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CIRCULAR ECONOMY EDUCATION: EXPERIENCE OF FINLAND

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ABSTRACT

Since the announcement of the National economic strategy 2030, the transition to a circular economy has become an agenda for Ukraine. In these conditions searching for good experience and practices is an essential priority for national higher education. The research focuses on analysing educational experience in the circular economy in the Republic of Finland. The Republic of Finland has become the first country to provide degree programmes in the circular economy. This theoretical research is based in particular on literature review as well as analysis of Finnish universities websites for studying the degree programmes (their learning content and structure), methods and forms of education. The article presents a generalised analysis of the bachelor, master and doctoral programmes in the circular economy or related sciences. The main findings are methods of education in circular economy distinguished according to the following principles: historical (project-based), priority in the pedagogy implementation (teaching and learning), students activities (combined methods), teaching strategies (heuristic methods), source of knowledge (direct or indirect study of reality). The project-based method dominates when a multidisciplinary student team designs the project. The education format varies from traditional to online.

Keywords: *higher education; circular economy; the degree programmes; methods; education format.*

INTRODUCTION

Improving resource efficiency is an essential step towards a circular economy. The circular economy is a regenerative system that aims to minimise waste, emissions and energy use by slowing down the production of material and energy

products, as well as the consumption of limited resources. Creating a society with a circular economy requires new experience, cooperation between disparate structures, the development of the operating environment and a general change in attitudes, working methods and learning. Experts and decision-makers will play a crucial role in building a new future. The change in the economic model affects the interests of all sectors of the economy and education in particular. Education plays a vital role in developing specialists in the circular economy. Accordingly, their professional training content, forms, and methods should change in the new economic conditions.

PROBLEM STATEMENT

The learning content integrates sustainable issues. Education for Sustainable Development empowers learners with the knowledge, skills, values for taking decisions and making responsible actions for environmental integrity, economic viability and society (UNESCO, 2021).

BACKGROUND

Education for sustainable development and circular economy is widely discussed in scientific literature. Educators investigate education for sustainable development from an international perspective (Khataybeha et al., 2010) in terms of educational outcomes (Kioupi and Voulvoulis, 2019), the role of universities in sustainable development and circular economy (Sukiennik et al., 2021), the concept of competencies (Sysoieva and Mospan, 2018), the concept of competencies for a circular economy (Sumter et al., 2021). They also pay much attention to students training tendency in the EU and Ukraine (Mospan, 2016a), teacher training (Mospan, 2016b), teacher training for a circular economy Bugallo-Rodríguez et al., 2020) and PhD training (Sysoieva et al., 2018). However, studying education for a circular economy still has new issues.

FINDINGS AND DISCUSSION

It is worth mentioning that since the announcement of the National economic strategy 2030 (2021), the transition to the circular economy has become an agenda for Ukraine. In these conditions searching for good experience and practices is an essential priority for national higher education. Therefore, the research focuses on analysing educational experience in the circular economy in the Republic of Finland as the first country started to provide degree programmes in the circular economy. This theoretical research is based in particular on literature review as well as analysis of Finnish universities websites for studying the degree programmes (their learning content and structure), methods and forms of education.

METHODOLOGY

It is worth mentioning that Finland has begun to change the content, forms, and training methods by the circular economy principles and implement them at all levels of education — in secondary and vocational institutions in 2017 and higher education in 2018. The content of professional training of specialists in circular economics is determined by the goals and needs of society in the conditions of economic transformation, an essential feature of which is the principle of imitation and gradual complication of educational information. The learning content begins being developed from school with gradual complication and final disclosure in higher education. The system of knowledge, skills and abilities is formed vertically from the bottom to the top; when secondary schools teach students to understand the environment and the principles of the circular economy, worldview and civic qualities are formed in a world of new challenges and opportunities. In vocational schools (colleges), students gain practice-oriented knowledge and conduct applied research to improve the circular transformation of the chosen field. In higher education institutions, students develop professional competencies, which during their studies conduct primary and applied research, taking into account the prospects of society, science, technology, technology in the transition to a circular economy.

The learning content, forms, and methods of professional training specialists in the circular economy are presented in a series of educational projects on the circular economy "Circular economy for all levels of education" conducted in Finland in 2017-2019. Secondary education institutions are a mainly in-depth study of mathematics and natural sciences — this knowledge is essential for future professionals in circular economics. Senior students visit the region's industries (such as chewing gum, cork, sugar, wood) and participate in project work to provide proposals for processing based on the circular economy principles. The content of teaching circular economics in vocational and technical educational institutions is directly the professional branch of economics, where students apply the principles of circular economics in practice.

MAIN RESULTS

The content of teaching circular economics in higher education depends on the educational program and speciality. For example, the content of engineering training is natural sciences and physics, environmental technology, circular economy, the principles of sustainable development, as well as their interaction with climate change, biological and technological cycles. The city manager's training content includes administrative, social, and technical sciences. The content of training an engineer in ecology are natural sciences and ecology. The learning content of organic farmers focuses on crop production.

