

Education in the concept of circular economy in times of global crises

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Abstract The article shows the relevance of transition to a cyclical economy in the society under the influence of global crises. Two hypotheses were proposed. Firstly, the formation of environmental values in Ukrainian society can be traced, which can create the basis for the transition of society to a circular economy model. Secondly, the important role of education in the implementation of the concepts of sustainable development and the circular economy has been confirmed, since it ensures the formation of environmental and economic consciousness, value orientations and social culture, trains specialists and develops the economy, in particular cyclical economy. To assess the hypotheses, the following were used: an online survey of representatives of the educational community. The results showed: 1) insufficient awareness of respondents about the nature of the circular economy; 2) the value of protecting the ecology of the region and the understanding of the importance of environmental protection in Ukrainian society are weak; 3) The most important problems include economic problems, but at the same time, environmental problems of the territories. An analysis of the scientific literature and coverage of foreign practical experience made it possible to determine the ways of developing education in support of sustainable development, the "green" and cyclical economy, the reorientation of higher and postgraduate education towards the training of specialists in the cyclical economy. The results can be useful in the formation and adaptation of educational and environmental strategies.

1. Introduction

The transition of society to the Fourth Industrial Revolution is accompanied by the spread of the global economic crisis, exacerbation of the global environmental, social, and political problems of mankind. In 2021, the population growth rate increased significantly, reaching 1.23%, the population amounted to 7.851 trillion. persons, which is more than projected by 53.8 million people [1]. The growth of the Earth's population deepens upon the problem of limited non-renewable natural resources. In addition, strong



marketing activity, behavioral economy, market principles of interaction of economic entities have led to the separation of business interests from public, rapid growth of production and consumption, as well as increased economic inequality. Existing economic models and concepts of development are not able to solve these problems, which are beginning to get out of control. The world community seeks to prevent collapse. The European Commission has approved a new Circular Economy Action Plan, which includes measures aimed at: making organic products the norm; empower consumers and public buyers, focus on sectors where cycle potential is high and which use the most resources, such as electronics and ICT, batteries and vehicles, textiles, plastics, packaging, construction and buildings, water and nutrients, food; provide less waste [2].

The fundamental basis of human development after the Fourth Industrial Revolutions should become the concepts of circular economy, social entrepreneurship and climate-neutral economy. Education, culture and the development of spirituality play a crucial role in the effectiveness of the implementation of these concepts.

2. Critical literature review

In recent years, many studies have been conducted to the development of circular economic. The current economic crisis related to the COVID-19 Pandemic is an economic and environmental downturn. For most countries, the impact of the dynamics of economic growth on the level of air pollution is one or two years behind. The level of air pollution changes simultaneously with the change in GDP growth per capita in 28% of countries of the world [3].

Crisis situations have given impetus to finding effective ways out of them, restoring economic, environmental and social processes. in particular the appeal to the concept of cyclical economy. This movement is also reflected in scientific publications. For example, Per Klevnäs, Alexandra Kulldorf, Per-Anders Enkvist (2019) believe that «the transition to a circular economy can make a significant contribution to the EU's priorities for sustainability, jobs and environmental protection, while opening up great opportunities in purely economic terms - both short-term incentives and long-term productivity» [4].

In a number of scientific works attention is paid to the study of the concept of cyclical economy, defining its essence, ways of effective transition to its functioning. Thus, a study by J. Kirchherr, D. Reike, M. Hekkert based on an analysis of 114 definitions of the circular economy, revealed: its basic principles, systemic perspectives, goals, activators / enablers. A study by these authors found that: 1) the circular economy is often portrayed as a combination of measures to reduce, reuse and recycle; 2) the goal of the circular economy is often considered economic prosperity, then the quality of the environment; and to a lesser extent, the impact on social justice and future generations; 3) among the activators of the cyclical economy are business models and consumers [5].

The analysis of scientists' works allowed to reveal approaches to defining the essence of cyclical economy as: 1) **model of economic development**, based on the rational use of resources and their restoration [6]; 2) **an alternative to the traditional, linear economy**, based on three principles of «3R»: reduction of consumption, reuse and recycling (reduce, reuse, recycle) [7]; 3) **industrial system** that is restored or regenerated by design and construction [8]; 4) **economic model**, in which both the outcomes and the actual processes of resource supply and production are organized in such a way as to increase human well-being and efficiency of ecosystems [9].

