 30 million jobs in EU depend on the availability of raw materials. Eurostat is publishing waste management data and indicators for member states.

Skills and competences in the field of Zero Waste and Circular Economy (ZW&CE) are becoming extremely important. In 2016, sectors relevant to the circular economy employed more than four million workers, a 6 % increase compared to 2012. According to the statistics, the EU economy still loses a significant fraction of potential "secondary raw materials" in waste streams. In order to avoid that, the EU has adopted in 2015 an ambitious programme called "Towards a Circular Economy" – an economy package to help European businesses and consumers to make the transition to a stronger and more circular economy where resources are used in a more sustainable way, boosting global competitiveness, fostering sustainable economic growth and generating new jobs (EC, 2015). As part of its continuous effort to transform European economy into a more sustainable one and to implement the ambitious CE Action Plan, in January 2018, the European Commission adopted a new set of measures known as the 2018 CE Package. Above all, the circular economy transition reinforces social and territorial cohesion and favours a balanced distribution of jobs meeting health and safety standards, enabling generation of fair and sustainable growth.

The European Parliament declared a climate and environmental emergency in Europe and globally in November 2019. The European Commission adopted The European Green Deal (EGD) to tackle

climate and environmentally-related challenges (EC, 2019b). It is a new growth strategy that aims to transform the EU into resource-efficient and competitive economy with zero greenhouse gas (GHG) emissions and economic growth decoupled from resource use. It also aims to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks. Eight points of EU's deep transformation policies include "Mobilising industry for a clean and circular economy" and five points of mainstreaming sustainability in all EU policies will include "Activating education and training" (EC, 2019b).

In January 2020 the EGD investment plan and the just transition mechanism have been proposed the European Commission (EC, 2020b). In March 2020 European climate law has been proposed, public consultation on the European Climate Pact started, European Industrial strategy was adopted, and Circular Action plan was proposed by EC. The EGD is an integral part of the United Nation's 2030 Agenda, and the Sustainable Development Goals (SDGs, 2015). EU has an ambition to become a global leader and to launch a European Climate Pact. The EC presented a roadmap of the key policies needed to achieve the EGD.

At COP25 in Madrid in December 2019, a record of 631 institutional investors managing more than 37 TUSD (trillion US dollars) in assets urged governments to step up efforts to tackle the global climate crisis and achieve the goals of the Paris Agreement (Global investors, 2019). Millions of youths demonstrated in the world cities and protested also at: United Nations Climate Action Summit in New York, September 2019, UN Climate Conference COP 25 in Madrid, December 2019, and the World Economic Forum (WEF) Meeting in Davos, January 2020.

According to the WEF's *Global Risks Report* (WEF, 2020), for the "first time in the survey's 10-year outlook, the top five global risks in terms of likelihood are all environmental". The report sounds the alarm on: extreme weather events, failure of climate-change mitigation and adaptation, human-made environmental damage and disasters, major bio-diversity loss and ecosystem collapse with irreversible consequences for the environment, resulting in severely depleted resources for humankind as well as industries, etc.

The present article provides general information regarding the project EduZWaCE, an Erasmus+ project that aims to fill the gap in Vocational Education and Training through the creation of new training courses focusing on ZW&CE. The international consortium consists of ten partners from nine European countries with various backgrounds, ranging from Universities to Vocational training centres and from public organizations to private companies related to ZW&CE. The project is expected to create four distinct Intellectual Outputs until September 2020, a Knowledge Hub, two Online Courses, and a Diagnosis Tool, all connected through the Online Platform of the project.

The article does not intend to provide an overview of the current state of the field in the partner countries and EU27 as it has been presented at the European Roundtable for Sustainable Consumption and Production (Glavič et al., 2019). Major definitions are given there, along with the state of the art report related to the waste generation, waste recycling, organization of trainings upon ZW&CE and good practices in the sector in all partner countries. Below, we are presenting just the main definitions.

