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CIRCULAR ECONOMY AND RENEWABLE BUSINESS MODELS

Tetyana Mostenska, Volodymyr Davydenko. *"Circular economy and renewable business models".* The article is devoted to the analysis of the possibilities of using circular economy tools. The current state of the circular economy is considered. The article describes the theoretical and practical aspects of the circular economy. An analysis of the basic tools and methods that can be applied in the introduction of the circular economy has been carried out. A chain of creation of added value is proposed. A model of using the circular economy is proposed. The main strategic goals of introducing the circular economy are defined. An additional model is considered - SmartCitiesMarketplace. The possibilities of obtaining benefits from the introduction of the circular economy are considered. Recommendations for further research are given.

Keywords: circular economy, circular business models, waste management, resource management, cyclical production management, SmartCities Marketplace.

Тетяна Мостенська, Володимир Давиденко. *«Циркулярна економіка та відновлювальні бізнес-моделі».* Стаття присвячена аналізу можливостей використання інструментів циркулярної економіки. Розглядається сучасний стан циркулярної економіки. У статті викладені теоретичні і практичні аспекти циркулярної економіки. Проведено аналіз базових інструментів та методів, які можуть бути застосовані при запровадженні циркулярної економіки. Запропоновано ланцюг створення додаткової вартості. Запропоновано модель використання циркулярної економіки. Визначені основні стратегічні цілі запровадження циркулярної економіки. Розглянуто додаткову модель - Smart Cities Marketplace. Розглянуто можливості отримання переваг від запровадження циркулярної економіки. Надано рекомендації подальших досліджень.

Ключові слова: циркулярна економіка, циркулярні бізнес-моделі, управління відходами, управління ресурсами, управління циклічністю виробництва, Smart Cities Marketplace.

Татьяна Мостенская, Владимир Давыденко. *«Циркулярная экономика и обновительные бизнес-модели».* Статья посвящена анализу возможностей использования инструментов

циркулярной экономики. Рассматривается современное состояние циркулярной экономики. В статье изложены теоретические и практические аспекты циркулярной экономики. Проведен анализ базовых инструментов и методов, которые могут применяться при внедрении циркулярной экономики. Предложена цепь создания добавленной стоимости. Предложена модель использования циркулярной экономики. Определены главные стратегические цели введения циркулярной экономики. Рассмотрена дополнительная модель – Smart Cities Marketplace. Рассмотрены возможности получения преимуществ от введения циркулярной экономики. Даны рекомендации дальнейших исследований.

Ключевые слова: циркулярная экономика, циркулярные бизнес-модели, управление отходами, управление ресурсами, управление цикличностью производства, Smart Cities Marketplace.

Introduction. Before the global pandemic, active efforts were made in Europe to develop a circular economy, in particular, to develop infrastructure on a more sustainable and economical basis. Even if today's reality of Ukraine has corresponding problems in promoting this idea, at the same time there is an opportunity to expand opportunities to promote innovative solutions that will allow attracting investments, to move towards a green economy, thereby contributing to future economic prosperity.

Greening the economy is increasingly becoming a strategic priority for governments around the world. As part of efforts to promote a green economy in the pan-European region, the Committee on Environmental Policy (CEP) of the Economic Commission for Europe of the United Nations (UNECE) with the support of the UNECE and the United Nations Environment Program (UNEP), as well as in cooperation with other key participants, such as the Organization for Economic Co-operation and Development (OECD) and the European Environment Agency (EEA), developed a pan-European strategic framework for greening the economy. These strategic frameworks are the basis for a comprehensive regional vision, goals and results for the promotion of the green economy [6].

Closed-loop economy or circular economy, based on the rational use of resources and limiting the harmful impact of manufactured products on the environment. The main approach is the maximum use of raw materials in circulation for a long period

of time, until they lose their properties. With this approach, the amount of waste generated can be minimized. At the end of a product's life cycle, all its residues should remain in the economy, as there is a high probability that they can be reused.

The reuse of materials is an extremely attractive prospect from a financial and environmental point of view. This can be a significant breakthrough in the transition from the linear model of the economy that exists today, where the necessary raw materials are first collected, then transformed into a product, distributed and exploited, and finally thrown away.

