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SUSTAINABILITY OF AGRICULTURE AND RURAL AREAS IN REGIONAL TERMS

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ABSTRACT: The technological advances seen over the last 250 years led to a radical revaluation of social and economic structures both on the level of individual countries and the world as a whole. One of the basic consequences of these changes, in addition to their obvious benefits, is the accelerated pace of consumption of natural resources, which, in some locations, takes the form of unbridled destruction of nature and the environment. In these conditions, the key question concerns the future model of economic development, including agriculture and rural areas. One idea that has become increasingly important since the 1970s/1980s as the future direction for change is the sustainable development of agriculture and, consequently, rural areas. This study attempts to define the level of sustainability of both agriculture and rural areas in a supranational configuration, and specifically through a comparative analysis of the relevant regions in Poland and Ukraine. The article employs two research methods: the scoring method and the ranking method. In total, the study was based on twenty variables. The studies that were conducted led to a number of conclusions concerning the sustainability of both agriculture and rural areas in the regional (supranational) configuration.

KEYWORDS: sustainable agriculture, sustainable rural areas, environment, Poland, Ukraine

Introduction

The technological advances seen over at least the last 250 years led to a radical revaluation of social and economic structures both on the level of individual countries and the world as a whole. One of the basic consequences of these changes, in addition to their obvious benefits, is the accelerated pace of consumption of natural resources, which, in some locations, takes the form of unbridled destruction of nature and the environment. In these conditions, the key question concerns the future model of economic development, including agriculture and rural areas.

One idea which has become increasingly important since the 1970s/1980s as the future direction for change is sustainable development, including sustainable development of agriculture and, consequently, rural areas. This concept is undoubtedly based on the correct premises but is often defined in a generalised, if not superficial, way. For example, sustainable development is assumed to be the ability to organise manufacturing potential so as to maintain profitability in the long term (Kassem et al., 2016), or a set of actions aimed at meeting the basic needs of the population while preserving natural resources for future generations and maximising net benefits from economic development while protecting natural resources in the long term (Czudec et al., 2018).

The starting point for work on the sustainable development concept was resolution no. 38/161 of the UN General Assembly of 19 December 1983, which established the *World Commission on Environment and Development*, known as the *Brundtland Commission*. A report of the Brundtland Commission entitled *Our Common Future* was published in 1987 and defined sustainable development as *"... development that meets the needs of the present without compromising the ability of future generations to meet their own needs*" (UN General Assembly, 1987). This description, while also general in tone – as no one is able to define the needs of future generations – nevertheless remains the most frequently cited both in research work and official national and international documents.

On the other hand, one of the first approaches to the sustainable agriculture concept was proposed by the *American Society of Agronomy*. According to the ASA (1989), "*[a] sustainable agriculture is one that, over the long term, enhances environmental quality and the resource base on which agriculture depends; provides for basic human food and fibre needs; is economically viable; and enhances the quality of life for farmers and society as a whole*" (American Society of Agronomy, 1989).

Even though thirty years have passed, no general consensus has been reached on an acceptable definition of either "sustainable development of agriculture" or "sustainable development of rural areas".

Sustainable agriculture (condition) or sustainable development of agriculture (process) is understood for instance in the following ways:

- the ability to maintain productivity, whether in a field farm or nation, in the face of stress or shock (Conway & Barbier, 1990),
- meeting the needs of the present generation without compromising the ability of future generations to meet their needs (Ikerd, 2008),
- a global dynamic process taking place in three components (economical, ecological and social/institutional) and on five levels (field, farm, community, national and international) (Hayati et al., 2010),
- enhancing or maintaining the quality and long-term viability of farms, enhancing rather than diminishing the long-term productivity of the agricultural and natural ecosystem, as well as enhancing rather than threatening the health and safety of agricultural producers and consumers alike (Weil, 1990),
- agriculture able to maintain the required vitality in the long term (Pintér, 2007),
- a philosophy based on human goals and on understanding the long-term impact of our activities on the environment and on other species (Francis & Youngberg, 1990),
- the management and conservation of the natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations (FAO, 2024),
- the relationship between agriculture and the environment, which meets the needs of the present without compromising the ability of future generations to meet their own needs (European Commission, 1999).

DOI: 10.34659/eis.2024.89.2.773

So, is sustainable agriculture a particular kind of *cure* for the challenges we face (Kryk, 2010), a set of simple but essential economic practices (Fretz et al., 1993), or even a new paradigm in science? (in the meaning of a paradigm in social sciences, not just economy) (Wilkin, 2011). As stated by Wilkin, this paradigm has a strong normative substratum since it refers to multiple social values but is also supported by achievements in empirical research and, therefore, demonstrates many features of a positive approach (Wilkin, 2011). This is also the way in which the sustainability of agriculture and rural areas is treated in this study. It is a slice of our reality that is of considerable importance to economic science and practice and forms a fertile ground for research.

Even in the above, greatly synthetic review of definitions, or more accurately ideas or philosophies of sustainable agriculture, an extremely wide spectrum of issues and areas classified by individual representatives of science, business and social organisations under this model of agricultural development can be perceived. According to Laurett et al. (2021) sustainable development in agriculture can be measured through three dimensions: (i) natural agriculture, (ii) investment in innovation and (iii) technology and environmental aspects. However, the barriers to this development can be related to two dimensions: (i) lack of information and knowledge, and (ii) lack of planning and support.