Zero waste, ZW, is the conservation of all resources by means of responsible production, consumption, reuse, and recovery of all products, packaging, and materials, without burning them, and without discharges to land, water, or air that threaten the environment or human health (ZWIA, 2019). ZW refers to waste management and planning approaches which emphasize waste prevention

as opposed to end-of-pipe waste management. The three most important areas of ZW are: cities (ZW Municipality), businesses and Life-style.

Circular economy, CE is an alternative to a traditional linear economy (make, use, dispose) in which we keep resources in use for as long as possible, extract the maximum value from them whilst in use, then recover and regenerate products and materials at the end of each service life" (WRAP, 2019). CE is an economy "where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised''.

CE is central to the achievement of Sustainable Development Goal (SDG) 12 on Ensuring **sustainable production and consumption** patterns. It is about promoting resource and energy efficiency, sustainable infrastructure, and providing access to basic services, green and decent jobs and a better quality of life for all. Its horizontal approach is supporting other SDGs, such as SDG 6 on clean water, SDG 7 on energy, SDG 11 on sustainable cities, SDG 13 on climate change, SDG 14 on life below water, and SDG 15 on sustainable use of natural resources.

2 Methods

From its inception, the project proposal stressed the importance of developing the EduZWaCE course according to the European Qualification Framework (EQF) and the European credit system for vocational education and training (ECVET).

The European Qualifications Framework (EQF) is a common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems. It is important to support cross-border mobility of learners and workers and lifelong learning across Europe. The EQF is considered, therefore, a bridge between national qualifications systems and the core of the system are eight reference levels defined in terms of learning outcomes, i.e. knowledge, skills and competences (Cedefop, 2018). According to the Recommendation of the European Parliament and of the Council on the establishment of the EQF, and in a similar ECVET Recommendation, learning outcomes are defined as "statements of what a learner knows, understands and is able to do on completion of a learning process, and which are defined in terms of knowledge, skills and competence". "Knowledge", means the outcome of the assimilation of information through learning, is the body of facts, principles, theories and practices that is related to a field of work or study. "Skills" means the ability to apply knowledge and use know-how to complete tasks and solve problems and are described as cognitive or practical and "competence" means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development (Reynolds, 2010).

The European credit system for vocational education and training (ECVET) is one of the instruments proposed by the EU for helping individuals in transfer, recognition and accumulation of their assessed learning outcomes, to achieve a qualification or to take part in lifelong learning. This enables building a qualification at learners own pace, from learning outcomes acquired in formal, non-formal and informal contexts, in their own country and abroad. The system is based on units of learning outcomes as part of qualifications that can be assessed and validated (Cedefop, 2016).

The EduZWaCE Job profiles, Learning Units & Outcomes have been developed taking into consideration EQF, ECVET and the National Qualification Framework requirements (Figure 1). The

main intention was to harmonize the knowledge, skills and competences in all nine participating countries and prepare the course for further certification.

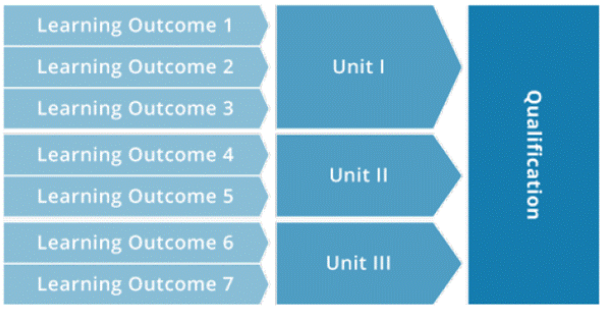

Figure 1: The ECVET methodological tool. Learning outcomes and Qualification

The following methodological steps have been applied: (1) establish of the clear goal of the course based on the job profiles; (2) establish the entry requirements for the two job profiles based on the EQF and NQF levels; (3) establish the job descriptions: what the new functions have to do?; (4) describe the activities expected to be performed; (6) define the learning units for each job profile; (7) define the learning outcomes for each learning unit in terms of knowledge, skills and competences; (8) establish the sub contents and select the relevant contents for the two job roles and finally (9) Set up the ICT solution for the online training.

