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The presence of circular (bio)economy in the environmental investment projects of the Western Balkan countries

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***Abstract**: The uncontrolled use of natural resources, loss of biodiversity and natural capital, pollution of water resources, CO_2 emissions, inadequate waste disposal and other environmental problems have influenced the growth of investments in green technologies, as well as the development of more efficient methods in terms of the use of resources to increase productivity in different sectors of the economy without endangering the land and biodiversity. The paper examines the advantages of developing the investment projects that promote the concepts of bioeconomy and circular economy and ensure profitability without a negative impact on the natural environment. The innovation projects supported by the Western Balkans Investment Framework in the field of energy, environment, transport, social protection and digital infrastructure are analyzed. It is concluded that about 50% of the supported projects are environmental projects that aim at providing environmental benefits or preventing the environmental damage. Special attention is paid to the environmental projects co-financed by the Innovation Fund of the Republic of Serbia.*

***Keywords**: Bioeconomy, innovations, projects, economic methods, Western Balkans.*

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Zastupljenost cirkularne (bio)ekonomije u ekološkim investicionim projektima zemalja Zapadnog Balkana

***Apstrakt**: Nekontrolisana upotreba prirodnih resursa, gubitak biodiverziteta i prirodnog kapitala, zagađenje vodnih resursa, emisija CO_2, neadekvatno odlaganje otpada i drugi ekološki problemi uticali su na rast ulaganja u razvoj zelenih tehnologija i metoda koje su efikasnije u korišćenju resursa za povećanje produktivnosti u različitim sektorima privrede bez zagađenja zemljišta i biodiverziteta. U radu se sagledavaju prednosti razvoja investicionih projekata koji promovišu koncepte zelene (bio)ekonomije i cirkularne ekonomije i koji obezbeđuju profitabilnost bez negativnih uticaja na prirodno okruženje. Analizirani su podržani inovacioni projekti Investicionim okvirom za Zapadni Balkan u oblasti energetike, životne sredine, saobraćaja, socijalne zaštite i digitalne infrastrukture. U radu se zaključuje da oko 50% podržanih projekata predstavljaju ekološke projekte koji imaju za cilj obezbeđenje ekoloških koristi ili sprečavanje ekoloških šteta. Posebna pažnja u radu posvećena je ekološkim projektima u čijem sufinansiranju učestvuje Fond za inovacionu delatnost Republike Srbije.*

***Ključne reči**: Bioekonomija, inovacije, projekti, ekonomski metodi, Zapadni Balkan.*

1. Introduction

The paper examines new global development concepts aimed at improving the economic and environmental performance of the developed and developing countries. The paper provides a comprehensive evaluation of the socio-economic justification of the environmental projects by applying revealed preference methods and stated preference methods. The research aims at indicating their important role in the process of transition to green development models and the need to define an appropriate investment framework of environmental projects.

The paper consists of five parts. After the introduction, the most important areas of technological and innovative activities in the field of bioeconomy are presented in the second part of the paper. The third part presents an overview of the methods for assessing value of environmental benefits that arise as a result of different projects, policies or programs. The investment projects supported by the Western Balkans Investment Framework and the Innovation Fund of the Republic of Serbia are analyzed in the fourth part of the paper, while the final part outlines the concluding remarks.

2. The most important areas of technological and innovative activities in the bioeconomy

After a long period during which economic development was based on the use, that is, the exploitation of fossils, the awareness has matured that this pattern creates major problems in the form of CO_2 emissions and other gases with a greenhouse effect (GHG), which contributes to global warming and the intensification of climate change. Therefore, a general consensus was reached on the biomass resurces as a basic element of the future economic model, which should be an essential consitituent of sustainable production process and (bio)technologies. Bearing in mind that on the world level food, materials and renewable energy sources consumption is continuously increasing, extensive attention is being invested in more efficiently production processes as fundament of innovative development in filed of agriculture and forestry, energy and aquaculture in order to preserve soil function (quality and helath) and biodiversity profile of some area or region.

Within biological sciences, in the past few years, there have been important breakthroughs in terms of innovation through the development of new processes and products. Development based on biological sciences is called bioeconomy. The bioeconomy enriches economic model through biological resource and processes application as one of sustainability tool. The bioeconomy is based on one hand on applied knowledge in field of natural sciences in (bio)technology and on the other hand demands innovation approach in management, governance but also in part of ecosystem services that are affected by economy and industry (soil, water and air quality and biosphere).

