



R2.3 - Characterisation of emerging professionals' profile



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Glossary of terms, abbreviations and acronyms

Abbreviation / Acronym / Term	Description
CE	Circular Economy
CHAINS	CHALLENGES INNOVATION teams. Collaborative teams of students of the PackAlliance postgraduate programme to work on a specific industry challenge
EACEA	Education, Audiovisual and Culture Executive Agency
HEI	Higher Education Institution
PackAlliance Hubs	Physical places where the academia-industry collaboration within the project will take place
WP	Work Package

Partner Info

Partner short name	
P1-Campus Iberus	Partner 1 - Campus Iberus (Spain)
P2-Ecoembes	Partner 2 - Ecoembes (Spain)
P3-AGH	Partner 3 - AGH University of Science and Technology (Poland)
P4-Synthos	Partner 4 - Synthos Group (Poland)
P5-TAMK	Partner 5 - TAMK Tampere University of Applied Sciences (Finland)
P6-Pyroll	Partner 6 - Pyroll Group (Finland)
P7-Proplast	Partner 7 - Consorzio per la promozione della cultura plastica - Proplast (Italy)
P8-UNISA	Partner 8 - Univeristà degli Studi di Salerno (Italy)

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1 Introduction

The report summarises the outcomes of the characterisation process of the professional profiles for future experts in the transition of the plastics packaging industry to the circular economy. It was conducted in industry-academia collaboration in the four partner countries of the PackAlliance project.

The PackAlliance project (funded by Erasmus+ Knowledge Alliance programme in 2020-2022) intends to contribute to modernising the Higher Education curricula by enhancing its alignment with the labour market needs of plastics packaging. The Knowledge Alliance project brings together academic and industry partners from Spain, Poland, Finland, and Italy, in order to foster academia-industry collaboration for innovation and competence building in innovative and sustainable packaging. This is seen as a key element for the transition to the circular economy (CE) within the plastic packaging industry.

The outcomes of this report are part of WP2, where the overall objective was to analyse plastic packaging industry needs and challenges, present the educational offer, and policy priorities outlining the initiatives in the plastic packaging and the CE, both nationally and globally. The aim of the current task and this report is to transform these previous results to professional profiles associated with qualifications frameworks and recommendations for competence-based educational offer in the higher education curricula, in order to develop a first-of-its-kind of a training programme on CE focused on the plastics packaging value chain.

The report presents the outcomes of the characterisation of the professional profiles associated with qualifications frameworks, and recommended learning modules for different thematic areas, which include 1) new materials and biomaterials; 2) eco-design & novel manufacturing processing; 3) citizen interaction & eco-marketing; and 4) residue management and valorisation. In addition, the main enablers and barriers for adapting this training programme to existing HEI curricula, are suggested. Chapter 2 introduces a basic introduction of the CE and education, and the main skills needs recognised for the thematic areas, Chapter 3 presents the qualifications frameworks, Chapter 4 the professional profile, and the Chapter 5 the recommended learning modules. The Chapter 6 describes the barriers and enablers for the training to be included in existing HEI curricula, and Chapter 7 summarises the outcomes.

2 Educating the circular economy

The circular economy is an economic model based on the sustainable use of resources. It aims to minimise waste and promote sustainability by producing materials and products that are circulated and are maintained longer. It is also about innovation and creation of added value across the business sectors through new business models with extended lifecycles and new services. Compared to the linear economy models, the circular economy aims at closing the loop of natural resources, materials, products, services, and waste. The circular economy is one of the key elements contributing to several of the UN sustainability development goals (Schroeder et al. 2019).