In this situation, it is more important not just to find a single all-encompassing definition of sustainable agriculture but also to understand and widely accept the processes related to this model, in particular to implement it (Velten et al., 2015).

A large majority of perspectives on definitions and concepts of sustainable agriculture take the form of more or less general ideas or proposals. This study attempts to define the level of sustainability of agriculture and rural areas in a supranational configuration, and specifically through a comparative analysis of relevant regions in Poland and Ukraine. For these reasons, the study adopted a definition of sustainable agriculture, making it possible to operationalise the issues and processes making up this development model. This condition is met by the approach proposed by Zegar (2015), who considers sustainable agriculture to come down to: "*… forms (shapes) of agriculture that meet predefined (maximum or minimum) threshold values and/or preserve (...) balance between various sustainability governances (environmental, economic and social)*". The key factor in this approach is the definition of the upper or lower values of the tendencies/states adopted in the studies. In other words, the values are either desirable (stimulating) or undesirable (destimulating).

It is not possible to deliberate about sustainable development of agriculture without taking rural areas into account in the process, or conversely, ignore sustainable agriculture in the context of sustainable development of these areas. One of the basic features of agricultural activities is their spatial nature. This is why agricultural areas and their characteristics are important for the result achieved in this branch of production (Manteuffel, 1979).

Rural areas are areas outside the administrative limits of cities (GUS, 2022). In Poland, they cover 29.0 million hectares, of which usable agricultural land accounts for 18.7 million hectares (as of 2020), or 64.5% of rural areas. In Ukraine, the figures are 48.7 million and 41.3 million hectares respectively (84.8% of all rural areas). Therefore, locations where agricultural activities can be conducted comprise approximately two-thirds of all rural areas. Multiple and particularly complex dependencies exist between these *configurations*. They relate not only to space, that is agricultural area and its various functions (both productive and non-productive), but also the "extended" nature of the workforce (a means of production in agriculture and workforce on non-agricultural markets), local social structures, ties to the natural environment, the multi-functional character of rural areas, and finally cultural and neighbourhood relations. Generally speaking, rural areas are locations where agricultural activities are conducted. Learning about the trends occurring in sustainable development requires parallel studies on agriculture and rural areas since they overlap and are interlocked. Such an approach has accordingly been adopted in this study.

In the most general terms, the sustainability of rural areas is understood as the diversification of economic activities (in addition to *traditional* agricultural activities) in these areas, to ensure that the value of the natural environment is conserved and that the living conditions of their inhabitants improve through developing infrastructure and services as well as ensure access to cultural and social institutions in the countryside. The purpose of diversification is drive to improve the living conditions of the population and the opportunities for conducting economic activities in these areas while leaving specific rural resources such as the natural environment, the rural landscape and cul-

DOI: 10.34659/eis.2024.89.2.773

tural heritage untouched (Żmija, 2014). This perspective, and other perspectives related to this issue, are rather a set of proposals than concrete norms since a "drive to improve the living conditions of the population and the opportunities for conducting economic activities" can hardly be quantified. Effectively, many publications which purport to treat the sustainability of rural areas do not explicitly define this term. It is assumed to be synonymous with processes consisting of diversifying and, first and foremost, deagrarianization of rural areas. This process, however, does not lead to industrialisation as was the case one hundred or even fifty years ago, but to moderately parallel development of many complementary economic, environmental and social activities related to these areas.

A query run on available literature resources allowed for the identification of the primary components of sustainable development of rural areas. They include at least the following tendencies and processes: improving the level and quality of life of the rural population, resulting in diversification of agricultural and non-agricultural activities, increased employment in non-agricultural occupations in the countryside, greater income of rural farms, social security of countryside inhabitants, modern development of infrastructure in rural areas, conserving and improving soil fertility, and protection of landscape and biological diversity. Thus delimited, sustainable development of rural areas subsequently formed the basis for choosing the variables (indicators) used in this study.

Neither agriculture nor rural areas exist in a vacuum, and they are not self-standing entities, being instead embedded in a specific *environment* or surroundings (Figure 1).