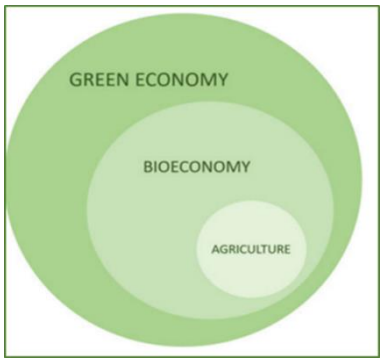
In 2012, the European Commission launched its sustainable bioeconomy strategy (see: Lewandowski & Regina, 2018, p. 3), and today the bioeconomy of the European Union includes agriculture, aquaculture, forestry, fisheries, energy, textiles and bio-based products. This is a significant part of the economy, which makes up 8% of the workforce in the EU and 2 trillion euros in annual turnover. In the period from 2012 to 2015, the use of bioeconomy in the EU increased by about 8.5%, mainly in the fields of energy and production of biomass-based materials. Kuckertz and associates (2018, p. 276) estimated that every 1 euro invested in the bioeconomy provides additional 10 euros of added value by 2025.

To move to a bioeconomy we need to discover different sustainable schemes that will combine sustainability and profitability. This is a very demanding task that will certainly be a challenge in the coming period. Bioeconomy directly uses

natural resources and processes philosophy and if it is done in a responsible way (rational use, concervation, denaturation and recycling) it can contribute to the transformation of the economy towards sustainable development golas. The opinion has matured that this process of transformation requires the initiation of innovations at all levels of the economy. In order to move to bioeconomy, it is necessary for all economic actors to have quality knowledge about natural resources and their features. Otherwise, it will not be possible to recognize viable products and services and there will be not will to pay a higher price for higher value goods.

In addition to the green (bio)economy, another important concept – circular economy - has become significant in the last few years. In December 2015, at the global summit on the bioeconomy held in Berlin, over 700 bioeconomy experts from more than 80 countries came together (Lewandowski & Regina, 2018, p. 22). It was emphasized that it is necessary for countries to harmonize the principles of a sustainable bioeconomy with the concept of a circular economy in order to enable the expansion of innovation policy measures. Innovation policy measures aim to optimize the value network of the bioeconomy and minimize waste and losses. The circular economy represents a regenerative economic system (see: Shannon et al., 2022; Jain, 2021) in which complete production proces (i.e. product life cycle) is based on rational and efficent resource exploatation, waste minimization and energetic efficiency path. This is achieved primarily by designing and creating products in such a way as to maximize their life span, but also by maintenance, servicing and recycling (see: Mitrović & Pešalj, 2021, p. 136-159).

Chart 1. Connection between bioeconomy and green economy



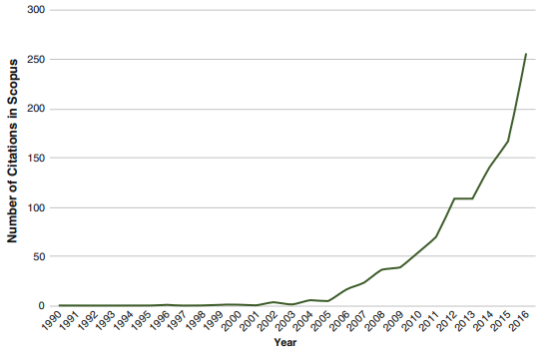
Source: Lewandowski & Regina (2018), p. 26.

The renewable energy sources and biotechnological innovations are basic elements of the bioeconomy and can play an important role in the implementation and further development of the circular economy principles. Linking these two economies has led to the development of a biomass-based value network.

The technology evolution is narrowly connected to the funding of research and innovation in order to create novel and improved technologies. Applied knowledge and its connection with production and technology transfer is essential for research in bioeconomy studies (see: Golembiewski, Sick, & Bröring, 2015; Festel & Rittershaus, 2014). It is no surprise that a large branch of literature is devoted to the unraveling of economic and management issues related to innovation processes (Viaggi, 2018, p. 59).

In order to overcome the complex and interconnected challenges, it is necessary to focus on the financing of investments and innovations in order to achieve faster, coordinated and sustainable changes in the way of living and the use of resources. If the necessary transformations are started on time, a better future will be ensured for all citizens globally and the well being of future generations will be ensured. However, the rise of the bioeconomy is not only reflected in the number of adopted strategies in an increasing number of countries, but also in the number of published scientific studies on this filed. As can be seen in the following chart (Chart 2), the number of published papers relate to the bioeconomy that are ranked on Scopus is shown. It can be noted that since 2005, the publication of papers on the topic of bioeconomy has intensified. Similar findings were reached by another group of researchers whose goal was to get an overview of the research profile dealing with the bioeconomy (Golembiewski et al., 2015).

