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## ECOSYSTEM SERVICES IN THE CIRCULAR ECONOMY

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### USŁUGI EKOSYSTEMÓW W KONCEPCJI GOSPODARKI CYRKULACYJNEJ

**STRESZCZENIE:** Zrównoważone wykorzystanie zasobów wymaga oszacowania ich dostępności oraz ochrony ekosystemów. Istotne jest utrzymanie zdolności środowiska do pochłaniania zanieczyszczeń i zachowanie różnorodności biologicznej. Koncepcja gospodarki cyrkulacyjnej, w szerokim ujęciu, obejmuje nie tylko zagadnienia efektywności produkcji i eliminacji powstawania odpadów lecz całokształt usług ekosystemów. Zmniejszenie ilości wykorzystanych zasobów oraz zanieczyszczeń niesie za sobą poprawę jakości życia jak również i ekonomikę przedsięwzięć.

**SŁOWA KLUCZOWE:** świadczenia ekosystemów, gospodarka cyrkulacyjna

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## Introduction

The increased interest in problems of dwindling natural resources and environmental pollution occurred in the seventies of the twentieth century due to the crisis of raw material and energy and the progressive degradation of the environment. The effect of consideration on the environmental protection aspects in the field of economic and environmental sciences were concepts of “decoupling”, the green economy and the circular economy.

Sustainable and long-term use of resources requires the estimation of their availability, to ensure the security of supply and protection of ecosystems. It is also important to maintain the environment’s capacity to absorb the pollutants and keep the balance of nature and biodiversity.

The main purpose of the article is to discuss actions taken in the quest for sustainable growth and the role of ecosystem services in the development of the circular economy. The hypothesis in this study is that knowledge of ecosystem services and its application in the economy will offer a number of benefits (environmental and economic).

The article also contains information regarding the first proposals for the development of the circular economy in Poland, co-developed by partners of the international project titled “*Improving skills in the Green Economy through Advanced Training Program*” on Cradle to Cradle “(C2C SMEs)”.

## Relationships between circular economy and ecosystem services

The concept of ecosystem services can be considered not only as services, but also goods which are mobilized with the functioning of ecosystems. It’s a set of material goods, directly used, and ecosystem services, useful for society (supporting the possibility of life – for example, the functions of cleaning, and raising its quality-for example, the aesthetic and cultural or scientific)<sup>1</sup>.

The ecosystem was recognized as an object of research, important in the development of economic theory. Considering obtaining benefits, ecosystem services can be divided into four categories<sup>2</sup>:

- supporting, which allow the life and operation of the other components of the ecosystems, including humans;
- provisioning, consisting of the supply of goods;

<sup>1</sup> B. Raszka, M. Hełdak, *Świadczenia ekosystemów w polityce przestrzennej gmin powiatu wrocławskiego*, Wrocław 2013, p. 14

<sup>2</sup> A. Mizgajski, *Świadczenia ekosystemów jako rozwijające się pole badawcze i aplikacyjne*, “*Ekonomia i Środowisko*” 2010 no. 1(37), p. 10–19.

- regulating, associated with the settlement of local microclimate and water retention by the tree and preventing flooding by natural floodplains;
- cultural, referring to the aesthetic, recreational, educational, spiritual, etc.

All these processes necessary for life and human development, remained outside the area of interest of economic analysis until the intense anthropopressure and economic use of resources has led to, among others, extinction of species and biodiversity loss. Many of these ecosystem services were used almost as if their supply is unlimited. They were treated as “free” commodities, their economic value was not properly accounted for on the market.

The idea of sustainable development started from the reports of the General Secretary of the United Nations U'Thant *Man and his environment* (1968) and reports the Club of Rome entitled: *The Limits of growth* (1972), *Mankind at the turning point* (1973), *About a new international order* (1978) and the final took place through the adoption of the sustainable development strategy during the first Earth Summit in Rio de Janeiro in 1992.

Issues associated with using the environment are presented in contemporary economics in the different scope, but they can be distinguished in two general ways, ie.:

- ecological paradigm of economics (the greening of the economy), identified as ecological economics, and
- economization of environment in the context of its economic use and conservation, identified as environmental economics.

In the ecological paradigm of economics, environmental conditions have a higher value – natural capital (rather than physical capital and its accumulation), ecosystem services are the most important limitation of the development. The state of the environment and its stability is the ultimate goal of development. The opposite view is the paradigm of economization of environment which indicates using of economic instruments to minimize costs to run environmental policy with more efficient use of resources.