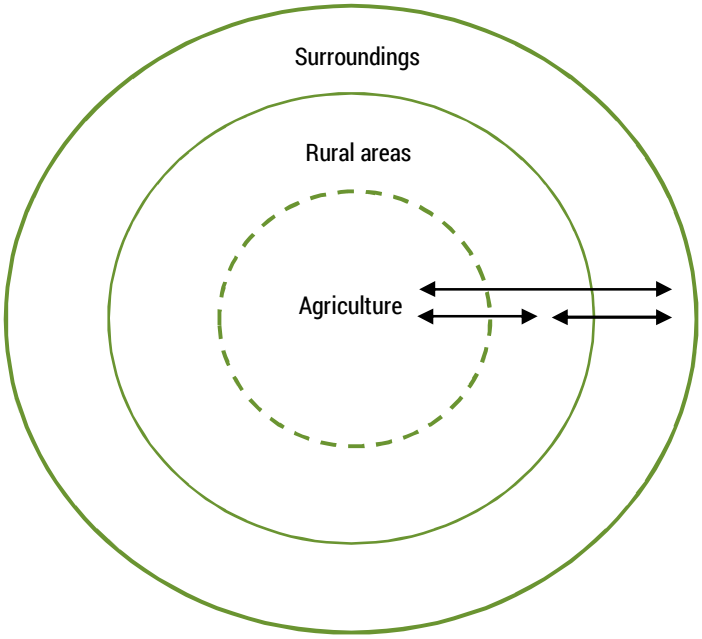

Figure 1. Interdependencies between configurations analysed in the study

Sustainable development of the surroundings is only possible in combination with sustainable social, economic and environmental development. This, in turn, forms the foundation of sustainable development of rural areas and offers a chance for truly sustainable agriculture. Under the conditions that existed to date, based on the maximisation of the effectiveness of invested capital and competitive market mechanisms, farmers were usually forced to behave in a manner contrary to sustainable development or compliance with environmental requirements. Experience shows that this approach invariably impoverishes the agricultural population and leads to a rise in agricultural farm bankruptcy.

Generally speaking, sustainable development is achieved when economic, social, and environmental governance is managed in an integrated, consistent, and harmonious manner. This is understood as achieving an average level of development in all the studied dimensions. In other words, agriculture in a region becomes sustainable when it is characterised by average or close-to-average measurement values of the synthetic index of economic, environmental and social development

DOI: 10.34659/eis.2024.89.2.773

(Matuszczak, 2013). This study addresses the question of how close selected regions in Poland and Ukraine are to this desirable scenario.

The scope and methods of study

The basic purpose of sustainable development, including with respect to agriculture and rural areas, is the pursuit of a new *order*, often called *integrated governance*. This kind of arrangement ensures a specific, desirable state of balance between economic development, social development, and the scale of exploitation and protection of the environment (environmental governance). Studies on the sustainability of development, including the development of agriculture and rural areas, are therefore based on quantitative characteristics referring to these three elements (governances).

It is known that studies in this area face numerous obstacles, some of which are as follows: (i) selecting measures/indicators that correctly and fully describe individual sustainability dimensions is problematic, (ii) some indicators refer to different dimensions and cannot be easily assigned to a specific dimension, (iii) there are no sufficient input/sources to ensure that individual dimensions/governances of sustainability are correctly characterised.

In the case of agriculture, an additional difficulty lies in the mutual competitiveness between the areas, especially in terms of economic and environmental issues (Kociszewski, 2020). While the capital-intensive growth of agricultural production by means of mechanisation and chemigation does help to improve the economic situation of agriculture (agricultural farms) and also, through a network of financial transfers, contributes to social development, it also degrades the environment to a greater or lesser extent. As greater effort is made and measures are undertaken to limit the exploitation and destruction of the environment, this problem becomes increasingly noted and discussed. EU decision-making bodies have been aware of this issue since the 1990s, when the CAP reform called *Agenda 2000* was being discussed. After 2000, the intensification of these discussions and the unavoidable controversies were observed in relation to the *CAP greening activities*, which were particularly highlighted in the *Farm to Fork* strategy.

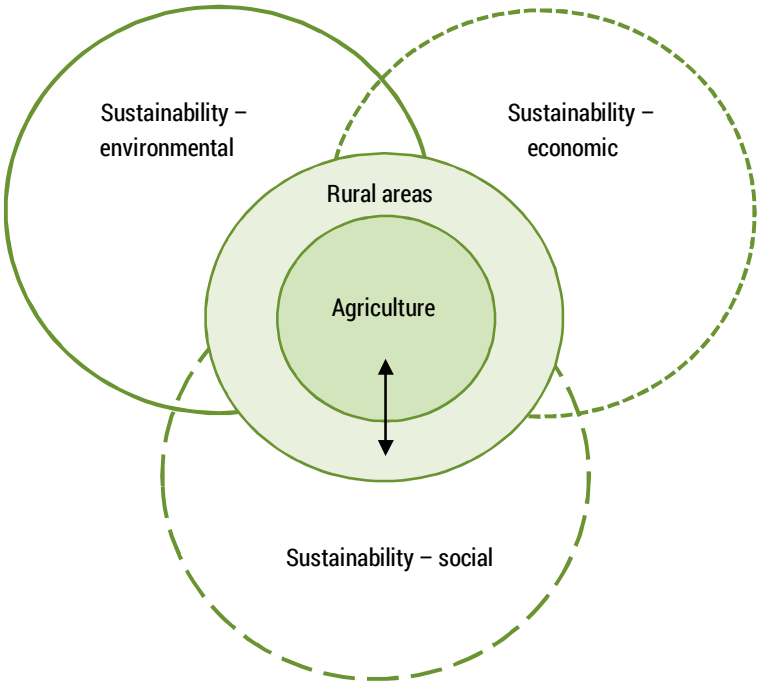

Figure 2. Areas of sustainability between agriculture and rural areas

Studies on sustainable development may refer to sustainable development of agriculture (Wrzaszcz, 2013; Harasim, 2013) or sustainable development of rural areas (Czudec et al., 2018).