Chart 2. Number of citation in Scopus



Source: Lewandowski & Regina (2018), p. 22.

The bioeconomy includes a wide spectrum of (bio)technologies that are continually changing over time. At this point, we only give a brief overview of the areas in which technological breakthroughs and novelties are relevant to the bioeconomy (according to: Viaggi, 2018, p. 33-41):

1. **Environmental and ecosystems management and bioremediation –** covers a very diverse technology spectra. The point is that humans are dominant force that changes and affect the overall biosphere on the planet, and this provides a major background for all other bioeconomy technologies;
2. **Harvesting and cultivating living organisms (primary production in farming, forestry and fisheries) –** actual consumption demands a wider adoption of *ad hoc* harvesting machinery, the optimization of logistic and the development of the novel bio-based value chains;
3. **Food preservation and processing technologies –** the food waste originating from industry (food production and processing) as well as from consumers at the final part of supply chain;
4. **Genetic modification technologies –** they modify the genetic material and in that way characteristic of living organisms, especially in terms of the transformation of inputs into productive outputs (amount and stability of yields);
5. **Biomass (bio)degradation and recomposing –** the simplest approaches include physico-chemical methods (drying and physical separation techniques), while more innovated approaches include biocatalysts;
6. **Bioenergy production –** technologies are differentiated according to the type of biomass that is transformed as well as according to the applied process. The possible pathway include direct combustion of biomass, production and combustion of biogas to produce electricity and production and combustion of biofuel;
7. **Biorefinery –** as a type of process, as a facility or a form of industrial organization. A very important aspect of biorefinery is that these technologies recognizes the waste as a renewable resource to recover bio-based materials and/or energy;
8. **Use of biowaste –** highlights the circular economy approach of the bioeconomy. Biowaste fractions are related to agriculture and food production and consumption, paper and wood industry and urban organic wastes and their wastewater effluents. Some of the main areas of interest involve: biomass cascading, design of new bio-based materials, chemicals and processes and appropriate biowaste management;

9. **Synthetic biology and cell-free systems –** is an interdisciplinary branch of biology and molecular engineering, which encompasses various disciplines (biotechnology, evolutionary biology, genetic engineering and molecular biology, biophysics and computer engineering, etc.). This filed has a huge economic potential due to applied approaches in research and the unique nature of the carefully designed, stakeholder inclusive, community-directed evolution of the field.
10. **Characterization and monitoring –** innovations in this field are very important (e.g. biosensors, bioindicators and biomarkers, biobased essays, etc.) and increasingly connected to the process digitalization and packaging features.

3. Economic valuation of the environmental benefits of the investment projects

Environmental resources provide goods and services for which there is no market price as the main indicator of their value. Analysis of the socio-economic justification of the implementation of various investment projects includes the identification, quantification and evaluation of potential environmental effects that may occur during the economic life of a particular project. The aforementioned stems from the need to ensure equal treatment of environmental effects with direct financial effects (investment costs, operating costs and operating revenue) of the project activity and their consideration when calculating the basic criteria for making a decision on accepting or not accepting the project. The inclusion of environmental effects when evaluating the justification of the implementation of investment projects creates a double challenge. The first one refers to how environmental effects affect social well-being, and the second challenge is about valuating the identified changes in social well-being using different economic methods.

The Total economic value points to the changes in social well-being that occur as a result of changes in the quantity and quality of ecological resources due to the implementation of various investment projects. Total economic value is a comprehensive measure of use and non-use (passive) value of ecological resources. Use value of ecological resources refers to the actual and planned use of the analyzed ecological resource, as well as the possibility of its use in the future. It includes three forms of value, namely: direct use value, indirect use value and option value. Passive value of environmental resources refers to the willingness to pay to secure a certain environmental resource even though there is no actual, planned or possible use of it in the future (Krutilla, 1967). It

includes three forms of value: existence value, altruistic value and bequest value.