Table 1

Bachelor's Programmes in Circular Economy

Programme/HEIs	Scientific Degree	Length	Credits	Education format
Sustainable Solutions Engineering	Bachelor of Engineering	4 years	240 ECTS	Online
Smart and Sustainable Design	Bachelor of Culture and Arts in Smart and Sustainable Design	4 years	240 ECTS	Traditional / full-time
Sustainable Urban Development	Bachelor in Social Sciences	3 years	180 ECTS	Traditional / full-time
Environmental Engineering	Bachelor of Engineering	4 years	240 ECTS	Traditional / full-time
Smart Organic Farming	Bachelor of Smart Organic Farming	4 years	240 ECTS	Traditional / full-time
Sustainability Studies	Bachelor in Nature and the Environment	4 years	240 ECTS	Traditional / full-time

Here are some examples of educational programs for bachelors in circular economics in Finland.

The Degree Program in Sustainable Engineering Solutions at LAB University of Applied Sciences. The Degree Program in Sustainable Solutions Engineering) offers tools to address today's significant challenges, such as climate change and sustainability. The program aims to teach technology management on a sustainable basis, taking the perspective of a circular economy.

LAB University of Applied Sciences is one of Finland's leading players in environmental technology and the circular economy. Students study natural and physical sciences, environmental technologies, circular economics, principles of sustainable development, as well as their interaction with climate change, biological and technological cycles. Professional research includes resource and material efficiency, digital tools, quality and project management, the built environment, product design and responsible business that meets the prospects of sustainable solutions and the circular economy.

The curriculum structure is flexible, which allows studying the course online. However, additional studies (15 ECTS) include visiting the campus in Lahti, Finland. In addition, students have access to summer and winter schools and online courses. Graduates of the program can work as technology experts, project managers, quality and safety developers and sales engineers in Finland and worldwide. Entrepreneurship is also a career alternative (Bachelor Programs in Sustainability Studies in Finland, 2021).

Bachelor of Culture and Arts in Smart and Sustainable Design at Häme University of Applied Sciences (HAMK). Students gain experience in providing services, design and marketing, competence in the creation and use of social networks, and the product designer's competence to manufacture (fashion, footwear, glass or ceramics). Graduates of the program can work as a designer in companies in various industries and the public sector or act as an entrepreneur, as well as a designer, assistant product developer, entrepreneur, project and sales manager (Bachelor Programs in Sustainability Studies in Finland, 2021).

It should be noted that in Finland, the training of masters in environmental economics and politics is provided by 5 universities. Such HSEs include the University of Helsinki (Master's program in Urban Studies and Planning, Environmental Change and Global Sustainability), UEF Law School (Master's program in Environmental Policy and Law), LUT University (Master's program in Circular Economy) and Tampere University of Applied Sciences (Master's program in Risk Management and Circular Economy). They offer programs to teach students how to use limited natural resources and allocate them for economic benefit in a sustainable way that does not harm the environment; learn to consider environmental policies in decision-making, assess the costs and benefits of measures on water quality, clean air, waste management and climate change. Here are some examples of master's degree programs in circular economics (see *Table 2*).

Table 2

Master's Programmes in Circular Economy

Programme	Scientific Degree	Length	Credits	Education format
Circular Economy	Master of Science in Technology	2 years	120 ECTS	Online
Life Cycle Assessment	Master of Natural Resources	1 year	60 ECTS	Online
Environmental Policy and Law	Master in Environmental Policy&Law	2 years	120 ECTS	Online
The Environmental Change and Global Sustainability	Master in Science/Social Sciences	2 years	120 ECTS	Online

The master's program in the circular economy at the University of LUT is aimed at teaching students how to save resources in different situations, for example, replacing goods with services, increasing the ICT use; making decisions to help build waste-free systems based on the biological base; learn about the dynamics of sustainable business models. The program is well suited for people already working in the field.

The research work is designed for 34 ECTS, introduces the concept of a circular economy in different contexts and provides an understanding of the global challenges of sustainable development. The master's program prepares a specialist in circular economics in a wide range of sustainable business and manufacturing jobs. The graduate can work in industry, consulting companies, regulators, governmental and non-governmental organisations (LUTUniversity).

PhD training is also provided in the field of circular economics in Finland (see Table 3). Here is an example of the program. For example, the Doctoral Program in Bio and Circular Economics at the University of Applied Sciences in Tampere involves research in environmental technology, synthetic biology and bioenergy, and bioprocessing with the ultimate goal of promoting a cleaner and safer future for the benefit of humans and the environment. The doctoral dissertation focuses on the analysis of various wastewater treatment technologies. In the project, the candidate will develop a selection method of microplastic

samples from the treated sewage sludge. In addition, the doctoral student will collaborate with the research team on plastics and elastomeric technologies (Doctoral Researcher Bio and Circular Economy, 2019).