Using a closed value chain model, instead of producing disposable products, used parts are recovered or materials are remelted to return them to a new marketable form. This makes them reusable, sometimes even in a completely different industry. It is worth noting that the circular economy model offers many advantages for modern business. By implementing such a model, companies can spend less financial resources on certain types of raw materials, contribute to environmental protection and minimize the impact of prices on the market.

Analysis of recent research and publications.

The urgency of researching issues related to the implementation of circular approaches is due to the limitation of world resources and the increase in their consumption.

Research and development in the field of circular economy, focus mainly on some topical issues of logistics, production and

processing technology, in the works of U. Stahel, R. Lifset, Paula, and others.

Domestic researchers and scientists in the field of circular economy mostly refer to the analysis of foreign experience.

The purpose and tasks of the research.

The purpose of this article is to study the application of business models for the introduction and management of circular processes in the economy.

Main material and results. The model of the circular economy is a model of production and consumption that involves the joint collective (or repeated) use, rental, repair, restoration and recycling of existing materials and products for as long as possible (Figure 1).

The circular economy takes a long-term perspective and covers all industrial sectors at

global, regional and local levels. This is one of the directions that will allow to reduce consumption and at the same time extend the service life of products and resources and is based on three basic principles (Figure 2):

- opportunities to design and construct products in such a way that they can be reused or upgraded in the future, which prevents the increase of waste and environmental pollution;
- possibilities of increasing the time of use of products and materials;
- opportunities to restore natural systems and create circular (closed) business models or a closed supply chain.