3 Results

3.1 Project platform

The EduZWaCE platform is a virtual learning and collaboration environment for all, an interactive and collaborative online structure with the following content: 1) Knowledge HUB Section; 2) Online Training Section with two courses; 3) Participants Section; 4) Collaborative Section (Figure 2).

Figure 2: The EduZWaCE platform (https://www.eduzwace.eu/index.php)

The Platform is developed around two innovative elements:

1) Multi-functional – the sections will serve various objectives: stakeholders' information (Knowledge HUB), target groups education and support for VET teachers (online course), participation, match making and collaboration.

2) Collaboration – besides the information and education functions, the Platform will enable interconnection and collaboration between various participants dispersed in different locations; they will be able to access the sections and interact with each other.

The platform serves future education and consultancy projects of the partners and other interested organizations. It is offering at the same time new experiences through interacting, exchanging ideas and good practices with peers from the same country or other countries, fostering the development of an innovative teaching approach. It is including new opportunities towards the reuse and sharing of learning resources, development of networks, offering more opportunities to establish further collaborations in research fields of common interest and for benchmarking the content and achieved performances. The innovation elements are the multi-functionality and collaborative function which intends to bring stakeholders together and inspire them to go for circular solutions. Such a model is perfectly transferable to other contexts, topics, environments or education field.

The **Knowledge Hub** (KH) is one of the intellectual outputs of the project. It is an interactive, open online resource centre that includes relevant contents about the circular economy, waste and zero waste concept, critical raw materials, circular design, etc., available in scientific and "grey" literature, standards and legislation, books, good practices, case studies, presentations, videos, software, methods, tools and other relevant resources. It has a user-friendly structure and functionalities, and due to its concept and architecture, it is easily transferable to other educational systems and topics. Therefore, the KH supports teachers and trainers, as well as professionals from companies and other users in preparing their training actions and in self-learning, and also to be inspired by ideas coming from existing best cases and success stories. There are currently 83 resources in the KH, in the project languages plus English, covering a vast array of materials, both cross-sectoral and sector-specific.

Vocational Education and Training (VET) teachers as well as professionals from companies and other users will have access to this open education resource, with tailored information in a structure that will allow further enclosure by all partners of new released information, which is continuously being developed in the area of ZW and CE.

The **Online Training** section of the Project EduZWaCE was developed on the open source of Moodle (2019), an e-learning platform designed to provide trainers, administrators and learners with a reliable, secure and integrated system of personalized learning environments. Moodle is provided freely as Open Source software that anyone can adapt, extend or modify for commercial or non-commercial projects without any licensing fees, and benefit from the cost-efficiencies and flexibility. The possibilities of the open source learning management system will be used in the EduZWaCE platform by a modular approach to use exactly those features which are fulfilling the multifunctional and collaborative needs in the area of administration, the platform itself and the course content.

Two courses are available at the platform. First, the course for qualified Zero Waste and Circular Economy managers which consists of five learning units: 1) Introduction to CE, 2) Material and resource efficiency, 3) Circular design, 4) Value creation in CE, Circular business models, and 5) Self-assessment and co-creation of circular solutions. Their contents are elaborated in sub-contents. Second, the course for qualified ZW&CE workers from reuse centres in the construction & demolition sector which contains five learning units, too: 1) Introduction, 2) Construction elements, 3) Wooden elements, 4) Electric equipment in buildings, and 5) Conduction of a reuse audit.

Each course with all learning units is available in 10 languages (English and 9 languages of Project partners) containing on the front page of every course a space for announcements and a summary of every learning unit including planned achievements, the learning contents and required workload. Every Learning unit has Main Training Materials, additional audio-visual training materials and an Evaluation quiz – the learner has to answer 7 out of 10 questions to get access to the materials of the next learning unit (Figure 3).

Figure 3: A learning unit within the online training section.

The online training section was tested in December 2019 at the first national EduZWaCE workshop in Poland. In the next weeks it will be completed by translations to the participants' national languages.