At the same time, research related to the introduction of a cyclical economy highlights such an impact factor as education. In particular, when analyzing the state of research on the problems of the circular economy according to the search platform «Web of Science» it was found that among the publications in 2016 on this issue, 2.8% belong to the field of education [10]. Currently, attention to the role of education in building a cyclical economy in different countries is growing because «education is a significant potential for sustainable development of society. Its role consists in forecasting, forming and developing

the professional competence of future specialists throughout their lives, developing an energy-saving style of professional activity» [11].

A number of researchers believe that the concept of circular economy is a new stage in the development of the concept of sustainable development and green economy. [12]. Education plays a significant role in these concepts.

Thus, back in March 2005, the European Economic Commission (EEC) at the UN adopted the document «UNECE Strategy for Education for Sustainable Development». Therefore, a significant number of publications are devoted to the impact of education on sustainable development and its reorientation [13,14,15,16,17].

A number of scientific papers emphasize that the transition to a circular economy requires a sufficient number of specialists with relevant competencies (quality). Therefore, the role of higher education institutions for the specialists training at the request of society, the economy, employers [18,7,19,20].

A study by Finnish researchers points to the critical problem that more than two-thirds of adults with vocational education and training have poor or no problem-solving skills in technology-rich environments, and that more than one-fifth of these adults are at risk [21].

A number of scientific works outline educational approaches, tools, learning technologies in higher education, which will accelerate the transition to a circular economy, in particular: the development of incubators in a circular economy [19]; development of special courses for students on cyclical economics [22]; introduction of an educational module created in collaboration with industry and academia [23]; introduction into the educational process of tasks related to the analysis of products that claim to be cyclical processes [24]; study the economics of the cycle (CE) with the help of a serious game In the Loop [25].

A systematic review of the literature and epistemological perspectives on the level of maturity of the circular economy and bioenergy research in the fields of education and communication by Spanish scholars has revealed that the scientific literature is limited and still in its infancy [26].

Reviewing research allows us to formulate new hypotheses and expand the scope of research.

Hypothesis 1. Ukrainian society is at the stage of forming a system of values, which can lay the foundation for the transition to a model of a circular economy.

Hypothesis 2. Education as a social institution has a significant impact on the implementation of the concepts of sustainable development and cyclical economy, because it ensures the formation of environmental and economic awareness, values, culture of society, and higher and postgraduate education - the training of specialists..

3. Methodology and results

An empirical study was conducted to identify the awareness and readiness of representatives of the educational environment to carry out the processes of the cyclical economy.

To study the readiness of Ukrainian society to implement a circular economy, a sociological study was conducted. The organization and conduct of the study included three stages:

Stage 1. collection of primary sociological information;

Stage 2. the stage of information processing;

Stage 3. analysis of the received information, generalization of conclusions, preparation of the recommendations. with the StatSoft's software package «Statistica»

The social survey was conducted in January 2021. It was attended by 74 respondents who are representatives of the educational environment (higher education, teachers, educators, teachers, scientists), of whom: 35% - aged 41-50 years, 23% - aged 31-40 years, 20% - at the age of 18-20 years, 9% - 21-30 years, 13% - over 60 years. The study was conducted using an online survey using the Google Forms tool. Objective: to study the readiness of society to implement the model of circular economy in conditions of global crises.

The questionnaire contains questions on awareness and understanding of the essence of the cyclical economy; determining the place of economic and environmental problems in crisis conditions; readiness to participate in the processes of sustainable development, green and cyclical economy; the importance of social, family, socio-economic, environmental values.

The results of a sociological survey show that representatives of the educational environment (for example, the Kharkiv region, Ukraine) are not sufficiently aware of the nature of the circular economy (38.9% of respondents said they know nothing about it, 29.2% - heard something about it, however, they do not have a clear idea, 30.6% believe that they understand what we are talking about. This indicates that the importance of the transition to a new ecological model of the economy is not yet fully formed.