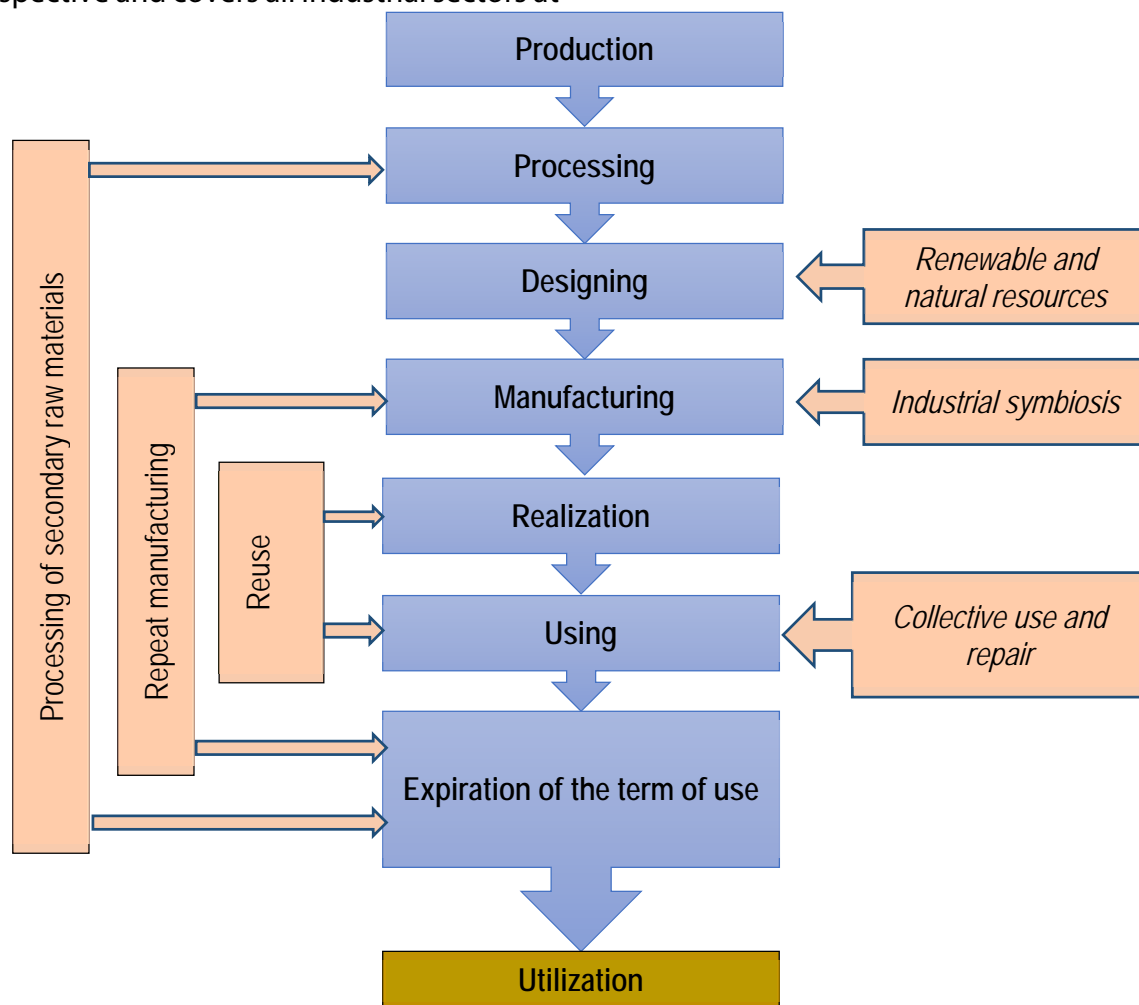


Figure 1 – The chain of creation of additional value based on the introduction of elements of the circular economy

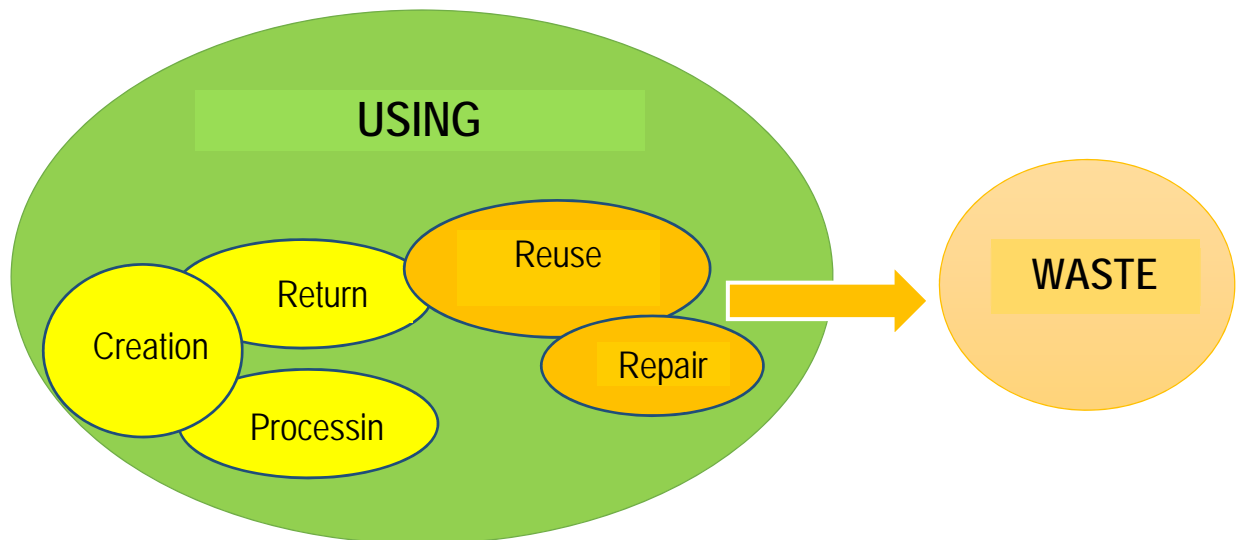


Figure 2 – Circular economy usage model

In addition, the use of the insert "possibility" (not as affirmative and binding principles) defines the desire to implement the specified principles, within the limits of financial and technological capabilities, using both internal and external resources [2].

The multiannual European financial framework for 2021-2027 and the "Next Generation EU" include a recovery plan that is set to be the biggest stimulus package ever funded in Europe. A total of €1.8 trillion should be dedicated to rebuilding a greener, digital and sustainable Europe. It is planned that about €374 billion will be allocated to finding ways to preserve natural resources and the environment. In addition, European countries have pledged to shift from fossil fuels to green energy, buildings, transportation and other investments as a recovery strategy worth about \$295 billion. Such concerted approaches by Europeans demonstrate an unprecedented opportunity to efficiently allocate current resources and provide more efficient recovery to fill infrastructure investment gaps, with clean energy or ecosystem-restoring infrastructural solutions [4, 7].

Taking into account the common readiness to implement the principles of the circular economy, the European Union has defined the main strategic goals in this direction:

- simplification of collection and sorting of various materials for reuse and recycling, turning this system into a mandatory one;
- reducing the amount of food waste;
- implementation of financial incentives to encourage reuse and recycling of packaging;
- prohibitions on burning and burying waste collected for recycling or reuse;
- setting higher goals for recycling and reuse of goods;
- oblige manufacturers to pay more for the collection and recycling of packaging waste;
- establishment of a more accurate methodology for assessing the degree of processing.

