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SCIENCE AND EDUCATION: PATHS TO PROGRESS

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**«SCIENCE AND EDUCATION:
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SERVITIZATION AS A TOOL FOR SHAPING A CIRCULAR BUSINESS MODEL

Introduction. The modern economy is undergoing a profound transformation driven by global environmental challenges, resource const-

raints, stricter regulatory requirements, and shifts in consumer behavior. The linear economic model, based on the “take–make–use–dispose” principle, is gradually losing its efficiency from both economic and environmental perspectives. In response to these challenges, the concept of the circular economy has emerged, emphasizing closed material loops, waste minimization, resource reuse, and the extension of product lifecycles. The circular economy is increasingly viewed as a new paradigm of sustainable development, combining economic efficiency with environmental responsibility [4]. New business models aimed at preserving the value of resources within the economic system play a key role in its implementation [3].

In this context, servitization – the process of transforming manufacturing business models by shifting from selling products to providing comprehensive product-service solutions – takes on particular importance [9; 1].

Main Body. The circular economy offers an alternative to the linear economic model by creating closed loops for resource use [7]. Its key principles include extending product lifecycles, reusing materials, minimizing waste, and implementing ecodesign [2].

A circular business model is defined as a way of creating, delivering, and capturing value that aims to keep resources in economic circulation for as long as possible [4]. The main types of circular models include reuse, remanufacturing, recycling, sharing, and Product-as-a-Service (PaaS) models [8].

The Product-as-a-Service (PaaS) model is directly linked to the concept of Product-Service Systems (PSS), which integrate products and services into a single value proposition [6]. This model provides the foundation for the development of servitization within the context of a circular economy.

The term “servitization” was originally introduced to describe the process of adding service components to traditional manufacturing businesses [9]. Subsequent research expanded its meaning, defining it as a strategic transformation of manufacturing enterprises toward integrated product-service solutions [1].

Servitization involves:

- integrating services into product offerings;
- establishing long-term contracts;
- shifting from a transactional to a relational interaction model;
- focusing on outcomes or functionality [1].

According to the classification of Product-Service Systems (PSS), they can be product-oriented, use-oriented, or result-oriented [8]. The most circular-oriented models are those based on usage and outcomes, as they maintain the manufacturer's responsibility for the product lifecycle.

Digitalization significantly accelerates servitization by leveraging remote monitoring technologies, data analytics, and predictive maintenance [1].

Servitization creates the conditions for developing a circular business model through several mechanisms:

1. Retention of manufacturer ownership – In rental or PaaS models, the manufacturer retains ownership of the product, providing an economic incentive to enhance its durability and maintainability [8]. This encourages the adoption of ecodesign and the organization of reverse logistics [2].
2. Extension of product lifecycle – Servitization supports regular maintenance, upgrades, and the reuse of components, aligning with circular economy principles [7]. Extending the product lifecycle reduces the need to produce new items and lowers the consumption of primary resources [3].
3. Optimization of resource use – Sharing models increase asset utilization rates and reduce the overall flow of materials within the system [4]. This contributes to improving resource efficiency across the economy.
4. Waste reduction – Manufacturer control over the product lifecycle enables recycling, remanufacturing, and material reuse [2]. This approach aligns with the “waste-to-wealth” concept, which transforms waste into a resource [5].

Key advantages of servitization include the creation of stable long-term revenue, increased customer loyalty, and market differentiation [1]. Additionally, it supports the implementation of circular economy principles and sustainable development goals [4].

At the same time, there are risks associated with high initial investments, the complexity of transforming organizational structures, and the need to shift corporate culture [1]. Additional challenges include financial risks related to retaining assets on the company's balance sheet and uncertainty regarding long-term revenue streams [8].

Conclusions. Servitization is a strategic tool for shaping a circular business model, as it integrates economic benefits with environmental responsibility. Shifting from selling products to providing functionality enables the extension of product lifecycles, optimization of resource use, and reduction of waste generation.

Retaining manufacturer ownership of products encourages the adoption of ecodesign, the development of remanufacturing, and the implementation of reverse logistics systems. In the long term, servitization can become a key factor in enhancing enterprise competitiveness within the circular economy and an important mechanism for achieving sustainable development goals.

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