Scientific Bulletin of Mukachevo State University

Series

Economics

Volume 9, No. 3, 30-39
Journal homepage: https://economics-msu.com.ua/en

UDC 330.15/.34
DOI: 10.52566/msu-econ.9(3).2022.30-39

Decoupling as a Measurement of the Environmental Impact of Economic Growth

Maryna I. Yaremova*, Anna S. Mytrofanova

Polissia National University
10008, 7 Staryi Blvd., Zhytomyr, Ukraine

Abstract. Accelerated population growth on the planet leads to an increase in production, which causes the need to increase the production of raw materials, expand the construction of industrial structures, increase social infrastructure facilities, and so on. Consequently, the creation of appropriate conditions for the existence of modern civilisation leads to an exhaustible use of natural resource potential and an aggravation of global environmental problems that have a destructive impact on the environment. Considering the above, the issue of monitoring environmental consequences from economic activities acquires significant theoretical and practical significance, which determines the relevance of the subject matter. The purpose of this study is to substantiate the theoretical and methodological foundations and applied aspects of measuring the decoupling effect under the condition of an environmentally oriented course of social development. The methodological basis of the study is the methods of empirical research and theoretical cognition, in particular the method of formalisation, abstract and logical, observation, measurement, and comparison. The study used general scientific methods and techniques, in particular, analysis and synthesis, analogy and economic modelling, induction and deduction. The paper systematises the opinions of leading researchers on understanding the concept of decoupling based on the resource approach and environmental impact. The analysis provided the basis for investigating the impact of production on the environment in the context of regions in 2016-2020 and visualising an integral indicator of the regional decoupling effect. Generalisation of the value of factors in Ukraine as a whole allowed projecting the environmental consequences of economic activities for the future. The practical significance of the study is to substantiate practical recommendations for strengthening environmental policy and minimising the destructive impact on the environment, considering the challenges associated with military operations on the territory of Ukraine. Further research is aimed at considering the achieved effect of decoupling within certain branches of the national economy

Keywords: decoupling effect, decoupling factor, anthropogenic impact, economic activity, decoupling analysis, strategic areas

Received: 11.08.2022, Revised: 29.09.2022, Accepted: 24.10.2022

Suggested Citation: Yaremova, M., & Mytrofanova, A. (2022). Decoupling as a measurement of the environmental impact of economic growth. *Scientific Bulletin of Mukachevo State University. Series "Economics"*, 9(3), 30-39.

*Corresponding author

Introduction

The existence of modern man is caused by excessive needs for the consumption of food and non-food products. Their production in significant quantities leads to the depletion of natural resource potential and aggravation of global environmental problems. In addition, the accelerated rate of population growth on the planet leads to a significant accumulation of industrial residues and household waste, which, due to improper disposal, cause local pollution. These challenges have led to the emergence of multiple ideas for preserving the state of the environment among researchers, among which it is worth highlighting the concept of decoupling. The term "decoupling" can be interpreted as "delineation, disconnection, and disruption of communication". The ability to increase the pace of economic development without accumulating a destructive anthropogenic impact on the environment is called the decoupling effect. The founders of this area are considered to be Finnish researchers J. Vehmas [1] & P. Tapio [2]. At the same time, the experience of E. Weizsacker [3] regarding the multiplication of production with reduced consumption of natural resources is valuable for world science. The concept became widespread at the beginning of the 21st century, while the implementation of the decoupling effect is recognised as the main mission of the environmental strategy for the first decade developed by the Organization for Economic Cooperation and Development [4].

Retrospective aspects of the development of the economic system as part of an ecosystem are comprehensively studied by the American environmental economist G. Daly [5], who argues for the need to develop the economy from quantitative to qualitative growth. The problem of environmental pollution as a result of increasing global production due to the need to meet the requirements of a growing population is thoroughly substantiated by an American team of researchers who managed to design several options for economic development [6]. These studies caused public concern about the future state of the environment and led to a heated discussion among the scientific community of ways to improve it. T. Jackson's [7] assertion that continued economic development is based on environmental destruction and social injustice, and that the key challenge for humanity is the ability to thrive on a planet with limited resources, is substantiated. As part of the implementation of modern international practice, researchers use retrospective data to prove a cyclical symmetric relationship between greenhouse gas emissions and real GDP growth, justifying the need for constant progress in their differentiation, especially in developing economies [8]. In this context, it is relevant to investigate the binary concepts of decoupling and dematerialisation, which is proposed to be evaluated both by territorial and consumer approaches using environmental elasticity as a key indicator [9].

