

Formation of a Circular Economy to Mitigate the Threats of the COVID-19 Pandemic

Maria A. Vetrova and Dinara V. Ivanova

Abstract—The article is devoted to the analysis of the opportunities, risks and threats of the crisis and post-crisis period of the COVID19 pandemic, in particular, the assessment of its impact on the achievement of sustainable development goals. Particular attention is paid to systematizing the short-term and long-term effects of the COVID19 pandemic, affecting the formation of a circular economy. The object of special attention is the role of digital technologies in the formation of closed supply chains, as the basis for the development of a circular economy, which contributes to the highly effective achievement of sustainable development goals. Based on the analysis of best practices, the article provides key technologies that contribute to the spread of the principles of a circular economy at different stages of the formation of closed supply chains, as well as presents the necessary government initiatives to mitigate the threats of the COVID19 pandemic.

Index Terms—Circular economy, sustainable development, COVID-19 pandemic, digital technologies, digital transformation.

I. INTRODUCTION

The disastrous consequences of the COVID-19 pandemic are primarily associated with the threat to human lives. At the same time, the current crisis has revealed the shortcomings of the modern economic system that require review in order to mitigate the risks and achieve the goals of sustainable development. A critical analysis of the impact of COVID-19 on the global economy and ecosystems conducted by a team of researchers from the University of Warwick in the UK has confirmed that a circular economy will help cope with the effects of the pandemic [1]. Thus, according to the study, the COVID-19 pandemic has identified additional weaknesses and threats to the linear economy and has actualized the transition of all industries to circular production and consumption patterns in order to achieve goals for zero emissions and waste, financial recovery of the global economy, and strengthening resilience. By the term ‘the circular economy’ the authors mean an economy based on the processes of restoration, optimization and conservation of resources using digital technologies to achieve zero-waste production and consumption, sustainable economic growth, socio-economic and environmental efficiency [2].

While some studies show a positive effect of the pandemic COVID-19 on the environment, which is primarily reflected

in the reduction of CO₂ emissions as well as wastewater discharges into water bodies [3], the cumulative risks threaten sustainable development in general. At the same time, the visible positive effects are rather short-term in nature due to the slowdown in economic development. Only the EU, with its updated Circular Economy Action Plan 2020 and the 2019 European Green Deal, is prepared to tackle the impact of the pandemic in a sustainable manner. Other countries need to develop economic recovery plans while avoiding short-term solutions with significant pressure on the environment. Thus, a mechanism for overcoming the crisis can lay the foundation for achieving sustainable development goals, develop renewable energy, waste-free production and consumption, minimize the consumption of raw materials, and create additional jobs.

Thus, this study is aimed, firstly, at systematizing the threats of the COVID-19 pandemic to sustainable development; secondly, at the analysis of the impact of digital technologies on the formation of closed supply chains for the development of a circular economy; third, to systematize the opportunities and threats of the circular economy during the crisis and post-crisis period of the COVID-19 pandemic.

II. DATA AND METHODS

The tasks set in the study were solved within the framework of such theoretical approaches as the concept of sustainable development, institutional and economic and legal analysis, as well as the concept of natural and production cycles. The tasks were solved in several stages, shown in Fig. 1.

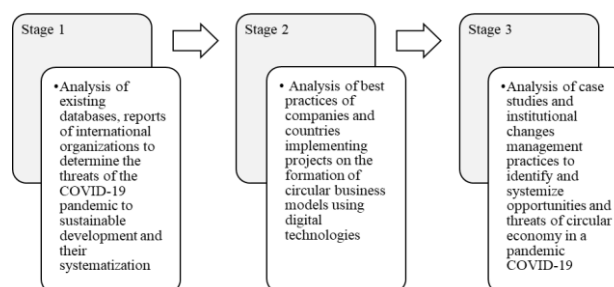


Fig. 1. Stages of the study.
Source: compiled by authors.

III. RESULTS

The coronavirus outbreak has become a threat not only to human health and life, but also significantly changed the ability to achieve sustainable development goals around the

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world. According to experts from the UN Program, all achievements in the field of sustainable development can be reversed [4]. A comprehensive analysis of the literature and practice made it possible to systematize the threats of a pandemic to sustainable development (Table I).