The circular economy can be defined in several ways (Kirchherr et al. 2017). In the EU, the circular economy

“[...]aims to maintain the value of products, materials and resources for as long as possible by returning them into the product cycle at the end of their use, while minimising the generation of waste. The fewer products we discard, the less materials we extract, the better for our environment. This process starts at the very beginning of a product’s lifecycle: smart product design and production processes can help save resources, avoid inefficient waste management and create new business opportunities.” (Circular economy – Overview 2020)

The circular economy is, however, not only about recycling, although the economical view often gets lost in the discussion. Ellen MacArthur Foundation (EMF) is a recognised forerunner concerning the circular economy, and has defined the principles of the CE as follows (What is the CE 2017):

- 1) **Design out waste and pollution** by preserving the natural resources by designing the products, harnessing new materials and technologies that waste will be minimised.
- 2) **Keep products and materials in use** by redesigning products and components for reuse, repair, and remanufacture.
- 3) **Regenerate natural systems** by transforming waste streams to higher value materials and by restoring valuable nutrient cycles.

Circular economy is both restorative and regenerative by design and requires efficiency at all levels, big and small businesses, organisations, and individuals. Stated by the EMF:

“Shifting the system involves everyone and everything: businesses, governments, and individuals; our cities, our products, and our jobs. By designing out waste and pollution, keeping products and materials in use, and regenerating natural systems we can reinvent everything.”

This statement includes a concept of systems thinking for making sense of the whole and not just the part, i.e., viewing systems in a holistic manner. It concerns an understanding of a system by examining the linkages and interactions between the elements that comprise the whole of the system (see, for example, BS8001:2017). Rather than trying to solve the problem alone, systems thinking considers how a change made to one part of the system might impact the system as a whole. On a corporate level, it allows the organisation to identify the key elements within its system, including which stakeholders are involved and what potential

synergies may exist within the system that would enable a more circular approach. Similarly, systems thinking can also be extended to education, e.g. curricula and their learning contents which also may work across disciplines (Matlin et al. 2016)

The transition to the circular economy requires the capability of working in a multidisciplinary working community, skills to bring one's expertise to the whole community's benefit, and understanding of the systems thinking, i.e. how an individual affects the system and how the systems affects the individual. In the circular economy education the student is engaged in an active learning cycle (Webster & Johnson 2008). Circular economy education follows nonlinear learning where, for example, different learners follow different paths, learning is self-organised and is based on learner's own activity. Different disciplines are integrated, roles are flexible, and people co-evolve together in a learning community. As the systems thinking is central to the CE education, the students should develop skills that are required for constructing multidisciplinary links. Lundgren (2012) showed that multisectoral and shared expertise are required to solve the environmental challenges in the future. Not only engineers and scientists tackle these problems, but several disciplines from the societal sciences, economy or ICT skills are required. The theoretical knowledge of one's own discipline is not enough, but one should have resilience to adapt to various economical, technological, and political changes and skills to actively promote or hinder the change. Both resilience and involvement require competences, such as self-directedness, communication skills, critical thinking, problem solving, decision-making, and self-assessment skills. In addition, innovation processes are also associated with working in multidisciplinary teams, as complex problems benefit from versatile perspectives (Hero & Lindfors 2019). This also gives an opportunity to the individual innovation competence building for future challenges.

As part of the PackAlliance WP2, the main skills needs and challenges related to human resources in the transition to the CE in the packaging sector were discussed in different thematic areas (new materials and biomaterials; eco-design & novel manufacturing processing; citizen interaction & eco-marketing; and residue management and valorisation). Also here, the main skills needs and challenges were recognised to be related to soft and transversal skills. Good technical and design skills, creativity, good IT skills (including, for example CAD), and awareness of the substance background are prerequisites. Further skills are yet needed, for example, interaction with the other parts of the plastic packaging supply chain requires team working with other companies and stakeholders, sharing data between different company departments, marketing skills and commercial awareness, excellent communication and interpersonal skills, and multidisciplinary thinking. Dealing with continuous change in the industry also requires innovation, rapid acquisition of knowledge, problem solving skills, and developed skills for resilience, and the ability to work well under pressure. Working in silos, or merely weak systems thinking ability, may pose a challenge. To overcome this, a better understanding of the CE is needed in the plastics packaging industry *per se* and it will be achieved by knowledge, networking, openness, mutual understanding of the common goals, and by the recognition of the whole value chain and its stakeholders. Weak understanding of consumers and citizens can be improved by consumer and citizen-centred approaches in communications and marketing.