DOI: 10.34659/eis.2024.89.2.773

Such a two-track study, although undoubtedly valuable in cognitive terms, may nevertheless spark some substantive doubts. Since these two aspects, agriculture and rural areas, are universally and unequivocally recognised as inseparable, the study should illustrate this interdependence. Accordingly, in the approach presented here, we started with a partially different assumption as to the role and importance of individual governances/dimensions of sustainability. We assume that the economic and environmental dimensions are primarily productive and refer to manufacturing systems, that is, agriculture and its basic organisational unit, the agricultural farm. The social dimension, however, refers to people and relationships that exist in the social configuration of rural areas and only later *permeate* to agriculture (Figure 2).

Obviously, agriculture itself also affects the sustainability of rural areas through interaction. This approach is justified firstly by measures commonly used when studying the social sustainability of agriculture, such as the age and education of the farm owner or work expenditures. These measures, however, decide mainly the potential and production/economic capacities of an agricultural farm and not the sustainability of a particular rural area. Secondly, measures such as the value of environmental services produced by agriculture, maintaining or enhancing economic and social vitality of rural localities, and cultural values are characteristic primarily for rural areas and not for agricultural farms. In addition, agriculture sustainability studies often analyse only the economic and the environmental elements, ignoring the social dimension. This approach seems to assume by default that the latter does not apply directly to agriculture.

This study covers the sustainability of agriculture and rural areas in Poland and Ukraine, and this is ground breaking because of its purpose and scope. This is an important study due, on one hand, to Ukraine's aspirations to join the EU and the start of negotiations in this regard, and on the other, to the manufacturing potential of Ukrainian agriculture.

The basic subject matter of the study is the equivalent administrative divisions in the two countries, namely voivodships in the case of Poland and oblasts in the case of Ukraine, both of which are referred to below as *regions*. The study was conducted on a group of regions representative of each country. The regions for the study were selected according to two criteria: the level of total agricultural production per hectare as a variable characterising the development of agriculture, and the share of the population in rural areas in the region as a basic characteristic of these areas. According to the adopted criteria, regions in which at least one of these figures was higher than the national average were selected for the study. In this manner, ten Polish voivodships and thirteen Ukrainian oblasts were selected. The selected regions account for 72.6% of the total population in rural areas in Poland 57.4% in Ukraine, and 69.6% and 54.1%, respectively, of all agricultural land.

The statistical information sets used in the study were derived from official sources of the relevant institutions in Poland (Central Statistical Office) and Ukraine (State Statistic Service of Ukraine). The data used in the study refer to 2021. Where data for the base year was missing, data for the next or previous year (2020 or 2022) were used.

The article employs two research methods: the scoring method and the ranking method. The scoring method assumes that all features, both quantitative and qualitative, are expressed in the same units by assigning relevant scores to the value of each index. The scoring method system was based on a scale from 0 to 5 (Harasim, 2013). In the next step, using the predefined score range, each analytic index was assigned index class values and the corresponding scores. A uniform score scale (from 0 to 5) was adopted for each analytic (partial) index, based on the assumption that each variable and each sustainability aspect wasequally important for the concept of continuous and sustainable development (Majewski, 2002).

The values of analytic index scores (W_A) are used to calculate the aggregated index of sustainability level evaluation (W_z) for the studied areas according to the following formula:

$$W_z = \Sigma W_A / n, \quad (1)$$

where:
n – is the number of analytic indicators.

A synthetic evaluation of the level of sustainability of agriculture (Z_R) and rural areas (Z_{OW}) was conducted using the formula:

DOI: 10.34659/eis.2024.89.2.773

$$Z_{R/OW} = \Sigma W_Z/N, \quad (2)$$

where:
N – is the number of evaluated sustainability areas.

The evaluation of the sustainability of agriculture and rural areas of the studied countries in a synthetic perspective was conducted on a range from 0 (no sustainability) to 5 (very high level of sustainability).

In research on agricultural and rural sustainability, various indicators are used. They usually refer to the objectives of the implemented agricultural and environmental policy and the expected changes resulting from it (Streimikis & Baležentis, 2020).

The following indicators ($W_{E1...n}$) were adopted as characteristics of economic sustainability of agriculture:

- W_{E1} – the ratio of wages for own work on the farm to the average net wages in the economy/ outside agriculture,
- W_{E2} – the level of investment in agriculture per hectare of usable agricultural land (UAL),
- W_{E3} – agricultural production per hectare of UAL,
- W_{E4} – share of total agricultural production in the region's production,
- W_{E5} – crop yield per hectare of usable arable land in cereal units (CU),
- W_{E6} – milk yield per cow in litres.

The following indicators ($W_{S1...n}$) were adopted as measures of environmental sustainability of agriculture:

- W_{S1} – the share of cereals in the structure of crops sown in usable arable land,
- W_{S2} – density of livestock on usable agricultural land in large animal units (LAU/ha),
- W_{S3} – level of NPK fertilisation in kilograms per hectare,
- W_{S4} – share of forests in the region,
- W_{S5} – share of UAL farmed organically,
- W_{S6} – level of pesticide use in kilograms per hectare of UAL,
- W_{S7} – expenditures for protection of the environment in rural areas in PLN per hectare of the region,
- W_{S8} – share of protected areas (parks, preserves) in the region.