3.2 Online Training

In the last two years, a remarkable increase of training offers in the field of ZW & CE has been observed, especially at university level. The subject has been integrated in curricular units, and it has been the subject of new curricular units and even postgraduate courses. Outside Higher Education, the training offers are less systematic and, therefore, cover a much smaller number of potential students or trainees. The EduZWaCE project definitely contributes to filling a gap in vocational training in the field of zero waste and circular economy.

Even if education and training in CE & ZW was not usual some years ago, in the last year, the training offer has been improved in an important way. Professionals from companies can attend training courses in CE & ZW, provided by different organizations as Higher Education Institutions (i.e. postgraduates and masters) and other VET institutions (i.e. short courses). Additionally, professionals can participate in ad hoc seminars, scientific and professional conferences, read books or e-manuals, or access to eLearning platforms (this last option, not widely extended), as part of a non-regular and systematic education scheme.

3.2.1 Online course for managers

ZW&CE Manager is a professional able to asses resource use, waste generation, and products life cycles, and develop, implement and monitor specific projects for "closing the loops" in a company. It is a postsecondary qualification (professional specialization). Entry requirements are:

- EQF level 5 completed
- Interest in acquire specialized knowledge in zero waste and circular economy
- At least one year of work experience in resource and waste management, production operations
- Specialised, factual and theoretical knowledge within the field of waste and resource management and specific production operations
- A comprehensive range of cognitive and practical skills required to abstract problems and develop creative solutions

The Manager's activities foreseen are:

1. Assess resource consumption and waste generation
2. Develop material and waste balances;
3. Assess root causes of materials inefficiencies and wastes;
4. Generate waste reduction options, evaluate and implement them
5. Systems Evaluation -– Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.
6. Monitoring/Assessing performance of organization in material resource/waste management use, propose improvements or take corrective action.
7. Evaluate products and ways to greening the products
8. Perform circularity assessment in a company
9. Propose circular solutions for products, operations and services and /or new circular business models
10. Identify product and packaging improvement opportunities.

A Learning Unit consists of a coherent combination of learning outcomes, subject to evaluation and autonomous validation. Learning outcomes consist of knowledge, skills and competences that are mobilised in actions through which the individual shows/demonstrates mastery of the acquired learning outcome, in accordance with certain performance criteria and context conditions.

Five learning units are being developed:

1. Introduction to circular economy
2. Materials & resource efficiency
3. Circular design
4. Value creation in circular economy circular business models
5. Self-assessment and co–creation of circular solutions

Their contents are elaborated in sub-contents, described below.

The *Introduction* unit is described in three subunits: 1) Closing the loop – an EU action plan for the CE with the new skills agenda, 2) Introduction to zero waste, and 3) Introduction to CE with three chapters: a) global interdependence (ecological footprint, Sustainable Development Goals, and planetary and social boundaries), b) introducing the concept of circularity including the CE monitoring framework, c) opportunities for Europe, and d) three aspects of circular transition with the circular triangle (circular economy, circular change and circular culture).

Material and resource efficiency has three subunits, and each one is supported by a case study: 1) Resource efficiency and cleaner production, RECP (concepts, method and practices), 2) Materials and waste assessment, and 3) Technical materials and nutrients cycling strategies.

Circular design learning unit aims at explaining and discussing how the design of products and services contributes to the circular economy and sustainability. This topic is addressed from a conceptual perspective and from a practical perspective. Learners get acquainted with circular design strategies and how they can be applied to the development process of products and services, in a holistic manner, leading to innovative solutions. There are eight circular design strategies, with some criteria for assessment and implementation, illustrated with examples. The LU also includes a stepwise approach for the practice of design for circularity, based on the design for sustainability process that has been widely applied and validated in numerous projects worldwide. At the end of the LU, selected tools that are available to support circular design are presented.

The Learning Unit 4 for Managers is entitled *Value Creation in Circular Economy – Circular Business models*, and aims at supporting professionals to understand how value can be created through the transition from linear to new circular business strategies and models. It presents the main business model categories and business strategies to be implemented by companies, in order to get benefited from new value capture opportunities, together with explaining the key role of supply chains and reverse logistics when developing those strategies. It also includes main economic benefits and financial challenges of circular business models and it defines some steps to help companies transit from a linear to a circular business model.