Once the forms of ecological value are identified, their value can be monetized by applying appropriate economic methods (see: Molnar, Rikalović, & Josipović, 2024). The economic approach to valuation aims to include environmental effects in the cost-benefit analysis in order to make more correct choices based on real information. The literature indicated the possibility of applying different methods for evaluating the effects of investment projects, policies and programs on the environment (Hufschmidt et al., 1983; Navrud, 1992; Dixon & Scura, 1994; Dixon & Pagiola, 1998). At their core is the monetization of changes in social well-being and utility due to the action of various environmental effects that arise as a result of projects, policies or programs. Table 1 shows methods for assessing value of environmental effects.

Table 1. Methods for valuing the environmental effects

Basic groups of methods	Valuation approach	
	Direct	Indirect
Revealed preference methods	Direct observed behavior methods	Indirect observed behavior methods
Stated preference methods	Contingent valuation method – CV method	Choice modelling method

Source: Pearce, Atkinson, & Mourato (2006)

The classification of methods for valuing the environmental effects of investment projects depends on whether the valuation is based on a real or hypothetical market and whether the valuation approach is direct or indirect. From the aspect of how data is obtained for assesing the value of the observed ecological resource, valuation methods can be classified into two groups: revealed preference methods and stated preference methods. Revealed preference methods are based on the analysis of data on the actual behavior of consumers in the real market, while stated preference methods are based on data made up of individuals' answers to hypothetical questions (hypothetical behavior) in order to see their individual preferences in relation to the observed environmental resource (Freeman, Herriges, & Kling, 2014). Revealed preference methods can be applied exclusively to assess the use value of environmental resources. They cannot be applied to estimate passive value based on hypothetical behavior. The passive value of ecological resources can be estimated exclusively by applying stated preference methods, ie. using methods that involve conducting research through questionnaires in order to

assess the willingness of people to pay a certain amount of money in order to avoid environmental degradation (WTP) or the willingness to accept a certain amount of money as compensation for the harmful effects on the environment that occured (WTA).

Measures of the economic value of ecological effects based on actual behavior are direct observed behavior methods and indirect observed behavior methods. When environmental effects affect the goods and services traded on the market, direct observed behavior methods are applied. Their basis is the use of market prices or replacement costs. The prerequisite for their application is reflected in the possibility of identifying the market impact, the form of the "dose-response" function or the "exposure-response" function, on the change in the volume of production of a certain marketable good. In order to estimate the economic value of the ecological effect, the physical damage (determined on the basis of the "dose-response" function or the "exposure-response" function) is multiplied by the corresponding market price. Direct observed behavior method based on the use of replacement (repair) costs can be applied in cases where the economic cost of the loss of a certain environmental resource can be estimated based on the market price of a substitute good, i.e. a good that can replace it or restore its original quantity and quality (e.g. for assessment of economic damage due to soil erosion) (Navrud & Bergland, 2001). In practice, these methods are most often used when it is necessary to evaluate: soil damage, improvement of water quality, noise, etc. The main disadvantages of direct observed behavior methods are that they are complex and expensive methods that require the provision of numerous data.

Unlike the direct methods, indirect observed behavior methods are based on the use of data on the actual behavior of individuals on the so-called complementary (surrogate) market which is assumed to be connected with an ecological resource whose value needs to be estimated. These methods include (Boyle, 2003): *hedonic price method, travel cost method, averting and defensive expenditures method* and *cost of illness approach.*

Hedonic price method is applied in the case when the observed environmental good significantly affects the market price of another good. It starts from the assumption that the market price of a certain good indirectly indicates the demand for an environmental good whose value needs to be estimated. Two markets are of interest when valuing environmental goods using this method, namely: the real estate market and the labor market.

The hedonic price method is widely used in developed countries due to the development of the real estate market, which facilitates the statistical monitoring of factors that significantly affect the price of real estate (Ridker,

1967; Ridker and Henning, 1967). In addition to the building attributes (year of construction, size, number of rooms, etc.) and urban attributes (population density, traffic, etc.), the market price of real estate is significantly shaped by environmental attributes (green space, air pollution, natural landscape, etc.). The goal of applying this method is to assess the marginal WTP for each individual attribute that determines the price of real estate. It is necessary to identify the so-called "hedonic function" that relates the market price of real estate to various attributes using regression analysis. An appropriate multiple regression model is defined in which the real estate price is the dependent variable, while the independent variables are the attributes of the object, urban attributes and the environmental attributes. The estimated regression coefficient with the environmental attribute shows its participation in the real estate price, provided that other non-ecological attributes are unchanged, that is, it is an implicit representation of the environmental effect. Also, this method can be applied in the case of labor market analysis in order to estimate the premium for the risk of injury or death from other factors that determine the amount of earnings (such as education, work experience, etc.) (Kolstad, 1999). Hedonic price method is most often used to assess environmental effects such as: air pollution, noise and proximity (Pearce et al., 2006). Its application is accompanied by certain limitations, such as: individuals usually do not have perfect information as the basic assumptions for applying the method, the problem of multicollinearity due to a large number of variables and the sensitivity of the results to the defined spatial range of the real estate market.