Table 3

Doctoral Programmes in Circular Economy

Programme	Scientific Degree	Credits	Education format
Sustainable use of renewable natural resources	PhD	40 ECTS	Online
Bio and Circular Economy	PhD	40 ECTS	Online

It should be noted that these examples demonstrate the content and methods of teaching circular economics in higher education at all levels. The content of education is the economy of the region or country of residence of students, as well as the natural process of production and processing of goods on the principles of the circular economy. The competence of the circular economy integrates the set of systems thinking, design, and multi-perspective thinking necessary for decision-making in economic transformation processes.

The form of education in the HEIs is institutional (full-time, part-time, distance (online)), but learning based on online courses is spreading rapidly. The educational process in higher education institutions is carried out in the following forms: classroom classes (lectures, seminars and practicals), independent work, practical training on the job, and control activities that include the defence of a project or master's thesis. In addition, students give oral presentations, factsheets and reflections on the chosen topic of research or project development of a particular industry in a circular economy. Teachers use different project evaluation strategies to determine learning outcomes. However, traditional exams or multiple-choice tests are not used. The main types of educational classes in higher education institutions are lectures, practical and seminar classes. The form of study in the classroom is mainly the teamwork of students.

The primary method of training specialists in circular economics in higher education institutions in Finland is a case-based case study project with the study of subjects that are closely related to the environment under the guidance of a contractor or specialist in a particular field (Circular Economy and Education, 2016, 4). The project completion comes to an end with the decision presented to the customer (the campaign, the representative of the enterprise, the interested person in the decision of the given question). Students work on a project in a team (4-5 students) during the semester (Mäkiö, & Virta, 2019, p.7).

In addition, the methods of training specialists in circular economics are described in detail in the "Guidelines for Teaching Circular Economy in Universities" (Mäkiö, & Virta, 2019). The "Guidelines" are a universal guide that teachers of all HEIs can use. The use of "Guidelines" does not require teachers to have experience in teaching circular economics. They can learn about this using the training materials developed by the Sitra Foundation and the Ellen MacArthur Foundation:

- MOOC and edX.
- Higher Education Resources include videos, assignments, and publications on circular economics designed for teachers (Ellen MacArthur Foundation).
- Online courses in the circular economy for Finnish universities (www.campus online.fi).
- Printed materials and publications of the Sitra Circular Economy Foundation (The opportunities for the circular economy for Finland, 2015).

Teaching circular economics differs from traditional teaching in the classroom, which integrates three teaching methods — interdisciplinary, project and vocational. This enables students to simultaneously develop competence in circular economics and solve problems in working life (Mäkiö & Virta, 2019, p.4).

CONCLUSIONS AND PROSPECTS

In summary, we define the following methods of training specialists in circular economics in Finland: on a historical basis — modern methods (project method). According to the priority of the pedagogical function, teaching-learning methods prevail (methods of transferring and acquiring knowledge — presentation, problem-solving, reading, etc.). According to the method of organising students 'activities, combined methods provide several ways to organise students' activities. By teaching strategy — heuristic methods (problem-based learning). According to the source of knowledge — direct or indirect study of reality through individual work. Forms of study are full-time or distance (based on online courses). The primary teaching method is a method of projects developed by an interdisciplinary team of students. The participants in the educational process are not only students and teachers but also companies, businesses and professionals in various sectors of the economy.

A study of the experience of the Republic of Finland in training specialists in circular economics has shown that its universities offer a wide range of circular economics programs at all levels of higher education. In a relatively short time, Finland has managed to develop the content and forms of higher education in the circular economy to train green professionals capable of contributing to the sustainable development of the future.

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ОСВІТА ЦИРКУЛЯРНОЇ ЕКОНОМІКИ: ДОСВІД ФІНЛЯНДІЇ

Сисоєв Олексій, кандидат економічних наук, доцент, керівник департаменту ліцензування та акредитації, Київський міжнародний університет, вул. Львівська, 49, 03179 Київ, Україна, o.sysoiev@kymu.edu.ua

З моменту оголошення Національної економічної стратегії-2030 перехід до циркулярної економіки став порядком денним для України. У цих умовах пошук хорошого досвіду та практики є важливим пріоритетом

національної вищої освіти. Дослідження зосереджено на аналізі освітнього досвіду в циркулярній економіці у Фінляндській Республіці. Фінляндська Республіка стала першою країною, яка надала освітні програми з циркулярної економіки. Це теоретичне дослідження ґрунтується, на огляді літератури, а також аналізі веб-сайтів фінських університетів для вивчення ступеневих програм (їх змісту та структури навчання), методів та форм навчання. У статті представлено узагальнений аналіз бакалаврських, магістерських та докторських програм з циркулярної економіки або суміжних наук. Основними висновками є методи навчання в циркулярній економіці, виокремлені за такими принципами: історичний (проектний), пріоритет у впровадженні педагогіки (навчання та навчання), діяльність учнів (комбіновані методи), стратегії навчання (евристичні методи), джерело знань (безпосереднє чи опосередковане вивчення дійсності).

Ключові слова: *вища освіта; циркулярна економіка; дипломні програми; методи; формат освіти.*

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