The aim of the last learning unit, Self-assessment and co-creation of circular solutions, is to learn professionals how to carry out an assessment of company's performance in context of resource efficiency and circularity, and allow a company to estimate how advanced it is on its journey from linear to circular economy. The learning unit shows examples of existing self-assessment tools and provides their comparison in terms of methodological approach and content, and discusses their benefits and limitations. It focuses on circularity assessment of products, processes (material flows and waste streams) and value chain aspects as well as economic evaluation of circular solutions.

3.2.2 Online course for **workers**

Construction and demolition waste (CDW) is the largest waste stream in the European Union. According to Eurostat, it generates over 0.6 Gt/a (billion tons per year) of waste, i.e. 36 % of the total volume of waste. Lots of materials and components produced during demolition or renovation of buildings, including concrete, bricks, gypsum, wood, glass, metals, plastic, excavated soil or electric equipment can be recovered and reused in other construction projects or even outside this sector for other purposes.

This online course is designed for workers from reuse, repair or recycling centres who are interested in acquiring knowledge and new skills in the field of reuse and circular economy, with particular focus on construction and demolition sector. Entry requirements are:

- EQF level 3 completed
- Graduates from high schools, secondary schools or professional schools.

In this first learning unit they will gain a comprehensive understanding of the basic concepts related to circular economy as well as major benefits and potentials resulting from the implementation of circular economy principles in construction & demolition sector.

The course combines theoretical foundations with practical examples and tasks. It is divided into the following five learning units:

1. Introduction (including best practice in cities)
2. Construction elements
3. Wooden elements
4. Electric equipment in buildings
5. Conduction of an assessment of reusable construction and demolition materials

Based on the document "Guidelines for the waste audits before demolition and renovation works of buildings" (European Commission, 2015) the learning unit 1, *Introduction,* gives an overview of the aspects such as: What is a reuse audit in construction & demolition sector (purpose, target groups, added value, etc.); what are the major steps in conducting such an audit? Summary of best practices

in cities are then presented. The learning units 2–4 will focus on selected reusable materials and elements, i.e. wooden elements, construction elements, and electric equipment in buildings.

The learning unit 2, *Construction elements*, contains four subunits: 1) Categorization and construction elements in buildings, 2) Construction & Demolition Waste, CDW – dismantle, recovery, and reuse methods, techniques and instructions for these elements, 3) Reusable materials from construction and CDW sites, waste reduction and separation techniques, 4) Environmental, social and business /economic value and risks of construction elements in buildings.

The learning unit 3, *Wooden elements* includes five subunits: 1) Overview of main wood categories and characteristics in building sector (wood type, product, and quality grades), 2) Wooden structural elements in construction sites and buildings, hardwood and softwood, 3) Reclaimable, recyclable and reusable wood materials in building sector, 4) Reuse and recycle procedures, and 5) EU recommendations and regulations on wooden structural elements.

The learning unit 4, *Electric equipment in buildings*, gives an introduction to relevant regulation on European level, and based on this aspect an overview about the categorization of electric equipment in buildings. The most important stakeholder and elements in the reuse and recycling processes of electric equipment from buildings are business processes and environmental impacts. Therefore, the materials presents environmental and business values and risks connected to the processing of electric equipment in buildings. The learner will gain with the training specific knowledge on how to dismantle, reuse, recycle and recover electric equipment in buildings and can be inspired by the presented Good practices of recovery, reuse and recycling electric equipment in buildings.

At the end of the course (the learning unit 5, *Conduction of an assessment of reusable construction and demolition materials*) a fictitious reuse audit of a building is performed by the course participants. The participants will be given an opportunity to perform the audit within the framework of a focus group and under guidance of an expert in the field of CE. Reuse Auditor is a qualified expert who carries out an assessment of reusable construction and demolition waste streams prior to demolition and renovation of buildings (called “reuse audit”). The aim of the audit is to facilitate and maximize recovery of materials and components from demolition or renovation of buildings and infrastructures for beneficial reuse and recycling, without compromising the safety measures and practices. The main objective of this subunit is to provide guidance on best practices and methods to conduct a reuse audit. By the end of the course, participants should be familiar with demolition and material recovery techniques as well as treatment and storage of reusable materials and elements and have a basic knowledge of legal framework regarding construction & demolition waste, and basic knowledge of current and historical building materials.