The $W_{S1,}$ W_{S2}, W_{S3} and W_{S6} variables are treated as destimulants. Threshold values were defined for the following variables: W_{S1} – 66.0% and W_{S2} – 2.0 LAU/ha for AUL. To evaluate the remaining variables, it was assumed that their values would be spread over a wide range.

The following indicators were used for the study as regards the sustainability of rural areas ($W_{OW1...n}$):

- W_{OW1} – percentage of rural population in the region,
- W_{OW2} – share of population working in agriculture in the total workforce in the region,
- W_{OW3} – level of unemployment in rural areas (in %),
- W_{OW4} – balance of migration to rural areas compared to the total number of inhabitants of rural areas,
- W_{OW5} – ratio of the average size of dwellings per person in rural areas to the average size in cities,
- W_{OW6} – number of physicians per 10,000 inhabitants.

The following variables are treated as destimulants: W_{OW3}, $W_{OW4.}$

In total, the study was based on twenty variables. The collective (synthetic) indicators for each studied area, unit and country were used to evaluate the level and scale of variance in sustainability of agriculture and rural areas in the analysed areas of Poland and Ukraine.

The ranking method was classifying different objects (in this study, voivodships and oblasts) along a scale of natural numbers according to their ranks, from best to worst in the case of stimulants and from worst to best in the case of destimulants. The sum of sub-ranks produces the aggregate index. The method was used to determine the order of studied objects (regions) according to their sustainability and to verify the results obtained using the score method.

DOI: 10.34659/eis.2024.89.2.773

Study results and discussion

The Polish and Ukrainian regions studied were finally placed in order and evaluated according to the level of aggregated indicators of environmental and economic sustainability with respect to agriculture and social sustainability of rural areas (Table 1).

In the case of Poland, the highest level of environmental sustainability was noted in voivodships with a relatively low level of industrialisation of agricultural techniques, such as Podkarpackie (W_{ZS}- 3.75), Małopolskie (3.63) and Warmińsko-Mazurskie (3.38). On the other hand, the lowest level of sustainability in this aspect was observed in voivodships that use the most intensive production techniques, namely Opolskie (2.25), Wielkopolskie (2.50), or Kujawsko-Pomorskie and Lubelskie (2.75).

Table 1. Level of sustainability of agriculture and rural areas in studied regions of Poland and Ukraine

POLAND				UKRAINE			
Voivodship	Agriculture: environmental sustainability	Agriculture: economic sustainability	rural areas	Oblast	Agriculture: environmental sustainability	Agriculture: economic sustainability	rural areas
Kujawsko-Pomorskie	2.75	3.67	2.50	Khmelnytskyi	2.13	3.17	2.17
Lubelskie	2.75	3.50	2.33	Cherkasy	2.00	3.83	2.00
Łódzkie	2.88	3.00	3.17	Chernihiv	2.00	3.33	1.83
Małopolskie	3.63	2.33	2.83	Dnipropetrovsk	2.13	0.67	1.67
Mazowieckie	3.13	2.67	3.50	Kyiv	2.00	3.17	3.83
Opolskie	2.25	4.17	2.83	Lviv	2.13	2.33	2.83
Podkarpackie	3.75	2.17	1.83	Odesa	2.38	0.50	2.33
Świętokrzyskie	3.13	2.67	2.00	Poltava	2.13	2.67	2.00
Warmińsko-mazurskie	3.38	3.33	1.83	Rivne	2.50	1.50	2.50
Wielkopolskie	2.50	3.33	3.17	Sumy	1.50	2.83	1.50
				Ternopil	1.75	3.67	2.50
				Vinnytsia	1.38	3.50	2.33
				Zhytomyr	2.75	2.67	2.83
Average level of sustainability	**3.02**	**3.08**	**2.60**	**Average level of sustainability**	**2.06**	**2.60**	**2.33**

In the case of Ukraine, the highest level of environmental sustainability is found in agriculture in oblasts such as Zhytomyr (2.75), Rivne (2.50) and Odesa (2.38), and the lowest in Vinnytsia (1.38) and Sumy (1.50). In the case of the first group of oblasts, this is the result of the lower share in relative terms of agro holdings that utilise high-intensity techniques in the land use structure and a large share of forests and grazing lands. On the other hand, oblasts with low environmental sustainability have a large share of UAL worked by large-scale farms.

Generally speaking, the level of environmental sustainability is higher among the studied regions in Poland (W_{ZS}- 3.02) than in Ukraine (2.06). The spread between the outlying regions (maximum/minimum level) is 66.0% in Poland but as much as 83.0% in Ukraine, which means that Ukrainian regions show larger imbalances in this respect, where as Polish regions are less diverse environmentally.

The regional variance in sustainability level also applies to the economic sustainability of agriculture. In Poland, this sustainability was highest in voivodships such as Opolskie (4.17) and Kujawsko-Pomorskie (3.67), which are regions with the highest level of development of agricultural farms. This

DOI: 10.34659/eis.2024.89.2.773

confirms the often repeated statement about the competitive relationship between environmental and economic objectives in agriculture. A slightly lower level of economic sustainability (3.50) was observed in the Lubelskie voivodship, where the production techniques used are less capital-intensive compared to the two voivodships described above. Lubelskie agriculture, however, owes this relatively high level of economic sustainability primarily to features such as good-quality soil and the strong position of agriculture in the region's economy. The lowest level of economic sustainability was found in the Podkarpackie (2.17) and Małopolskie (2.33) voivodships.