An analysis of the economic and ecological considerations in economic theory reveals another postulate of consensus in balancing the processes of economization of the environment and greening the economy – sustainable economics.

In the economy of sustainable development, development implements a strong principle of sustainability and complementarity of capital, which means that the various types of capital must be retained, each separately. It follows from the assumption, that capital – natural and anthropogenic – are mutually complementary rather than substitutional and the loss of one type of resource should be supplemented by the same resource – not compen-

sated by another kind. The barrier of capacity of the environment sets environmentally safe boundaries of economic development. The slow depletion of existing factors of economic growth (relatively low labor costs, the cheap raw materials availability) makes it necessary to seek new sources of competitive advantage. If we want to achieve a maintain stable economic development we need to develop innovation, and, in particular – new business models, including new forms of organization concentrated on increasing of the resource efficiency.

The integration of environmental, economic and social policy helps to meet the challenges of sustainable development. This requires to treat environmental resources as limited economic resources and using of natural capital in a way that would preserve the ecosystem in the long term.



Figure 1.

The use of resources in the economy

Sustainable development is the basis for the European Union strategic planning. There is a great number of documents in the form of, i.a *EU Sustainable Development Strategy* and *the Europe 2020 Strategy – A strategy for smart, sustainable and inclusive growth*<sup>3</sup>. Smart, sustainable development is based on knowledge and innovation, with environmental issues taking into account. Responsibilities of the Member States can be realized by promoting and implementing of the circular economy which provides the stability of the products, materials and resources value and reduction of waste<sup>4</sup>.

<sup>3</sup> T. Borys, *Nowe kierunki ekonomii środowiska i zasobów naturalnych w aspekcie nowej perspektywy finansowej Unii Europejskiej*, "Ekonomia i Środowisko" 2013 no. 1(44), p. 14–23.

<sup>4</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. *Closing the loop – An EU action plan for the circular economy*, COM(2015) 614, p. 2.

Transition to a more the circular economy with requires changes in every phase of the value chain, from the design phase of the product (eco-design), new business and market models (closed circulation of water, non-waste technology, limiting waste and harmful emissions, use of ecological returnable packaging or packaging materials), new ways of turning waste into a resource (effective waste collection and recycling) to the new consumer behavior (prolonging product life). This is a complete systemic change and innovation is not only technological but also organizational. By helping to decouple economic growth from resource use and its impacts, it offers the prospect of sustainable growth that will last.

The report of The Ellen MacArthur Foundation – *Towards a Circular Economy, I* – which was presented in early 2012, defines the objectives as follows: “A circular economy is an industrial system that is restorative or regenerative by intention and design. It replaces the ‘end-of-life’ concept with restoration, shifts towards the use of renewable energy, eliminates the use of toxic chemicals, which impair reuse, and aims for the elimination of waste through the superior design of materials, products, systems, and, within this, business models”<sup>5</sup>.

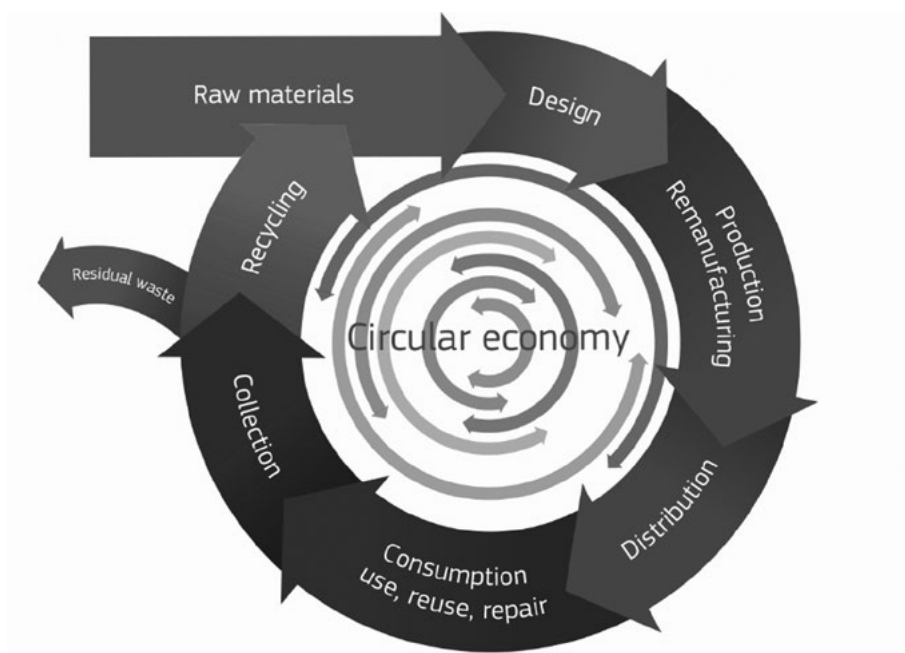


Figure 2. Main phases of a circular economy model: COM (2014) 0398

<sup>5</sup> *Towards a Circular Economy*, The Ellen MacArthur Foundation, 2012, p. 8.