In Ukraine, the theory of decoupling was put into scientific circulation in the early 2020s by B. Danylyshyn & O. Veklych. The researchers proposed an interpretation of "the decoupling effect as an economic phenomenon that reflects the ability of the economy of any state to grow without increasing pressure on the environment" [10]. Measurement of effective indicators for determining the impact of economic growth on the state of the environment is investigated by A. Barzhyna [11]. The experience of world practice allowed the study to carry out a decoupling analysis in the regional aspect using indices of the physical volume of the gross regional product as a factor of economic development and emissions of pollutants into the atmospheric air by stationary sources of pollution as a factor of pressure on the environment [11]. The effect of decoupling in the context of productive land use is considered by V. Makarova [12] with the substantiation of possible options for the tangent of economic growth and environmental sustainability. The theoretical understanding of the concept of decoupling was expanded by O. Vatchenko & K. Svystun [13]. The researchers provided a classification of the degrees and effects of decoupling, provided explanations on Ukraine's international environmental obligations, and presented the opposite concept of "overcoupling", which is noted as a phenomenon "when the increase in material flows occurs faster than the growth of GDP" [13]. O. Tur developed methodological tools for monitoring the ecological and economic model under the condition of rational consumption and restoration of natural capital [14]. A detailed description of the degree of environmental orientation of the Ukrainian economy in the framework of balanced development was provided by A. Horskyi [15]. Study on the problems of environmental awareness of modern society regarding the rational use of natural resources deserves attention [16], which is extremely relevant in the context of promoting a safe environment.

The joint efforts of researchers indicate the need for coordination of actions between countries towards preserving the environment. Consequently, the definition of "decoupling" is repeatedly mentioned in the political arena in the programmes of UN [17], OECD [4], Sustainable Development Strategies of individual countries [18], and international documents [19]. According to the Paris Climate Agreement [20], which was presented in 2015 under the UN Framework Convention on Climate Change [17], Ukraine has committed to reduce greenhouse gas emissions by 2030 to 35% compared to 1990. To achieve this goal, it is necessary to monitor the impact of economic results on the environment annually and, if necessary, adjust the action plan at the state level.

Thus, the purpose of the study is a substantiation of the theoretical and methodological foundations for assessing environmental pressure on the environment due to economic growth and the development of practical recommendations considering the military situation on the territory of Ukraine.

Materials and Methods

Achieving the set tasks in the process of scientific knowledge requires a clear algorithm of research actions, since

the inconsistency of step-by-step work may complicate the procedure for practical implementation of a scientific result. Consequently, the study of the environmental consequences of economic growth determines compliance with the appropriate algorithm of actions, which is shown in Figure 1.

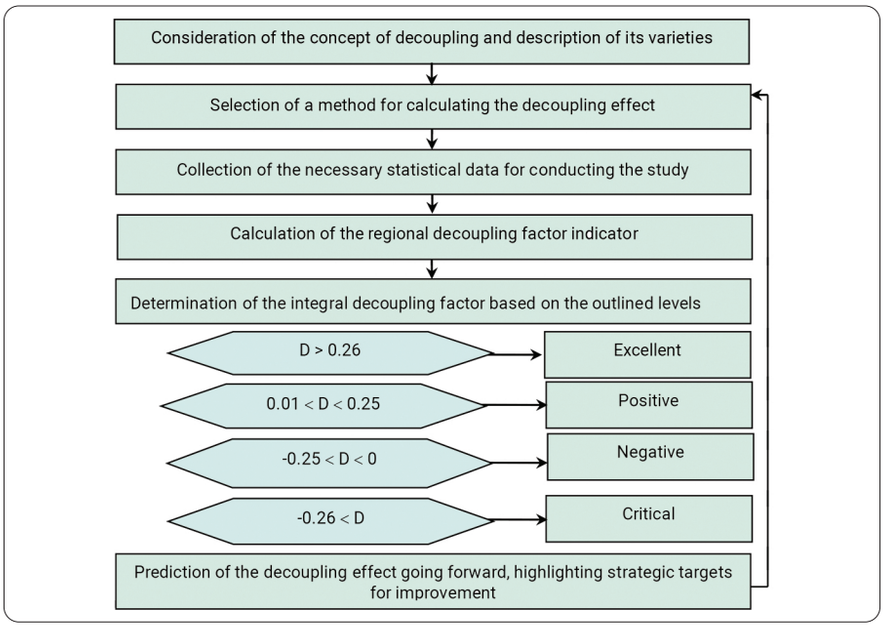

Figure 1. Sequence of actions in the process of studying the decoupling effect
Source: developed by the author based on own research

It is proposed to determine the decoupling effect using the following equation:

$$D_F = 1 - \frac{\Delta I_{EP}}{\Delta I_{DF}} \quad (1)$$

where D_F – integrated decoupling factor indicator; ΔI_{EP} – index of the physical volume of resource consumed when calculating resource decoupling; index of the volume of certain types of resources that pose a health hazard when calculating environmental impact decoupling; ΔI_{DF} – index of the economic growth indicator, expressed in terms of the index of physical volume of GDP [4].