According to the Circularity GAP report 2021 circularity in our world is trending down (8.6%), not up [27]. On the one hand, this is due to the fact that with the introduction of the circular model of the economy, large corporations must begin to reduce production and at the same time invest in improving their product and packaging. On the other hand, the population must be aware of and support this concept of human preservation. An online survey shows that the majority of respondents see the purpose of their work as income (70.8%), creating a comfortable living environment (66.7%), self-development and interaction with people (65.3%); creation of a useful product for people (48.6%). Respondents were not directly related to entrepreneurial activity, so they noted the development of business and their own projects much less often (23.6%).

Also, 62.5% of respondents believe that entrepreneurs should increase the economic efficiency of their activities, receive more income, pay taxes, assistance - this is a matter for the state. According to 47.2% of respondents, it is necessary to deduct part of the profits for socially important matters, and 45.8% - that it is also necessary to deal with the preservation of the environment. This indicates that society is in the process of realizing the importance of social and green entrepreneurship, however, it is obvious that the basis for significant dissemination and support of this area has not yet been laid. This is confirmed by the ranking of the value system (figure. 1).

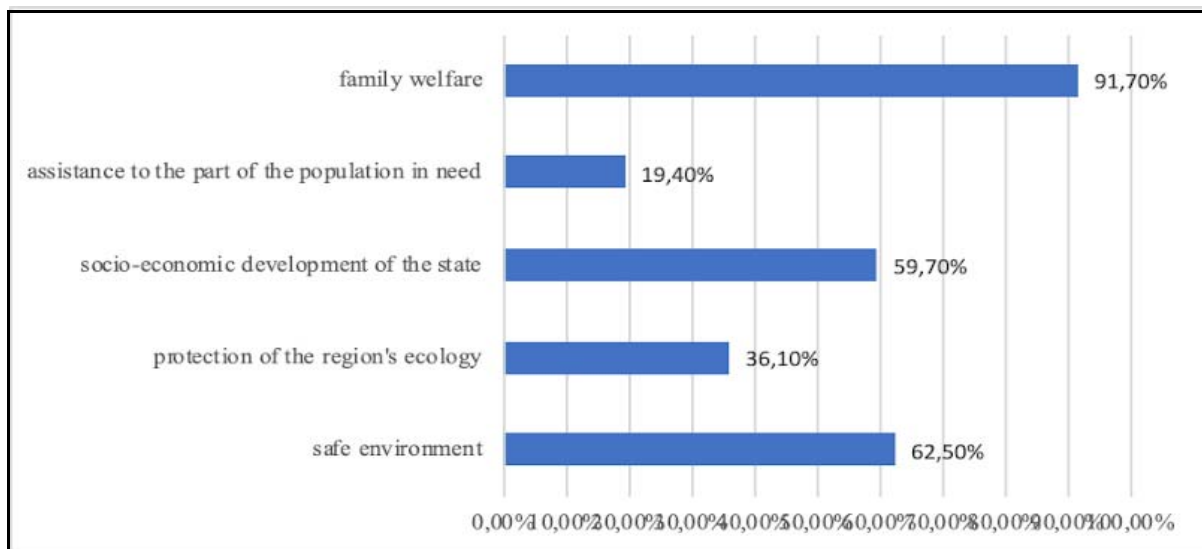


Figure 1. Assessment the importance of the values in Ukrainian society.

As can be seen from Fig. 1, the greatest value among 91.7% of respondents is the well-being of the family. The protection of the region's ecology is the least important for the educational environment (36.1%) and the assistance of the part of the population in need.

The analysis of the results of the social survey of the representatives of the educational environment of Ukrainian society was carried out based on descriptive statistics using the STATISTICA program package (Table 1).

Table 1. Significance of problems for Ukrainians (representatives of the educational environment) in conditions of global crises (1 - the least significant, 5 - the most acute).