The diagram illustrates the main phases of a circular economy model. The aim is to minimise the resources use and escaping from the circle so that the system functions in an optimal way<sup>6</sup>.

The concept of circular economy has important value to the conservation status of ecosystems and increasing of the ecosystem services potential. It helps to create more efficient ways of producing and consuming. At the same time, it saves energy and helps avoid the irreversible damages caused by using up resources at a rate that exceeds the Earth's capacity to renew them in terms of climate and biodiversity, air, soil and water pollution.

On the other hand, the idea of the circular economy make use of the concepts of ecosystem services and natural capital – the functioning of ecosystems is an exemplar for industrial processes and systems.

Below we can find examples of solutions for circular economy in the context of defined ecosystem services and associated with the solution environmental and economic effects.

**Table 1.** Examples of solutions related to the circular economy in the context of ecosystem services

Ecosystem services	The circular economy solutions	Environmental and economic effects
Provisioning: delivery of food, raw materials	<ul style="list-style-type: none"> <li>• reducing the quantity of materials required for the delivery of goods/ services (lightweighting)</li> <li>• reducing energy consumption and materials at the production and use</li> <li>• extension of products using</li> <li>• reducing the use of hazardous materials or products difficult to recycle</li> <li>• design of products easier to repair, modernization, recovery and recycling</li> <li>• closed circulation of water</li> <li>• the creation of markets for secondary raw materials (recyclates) (based on standards, public procurement, etc.)</li> <li>• industrial symbiosis</li> <li>• incentivising and supporting waste reduction and high-quality separation by consumers</li> <li>• incentivising separation, collection systems that minimise the costs of recycling and reuse</li> <li>• development of the services to consumers in an area of (maintenance/repair etc.)</li> </ul>	<ul style="list-style-type: none"> <li>• the efficiency of resource use</li> <li>• lower transport costs</li> <li>• durability of products</li> <li>• reduction of the amount of waste, (including hazardous waste) and the cost of recovery and recycling</li> </ul>

<sup>6</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *Towards a circular economy: A zero waste programme for Europe*. COM (2014) 0398, p. 2.

Regulating: noise reduction	the process of the absorption, reflection of sound waves by vegetation in the construction and the design of urban spaces (e.g acoustic screens construction)	<ul style="list-style-type: none"> <li>• reduction in the consumption of non-renewable resources</li> <li>• reduction of costs associated with the regulation of noise level</li> </ul>
Regulating: thermal and humidity contrast reduction. Improvement of air quality	the process of regulating the bioclimatic conditions and the absorption of co2 and o2 release by vegetation in the construction and the design of urban spaces	<ul style="list-style-type: none"> <li>• reduction in the consumption of non-renewable resources</li> <li>• reduction of cooling and heating costs</li> </ul>
Regulating: counteraction of water degradation (filtration, self-cleaning in reservoirs)	filtering, purifying water in production processes and services	<ul style="list-style-type: none"> <li>• reduction of the amount of product in the treatment process</li> <li>• closing the loop</li> <li>• reduction of the cost of water treatment</li> </ul>

In the time of transition economies into the circular economies, the main efforts are focused on increasing production efficiency and reducing the amount of resources used, but after that, circular economy should cover the whole complex ecosystem services, to keep the natural balance and stop the decline of biodiversity.

The circular economy is focused on technological systems, but it can benefit from a better understanding of connected ecological processes. Knowledge of ecosystem services and its application in the economy offers a number of benefits (environmental and economic). Valuating natural capital and the flows of ecosystem services provides a strong economic driver to preserve nature, and to use nature-based solutions to address today's economic challenges.

## Development of the circular economy in Poland

Decades ago the concept "Cradle to Cradle" was introduced by Walter Stahel, Founder-Director of the Product Life Institute and leading advocate of resource efficiency. Later, the concept was advocated by prof. Michael Braungart and William McDonough based on research at the Environmental Protection Encouragement Agency in Hamburg, Germany, for designing beneficial economics, social and environmental features into products, processes and system.