In the case of Ukraine, the highest level of economic sustainability was achieved by oblasts such as Cherkasy (3.83), Ternopil (3.67) and Vinnytsia (3.50), mostly due to the high importance of agriculture for the economy of these oblasts, good quality soil, and weather conditions favouring agricultural production. This is a level of sustainability comparable to, and even higher than, that achieved by the majority of Polish voivodships. At the opposite end of the scale, however, there are oblasts such as Odesa, where the level of economic sustainability was a mere 0.50, or Dnipropetrovsk with 0.67. This is primarily the result of features such as poorer soil quality and, consequently, lower agricultural production. Effectively, in general terms, the overall level of economic sustainability of agriculture in the studied regions was 3.08 in Poland and 2.60 in Ukraine. The spread was 92.0% in Poland and as much as 666.0% in Ukraine. This means that both the Polish and Ukrainian regions show more diversity when it comes to economic rather than environmental sustainability. In the case of Ukraine, the extreme developmental backwardness of some of the oblasts is apparent.

Considering both aspects of sustainability studied above, the literature uses the *level of environmental-economic sustainability of agriculture*. According to this approach, the synthetic index corresponding to the level of agriculture sustainability (Z_R) was 3.05 in the studied Polish voivodships and 2.33 in the studied Ukrainian oblasts. When these values are considered in reference to the 6-point scale for evaluating the level of sustainable development, in the case of Poland, the level is high (in the 3.0 to 4.0 range) and for Ukraine average (in the 2.0 to 3.0 range) (Harasim, 2013).

Four Polish voivodships achieved a high level of environmental-economic sustainability and the remaining six an average level. In the case of Ukraine however, eleven oblasts achieved an average level and two a low level.

The issue of variety in the scale of sustainability between regions also applies to rural areas. In Poland, the highest level of sustainability in this aspect was found in voivodships such as Mazowieckie (3.50) and Wielkopolskie and Łódzkie (both 3.17). This high level is the result of two characteristics typical for these regions: the multi-functional development of rural areas in these voivodships and the impact of large urban agglomerations (which is particularly noticeable in the Mazowieckie voivodship). The lowest level of sustainability in rural areas was noted in voivodships such as Podkarpackie, Warmińsko-Mazurskie (both 1.83), Świętokrzyskie (2.00), and Lubelskie (2.33). This, in turn, is the result of specific backwardness in the industrial evolution of these regions as areas which in the past were mainly devoted to agriculture, without any distinct non-agrarian functions.

In Ukraine, the rural areas with the highest level of sustainability are foundin oblasts such as Kyiv (3.83), Zhytomyr and Lviv (both 2.83). As in Poland, this is primarily due to the impact of local agglomerations (especially Kyiv and Lviv) on adjacent rural areas. In three oblasts, the sustainability level was below 2.00, a sign of particularly low development. Generally speaking, the level of sustainability of rural areas was 2.60 in Poland and 2.33 in Ukraine, with a spread of 91.0% in Poland and 155.0% in Ukraine. In both Poland and Ukraine, rural areas have a generally lower level of sustainability in all three studied aspects. The higher (in relative terms) average level of sustainability in rural areas in Ukraine is the consequence of an elevated level of sustainability occurring around agglomerations. In both countries, the sustainability of rural areas is on an average level (indicators in the 2.0 to 3.0 range), with a few exceptions. Out of 23 studied regions in the two countries, 19 had the average level of sustainability of rural areas.

The results obtained using the scoring method were subsequently confirmed by applying the ranking method (Figure 3). When studied in the three aspects of economic and environmental sustainability of agriculture and sustainability of rural areas, a vast majority of the regions matched the groups with either the highest or lowest sustainability estimated using the scoring method. This was true for both Polish voivodships and Ukrainian oblasts. The ranking method also confirmed that the level of sustainability was less diverse between regions in Poland compared to the Ukrainian oblasts.

DOI: 10.34659/eis.2024.89.2.773

For example, 80.0% of studied regions in Poland, compared to just 46.0% in Ukraine, fell within the 25-50 points range, which translates into an average sustainability level for all areas.