It should be noted that the specified areas should be laid down in the basis of state policy, taking into account the use of infrastructure, digital technologies, investments and process management. The state should create (primarily investment) opportunities for the circular economy, support sustainable and environmental initiatives, create opportunities for the development of public and private partnerships with a focus on circular projects. At the micro level, businesses need to implement the following steps:

– to implement strategic and tactical approaches to achieving environmental sustainability;

– conduct systematic research and development, design products and services in accordance with the circular economy;

– raise awareness of its employees, customers, consumers and the community about the opportunities to participate in the global project to introduce a circular economy.

In the system of scientific search for circular economy implementation directions, the researchers proposed the following business models [1, 5]:

– **Circular supply.** Replacement of traditional raw materials with organic or renewable ones, and long-term use of resources. Production waste should become raw material for new production processes.

– **Restoration of resources.** Recovery of raw materials and processing of waste from secondary raw materials, so that waste is transformed into raw materials and not disposed of - in this case, companies create new products from waste. This model is the most adapted.

– **Extending the service life of products.** Here we are talking about resource recovery and waste minimization. And thanks to the modernization or resale of products on secondary markets, their service life increases. This also includes repair and reuse.

– **Platform for shared use.** In this model, the product itself carries the raw material and increases the possibility of its use, that is, it can be used by many consumers, not just one person. Access to this product is sold here.

– **Product as a service.** A product is no longer something that belongs to one person, but can be used by one or more customers on a subscription basis (not a product, but a service). Here, various subscriptions are introduced, the costs of maintaining such services and management are reduced, and additional value is obtained after the end of the product life.

By studying the proposed business models, which are proposed for use in the implementation of the circular economy, a model was discovered that can be an effective element in the implementation of the circular economy, and in integration acquires a wide discussion study.

Such a model is "Smart Cities Marketplace" - Smart City.

This concept involves the integration of information and communication technologies, including IoT (Internet of Things), for the purpose of effective management of the city's infrastructure (transportation, security, medicine, utility system, etc.). The purpose of introducing this model is to improve the quality of life of city residents and reduce the costs of work processes, using modern technologies to meet the needs of citizens [8].

The application of "smart city" technology is being developed in order to improve the management of urban flows and quick response to complex tasks. Therefore, a "smart city" is more prepared to solve problems than in a simple "operational" relationship with its citizens. Nevertheless, the term itself remains unclear in its specifics, and therefore involves controversial discussions.

Smart Cities Marketplace allows city authorities to interact directly with communities and city infrastructure, and monitor what is happening in the city, how the city is developing, and what tools allow improving the quality of life. Through the use of sensors integrated in real time, the accumulated data from city residents and devices is processed and analyzed. Collected information is the key to solving inefficiencies.

Smart Cities Marketplace are used to increase the quality, productivity and interactivity of city services, reduce costs and resource consumption, and improve communication between city residents and the state [3].

Smart Cities Marketplace is a city that cares about the planet. Caring for the environment begins with controlling the consumption of energy resources. In a smart

city, different tools can be used to effectively implement this control:

- smart lighting (lights on the streets turn on and off automatically, reacting to the approach of a person);
- use of leakage sensors;
- optimized conditioning;

- automation of water consumption (smart sensor mixers);
- automation of the distribution network;
- use of intelligent thermostats, etc.