TABLE I: COVID-19 PANDEMIC THREATS TO SUSTAINABLE DEVELOPMENT

| Area | Description | Source |
|-----------------|--|---|
| People's health | COVID-19 has resulted in enormous loss of life worldwide and an unprecedented public health problem. As of July 7, 2021, the number of detected cases was 184 554 032 people, and the number of deaths was 3,991,923 people. | Statistics of sick people and deaths from coronavirus, 2021 [5] |
| Poverty | The economic and social upheaval caused by the pandemic are devastating, with millions of people at risk of falling into poverty. The number of undernourished people worldwide was 690 million in 2020, with a projected increase of 150 million in 2021. | World Bank, 2020 [6] |
| Food security | World food prices rose by almost 20% in 2020. Together with lower incomes, this has led to a decrease in the quantity and quality of food consumption by households. The COVID-19 pandemic has increased the number of people experiencing severe food insecurity from 149 million (including refugees) in 2019 to 272 million in 2020. | World Bank, 2021 [7] |
| Unemployment | According to the International Labor Organization (ILO), approximately 25 million people worldwide could lose their jobs due to the economic crisis caused by the COVID-19 pandemic. The pandemic has put pressure on wages, widening the gap between high-ranking and low-paid workers, at the same time, the main burden fell on women and low-paid employees, there was a decrease in wages. | United Nations, 2020 [8] |
| Ecology | The direct negative impact of the COVID-19 pandemic on the environment is reflected in an increase in the amount of medical waste, for example, in Wuhan, China, more than 240 tons of medical waste were produced daily during the coronavirus outbreak [9], which is almost 190 million tons more than the same period last year. [10]. The explosive growth in the use of digital technologies as a result of telecommuting and online conferencing is negatively affecting energy consumption and CO2 emissions. Studies prove that in an hour of videoconference with the camera on, 1 kg of CO2 emissions occur (which is equivalent to burning 0.5 liters of gasoline). The overall growth in global greenhouse gas emissions as a result of increased internet traffic consumption was 3.7%. [11]. | Saadat S., 2020; Zambrano-Monserrate M.A., 2020; |

Source: compiled by authors

Government programs and circular business models began to actively develop in the last 5 years, the impetus was the spread of digital technologies, which provided opportunities to implement the principles of the circular economy and achieve sustainable development goals at the maximum level of economic efficiency.

Digital technologies are creating closed supply chains, which are the basis for the dissemination of the principles of the circular economy in practice. For example, to develop closed-loop digital economy business models such as

product-as-a-service or sharing and exchange platforms, the Internet of Things, asset tracking technologies and predictive analytics optimize the ability to return products for repair, recovery or recycling. It is the digital transformation capabilities presented in Table II that help close the supply chain and keep resources within the chain.

TABLE II: COVID-19 PANDEMIC THREATS TO SUSTAINABLE DEVELOPMENT

| Stage | Digital technologies applied | Areas of application |
|---|--|---|
| Extraction and primary processing of resources | Industry 4.0 technologies, machine learning, industrial internet of things | Reduction of equipment breakdowns, deep processing of natural gas instead of not environmentally friendly combustion, recycling of polymeric materials, deep mining, processing and use of mining and mineral processing waste. |
| Production of finished products | Blockchain, big data analytics, digital twins, raw materials and materials databases, Industrial Internet of Things, 3D printing, robotics | Environmental design and design of products from fully renewable, recyclable or biodegradable materials, the transition to renewable energy sources, development of zero-waste production |
| Product usage and service delivery | Internet of things, big data collection and analytics, feedback platforms, predictive analytics | New consumption patterns: product-as-a-service, sharing, where products are subject to mass personalization, has feedback to owners without user participation for predictive analytics, quality improvement, and more. |
| Collecting and sorting products for disposal or reuse | Internet of Things, feedback platforms, big data analytics, robotics | Monitoring of location, quality and ownership of products, identifying persons responsible for disposal, as well as collecting information on the quality and quantity of products, their composition and disposal options. |

Source: compiled by authors.

However, disregarding the principles of a circular economy, digital technologies within the framework of linear production and consumption models can impede sustainable development. Thus, the explosive growth of digital technologies during the pandemic, on the one hand, provided opportunities for remote work, holding conferences, preserving many types of work activities and increasing their efficiency. On the other hand, electricity consumption and CO2 emissions from the increased use of Internet traffic have increased. At the same time, the existing digital divide has increased the polarization between developed and developing countries, the poor and the rich. Today, about half of the world's population does not have access to the Internet [12]. The United States and China create the vast majority of wealth in the digital economy, and these two countries account for 75% of all blockchain patents, 50% of global Internet of Things (IoT) spending, over 75% of the cloud computing market, and up to 90% of the market capitalization of the world's 70 largest digital platform

companies [13]. The rest of the world, especially Africa and Latin America, is lagging far behind, and this trajectory is likely to continue, further contributing to rising inequality.