Both types of decoupling are determined by the same equation, the difference is only in the initial data of the indicator ΔI_{EP}. As a result of mathematical actions, the calculation of the integral decoupling factor can be reflected as follows:

$$D_F = 1 - \left(\sqrt[n]{\frac{EP_{e1}}{EP_{b1}} \times \frac{EP_{e2}}{EP_{b2}} \ldots \times \frac{EP_{en}}{EP_{bn}}} \div \frac{DF_e}{DF_b}\right) \quad (2)$$

where n – number of types of pollution 1,2…; EP, $DF_{en,bn}$ – amount of resource consumed at the beginning and end of the reporting period.

According to the above calculations, provided that the Decoupling Factor is >0 and its growth is noticeable, it can be argued that there is a decoupling effect, that is, there is a decrease in the negative impact on the environment. If the Decoupling Factor is <0 and the indicator decreases, this indicates too high an environmental impact, which can lead to negative environmental consequences. Depending on the obtained values of the Decoupling Factor indicator, it is proposed to distinguish between excellent (D>0.26) and positive (0.01<D<0.25), negative (-0.25<D<0), and critical (-0.26<(D) effect levels indicating the close relationship between GDP and increased anthropogenic pressure on the environment.

Testing of the methodology should be carried out using mathematical and statistical research methods within each region (excluding the temporarily occupied territory of the Autonomous Republic of Crimea, city of Sevastopol, and parts of the temporarily occupied territories in Donetsk and Luhansk oblasts) for 2016-2020, which would allow identifying environmentally vulnerable areas in Ukraine. The use of the graphical method allows visualising changes in the decoupling factor indicators (comparison method) during the above-mentioned years. Observation of generalised values of the decoupling effect within the selected factors in Ukraine as a whole during 2011-2020 is the basis for economic modelling of the environmental situation conditioned by economic growth. The results of the study allow developing specific measures aimed at increasing the level of decoupling, which differ depending on the possible further scenario of environmental events within the framework of a single unchanged strategy for environmental-oriented development and are aimed at minimising the destructive impact on the environment from domestic production, considering the challenges associated with military operations on the territory of Ukraine.

Results and Discussion

The problem of irrational nature management is becoming critical for the entire population of the world, because it leads to the exhaustion of valuable natural resources and significant pollution of local and global territories. These challenges actualise the issues of monitoring the impact of economic activity on the state of the environment. Under the specified conditions, consideration of the definition of "decoupling" has become particularly important as a basis for achieving a long-term optimal complementary link between the well-being of the population and the natural environment. At the same time, there is a slight discrepancy in the understanding of the decoupling effect, which makes it necessary to systematise the definition (Table 1).

Table 1. The concept of "decoupling" in the interpretation of researchers

Author	Year	Interpretation
Organisation of Economic Cooperation and Development (OECD) [4]	2001	The distinction between economic growth and environmental pressure, which occurs when the growth rate of environmental pressure is less than its economic driving force, for example, gross domestic product (GDP) over a certain period of time
B.M. Danylyshyn & O.O. Veklych [10]	2008	The ability of the country's economy to increase economic power, which is not accompanied by increased pressure on the environment
O.M. Tour [14]	2012	Differentiation (levelling the relationship) between economic growth and environmental pressure
A.O. Akulov [21]	2013	Inconsistency and divergence of economic growth rates at the level of countries, regions, or industries with the rate of change in indicators that characterise the negative impact on the environment, environmental damage
L.O. Kokovskyi [22]	2013	Differentiation or separation of economic growth parameters from the use of natural resources and the impact on environment
I.M. Sotnyk & L.A. Kulyk [23]	2014	Phenomenon of the gap between economic development and the degree of anthropogenic impact on the environment
O.A. Litvak [24]	2015	The process of stable long-term, controlled and managed inconsistency of trends of economic growth, consumption of natural resources, and environmental pollution at all stages of life cycle
A.V. Barzhyna [11]	2018	Two processes that have a correlation or other relationship actually move in different lines

As a result of the generalisation of the above interpretations of the concept of "decoupling", the dual nature of its interpretation among researchers can be argued, namely: 1) decoupling as a lack of coherence between economic development and natural resources necessary to ensure appropriate growth; and 2) decoupling as an interdependence between economic development and consumed natural resources. Therefore, the binary understanding of the definition requires an organisation of the concept in the areas that were discussed in more detail in the "Thematic Strategy on the Sustainable Use of Natural Resources", published by the European Commission in 2005 [25]. The main goal of these prospects is to increase economic benefits with the least permissible negative consequences for the environment. This paper proposes to classify decoupling according to the factors that are studied within the concept, according to resource, and considering the state of the environment under anthropogenic pressure (Fig. 2).