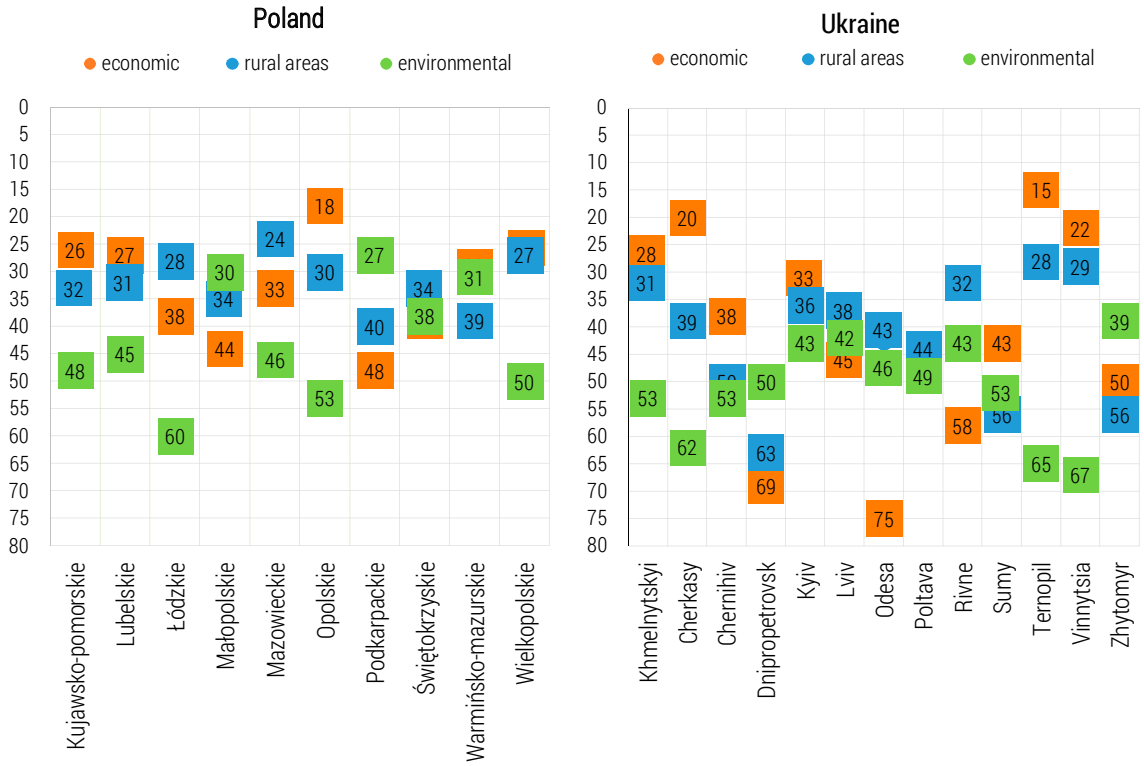

Figure 3. Results of ranking of regions according to the surveyed sustainability areas

In addition to the general conclusions described above, the results obtained using the two methods made it possible to identify regions with particularly "unusual" characteristics.

One example is the Warmińsko-Mazurskie voivodship, which has the highest share of organic farming in the AUL structure among Polish regions, the highest unemployment in rural areas, and at the same time one of the most favourable ratios of wages for own farm work to the average net wages in the voivodship's economy. This region, therefore, presents simultaneously positive and negative features in all studied aspects, which makes simple interpretation of this configuration of characteristics a complicated task.

On the other hand, in Ukraine, an "unusual" oblast is Rivne, which has more than double the national average of organic farming, a high share of forests, and at the same time one of the highest levels of use of mineral fertilisers and plant protection agents among the studied regions.

A study conducted on Ukrainian oblasts made it possible to demonstrate a strong positive and negative correlation between the level of economic and environmental sustainability and sustainability of rural areas and the level of land concentration in large agricultural farms, known as *agro holdings*. According to data provided by the State Statistic Service of Ukraine, the largest concentration of land in Ukraine occurs in the Vinnytsia, Kyiv, Sumy, Ternopil, Khmelnytskyi, Cherkasy and Chernihiv oblasts. At the same time, these regions have the lowest level of environmental sustainability and sustainability of rural areas (less than 2.00 using the scoring method and from 50 to 79 points using the ranking method) while demonstrating the highest level of economic sustainability (considerably more than 3.00 using the scoring method and from 15 to 38 points using the ranking method). Therefore, the concentration of land is a major factor impacting the intensity of agriculture, its final output, and consequently, the level of economic sustainability.

The existence of large agricultural farms in Ukraine is one of the factors that contributed to increased production and domestic export of agricultural products. According to the Latifundist (2021) website, 117 agro holdings farm 16.0% (6.45 million hectares) of the country's usable agri-

DOI: 10.34659/eis.2024.89.2.773

cultural land. Among these, there are more than ten foreign agricultural farms that cultivate around four million hectares of agricultural land (Latifundist, 2021). In 2021, among the one hundred largest agricultural farms in Ukraine, 36 enterprises had an average size of more than 50,000 hectares. In total, these enterprises managed 4.54 million hectares of usable agricultural land. The activity of such agricultural farms involves a high share of crops that cause soil degradation, such as maise, sunflower, rape and soybeans. The total share of such crops in total crops sown in Ukraine is currently 51.08% (State Statistics Service of Ukraine, 2021).

The studies have confirmed the negative impacts of concentrating large areas of land: a decreasing number of agricultural farms, a rise in unemployment in rural areas, insufficient capital investments in infrastructure and protection of the environment, an increase in monoculture systems, and degradation of soil and other aspects of the environment. In some cases, entire rural areas can be said to be "latifundised". Thus, while land concentration and the greater role played by large agricultural farms have a positive effect on the economy of the agricultural sector and thus on its economic sustainability, they undermine the sustainability of other aspects of agriculture (the environment) and rural areas. The studies demonstrate that large agricultural farms, including agro holdings, dominate with regard to both the positive and the negative impact.

For Poland, in turn, the studies have emphasised the decisive role played by the technical development of agricultural farms in a particular region and advancements in the multi-functionality of rural areas in achieving a higher level of sustainability in all of the studied aspects.