C2C promotes innovation partnerships along the chain of products to limit the amount of waste in production processes and technology through appropriate design and the elimination of toxic substances. It requires focusing on three basic principles:

- Treatment of waste as a potential raw material (waste = food);
- Use of renewable energy sources;
- Celebrate Diversity, Species, Cultural and Innovation Diversity.

To apply those principles, Cradle to Cradle focuses on optimizing the use of product. Products for consumption are designed in a way that degradation by products generated during their use can support the biological systems, for example: biodegradable textiles, cosmetics. Products for service are designed to be chemically stable during use and get dismantled into material resources.

The project “Improving of Skills in the Green Economy through Advanced Training Program on “Cradle to Cradle (C2C SMEs)” was carried out by lead partner Hanse-Parlament – an umbrella organization of 50 chambers of commerce, crafts and industry from 13 Baltic and 6 further partners from Germany, Finland, Poland and Hungary:

- EPEA – Internationale Umweltforschung GmbH (Germany);
- Berufsbildungs Und Technologiezentrum der Handwerkskammer Schwerin (Germany);
- Lower Silesia Chamber of Crafts in Wroclaw (Poland);
- Ipartestuletek Orszagos Szovetsege (Hungary);
- Satakunta University of Applied Sciences (Finland);
- The Regional Fund for Environmental Protection and Water Management in Gdansk (Poland) in the period from September 1st, 2014 to August 30th, 2016.

The aim of the project was to disseminate the concept (C2C) in the sector of Small and Medium Enterprises (SMEs) by: development, test and evaluation of the curriculum for C2C training staff (staff of universities, chambers of craft and economic and promoters of SMEs) and by development of a new training program C2C for SMEs and adapting to the specific needs of SMEs<sup>7</sup>.

Comments made by participants on the implementation of the concept of C2C include:

- The need for environmental education of society;
- Assumptions C2C are easier to introduce new companies than in the plants functioning from the 70s (required deep modernization)'
- The need for audits and environmental consultancy (including cost analysis and benefits);
- Concerns about the necessity of formalizing cooperation between companies;
- Limited organization of reverse logistics;

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<sup>7</sup> E. Priedulena, M. HogeForster, *Improving of Skills in the Green Economy through Advanced Training Program on “Cradle to Cradle (C2C SMEs)*, Baltic Sea Academy e.V, 2016, p. 9–16.



- Reduced impact on suppliers;
- The need for systemic support from the public administration and self-government.

It is also known, that market forces are not likely to move towards a more decoupled structure of the economy by themselves. A move towards a more circular economy would require a set of policy measures –a combination of regulation and economic instruments as well as significant investments in infrastructure, construction and manufacturing aiming at reducing the energy and material throughput in society<sup>8</sup>.

## Conclusions

Relative decoupling of economic growth from resource use has been happening over the past decades but the resources freed up by increased efficiency are used up very soon through increased consumption. There is the reason, why concept of the circular economy needs to include not only issues of the production efficiency and waste elimination, but the whole of ecosystem services.

Transition to a green, circular economy requires analysis of the economics of biodiversity and ecosystem services. We need to map the state of ecosystems and their services, assess their economic value, and promote the integration of these values into accounting.

Sustainable business practices and sustainable corporate strategies in economic system have become a majority economic measure of development. The circular economy or “Cradle to Cradle” design concept have good assumptions, but comments of participants of “Improving of Skills in the Green Economy through Advanced Training Program on “Cradle to Cradle (C2C SMEs)” project confirm the importance of implementing a comprehensive program covering all sectors of the economy, with defined objectives, targets and strategy measures to support enterprises in implementing a circular economy. The investments would be needed primarily in the following sectors<sup>9</sup>:

- agriculture, forestry, timber, pulp and paper to promote biofuels and to develop new biobased products;
- installation services and construction/renovation to promote energy-efficiency and renewable energy sources;

<sup>8</sup> A. Wijkman, K. Skånberg, *The Circular Economy and Benefits for Society Jobs and Climate Clear Winners in an Economy Based on Renewable Energy and Resource Efficiency*, The Club of Rome, 2015, p. 44.

<sup>9</sup> *Ibidem*, p. 10.

- sustainable infrastructure concerning especially energy and transport;
- maintenance and repair, recycling and development to promote material-efficiency;
- engineering services like product design, recycling and remanufacturing as well as new business models.

The development of low-carbon, resource-efficient and competitive economy also depends on the increase in public awareness of the required changes in production and consumption patterns.

## Literature

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