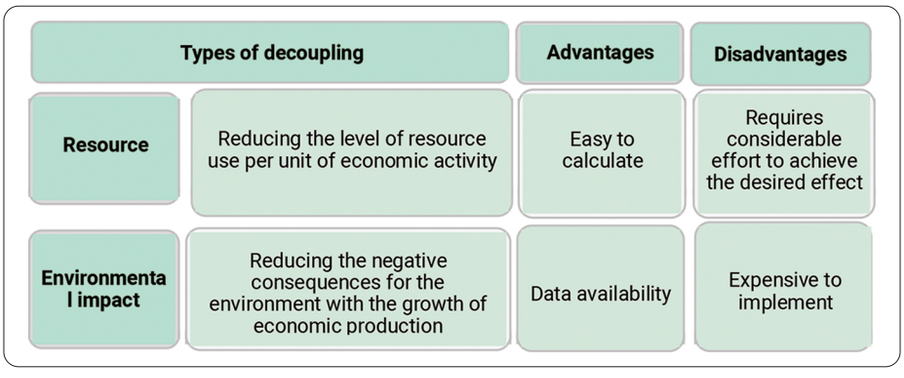

Figure 2. Streamlining the decoupling concept based on the resource approach and the state of the environment
Source: compiled by the author based on [25]

Resource decoupling is based on the consumption of a minimum amount of material, energy, water, and land resources. This area is easier in the calculation process, but more difficult if in terms of achieving positive results in the end. Basic indicators for assessing the volume of use of attracted natural resources are selected. As for environmental decoupling, the most common cases of its application are the study of resources that pose a health hazard to a particular group of people or the overall society. As a rule, its implementation as a result of calculation proves that improving production or eliminating destructive consequences requires significant material costs. Indicators of the volume of pollutants released, waste generation and discharges of contaminated wastewater are used to monitor the effect of decoupling on the impact on the environment.

According to O. Tour [14], resource decoupling is a determinant of the environmental intensity of the economy, while environmental decoupling reflects the process of measuring the environmental intensity of production. At the same time, the author's vision boils down to the need to use resource decoupling to scale the phenomenon under study. But decoupling in terms of the impact on the environment should be applied in the conditions of business entities, which allows assessing environmental losses in the process of doing business. This approach is the most successful for systematic monitoring of local results of economic growth for the environment. Therefore, the calculation of the integral indicator for determining the decoupling effect is proposed to be carried out using the method of determining the state of the environment, which will reveal the environmental consequences of business activities within a certain region (Table 2).

Table 2. Integral decoupling factor within the regions of Ukraine for 2016-2020

Oblast	Indicator of the integral decoupling factor, coefficient				
	2016	2017	2018	2019	2020
Vinnytsia	0.21	0.07	0.32	-0.02	0.25
Volyn	0.13	0.31	0.26	0.14	0.15
Dnipropetrovsk	0.12	0.23	0.14	0.04	-0.03
Donetsk	0.19	0.23	0.08	-0.01	-0.22
Zhytomyr	0.15	0.24	0.24	0.11	0.02
Zakarpattia	0.07	0.08	0.15	0.21	0.16
Zaporizhia	0.19	0.21	0.10	0.03	0.13
Ivano-Frankivsk	0.17	0.19	0.15	-0.04	0.23
Kyiv	-0.12	0.18	0.15	0.07	-0.01
Kirovohrad	0.18	0.10	0.16	-0.48	0.30
Luhansk	-0.09	0.23	0.27	0.24	0.16
Lviv	0.17	0.25	0.06	0.40	-0.04
Mykolayiv	0.25	0.17	0.15	0.18	0.06
Odesa	0.19	0.28	0.03	0.35	-0.30
Poltava	0.19	0.24	0.29	0.05	-0.03
Rivne	0.21	0.29	0.20	0.11	-0.24
Sumy	0.07	0.23	0.18	0.08	0.14
Ternopil	0.14	0.21	0.08	0.26	0.35
Kharkiv	-0.01	0.35	0.22	-0.45	0.10
Kherson	0.44	0.31	0.05	-0.30	0.69
Khmelnytskyi	0.11	0.50	0.10	0.11	0.29
Cherkasy	0.16	0.16	0.24	-0.05	0.26
Chernivtsi	0.25	0.26	0.26	0.21	0.41
Chernihiv	0.34	0.23	-0.14	0.08	0.27

Note: level depending on the decoupling effect: white indicates "excellent", yellow indicates "positive", grey indicates "negative", red indicates "critical"
Source: calculated based on [26]

The study results determine the list of the most environmentally vulnerable regions of Ukraine as a result of conducting economic activities. Consequently, the calculation results indicate a critical decoupling effect for 2019-2020 in such areas as Kirovohrad, Odesa, Kharkiv, and Kherson oblasts, which requires entrepreneurs to coordinate efforts to minimise local environmental pollution. However, according to the above data, the positive dynamics of the integral decoupling factor is observed in Zakarpattia, Ivano-Frankivsk, and Cherkasy (with the exception of 2019), Ternopil, Khmelnytskyi, and Chernivtsi oblasts, which are within excellent and positive levels.