3.3 Workshops

Invitations have been sent in advance to 30–50 people, 15–20 took part at the face to face meetings from November 2019 to February 2020. They were covering all types of stakeholders: local companies in the field, local chamber of industry, public authorities, VET institutions, universities, high-school institutions, trainers in waste management and circular economy, research institutions, etc. Drafts of both online courses have been presented to stakeholders for evaluation and discussion in five partner countries. The project Flyer and 2nd Newsletter were given to all the participants.

The workshops in Czech Republic, Poland and Slovenia were organized according to the following agenda:

1. Presentation of the project
2. The EduZWaCE Platform, in particular:
    a. The Knowledge Hub – outline, resources and functionalities, how to access and search for the documents
    b. The Online course for EduZWaCE Manager and Worker – description of entry requirements, the job description for all two user profiles, LUs content and how to access and use the online course
3. The presentations have been followed by discussions between participants and the presenter(s) about the needs of the stakeholders, advantages and disadvantages of the presented project, possible cooperation among the stakeholders as well as the values of such support in daily business of the participants.
4. In total 40 participants have filled in the evaluation forms or evaluated the workshop online through Google forms. Four participants did not respond.

The responses were as follows:

1. KH evaluation:
    a. 93 % of participants evaluated the *user-friendliness* as good and very good (3 % as poor), 93 % of them valued the *relevance* but only 83 % regarded the number of *resources* (18 % of participants evaluated them as bad), and 90 % their variety as good or very good.
    b. 58 % of participants agreed or totally agreed they *will use* the KH for learning, teaching and implementing circular economy measures, and 13 % of participants declared *not to use* the KH. The rest of participants were *neutral* – it was difficult for them to say whether they will use the KH in their daily processes.
    c. The following *comments* were given: A very interesting project – it has many opportunities for development and a huge potential for companies. The interface and materials shall be available in national languages. In general, the KH needs more materials, more resources about CSR and more examples from practice (case studies).
2. Course structure evaluation:
    a. 78 % of participants were interested for the *Manager* course, 20 % of participants declared to be interested for the *Worker* course.
    b. Only 13 % of participants considered that some subjects and content were missing.
    c. The following comments were given: the cost-benefit-analysis is missing in the circular economy approach (esp. the business value). More information about WEEE (especially the process of collecting waste from consumers), waste assessment methods, polymers and plastic materials, biological waste and land use – rehabilitation of degraded areas would be useful. More practical examples (case studies), and information about legislation, regulation, directives and legal obligations are necessary.
3. Evaluation of the training procedure:
    a. 60 % of participants agreed or strongly agreed that the proposed methodology is in line with the objectives of the EduZWaCe Manager Job profile. For 37 % of participants it was difficult to say, and only 3 % of participants do not agree that the methodology is in line with the objectives
    b. 18 % of participants agreed or totally agreed that they knew the ECVET procedure, 45 % of participants did not know the ECVET procedure, and 37 % of participants were neutral.

c. The majority of participants (70 %) declared to prefer a mixed learning approach (online and face-to-face), 23 % preferred to have only online learning, and 7 % of participants claimed to prefer direct (face to face) learning.

4. General comment**:**
   a. What "professional title/name" should be given to participants when successfully finishing the course? Proposed: Technician for ZW and CE

The **Spanish** workshop was organized with the aim of discussing the suitability of the developed training materials with potential users, specifically with business consultants from different working fields (i.e. strategy, training and human resources, industry and operational excellence). It was a very good and participative exercise to discuss about how the training materials could be improved. Some of the main conclusions were related a) to the need of making the benefits of circular economy and zero waste visible, the possibility of linking circular economy to frameworks which companies are already used to work with, such as ISO standards and other usual certifications, and b) to the importance of highlighting the role of value chains, and collaboration among stakeholders when implementing circular economy practices.