Variable	Valid N	Mean	Median	Mode	Frequency of Mode	Std.Dev.	Skewness	Kurtosis
Economic problems	72	14.4	13.0	13.0	2	16.395	1.62	2.89
political instability, life-threatening;	72	14.4	13.0	13.0	2	15.773	1.63	2.93
high corruption;	72	14.2	14.0	14.0	2	13.31	1.37	2.15
intensive migration of the population of Ukraine;	72	14.2	15.0	Multiple		5.80	-0.59	-1.07
education crisis, online education;	72	14.2	14.0	Multiple		5.40	-0.80	0.59
ecological condition of territories	72	14.2	14.0	Multiple		7.98	1.21	1.55

As can be seen from Table 1, on average, the greatest value among people is economic problems and political instability, life-threatening. The distribution of the survey results for more blocks of problems has a right-hand bias, as evidenced by the asymmetry coefficient (the largest for economic problems (1,62), political instability - 1.63 and 1.21 - ecological condition of territories). In addition, the ecological conditions of the territory are more important than the issues of education and migration in Ukraine.

An important stage in the implementation of the circular economy model is not only awareness and awareness of the importance of environmental behavior of society, but also the willingness to change the norms of behavior and habits. The results of the survey on the readiness to sort garbage are presented in figure. 2.

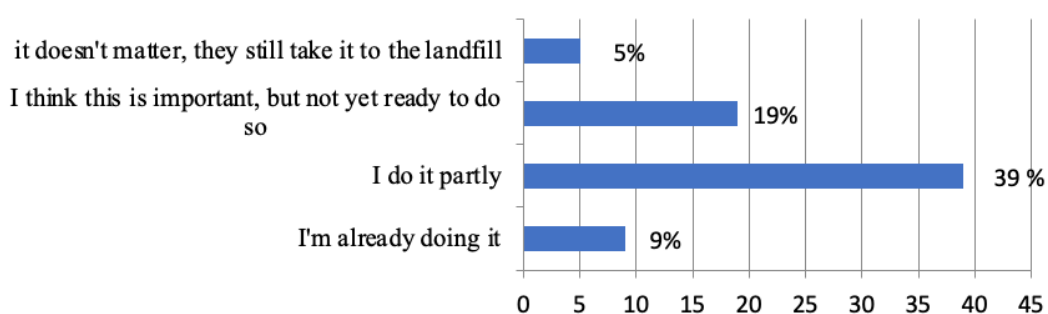


Figure 2. Assessment of your readiness to sort garbage.

As can be seen in Figure 2, the results of a social survey have shown a lack of willingness of Ukrainians to participate in the recovery of products, but only 12.5% of respondents are already sorting garbage, 54% - does it in part, 22% - think it's important, however, are not ready to join the garbage sorting process. The results of the empirical study indicate a lack of awareness of the educational environment (not the economic sector) about the nature and processes of cyclical economics. At the same

time, there is an understanding of the need of the economic sector to invest in minimizing the negative impact of production on the environment, take care of the region's ecology, create a safe environment, and willingness to take responsibility and participate in the preservation of natural, resource and social potential.

To move to a circular model of the economy, society must develop values, norms, patterns of behavior, skills, experiences related to a culture of sustainable development, environmental protection, and the reproduction of resources. The solution of these issues is facilitated by the orientation of education as a social institution in general and at all its levels in particular) preschool, general secondary, pre-professional higher, higher, vocational, postgraduate. «Education is a significant potential for sustainable development of society. Its role is to predict, shape and develop the professional competence of future specialists during their lifetime, to develop an energy-saving style of professional activity» [11].

Analysis of scientific sources revealed successful experience in this area of Europe (Poland, Germany, Finland, etc.), China. This issue is also relevant in Ukraine.

To transition and implement the concepts of sustainable development and cyclical economy, scientists and practitioners propose:

- addressing this issue at the state and legislative levels by including education in national strategic plans, programs and roadmaps for sustainable development, green economy, cyclical economy [28];
- introduction into the strategy of education development, in particular higher education, in addition to supporting the direction of sustainable development, also supporting the transition to a circular economy;
- dissemination of measures in the field of education to implement the principles of the circular economy: the formation of society's worldview, the formation of leadership competencies, exchange of experiences and best practices, providing the necessary infrastructure [29];
- to introduce in institutions of higher education the training of specialists in a fundamentally new direction for Ukraine, namely specialists in circular economics [11];
- modernization of the existing professional training of future specialists-economists, diversification of educational programs in the specialty «Economics» in the context of the tasks of global sustainable development, development of «green» and cyclical economy. For example, updating the content of educational «Business Economics», «Agribusiness Economics», «Economics and Economic Policy», «International Economics» [30]. Study by future specialists of the latest technologies and methods of prevention and prevention of environmental catastrophes [28], processes and procedures for closed-loop production;
- directing educational and training processes in preschool, general secondary and higher education institutions on the development of ecological and economic culture of students, formation of values, norms of behavior for conservation of natural resources, the culture of waste disposal, knowledge of recycled goods, experience in using them. Formation of worldview, the idea of the state of the environment, economic thinking on the rational use and distribution of material, technical, human resources, harmonization of human and nature. Fostering a sense of belonging to the environment and dependence on its consequences;
- modernization of methods, technologies and methods of teaching, taking into account the possibilities of IT education, the use of distance learning, gaming technology and educational software products;
- introduction of basic modules on sustainable development, «green» and cyclical economy in the advanced training system of pedagogical workers in the system of postgraduate education;
- development of educational environment and infrastructure by involving higher education institutions in techno- and science parks, creation of FabLab- and startup centers on the basis of ZVO to attract research and teaching staff, students to create and use closed-loop technologies, product processing;

- realization of interaction of links: «production, business» - «education» - «science» - «sphere of professional activity»;
- providing a holistic and focused approach to education for sustainable development, covering curriculum content, learning outcomes, teaching methods, educational environment development, and building green economies and societies [31].

Implementation of the strategy of sustainable development and training of new generation economics in higher education can be carried out according to several models: a) disciplinary (thematic) - the introduction into the educational process of a separate discipline to study the basics of sustainable development and cyclical economy; b) interdisciplinary - training based on the study of related sciences in terms of sustainable development, «green» and cyclical economy; c) educational - the implementation of economic, environmental, national, multicultural, labor, moral and ethical education of higher education; d) system - the development of all components of the educational environment of higher education [32]; e) saturation of the educational environment of universities with examples of energy, resource-saving, reproductive, processing technologies, partnership of stakeholders of sustainable development and cyclical economy (managers, teachers, graduates; scientists; representatives of industry and business) and implementation of projects based on the best practices (i.e. project «Nature is society»).

The implementation of these areas and educational activities will facilitate the transition to a cyclical economy.

4. Conclusions

Thus, one of the ways out of the global crisis of today (economic, environmental, social) in many countries is the transition to a cyclical economy.

The analysis of literature sources revealed the wide attention and diversity of approaches to determining the nature and definitions of the circular economy. In particular, scientists consider the category of cyclical economy as: a model of economic development; alternative to traditional, linear economy; industrial system that is being restored or regenerated; economic model aimed at ensuring economic prosperity, efficiency of ecosystems, human well-being.

Also, a review of scientific papers revealed that one of the important levers for the introduction and development of a cyclical economy is education. This is due to the need for specialists in cyclical economics for its implementation and effective implementation, the formation of consciousness, values, culture of economic and environmental behavior, willingness to participate in the conservation and reproduction of resources. But such works are currently insignificant.

The relevance of the role of education in addressing the issues of effective implementation of the cyclical economy was confirmed by our empirical study. The survey of representatives of the educational environment of non-economic specialties revealed: 1) insufficient awareness of the essence of the circular economy (only 30.6% - believe that they understand what we are talking about); 2) weak formation of the value of environmental protection in the region (36.1%) and insufficient understanding of importance of dealing with environmental protection by business entities (45.8%); 3) among the most significant problems are economic and political, but at the same time, among the least significant the ecological condition of the territories, educational and migration problems were revealed; 4) insufficient readiness to participate in the processes of recovery of production products, as only 12.5% of respondents are already sorting garbage, 54% - does so in part.

These results indicate the need for more active formation of basic knowledge, values, norms of behavior, responsible environmental, economic and social culture and responsibility.

Based on the analysis of highlighted international practical experience and scientific literature, the ways of education development in support of sustainable development, cyclical economy, reorientation of higher and postgraduate education to train specialists in cyclical economics are identified.

The limitation of this work is the quantitative and qualitative composition of the target group of empirical research, which mainly included representatives of the educational environment of non-economic specialties. The direction of further research will be the study of readiness and experience in the transition to a cyclical economy of future and current economists.

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