3 The qualifications framework in the PackAlliance programme

The European Qualifications Framework for Lifelong Learning (EQF) is a shared European framework tool to describe competences. It supports the comparability, understanding and valuing of skills and qualifications in different European countries. In the EQF, qualifications and competences are expressed as learning outcomes at increasing levels of expertise (The European Qualifications Framework 2018). In the EQF, each level is defined by a set of descriptors (knowledge, skills, responsibility & autonomy) indicating the learning outcomes relevant to qualifications at that level in any system of qualifications. The EQF levels for HEI are level 6 (B. Sc) and level 7 (M. Sc.). The EQF level for specialist vocational qualification is 5.

In the EQF, learning outcomes define what the student will know, understand, and be able to do after completing a learning module. Knowledge is understood as theoretical and/or factual, skills are recognised as both cognitive and practical abilities, and responsibility & autonomy means the ability of the student to apply knowledge and skills autonomously and with responsibility (The European Qualifications Framework 2018).

The qualifications framework (QF) generated in the PackAlliance programme is based on the background material generated in the previous parts of the WP2 (see the PackAlliance project reports: Kulczycka et al. 2020 and Kukkasniemi et al. 2020). The collected data provides information on what kind of knowledge and skills are needed for the transition to the CE in the plastics packaging industry in different thematic areas. The overall objective of the qualifications framework is to attain the professional profile through the specific learning outcomes. In other words, the qualifications framework is a route to the final professional profile (see figure 1 below).

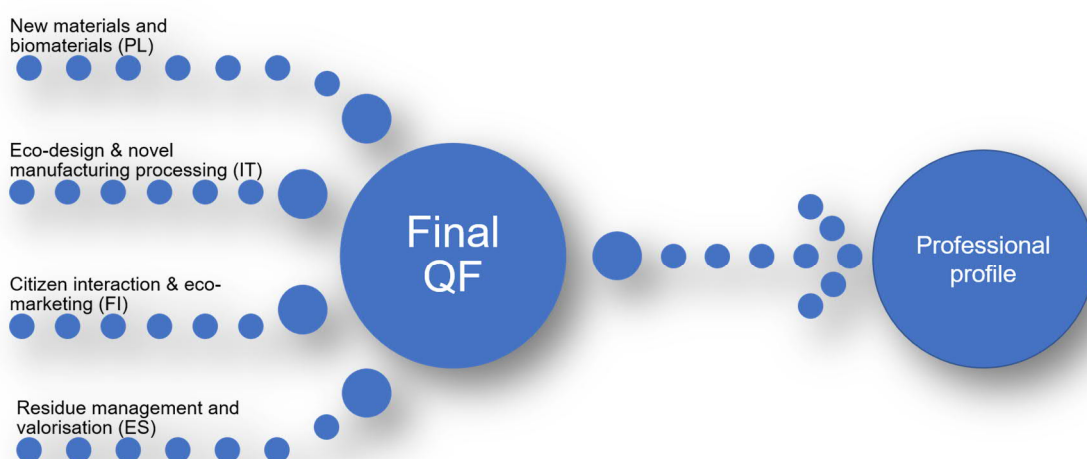


Figure 1. The qualifications frameworks (QF) generated for different thematic areas will make the final QF, which helps to achieve the objectives of a professional profile.

The PackAlliance qualifications frameworks were developed for all the thematic areas. Through studying the training programme, the student is to achieve several learning outcomes. In summary, when considering the knowledge and skills required to implement the circular economy concepts, a student should

- gain knowledge for designing of more efficient, recyclable, and reusable packaging
- gain awareness of the use of new sustainable materials or biomaterials, which are suitable for CO₂ footprint reduction
- achieve the capacity for managing and coordinating the activities of personnel involved in plastic products manufacturing, making sure the production is efficiently, safely, and cost-effectively processed
- be able to consider, according to industrial needs, the packaging end-of-life scenarios as well as to avoid microplastic generation
- gain knowledge of recycling and reuse processes connected to logistics, sorting, and recycling systems, but also of innovation and creation of novel business models to give added value to second life of residues
- be able to comply with legislative regulations related to plastic recycling and recovery, new materials, and biomaterials
- gain knowledge of the consumer-centred communication activities and the societal dimension of the CE, as well as understanding of consumer-centred design principles (service design) in marketing communications
- be able to differentiate the societal stakeholders of the plastic packaging sector, as well as conduct citizen engagement activities, as it also helps to consider the advantage of the CE for the whole society and individuals.