When evaluating the use of non-marketable environmental goods, such as geographical areas suitable for various recreational activities, the travel cost method is applied. Geographical areas of significant natural environmental benefits (such as pleasant climate, abundant water and forest resources, diverse topography, etc.) are most often identified as recreational areas. The value of a particular recreational area cannot be directly assessed because there is no market price for its use. However, for the factors that ensure the opportunity of enjoying recreational activities in a certain geographical area, a market price does exist (such as for the costs of travel, accommodation, etc.). The expenses (money and time) incurred as a result of the need to use environmental goods represent a relevant indicator of the value of a particular recreational area (Ward and Beal, 2000). The main advantage of this method is that it is based on actual observed behavior, and the main problems in the case of its application are: providing a large amount of data, the difficulty of estimating the value of time and the choice of how to treat the combined benefits (in the case when the visit to a certain recreational area represents only a part of a tourist trip).

Averting and defensive expenditures method can be applied in cases when individuals spend money to reduce environmental effects. At the base of the method is the assumption that an individual or a household can protect itself from negative environmental effects by changing its behavior or by purchasing certain marketable goods. Under certain conditions, marketable goods can play a role of a substitute for the lost environmental goods, and their market price represents an implicit price of the ecological effect. Individuals spend money on certain goods to reduce a certain risk (e.g. buying air purifiers to reduce the impact of air pollution) and these goods are purchased until the marginal cost of purchasing an additional unit does not equal the marginal value of the reduced impact (European Commission, 2004, p. 19). As an example, Garrod & Willis (1999) cite households purchasing double-glazed windows to reduce their exposure to traffic noise. Freeman et al. (2014) give the example of an individual spending more time indoors to avoid exposure to air pollution. Although the averting and defensive expenditures method uses market prices, estimated defensive expenditures usually represent only a part (lower value) of the actual impact of the environmental effect and create compound effects.

Cost of illness approach is based on the analysis of the costs for health services and the purchase of products that arise as a response to negative environmental effects. As an example, the literature most often mentions financial expenses for the purchase of medications and lost earnings as an approximation for people's willingness to reduce negative environmental effects. The difference between the cost of illness approach and the averting and defensive expenditures method is reflected in the fact that often the decision on expenditures for health care is not made by an individual independently, but by the state body responsible for social and health insurance affairs. In this case, we cannot claim with certainty that the decision on the expenditure trully reflects the preferences of individuals to remove environmental effects. The main problem with applying this approach to valuing environmental effects is that the costs are often not easily estimated because the relationship between health and air pollution is stochastic. It is not always easy to determine the shape of the "exposure-response" function (e. g. "air pollution level-impact on human health"), that is, to assess the economic consequences of the identified physical response.

Stated preference methods are based on the analysis of the behavior of individuals on the so-called *hypothetical market* in which the observed environmental good can be traded (Shelling, 1968). The hypothetical market defines the environmental good, the institutional framework for its provision and the method of financing it. By conducting a questionnaire, randomly selected respondents reveal their maximum WTP or maximum WTA for a hypothetical

change in the provision of an environmental good whose value needs to be estimated. These evaluation methods are based on the assumption that the stated behavior of individuals in a hypothetical market is an adequate approximation for the behavior of individuals in the case of the existence of a real market. The advantages compared to revealed preference methods are: assessment of the non-use value of environmental goods, greater information, ex-ante valuation and flexibility. *Contingent valuation method (CV method)* and *choice modeling method* represent basic methods of stated preferences.