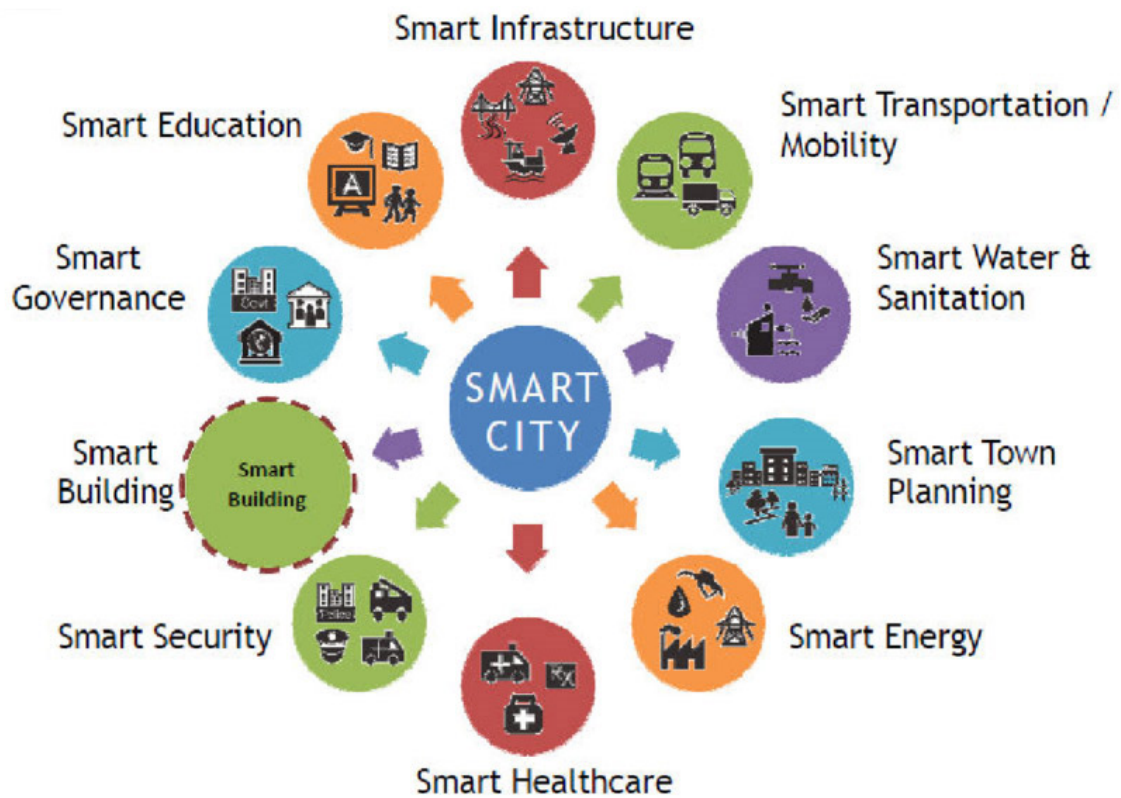


Figure 3 – Components of Smart Cities Marketplace [8].

The introduction of Smart Cities Marketplace improves the quality of life of citizens, increases the competitiveness and

energy efficiency of cities and industry, and also improves the ecological climate of the urban environment (Table 1).

Table 1 – Functional elements Smart Cities Marketplace

Energy	Energy consumption meters	Management of final consumption	Electric transport	Distributed generation	Cogeneration	Renewable generation
Transport	Intelligent transport systems	Infrastructure payment systems	Automated and intelligent parking	Public information notice	ECO cars	Ecological transport
Water supply, gas supply	Smart meters	Automatic/remote consumption control	Definition of breakthroughs	Management of emergency situations	Reducing the level of losses from breakthroughs	Innovative cleaning methods
Urban environment	Video surveillance and security	Smart lighting	Smart waste disposal	Management of urban development	Efficient hospitals	Social service provision
Dwelling	Integrated automation	Remote housing management	Smart devices	Smart applications and services	Energy-efficient construction	Energy-efficient restoration of construction objects

An example of the practical application of Smart Cities Marketplace elements in Ukraine is the use of such an application as the "Diya" application, which belongs to the ecosystem of the "Digital State" project from the Ministry of Digital Transformation.

The ecosystem also includes:

- state portal «Diya»;
- «Diya Education» — portal with online courses: basic digital literacy;
- «Diya Business» — a portal to help small and medium-sized businesses and others.

Conclusions. The circular economy is based on three principles. First, it is a reduction in the amount of waste or its elimination altogether. To achieve this, products must be durable and optimized for recycling and reuse. For this, they must be made from quality materials.

Second, products and materials must be in constant use in the ecosystem. Biological

materials, such as food or clothing made from natural fabrics, return to the ecosystem naturally through decomposition. Man-made materials such as plastic are recovered in eco-chains through reuse, repair or recycling (in practice this means, for example, pumping out an old Smartphone rather than buying a new one).

Third, the energy used to operate the circular economy must be renewable. This reduces dependence on finite resources (for example, oil) and increases the sustainability of the system.

In general, the circular economy can contribute to economic prosperity. It reduces the cost of resources - both human and energy - for the production of products. Carbon emissions in the supply chain also decrease. Furthermore, the circular economy makes the economy more sustainable in the long run.

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