To this end, the level of the descriptor of autonomy and responsibility of the learning outcomes was set to be flexible. This is because the programme is not intended to be a university master's programme, but the objective is to give specific and practical knowledge close to the real-life situations in plastic packaging companies. Students participating in the training may reach different grades of autonomy by the end of the programme, depending on their starting level. If the students who enrol in the programme have already completed a degree, or have equivalent working experience, in terms of responsibility and autonomy this programme could reach level 6. The possible accreditation of the programme will be considered in more detail in the PackAlliance WP3, where a new training programme on innovative CE processes for the future plastics packaging industry will be developed.

4 The professional profiles in the PackAlliance programme

A professional profile is a brief summary of key/most relevant CE knowledge and skills that a plastic packaging professional has in the respective field.

Like for the qualifications framework, the professional profiles for the PackAlliance programme are based on the background materials generated in other tasks of the WP2 (see the

PackAlliance project reports: Kulczycka et al. 2020 and Kukkasniemi et al. 2020). When describing the professional profiles for the PackAlliance project, the following points should be considered:

- the students will study 30 ECTS in a complete programme comprising of four thematic areas and an innovation module
- the programme is not a degree programme but is rather considered as continuing education
- each student on the programme already has a professional profile, since the target groups are described as recently graduated and working life professionals. Therefore, a student enrolling in the programme already has professional competence from their own field, achieved through a degree or working life.

The resulting professional profile would be the one the student already has when enrolling in the PackAlliance programme, with the added specialisation in the needs for the CE of the plastics packaging industry. It was noted that although there are skills, which are demanded by the industry that could be acquired from initial non-technical profiles, a large part of them do require previous scientific-technical training. Graduates from any engineering or many scientific fields will have the capacity to follow the training. However, for example, for an economist or a law graduate, who does not have any other training or professional experience in the topics covered in the programme, it might be difficult to follow. Even in that case, students with a non-technical background may also be interested in enrolling in the programme to strengthen their professional profiles if, for example, they get a position in some part of the plastics packaging value chain.

The overall professional profile for a person taking the programme is therefore more generic, and the profile is not necessarily connected to a certain discipline, but the needs of a professional are recognised in all or several of the thematic areas. A brief summary of some profiles is shown below.

Technical professionals in product and process development utilising the CE approach

Packaging professionals are responsible for the design, development, and manufacturing of packaging for a range of products. They have knowledge of new sustainable materials and biomaterials, as well as reuse, recovery, and recycling of the packaging.

Product or process development scientists are responsible for researching and developing new production processes and making modifications to existing manufacturing systems to improve the overall efficiency and profitability.

Industrial/product design professionals

Industrial/product designers work from design briefs to create solutions for new products, which are innovative, practical, and suitable for manufacturing. The professionals are innovative, open-minded, and multidisciplinary, and can discover new solutions, for example in the field of eco-design and new technologies.

Consumer-centred plastics packaging communications professionals utilising the CE

The professionals use a consumer-centred approach as part of the communication, marketing, and plastics packaging development activities. They actively engage consumers in the design processes, which shift the plastics packaging sector towards the circular economy. They develop solutions the consumers can benefit from and thus, create value for themselves. They hold a high ethical standard in communications and marketing regarding providing accurate information in the field of the CE.

The professionals differentiate the stakeholders from individual citizens in legislative instances and in their role in the transition to the CE. They are active in networking and collaboration with different stakeholders. They know critical fields, such as anti-littering, sorting, and recycling, of societal engagement in the plastics packaging circular economy, and can design communications and promotional activities for social engagement regarding the plastics packaging CE.