IV. DISCUSSION

A circular economy can increase productivity, reduce costs and stimulate investment, create new business areas and additional jobs, while improving sustainability and protecting the environment and human health. However, the pandemic and the ensuing economic crisis have introduced a number of threats and risks that hinder the implementation of the principles and tools of a circular economy.

In this study, the authors systematized not only the threats, but also the opportunities for the development of a circular economy and sustainable development that arose in response to the pandemic. Table III shows the main effects and consequences of the pandemic.

TABLE III: OPPORTUNITIES AND THREATS TO THE CIRCULAR ECONOMY DUE TO THE PANDEMIC COVID-19

| Pandemic effects | Opportunities | Threats |
|--|---|---|
| Changing consumer eating behaviour in favour of self-cooking | reduction of food waste in households due to more rational consumption of food; | increase of household electricity consumption; |
| Remote work out of the office | reduction of costs, electricity and CO2 emissions for the maintenance of commercial real estate; reduced fuel consumption and exhaust emissions of personal cars. | reduction of sales volume in light industry, increase of electric power consumption by remote communications. |
| Closing of cafes, restaurants | reduction of food waste in cafes and restaurants; reduction of water and electricity consumption. | disruption of supply chains with fresh food producers. |
| Growth of e-commerce in the consumer segment | development of a delivery system in farms; reduced fuel consumption for trips to stores. | development of delivery services has increased tension on the roads, including pedestrian ones. |
| Ban on mass events | reduction of household waste from mass events. | violation of the mechanism of separate collection of waste by the population in the form of separate actions. |
| Public transport restrictions | reduction of exhaust emissions; reduction of fuel consumption by public transport. | increased consumption of fuel and exhaust gases from cars due to increased activity of taxi services. |
| Reduction of civil aviation flights | reduction of waste, including food one; reduction of emissions into the atmosphere. | increased activity in alternative less environmentally friendly modes of transport (road and rail). |

Source: compiled by authors

The scientific community has yet to comprehend the consequences of the pandemic, but it can be said now that the reduction in emissions into the environment was mainly of a

short-term nature, associated with the imposed quarantine restrictions. Thus, according to a study by the environmental group WRAP, before the pandemic, food waste of UK households was 24%, during the pandemic there was a decrease to 14% [14]. Air pollution in New York fell by almost 50%, in China by 25% [15] in the first two months of the pandemic. Water pollution from industrial sources during the pandemic period decreased or disappeared completely [16]. For example, wastewater discharge into the Ganges River has decreased by 500% [17]. In Russia, according to Statista data for April 2020 [18], the added value in the transport and storage sector decreased by 26.1%, and this is directly related to the volume of emissions into the environment. Global CO2 emissions in 2020 are estimated at 4 to 7% lower compared to 2019. However, this is achieved mainly due to a decrease in population mobility [19]. The pandemic has shown that changes in consumer behaviour alone are not sufficient to achieve sustainable development goals. Recovery from the crisis must be accompanied by the increased use of new technologies, the development of closed supply chains and the reduction of waste production.

V. CONCLUSION

The global experience in combating the pandemic and its consequences relies heavily on the principles of sustainable development. Many of the positive effects of a decline in business activity during this period are temporary. The restoration of economic growth will lead to an increase in greenhouse gas emissions and other emissions into the environment. The principles of a circular economy, laid down in the public policies of many countries, provide a forward movement towards the restoration of sustainable development. These include government purchases of surplus agricultural products, incentives for enterprises to rational use of office space, and a combination of office and remote work. However, the effects of the taken measures should be considered in a comprehensive manner, taking into account the production and household sector, to which electricity consumption on remote communications is largely transferred.

One of the most important effects of the pandemic is a change in priorities in the minds and behavior of the population in favor of environmentally friendly and conscious consumption. However, rising global poverty and declining incomes in many countries require active assistance from the State and international organizations to maintain the balance of sustainable development.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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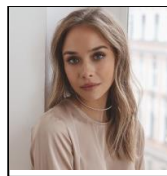
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