A study of the impact of production on the environment by region cannot say anything about the overall effect of decoupling in Ukraine, but it provides an understanding of which areas need more attention in the process of development of regional environmental policy and the mechanisms to ensure it. In order to detail the results and better understand the environmental consequences of doing business in a certain territory for 2016-2020, a graphical visualisation of changes in the integral indicator of the regional decoupling effect for the state of the environment is proposed (Fig. 3).

Figure 3. Dynamics of the decoupling factor indicator by region for 2016-2020
Note: areas with positive dynamics are marked in white, and areas with negative values are marked in grey
Source: compiled based on the original data contained in Table 2

The results of the study indicate negative dynamics in 10 regions of Ukraine. Considering the localisation of heavy industry enterprises, the predicted feature is negative values of indicators of individual regions. In addition, the destructive impact on the environment conditioned by economic activity is caused by the use of too worn-out equipment and outdated energy and material-intensive technologies, high environmental intensity of production, etc. Generalisation of the value of the decoupling effect on the selected factors in Ukraine as a whole would allow specifying the destructive direction conditioned by economic growth over a long period, which would allow identifying the key cause of anthropogenic pressure on the environment and predicting development according to a trivariative scenario (Table 3).

Table 3. Integral decoupling factor within the regions of Ukraine for 2016-2020

Indicator	Year									
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Decoupling factor for emissions of pollutants into the atmosphere	0.12	0.12	0.05	0.25	0.32	0.07	0.34	0.25	0.16	0.30
Decoupling factor for production waste generation	0.13	0.10	0.05	0.23	0.30	0.19	0.26	0.21	0.12	0.34
Decoupling factor by volume of contaminated wastewater discharges	0.18	0.16	0.13	0.37	0.16	0.77	0.08	-0.17	-0.03	0.18
Integral decoupling factor	0.14	0.13	0.08	0.28	0.26	0.34	0.23	0.10	0.08	0.27

Source: compiled by the author based on [25]

The analysis of the results obtained reveals fluctuations in the integral decoupling factor, which indicates the instability of environmental policy in the state. The decoupling factor indicator for pollutant emissions ranged from 0.05 to 0.32 during 2011-2020. In recent years, there has been a significant decrease in waste from production, as evidenced by the calculations of the corresponding decoupling factor. The most unstable situation is related to polluted wastewater discharges, as within the designated decoupling factor there is the highest value of the indicator (0.77) and the lowest (-0.03) of the others. It is the volume of contaminated wastewater that is the reason for the decrease in the integral decoupling factor for 2015-2020.

Predictive studies will help to design predictions of future environmental consequences from the implementation of economic activities and outline promising areas for improving the environmental situation (Fig. 4).

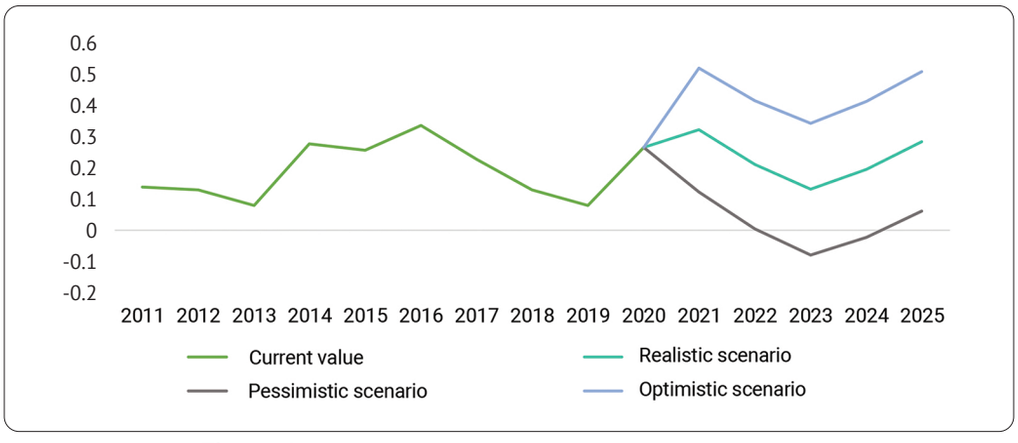

Figure 4. Integral decoupling factor forecast for 2021-2025

Source: compiled based on data from Table 3

Three scenarios for the development of events regarding anthropogenic pressure on the environment as a result of economic activity are presented. It is worth noting that an optimistic forecast is desirable for modern society, that is, an excellent level of decoupling, which provides for maximum environmental protection due to economic activity conditioned by the absence of pollutants released into the atmospheric air at the object of taxation, ensuring waste-free production, and the availability of modern equipment and modern devices for maximum wastewater treatment. However, considering the realities of today, a realistic course for the development of the further environmental situation in Ukraine is the most likely, which corresponds to a positive level of decoupling, which controls the emissions of pollutants into the atmospheric air, uses low-waste technologies for the production of products, and wastewater treatment. According to the results of the study, the decline in the integral decoupling factor during 2022-2023 indicates a possible pessimistic scenario, close to the negative or critical level of the decoupling effect, which is primarily associated with the risks of military events on the territory of Ukraine.