Innovation professionals for the CE of residue management

To improve and make the current processes as efficient as possible, the professional must be an optimistic, innovative person with an industrial insight. They are persons looking for efficiency and producing fresh ideas to develop systems level solutions. They must be able to identify new business opportunities. The professionals are multidisciplinary and, in addition to the technology, their point of view may be societal.

The common themes in all the thematic areas related to the circular economy principles in the plastics packaging industry are the ability to apply life-cycle analysis and regulative legislation, concerning for example new materials, food packaging, and plastics recovery. A basic understanding of these should be included in all professional profiles.

5 Recommendations for the PackAlliance learning modules

Recommendations for different learning modules in the PackAlliance programme were given after describing the learning outcomes in the qualifications frameworks, and the characterisation of the professional profiles for different thematic areas. Each of the learning modules will provide 5 ECTS of theoretical education per a thematic area, a total of 20 ECTS. In addition to the theory part, the PackAlliance training programme is completed by an innovative CHAINs module including student mobility. The recommendations for the proposed courses and their contents for each thematic area are shown at glance in table 1. For each learning module there are recommendations of 2–3 courses of 1–3 ECTS. The recommendations mostly follow the knowledge and skills descriptors of the qualifications framework.

Table 1. Summary of the recommendations for the learning contents in the PackAlliance programme

New materials and biomaterials

Proposed courses	The main contents
New materials and bio-based materials in plastic packaging sector in the context of development of the CE (3 ECTS)	The contents will cover the characteristics of new materials and biomaterials, their use, reuse, and recycling. In addition, advantages and disadvantages of the use of new materials and bio-based materials in the context of development of CE will be covered.
Plastic packaging in the context of development of new materials and bio-based materials technology (2 ECTS)	The contents will cover the characteristics of biomaterials in the plastics packaging sector, as well as selection criteria and legislation for the approval of new materials and biomaterials.

Eco-design and novel manufacturing processing

Proposed courses	The main contents
Materials and production techniques for packaging systems (2 ECTS)	The contents will cover the identification of recent production and processing technologies of food packaging systems with new materials in an economical and sustainable way.
Design and eco-design for packaging materials 1 ECTS)	The contents will cover the identification of the eco-packaging market trends, analysis of consumer behaviour, and reduction of overall costs.
Life Cycle Assessment (LCA) for packaging materials and polymer recycling (2 ECTS)	The contents will cover the utilisation of the LCA tool in the identification of materials and processes for sustainable packaging, as well as the plastics recycling and its challenges.

Citizen interaction and eco-marketing

Proposed courses	The main contents
Consumer-centred plastics packaging communications in the CE (3 ECTS)	The contents will cover the consumer-centred CE business modelling and service design in marketing communications. Consumer innovation solutions for plastics packaging and marketing ethics will also be discussed.
Plastics packaging and social engagement in the CE (2 ECTS)	The contents will cover the CE in broad socio-economical context, such as the advantages of the CE for society and citizen engagement. and communication channels in the CE plastics packaging sector.

Residue management and valorisation

Proposed courses	The main contents
Logistics & sorting (Residue Management) (2 ECTS)	The contents will cover the route optimisation for residue logistics, describe methods to improve sorting and recycling systems and use of data analysis for decision making.
Recycling Systems & novel business models for the second life of residues (2 ECTS)	The contents will cover the characteristics of polymeric materials, recycling systems, and new recycling opportunities in creation of business models.
European legislation (1 ECTS)	The contents will cover new legislation regarding plastics packaging and recycling rates in the European Union.

Some themes, such as recyclability and recycling, legislation, and LCA, were recognised to be common for all thematic areas. They should therefore be considered widely and through several aspects, as these subjects were also mentioned in majority of the company interviews and workshops conducted in the earlier phase of the WP2 (see Kukkasniemi et al. 2020). For example, for LCA materials and biomaterials, flow of processes, energy consumption, and design can be considered. Similarly, legislation can be studied from the viewpoint of new materials and biomaterials, food contact approval and new regulations, recycling, and marketing ethics. As mentioned, these learning modules will be theoretical. Some of the knowledge, such as new business models, can be deepened in the CHAINs programme. In addition, soft skills, such as the ones related to human relations and interaction, communication skills, team working skills, and problem-solving, may also be inserted in the CHAINs programme.