Experts from the **Austrian** associations RepaNet and Arge Abfallvermeidung were guests in the StadtLABOR for an exchange of experience on recycling management. The unanimous opinion was that there is still a lot of awareness raising and qualification work to be done in companies. The EduZWaCE training program was received with great interest. Synergies to existing national platforms with the Knowledge Hub were discussed. The participants are interested in participating at a pilot training.

The workshop in **Romania** brought together 15 people, covering all stakeholders' types. The project, the Knowledge Hub and the online courses for EduZWaCE Managers and Workers including the entry requirements, the job description, and the Learning Outcomes content have been explained and demonstrated by the presenters. Participants responded to the evaluation questionnaires, and provided generous feedback about the utility of the knowledge platform and the course, making also considerations about the need for a sectorial approach in circular economy training and for introducing more examples and case studies.

The workshop in the **Czech Republic**, organized as two smaller separate events, was attended by ten representatives of public sector and various organizations providing environment-related education and training mostly to businesses (NGOs, private companies, associations), as well as one private environmental consultant working with industrial enterprises. The goal of the workshop was to demonstrate to the participants the EduZWaCE Knowledge Hub, and to present a content of the two training courses as well as the intended learning methodology. The participants raised their comments on the specific topics and provided their feedback via questionnaires.

4 Diagnosis Tool

The ZW&CE Diagnosis Tool, developed within the EduZWaCE project, aims to be a useful self-assessment tool for companies (in particular SMEs) that will help them investigate opportunities for circular economy solutions in their specific context. The company will be able to identify the most effective opportunities for improvements in terms of circularity as well as the overall sustainability performance, and to choose the most effective leverage points and feasible measures leading to both an improvement in circularity and efficient allocation of its limited resources.

In order to optimise improvement measures and actions, it is important to review the whole system of a business in a consistent way; therefore all levels of a company need to be assessed in a systematic way, including the physical level (products, production processes), the information level (management systems) as well as the governance level (business strategy, stakeholders relations).

Understanding of the main material (and energy) flows, and waste streams is a key for assessing the company's situation in relation with circularity; in this regard, the internal circular economy opportunities are addressed in a first step based on the following elements:

- Level of integration of circular economy objectives into the core business strategy and business models;
- Key materials used, risks and opportunities related with them and relevant waste flows;
- Real costs of materials and waste flows, including non-product output related costs;
- Actions already implemented towards circularity.

At the same time, the external opportunities of circular economy will be assessed. They will address in particular life cycle perspective of products, and cooperation within the value chains and with other stakeholders (e.g. industrial symbiosis).

The main feature of the Diagnosis Tool is the holistic approach, which is manageable at the SME level. In contrast to other methodologies, which provide a diagnosis in this field, our tool is strictly based on a need-driven approach. Instead of assuming that any existing tool can bring desired positive changes, the Diagnosis Tool focuses first on improvement potentials within the given company, and only after then, it assigns suitable measures that address these potentials to be further developed by the company.

The tool will be made available in the Collaborative Section of the Platform to be used for free by companies and circular economy experts. We expect about 10 companies per partner to get logged in on the Platform and use the Diagnosis Tool during the project lifetime.

Apart from the Platform, the Diagnosis Tool will be closely linked also with the other intellectual outputs. The tool users will have a possibility to explore received recommendations through the resources of the Knowledge Hub as well as learn more about concrete topics in the On-line Course.