The desire for positive dynamics of values in the future makes it necessary to develop strategic guidelines for neutralising destructive environmental impacts from economic activities. The proposed measures for implementing the environmental-oriented development strategy are summarised according to a possible pessimistic, likely realistic, and desirable optimistic scenario (Fig. 5).

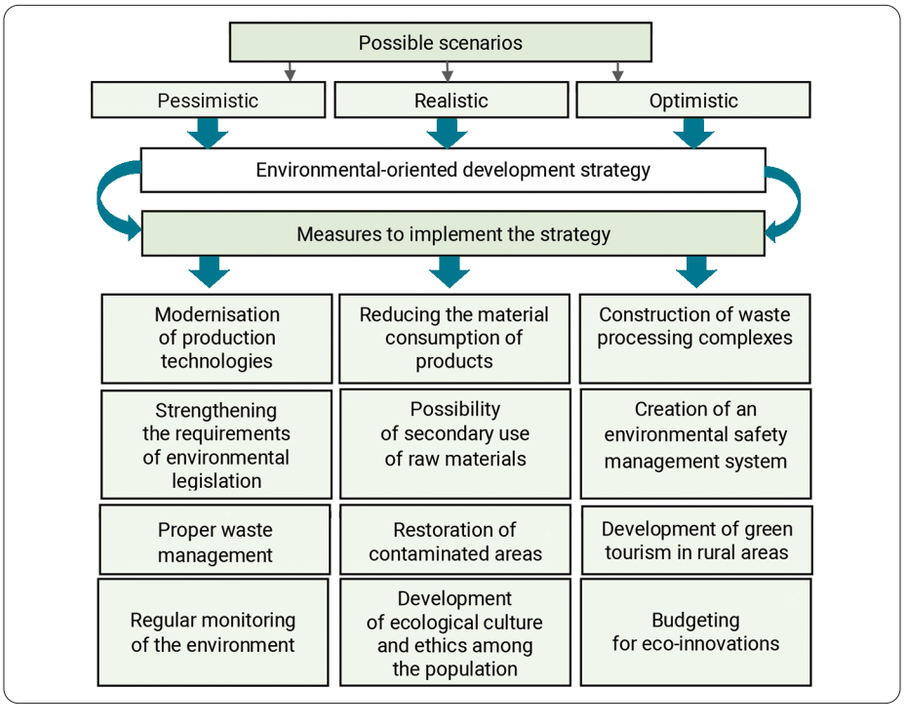

Figure 5. Strategic areas for achieving the desired decoupling effect in Ukraine
Source: compiled based on the author's own research

The proposed strategic guidelines are aimed at strengthening the country's environmental policy in general. The areas differ depending on the possible further scenario of events within the framework of a single unchanged strategy for environmental-oriented development. The implementation of the measures is aimed at increasing the level of decoupling, which means that it would allow minimising the destructive impact on the environment from production. At the same time, the outlined environmental course is too relevant in the period of war, as the problem of air, soil, and water pollution has increased due to the destruction of the ecosystem, the accumulation of chemicals and heavy metals released from destroyed equipment, burned fuels and lubricants, exploded missiles and aerial bombs, etc. As a result of military operations, sewage treatment plants fail, which provokes the build-up of a significant amount of household waste, which is dangerous to transport at the moment. At the same time, the number of environmental offences that have arisen due to the inability of the state to control the emissions of industrial enterprises during wartime is growing [27].

In general, the country's economy suffers significant losses as a result of a full-scale war, which is associated with a high level of migration of young people and working-age people, difficulties in relocating enterprises, destruction of social infrastructure, slowing down investment support, additional costs for the country's defence, and support for internally displaced persons. The blocking of ports and the inability to provide logistics routes leads to a reduction in exports. Fuel shortages lead to higher prices for goods and services, etc. The outlined results of military operations complicate the procedure for conducting economic activities and slow down the processes of modernisation towards greening Ukrainian production, which emphasises the need to strengthen measures to implement the strategy of environmental-oriented development. At the same time, additional environmental rehabilitation measures are extremely important after the end of hostilities on the territory of Ukraine. The concentration of efforts should be directed to the disposal of military scrap metal in order to avoid problems of groundwater contamination and loss of soil fertility. Forestry enterprises will be faced with the task of reproducing a large area of forests, and fish farms will be faced with stocking rivers to renew bioresources. Government business support programmes will encourage the creation of additional jobs and the restoration of social infrastructure.