6 Enablers and barriers of the implementation of the new education

The description of the factors that enhance or hinder the implementation of PackAlliance curriculum (30 ECTS) in the existing HEI curricula among the PackAlliance partner HEIs was conducted by SWOT analyses. The main enablers and barriers of the implementation recognised for each thematic area are shown in table 2.

Table 2. The main enablers and barriers of implementation of the PackAlliance learning module in the existing curricula of the partner HEI's.

Thematic area	Main enablers:	Main barriers
New materials and biomaterials	<ul style="list-style-type: none"> - The module is competitive and available for students from different disciplines, even without having completed previous degree studies. 	<ul style="list-style-type: none"> - The target group is currently not known - Similar, more extensive, postgraduate studies are available
Eco-design and novel manufacturing processing	<ul style="list-style-type: none"> - The concepts of source reduction, recycling and reuse are well known as basic knowledge for chemical and food engineers. This can simplify the ways to implement practically the eco-design of packaging without sacrificing product safety. 	<ul style="list-style-type: none"> - The eco-design may use very complicated mathematical modelling to predict some fundamental material or packaging properties - The training programme might be too difficult for students coming from non-technical programmes
Citizen interaction and eco-marketing	<ul style="list-style-type: none"> - Expertise and good collaboration and the recognised need from the industry can be used to connect the consumers and citizens to the circular economy framework. 	<ul style="list-style-type: none"> - Special attention is needed for ensuring that the module addresses well the desired target groups
Residue management and valorisation	<ul style="list-style-type: none"> - The expertise on teaching technical degrees. 	<ul style="list-style-type: none"> - The previous knowledge of students will be the key on the understanding of residue management.

The strengths and opportunities for the training programme implementation include existing good collaboration with industry and HEIs, as well as strong expertise in technical education. On the other hand, the main concern recognised for the implementation as part of an existing HEI curriculum was the lack of specific technical skills and specific technical background knowledge. Table 3 shows in more detail the overview of factors observed as possible enablers and barriers of the PackAlliance programme to be implemented as a part of the existing curricula in the partner universities.

Table 3. The overview of the SWOT analysis conducted for the PackAlliance training programme to discover the main factors enhancing or hindering the implementation of the PackAlliance learning module in the existing curricula.

STRENGTHS
<ul style="list-style-type: none"> - The learning outcomes are based on industry and environmental needs and requirements, and there is a recognised need for the programme that offers a cooperation along the entire plastic packaging value chain. - The module structure makes it easy to adapt the contents to separate courses, which are usually 4,5 or 6 ECTS. - The university is committed to starting the programme and provides facilities, e.g. laboratories for the programme. - The partner HEIs have expertise in teaching diverse plastics packaging related courses and have a solid background of, for example, sustainability, bio-based polymers, polymer recycling, packaging, and LCA. The programme may combine technological knowledge with economic and legislative knowledge. - The project and innovation coaching skills are strong among the partners. - e-learning is a common practice at the universities. - The international implementation is in line with the HEI strategy. European mobility which implies an exchange of expertise on thematic areas, is spread through the countries. - The CHAINs module could be offered to PhD students as supplementary training to develop collaborative and innovative skills, as well as to enhance their employability.
OPPORTUNITIES
<ul style="list-style-type: none"> - The constant cooperation with companies in the field of packaging gives the opportunity for field training. - There are stable internal cooperation frameworks between PackAlliance partners. This framework will ease the management of the collaborative training module. - For some partners, the HUBs approach is already in use and provides excellent platforms and support for the PackAlliance programme. - The CHAINs provide opportunities to practice more of the required skills of the module. - The training programme may be of interest also to other fields than plastics students and professionals. - The skills acquired in this programme will also impact other industrial sectors. The knowledge acquired will also have an effect in raising awareness of reusability and recyclability of plastics packaging on citizens. - Opens the possibility to offer Minor Programmes in the partner universities. - The modules will be readily suitable for online teaching; thus, this programme is already prepared to confront adversities, such as the current pandemic and possible transport restrictions due to climate change. - Political climate, businesses and societal attitude are favourable to diverse CE initiatives.
WEAKNESSES
<ul style="list-style-type: none"> - There are some similar kinds of postgraduate studies on the educational market. - The target student groups are not yet known. - The extent of each module (ECTS) is rather small to cover a large area of topics. - The focus on plastics packaging may restrict the usability of the module. The programme could be extended to other products and materials in the packaging industry. - Frequently changing legal regulations in the field of waste management may affect the implementation. - Only some of students might have the basic technical knowledge required for some technical topics covered. In contrast, only a fraction of students might have the basic knowledge on economy and law. - Procedures to modify universities' curricula might be heavy and there might not be previous experience of Minor Programme offering.
THREATS
<ul style="list-style-type: none"> - The programme may not be precisely adjusted to the needs of the market, enterprises, and legal requirements. The courses may be too simple compared to the supply of other academic courses in this field. - The recruitment of the students for the programme does not meet the project objectives. - The training programme profile does not meet the requirement for a wide attendance of professionals from several fields, such as marketing and business (the whole value chain is not represented). - Current economic situation will affect interest on the programme since an economic effort is needed for e.g. a proper residue management. - Constant changes in regulations can make content obsolete. - The CHAINs are meant to be carried out face-to-face and they are not very resilient to external situations restraining mobility.