Since the 1990s, the contingent valuation method has been the most commonly applied stated preference method in both developed countries (Mitchell and Carson, 1989; Alberini and Cooper, 2000) and developing countries (Arrow et al., 1993; Bateman et al., 2002; Boyle, 2003). In the literature, this method is also called the direct interview method and is most often applied in the cost-benefit analysis of projects, programs and policies whose justification rate requires the consideration of environmental issues such as: water quality, biodiversity, forest protection, air quality, waste management, conservation natural resources, impact on human health and reduction of environmental risks (Pearce et al., 2006, p. 106). The research procedure based on the contingent valuation method can be divided into ten basic phases (Boyle, 2003, p. 116): 1. Identifying changes in the quality and quantity of a certain environmental good; 2. Identifying the values that need to be assessed; 3. Selection of the appropriate method of data collection; 4. Determining the sample size; 5. Design the information component of the survey instrument; 6. Design the contingent-valuation question; 7. Develop auxiliary questions for inclusion in the survey instrument; 8. Pilot research and questionnaire implementation; 9. Statistical processing of collected data and 10. Report value estimates. According to Mitchell & Carson (1989), defining a hypothetical scenario that is sufficiently comprehensible, feasible and significant for the respondent is of key importance. The aforementioned needs to be ensured in order for respondents to express valid and reliable values regarding their WTP/WTA. The most frequently used forms of questions in the questionnaire are (Bishop & Heberlein, 1979; Pearce et al., 2006): *the direct open-ended, the bidding game, payment card approach and dichotomous (discrete) choice*. Despite the wide application and improvement of the methodology that is the basis of the contingent valuation method, there are certain shortcomings that make it difficult to provide valid assessment of the ecological goods value (unreliability of respondents' answers, hypothetical bias, information bias, strategic bias, embedding/scope problems, starting point bias, etc.).

Except contingent valuation method, stated preference methods also include the choice modeling method. This method is increasingly used due to the shortcomings related to the contingent valuation method, but with a certain

limitation related to different modeling techniques of hypothetical choice. The advantage of this method is reflected in the ability to evaluate changes that are multidimensional, that is, that imply a change in a larger number of attributes. At the base of this method is that the utility that analyzed good can have for the consumer can be decomposed into the utility of several complementary characteristics. Respondents are presented with different alternatives for the description of the good, which differ in terms of attributes and their levels. By including a price (cost) for each attribute, WTP can be indirectly estimated based on respondents' ranking, rating, or choice. The main steps in applying this method are: selection of attributes, assignment of levels, selection of alternative scenarios, performance measurement and application of ordinary least squares or econometric methods (panel models, probit, logit, etc.). One of four modeling techniques can be applied: choice experiments (choice between two or more alternatives), contingent ranking (ranking of a series of alternatives), contingent rating (rating of alternative scenarios on a scale from 1 to 10) and paired comparisons (rating of pairs of scenarios).

4. Investment framework of environmental projects of the Western Balkans countries

The Western Balkan countries have recognized the importance and necessity of applying green (bio)economy and circular economy and the implementation of environmental projects. This is confirmed by the launched regional initiatives aimed at improving the competitiveness of the economies of the Western Balkan countries and the formation of a common regional market (see more: Rikalović, Molnar, & Josipović, 2022). At the summit of the Berlin Process, held in Sofia in 2020, concrete steps were taken with the aim of starting the transition towards "green" models of economic development in the Western Balkans. As a result, the Common Regional Market action plan for 2020-2024 and the Green Agenda for the Western Balkans (GAWB) were adopted. Considering that the Western Balkan countries are at a disadvantage compared with the European Union member states with respect to innovativeness (Despotović, Cvetanović, & Nedić, 2014), one of the goals of the launched initiative is reflected in the building of a regional industrial and innovation area. The first step towards achieving that goal is defining the framework for the implementation of innovation projects, especially environmental projects with a focus on the application of the green economy and its concepts of circular economy and bioeconomy.

The implementation of the Green Agenda and the transition to "green" development models is supported by the Economic and Investment Plan for the

Western Balkans adopted in 2020 (hereinafter EIP) and the Western Balkans Investment Framework (hereinafter WBIF) established in 2009. The EIP provides funds intended to encourage long-term economic recovery, green and digital transition with the aim of sustainable economic growth, faster implementation of the rules and procedures of the European Union and bringing the Western Balkans closer to the single market of the European Union (European Commission, 2020). WBIF, supported by the European Commission, international financial institutions and bilateral donors, is the most important instrument that provides grants for technical assistance and investment grants during the preparation and implementation of projects in the region of the Western Balkans. Based on the analysis of supported projects, it can be concluded that a total of 217 projects have been underpined so far, in the following areas:

- Energetics (63 projects);
- Environment (62 projects);
- Traffic/Transport (55 projects);
- Social protection (28 projects) and
- Digital infrastructure (9 projects).

Table 2 provides data on the estimated value of supported projects in the Western Balkans region and the total amount of WBIF investment grants by area.