Conclusions

The concept of decoupling characterises the relationship between economic growth and consumed natural resources and reflects anthropogenic pressure on the environment. The dual nature of the concept gives grounds to consider resource decoupling and assess the impact of environmental consequences from conducting economic activities in general.

The authors' position boils down to the need to use an integral indicator for determining the effect of decoupling on the impact on the environment for systematic monitoring of local environmental results of economic growth. According to the obtained values, it is proposed to divide the decoupling effect into four levels: excellent, positive, negative, and critical. The study of the decoupling effect within individual

regions indicates a critical level of the indicator for 2019-2020 in 4 regions of Ukraine, which requires increased attention in the process of implementing measures to strengthen the environmental policy. At the same time, in most regions of the country, there is a positive level of local decoupling in 2016-2020 with slight fluctuations. A steady upward trend of the decoupling factor indicator was observed in 7 regions during the study period.

Possible scenarios of environmental development were created using the forecasting method based on data from decoupling analysis based on selected factors in Ukraine during 2011-2020. Measures for implementing environmental-oriented development are proposed within the framework of a possible pessimistic, likely realistic, and desired optimistic scenario corresponding to the level of the integral decoupling factor. In the long run, the situation is complicated by military operations on the territory of Ukraine, which leads to devastating impacts on the ecosystem as a whole. Therefore, the desire to achieve an excellent and positive level of decoupling makes it necessary to coordinate joint efforts of the state, business structures, international organisations, and scientific institutions in ensuring the implementation of strategic measures to reinforce the environmental-oriented development of Ukraine.

References

[1] Vehmas, J., Malaska, P., Luukkanen, J., Kaivo-oja, J., Hietanen, O., Vinnari, M., & Ilvonen, J. (2003). *Europe in global battle of sustainability: Rebound strikes back? Advanced sustainability analysis*. Turku: Turun Kauppakorkeakoulu.

[2] Zayika, P. (2006). Towards a theory of decoupling: Degrees of decoupling in the EU and the case of road traffic in Finland between 1970 and 2001. *Transport Policy*, 12, 137-151.

[3] Weizsacker, E.Yu. (1997). *Factor four: Twice the prosperity – half the consumption of nature: A new report to the Club of Rome*. Munich: Dremer Knaur.

[4] OECD Environmental Strategy. (2022). Retrieved from https://www.oecd.org/env/indicators-modelling outlooks/oecdenvironmentalstrategy.html.

[5] Herman, E.D. (2013). The challenge of ecological economics: Historical context and some specific issues. *Mechanism of Economic Regulation*, 2, 24-29.

[6] Meadows, D.H., Meadows, D.L., Randers, J., & Behrens III, W.W. (1972). *The limits to growth: A report for the club of Rome's project on the predicament of mankind*. New York: Universe Books.

[7] Keil, T. (2010). *Prosperity without growth: Economics for a finite planet*. Abingdon-on-Thames: Taylor & Francis Group.

[8] Cohen, G., Jalles, J.T., Loungani, P., & Pizzuto, P. (2022). Trends and cycles in CO_2 emissions and incomes: Cross-country evidence on decoupling. *Journal of Macroeconomics*, 71, article number 103397.

[9] Regueiro-Ferreira, R. M., & Alonso-Fernández, P. (2022). Ecological elasticity, decoupling, and dematerialization: Insights from the EU-15 study (1970-2018). *Ecological Indicators*, 140, article number 109010.

[10] Danylyshyn, B.M., & Veklych, O.O. (2008). Decoupling effect as a factor in the relationship between economic growth and pressure on the environment. *Journal of the National Academy of Sciences of Ukraine*, 5, 12-18.

[11] Dmytriiev, I., Shevchenko, I., Kudryavtsev, V., Shersheniuk, O., & Prokopenko, N. (2022). Development of a system for recycling used batteries and lead-containing batteries: Assessment of the economic effect with minimising damage to the environment. *Scientific Horizons,* 25(3), 98-104. doi: 10.48077/scihor.25(3).2022.98-104.

[12] Drincha, V. (2006). The effect of "decoupling" in the context of the organization of sustainable agricultural land use. *Efficient Economy*, 1, 1-10.

[13] Vatchenko, O.B., & Svistun, K.O. (2019). Decoupling in the economy – essence, definition and types. *Economic Space*, 141, 5-24.

[14] Tour, O.M. (2012). *Economic justification of the strategy of ecologically oriented development of the national economy*. Sumy: Sumy State University.