Table 4 shows the general SWOT analysis described for the PackAlliance training programme. It is of note that the learning modules described in this report (Chapter 5) are not necessarily the final ones, as they are to be developed in the PackAlliance WP3. Therefore, the data in table 4 may also be subject to change.

Table 4. A general SWOT analysis conducted for the PackAlliance training programme based on the recommended learning modules (see the Chapter 5)

STRENGTHS	WEAKNESSES
<p>The programme</p> <ul style="list-style-type: none"> - will give an innovative capacity in the field of all the aspect of the packaging supply chain - increases the ability to identify environmental aspects related to new materials - improves the ability to use new business models based on the circular economy - improves the knowledge on the influence of the materials on the production process - helps to respond to the recognised need for LCA approach and societal awareness on CE. For example, the programme gives the students all the tools to orient the companies towards an efficient LCA approach - helps to increase knowledge of the applications and uses of new materials and biomaterials - increases the ability to identify environmental aspects related to new materials and biomaterials. 	<ul style="list-style-type: none"> - Lack in the knowledge about the environmental impact of individual stages of the production - Difficulties in having the awareness on knowledge of user / consumer behaviour and experience - The focus on plastics packaging may restrict the usability of the module - Understanding of how the programme could be extended to other products and materials in the packaging industry.
OPPORTUNITIES	THREATS
<ul style="list-style-type: none"> - The EU and national level legislative regulations are supporting the possibility of using sustainable materials which increases public awareness of the CE - Possibility of gaining knowledge and raising the qualifications and competences in the field of environmental consciousness - Filling the gap in terms of lack of knowledge about legislation and the use of non-biodegradable plastics. 	<ul style="list-style-type: none"> - The mismatch between theoretical knowledge on new materials and existing technologies in the companies may highlight difficulties in applying the new knowledge in real-world companies - The training programme profile does not meet the requirements for a wide attendance of professionals from several disciplines such as marketing and business (the whole value chain is not represented).

7 Summary

The aim of this report is to provide the educational outlines for the further work packages in the PackAlliance project. The overall purpose of the project is to develop a first-of-its-kind training programme to strengthen the skills of the future professionals in their work in the transition of the plastics packaging industry towards circular economy. The work done is based mainly on the valuable information gathered in the previous phases of the WP2: the survey and interviews, and the workshops conducted with plastic packaging companies and their stakeholders in all partner countries (Kukkasniemi et al. 2020).