5 Dissemination

The results of the project need to achieve maximum impact: they should radiate as widely as possible so that the valuable lessons and experience gained by one group can benefit others. Moreover, what is learned from a project should inform future policy. All this can happen only if connections are made between the project partners and the wider community. The key means of connecting with the target audience is the process of communication and dissemination. Three types of audience have been defined: at individual, local and national, EU and global levels: 1) Dissemination inside and outside organization will tackle the first audience composed of project partners and users. 2) Dissemination at local and national level is targeting the second category of potential users: key players in VET, teachers' associations, VET learners/students and employees, universities and research institutions, NGO's, innovators and sustainability experts, representatives from companies., industrial associations , clusters, on one side, and local and regional policy makers on the other side; 3) Dissemination at European and Global levels is addressing the third audience category, a large category of European and international organisations and institutions, policy makers, academia, NGOs and international networks, with different interest from education and awareness creation, to

policy development and support. Dissemination is carried out according to the Plan for Communication and Dissemination having as main objectives to communicate the project objectives, collect feedback and contributions from target audience, and disseminate results, technical achievements and innovations. The project portal plays a central role for communication and dissemination of the project ambitions and results while communication in social media is of great importance.

Dissemination has been performed also through 9 parallel **national workshops,** held in partner's countries between November 2019 and February 2020. The workshops were designed to create awareness, collect feedback, facilitate interactions with the direct target groups and present the project main intellectual outputs and results achieved so far. More than 135 people representing various stakeholders participated in the presentations about the Knowledge Hub, the Online course for EduZWaCE Managers and Workers and the respective learning outcomes, and had the opportunity to provide generous feedback about the opportunity of the knowledge hub and the e-learning course, the proposed content and to discuss about how the training materials could be improved. The main conclusions were described in section 3.3.

Wider dissemination is ensured through the involvement of all partners, each of them having clear responsibilities at international and national level, according to actions defined in the PCD. The outcomes of our project, any tangible resources, products, deliverables and outputs resulting from the funded projects will also be made available for dissemination purpose at the Erasmus+ Project Results Platform.

6 Conclusions

The transition to Circular Economy (CE) is an essential contribution to the EU efforts of developing a sustainable, low carbon, resource efficient and competitive economy (CE, 2020c). Such a transition represents the opportunity to transform our economy, generate green jobs and build up sustainable competitive advantages for Europe. This project aims to fill a gap in Vocational Education and Training (VET) programmes dealing with zero waste and circular economy. Transition to CE may only be successful if the corresponding awareness, competences and skills are deeply embedded in the knowledge and daily routine of EU professionals and companies and from this perspective VET education for ZW&CE is critical.

The primary goal of project Strategic Partnerships is to support exchange of good practices, enabling stakeholders to deepen and spread out knowledge, develop and reinforce networks, increase their capacity to operate at transnational level, and share and confront ideas, practices and methods. The project aims to create new VET programmes dealing with waste and circular economy, and focuses on developing the interdisciplinary skills needed for the jobs of the future that are tailor-made for the needs of the employers/SMEs. With this project we would like to build up a common approach for VET Teachers and learners across EU to respond to the requirements of the future and flexible job market.

The project is implemented based on a collaborative approach: cooperation between the project partners and collaboration between the consortium and the stakeholders at the local, national, and international level, while the project outcomes are delivered using free, open, collective purpose based framework of patterns, supporting the exchange of good practices and allowing organisations to develop and reinforce networks, increasing their capacity to operate at transnational level, share

and confront ideas, practices and methods whilst respecting co-creativity principles, fostering transparency and guaranteeing the equivalence of all participants in decision making.

Through its deliverables: (1) Knowledge HUB; (2) Skill Card Sets for two jobs roles; (3) online collaborative platform; (4) online courses and (5) diagnosis tool, the project fosters cooperation between companies, stakeholders and VET educators. It will increase motivation of VET Teachers to use/re-use, adapt and/or modify the training materials, with the aim to improve the acquisition of key competences for their learners/students and to raise awareness of the local and regional policy makers on the importance of taking measures for promoting best practices and flexible learning pathways in VET from an interdisciplinary perspective.

On long term the project will have a strong impact on the creation of better interdisciplinary competences directly used for current or future professions and to the adoption of more circular economy solutions.

The project involves an appropriate mix of complementary participating organisations with the necessary profile, experience and expertise to successfully deliver all aspects of the project. They will become the facilitators of the EduZWaCE platform, support its utilization and the co-creation of CE solutions through cooperation and exchange – this will empower them as main stakeholders of ZW&CE application in the countries and will contribute to their organisational development

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