[15] Dell'Aquila, A. (2007). Decoupling effect as a criterion of ecologically oriented economic development of Ukraine. *Economics of Nature Use and Environmental Protection*, 8, 24-26.

[16] Bobrovska, N.V., & Kostyrko, A.H. (2016). Environmental awareness in the use of natural resources. *Scientific Herald of NULES of Ukraine.Series: Economy, Agrarian Management, Business*, 249, 37-44.

[17] UN General Assembly, United Nations Framework Convention on Climate Change: Resolution adopted by the General Assembly. (1994). Retrieved from https://www.refworld.org/docid/3b00f2770.html.

[18] European Union Strategy for Sustainable Development. (2009). Retrieved from https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0400:FIN:EN:PDF.

[19] Convention "On International Trade in Endangered Species of Wild Fauna and Flora (Ukrainian/Russian)". (1999, May). Retrieved from https://zakon.rada.gov.ua/laws/show/995_129.

[20] Paris Agreement. (2016, November). Retrieved from https://zakon.rada.gov.ua/laws/show/995_l61#Text.

[21] Akulov, A.O. (2014). Impact of the coal industry on the environment and development prospects according to the decoupling model. *Region: Economics and Sociology*, 1, 272-288.

[22] Kokovsky, L.O. (2013). The concept of decoupling: Distinguishing between economic growth, resource consumption and environmental impact in Ukraine. *Efficient Economy*, 11, 1-6.

[23] Sotnyk, I.M., & Kulyk, L.A. (2014). Decoupling analysis of economic growth and impact on the environment in the regions of Ukraine. *Economic Journal-XXI*, 7/8(2), 60-64.
[24] Sinyavska, O.A. (2019). Decoupling analysis of economic growth and rational agricultural land use in the agricultural sector. *Science Herald of the Kherson State University. Economic Sciences*, 15(4), 40-43.
[25] Thematic Strategy on the Sustainable Use of Natural Resources. European Environment Agency. (2005). Retrieved from https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32007R0864&from=en.
[26] Official webcite of the State Statistics Service of Ukraine. (n.d.). Retrieved fromhttps://www.ukrstat.gov.ua/.
[27] Skydan, O., Pyvovar, P., Topolnytskyi, P., & Prysiazhna, T. (2022). Analysis of rural areas of Ukraine on the basis of ESA WorldCover 2020. *Scientific Horizons,* 25(5), 74-85. doi: 10.48077/scihor.25(5).2022.74-85.

Декаплінг як вимір екологічних наслідків економічного зростання

Марина Іванівна Яремова, Анна Сергіївна Митрофанова

Поліський національний університет
10008, б-р Старий, 7, м. Житомир, Україна

Анотація. Прискорене зростання чисельності населення на планеті зумовлює збільшення обсягу виробництва, що викликає необхідність нарощування видобутку сировинних ресурсів, розширення будівництва виробничих споруд, примноження об'єктів соціальної інфраструктури тощо. Відтак, створення належних умов буття сучасної цивілізації призводить до виснажливого використання природо-ресурсного потенціалу та загострення глобальних екологічних проблем, які мають деструктивний вплив на довкілля. Беручи до уваги вищезазначене, питання моніторингу екологічних наслідків від господарської діяльності набуває вагомого теоретичного та практичного значення, що обумовлює актуальність обраної тематики. Метою даної статті є обґрунтування теоретико-методичних засад та прикладних аспектів вимірювання ефекту декаплінгу за умови еколого-орієнтованого напряму розвитку суспільства. Методологічною основою дослідження є методи емпіричного дослідження та теоретичного пізнання, зокрема метод формалізації, абстрактно-логічний, спостереження, вимірювання, порівняння. У процесі дослідження застосовуються загальнологічні методи та прийоми, зокрема метод аналізу і синтезу, аналогії та економічного моделювання, індукції та дедукції. У статті систематизовано думки провідних учених щодо розуміння концепції декаплінгу за ресурсним підходом та впливом на довкілля. Проведений аналіз став підґрунтям для дослідження впливу виробництва на стан довкілля у розрізі регіонів за 2016–2020 рр. та візуалізації інтегрального індикатора регіонального ефекту декаплінгу. Узагальненні значення за факторами вцілому по Україні дозволили спроектувати екологічні наслідки від здійснення господарської діяльності на перспективу. Практична цінність дослідження полягає у обґрунтуванні практичних рекомендацій зміцнення екологічної політики та мінімізації деструктивного впливу на довкілля враховуючи виклики, пов'язані з військовими діями на території України. Подальші дослідження спрямовані на розгляд досягнутого ефекту декаплінгу у межах окремих галузей народного господарства

Ключові слова: ефект декаплінгу, декаплінг-фактор, антропогенний вплив, господарська діяльність, декаплінг-аналіз, стратегічні напрями