This task started with description of qualifications frameworks (knowledge, skills or abilities, and attitudes) for all four thematic competency fields (New materials and biomaterials; Eco-design & novel manufacturing processing; Citizen interaction & eco-marketing, and Residue management and valorisation). The qualifications framework revealed an extensive collection of learning outcomes connected to the context of the CE in the plastics packaging industry. As clearly expressed in the company interviews, surveys, and workshops, in the transition to the CE, a cross-sectoral understanding of the plastics packaging supply and value chain is warranted. Therefore, the learning outcomes of the four thematic areas should further be unified. Similarly, as the students participating the training programme may reach different levels of autonomy by the end of the course, the level of this descriptor was set to be flexible here. Further specifications for the qualifications frameworks may be done in the WP3, where the final learning modules will be developed.

The main outcome of the current report are the professional profiles for the thematic areas. Like with the qualifications frameworks, they are based on the previous work conducted in the PackAlliance WP2. The target groups for the study programme are recently graduated academics, and persons who already have a career in the plastics packaging industry. Therefore, the professional profile of a student graduating from the programme will be the one the student has when enrolling in the PackAlliance programme, with the added specialisation in the needs for the CE of the plastics packaging industry. The characterisation revealed several professional profiles. These included, for example, technical professionals in product and process development utilising the CE approach, industrial/product design professionals, consumer-centred plastics packaging communications professionals utilising the CE, and innovation professionals for the CE of residue management. All the profiles contained diverse characteristics adapted from different thematic fields, which may be emphasised in a versatile way. For example, developing new products and services may require bold innovation skills, but also technical expertise of, for example, residue management.

Recommendations for different learning modules were described for the different thematic areas. The learning modules comprise a total of 20 ECTS of theoretical education. The courses described are small, 1–3 ECTS. Overall, the topics of the learning modules included characteristics, recycling, approval, and legislation related to new materials and biomaterials in the plastics packaging sector. In addition, recent sustainable production and processing technologies, especially in the sector of food packaging systems, will be covered, as well as the eco-packaging market trends and ways to reduce overall costs. LCA during the product life cycle of sustainable and recycled plastics packaging, as well as the related EU legislation

will be elemental parts of the studies. Courses about the logistics of sorting, as well as methods to improve sorting and recycling systems will be provided. In addition, for example, new recycling opportunities in creation of business models are included. Communications, service design and the societal impact of the CE will also be covered.

The target group for the PackAlliance education are recent graduates and persons already working in the plastics packaging industry. It is not specified, but it can be deduced especially from the qualifications frameworks and recommendations for the learning contents that students with a technical background might be the most obvious ones to register for the programme. As there was some concern about the students' background knowledge as a factor of success/fail rate for the PackAlliance programme, it was proposed that it may be interesting to encourage the candidates carry out self-assessment of their own knowledge, or provide a list of previous knowledge so that the students can evaluate themselves before applying.

SWOT analyses were conducted to describe the main enablers and barriers for implementing the PackAlliance programme in the existing HEI curricula. The analysis revealed several strengths and opportunities for the implementation, including existing good collaboration with industry and HEIs, strong expertise in technical education, the background knowledge the students plausibly have when enrolling in the programme, and the programme being available for several disciplines. On the other hand, lack of specific technical skills and specific technical background knowledge, as well as the fact that the specific target group is currently unknown, were found as the main barriers for the implementation as part of existing HEI curricula. The lack of knowledge is, however, relative as engineering students from different disciplines also have different background knowledge and professional expertise.

To summarize, the PackAlliance training programme will generate several types of professional profiles and expertise. In these profiles the technical knowledge and skills will be complemented with soft skills to be utilized to solve complex problems in the plastics packaging value chain in the transition to the CE. The qualification frameworks, based on the EQF, show the learning outcomes of the programme by descriptors of the knowledge, skills, and autonomy and responsibility. Both the professional profiles and the qualification frameworks are based on the previous research done in the WP2, especially on the company interviews and surveys and the national workshops with the companies and diverse stakeholders. These provided valuable data for the recommendations of correct modules and for attaining the learning outcomes outlined in the qualification frameworks. The WP2 is the prior phase for the WP3, where the final decisions for the PackAlliance training programme will take place. Unifying the qualification frameworks, as well as the recommendations for the learning contents, are warranted.

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