Table 2. Total value and investment grants of WBIF supported projects in the Western Balkans region

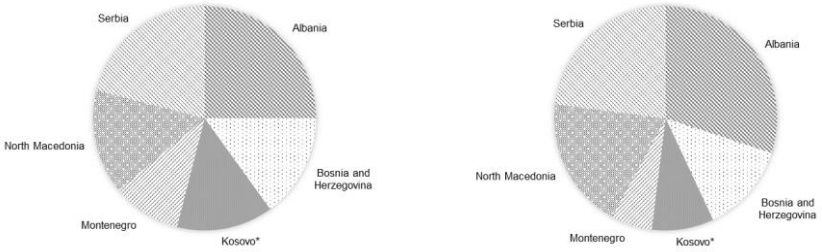
Area	Total value (€)	Grants WBIF (€)
Transportation	14,960,503,663	2,391,456,156
Energy	4,975,154,567	439,189,916
Environment	3,254,988,331	327,440,373
Social	2,210,498,112	112,397,808
Digital infrastructure	511,247,936	41,292,603

Source: Authors' calculations based on WBIF data

By analyzing the co-financed, we came to the conclusion that about 50% of the projects can be defined as environmental projects, given that they focus on the application of the principles of green economy, circular economy, bioeconomy in the fields of energy and environment. Graph 1 shows the participation of six Western Balkan countries and territories (Albania, Bosnia and Herzegovina,

Kosovo*[4], Montenegro, North Macedonia and Serbia) in supported environmental projects (total number and total estimated value).

Graph 1. Participation of Western Balkan countries in WBIF-supported environmental projects, in total number (a) and estimated value (b)



(a) (b)

Source: Authors ' calculations based on WBIF data

As can be seen from Graph 1, Albania (25%) and Serbia (21%) have a greater share in the total number of supported environmental projects compared to the other analyzed countries. Montenegro has the smallest participation (10%) with 11 environmental projects (three projects in the field of energy and eight projects in the field of the environment). From the point of view of participation in the total value of supported environmental projects, which amounts to € 6,864,865,186, Albania (30%) and Serbia (23%) have a significantly higher share than Kosovo* (9%) and Montenegro (6%).

Table 3 shows the estimated value of supported projects (environmental and all projects) and the total amount of WBIF grants for the six countries of the Western Balkans.

[4] This designation is without prejudice to positions on status, and is in line with United Nations Security Council Resolution 1244 and the International Court of Justice Opinion on the Kosovo declaration of independence. (see: https://www.srbija.gov.rs/kosovo-metohija/168200).

Table 3. Total investment value and approved grants of co-financed projects by WBIF

Country	Environmental projects		All projects	
	Total value (€)	WBIF grants (€)	Total value (€)	WBIF grants (€)
Albania	2,053,134,338	92,730,779	4,078,160,611	449,781,106
Serbia	1,552,900,593	130,045,762	8,816,584,189	754,422,705
North Macedonia	1,289,239,286	154,215,831	2,997,716,214	485,922,060
Bosnia and Herzegovina	909,387,101	105,863,077	6,193,685,557	992,246,065
Kosovo*	644,306,855	88,975,287	1,594,132,278	288,632,458
Montenegro	415,897,013	82,549,602	2,232,113,760	340,772,462

Source: Authors' calculations based on WBIF data

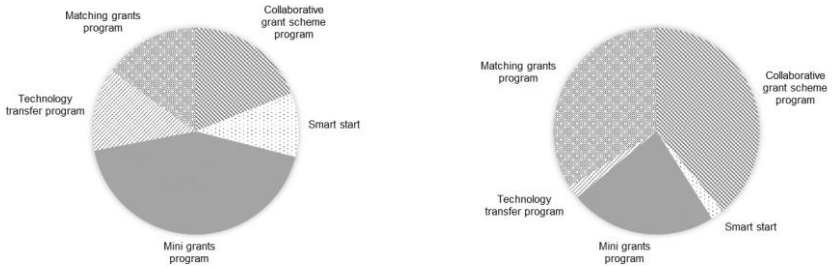
On the basis of the data from Table 3, it can be concluded that the highest total value has environmental projects supported by Albania, while the largest amount of WBIF investment grants for financing environmental projects was approved by North Macedonia and Serbia.

Apart from the financial and technical support of WBIF, an important actor in the institutional framework of financing innovation projects in Serbia is the Fund for Innovation Activities of the Republic of Serbia (hereinafter IFS). In cooperation with the European Union, international financial institutions, organizations, donors and the private sector, IFS was founded in 2011.

So far, the Fund has participated in the co-financing of 404 innovation projects through five support programs, namely: Collaborative grant scheme program, Maching grants program, Mini grants program, Smart start and Technology transfer program. Supported innovation projects, with a total value of € 78,098,159 belong to different fields: agriculture and food industry, energy and energy efficiency, information and communication technologies, mechanical engineering and mechanical engineering, biotechnology and bioengineering, construction and building materials, natural sciences and biomedicine, artificial intelligence, etc.

Based on the analysis of the IFS innovation projects supported so far, within the five mentioned programs, we came to the conclusion that about 20% of the projects with a total value of € 14,319,579 represent environmental projects. Graph 2 shows the participation of the IFS program in supported environmental projects, in their total number and total value.

Graph 2. Participation of the IFS program in supported environmental projects, total number (a) and estimated value (b)



(a) (b)

Source: Authors ' calculations based on IFS data

Most environmental projects are supported through the Mini grants program (36 projects, 43% of environmental projects) and their total investment value is € 3,245,782 (the IFS participation in financing is € 2,492,758). If we look at the value of environmental projects, the highest total value has environmental projects supported by the Collaborative grant scheme program (total value € 5,570,680 with IFS participation in financing in the amount of € 3,809,521) and the Matching grants program (total value € 4,793,537 with IFS participation in financing in in the amount of € 3,234,094).

Environmental projects in the field of Agriculture and Food industry have the highest overall value (€ 5,304,286, while the participation of IFS in financing is 69.91%). The fact that Agriculture and Food industry is one of the most important application areas of the green economy and its concepts is also confirmed by the participation of 76.20% of the value of environmental projects in the total value of all innovative projects approved in this area. In second place are environmental projects in the area of Environment Protection (€ 2,278,740, while the participation of IFS in their financing is 65.93%), and in third place are environmental projects in the area of Energy and energy efficiency (€ 1,909,832, while the participation of IFS in their financing is 72.20%). The mentioned areas represent the priority areas for the implementation of the green economy, circular economy and bioeconomy in Serbia (see more: Molnar et al., 2024).

5. Conclusions

In the conditions of growing ecological problems, the new models of economic development have been developed, advocating the utilization of the neglected potential of ecological processes (ecosystem services) and the improvement of social well-being, in the way that does not jeopardize their sustainability, as well as with a significant reduction of environmental risks.

Based on the implementation of the concepts of green, bioeconomy and circular economy, new development models indicate possible solutions for the use of natural resorces in a responsible way, reducing CO_2 emissions, increasing energy efficiency and preventing the loss of biodiversity. The most important areas of technological and innovative activities in the bioeconomy are the following: environmental and ecosystems management and bioremediation, harvesting and cultivating biological organisms, food preservation and processing technologies, genetic modification technologies, breaking down and recomposing biomass, production of bioenergy, biorefinery, use of biowaste, etc.

The accelerated development of green technologies is closely related to the funding of environmental projects. Their implementation supports sustainable development due to ecological effects, such as: the preservation and improvement of natural capital, the improvement of soil productivity, the maintenance of materials and products in use as long as possible and the elimination of negative external effects on human health and natural systems. The Total economic value points to the changes in social well-being that occur as a result of changes in the quantity and quality of ecological resources due to the implementation of various investment projects. The methods for assessing the economic value of environmental benefits aim at including the environmental effects in the cost-benefit analysis of investment projects in order to make more correct choices based on real information.

The Western Balkan countries have recognized the importance and necessity of applying the new models of economic development focused on ensuring satisfactory profitability, while simultaneously preserving the environment and improving the people's quality of life. As a result of the Berlin Process the framework for the implementation of innovation projects, especially environmental projects with a focus on the application of the green economy and its concepts of circular economy and bioeconomy in the region of the Western Balkans, was defined. The WBIF is the most important instrument that provides grants for technical assistance and investment grants during the realisation of investment projects in the Western Balkan countries. The analysis of the WBIF co-financed projects pointed out that about 50% of the projects can

be defined as environmental projects. Albania and Serbia have a greater share in the total number of the supported environmental projects compared to the other Western Balkan countries. Apart from the financial and technical support of the WBIF, an important actor in the institutional framework of financing the innovation projects in Serbia is the IFS. Supported IFS environmental projects in the field of Agriculture and Food industry have the highest overall value, while environmental projects in the areas of Environment protection and Energy and energy efficiency come at the second and third place, respectively.

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