The progress made with the concentration of land is at a much lower level in Polish agriculture than in Ukraine. In addition, in Poland, these processes are slower and decisively evolutionary in character due to the limited pool of agricultural land. This means that other ways need to be found to expand capital-intensive production in combination with gradual concentration of the area of farms and the continued use of labour-intensive techniques and branches by some farms. This made it possible to produce a model of agriculture that is relatively intense but less advanced as far as land concentration processes and industrialisation of production methods are concerned. This is the essence of the *EU family farming model*, which, studies have shown, also determines the level of its economic sustainability (Kowalczyk & Sobiecki, 2014).

As regards the sustainability of rural areas, in turn, their drive towards planned multi-functionality was decisive. Since the early 1990s, a number of national programmes have been launched to allow these areas to develop a new image, taking into account needs related to expanding non-agricultural services and activities based on local resources. Thanks to these programmes, a number of efficient local labour markets emerged in villages and small towns to effectively shape acceptable work and life conditions, both for the agricultural population and for inhabitants of cities that eagerly migrate to these areas.

Summary

The conducted study points to a far-reaching regional (spatial) variance in the sustainability of both agriculture and rural areas in the studied countries. In general, the results obtained by way of the scoring method and the ranking method led to the following observations:

- first, in all of the studied areas, the average level of sustainability was higher in Poland than in Ukraine,
- second, for both Poland and Ukraine, the highest level of sustainability was that of economic sustainability of agriculture, which is perhaps the consequence of a higher position of this sector in the economies of the studied regions in relation to other areas, such as the environment or social development of rural areas,
- third, the regions with the highest level of environmental sustainability do not overlap with the regions with the highest level of economic sustainability, either in Poland or Ukraine, which confirms opinions about the mutually competitive relationship between sustainability in these two areas; similar conclusions result from research: Sokil et al. (2018),
- fourth, in all studied aspects, the scale of regional diversity of the level of sustainability was lower in Poland than in Ukraine, which is a consequence of the generally higher level of economic devel-

DOI: 10.34659/eis.2024.89.2.773

opment of individual voivodships and Poland as a whole (measured for instance according to GDP),

- fifth, in the case of both Poland and Ukraine, agglomerations have a large impact on sustainability, both in agriculture itself and in rural areas, which confirms the powerful economic and civilisation-related functions of large urban centres,
- sixth, the dominant level of sustainability for individual regions and the studied aspects is average/high for Poland and decidedly average in Ukraine.

Considerable regional variances in the level of agriculture sustainability do not, however, rule out the possibility of achieving environmental and economic goals on the level of both agricultural farms and the sector as a whole. Naturally, maximising economic effects using today's most common methods of capital-intensive growth often leads to excessive exploitation of the natural environment. However, there is no reason to equate environmentally safe production solely with semi-subsistence and low-income production (Wrzaszcz, 2013).

The studies that were conducted prove that under certain conditions, it is possible to achieve economic and environmental objectives at the same time. This is proven by the fact that some determinants have an effect in the same direction in both scopes of sustainability. An example is the emerging relationship between the increased income of larger farms and their growing propensity to implement more environmentally friendly manufacturing techniques, such as EU environment and agriculture programmes, multi-directional agricultural production, and more moderate use of agricultural chemicals.

However, at present, it is difficult to expect a voluntary and large-scale switch on the part of farmers to manufacturing methods that are friendly and safe for the environment. This is because they still conflict considerably with economic results achieved using such methods, which means that the income of agricultural farms that decide to adopt less capital-intensive manufacturing methods tends to decrease. What is therefore necessary is specific institutional *compensation* provided by the state and CAP instruments to account for the potential economic advantages lost as a result of implementing changes favourable for the environment and public good.

Ultimately, as clearly proven by the conducted comparative study of Poland and Ukraine, there is no evident means of "leapfrogging" and thus no advantages to a lower level of progress of developmental processes in the economy (*advantages of backwardness*), including industrialisation of agriculture and evolution of urban areas into organised urban/metropolitan structures (Weede, 2007). Economies with a lower level of development do take advantage of the experiences of more advanced economies, for example as regards the sharing economy, absorption of innovation or new marketing methods (Vu & Asongu, 2020). This does not, however, apply to institutionally and economically demanding challenges, such as parallel sustainability of agriculture and ensuring food security in a country or region. It is assumed that desirable changes need to be bolstered by positive organisation of social initiatives, relevant legal instruments, and suitable dedicated development funds. In general, a new, *higher* level of agreement between the state, society and business is required to harmoniously implement the intents and purposes of such important and prospective initiatives of modern civilisation. The research presented in this article is the first stage of research. In the next stage, according to the plan, they are to cover all oblasts and voivodeships and attempt to examine the impact of the war on changes in the level of sustainability in Ukraine.

The contribution of the authors

Conceptualization, S.K. and Y.Z.; literature review, Y.Z.; methodology, S.K.; formal analysis, Y.Z. and S.K.; writing, Y.Z. and S.K.; conclusions and discussion, S.K. and Y.Z.

The authors have read and agreed to the published version of the manuscript

DOI: 10.34659/eis.2024.89.2.773

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Yulia ZOLOTNYTSKA • Stanisław KOWALCZYK

ZRÓWNOWAŻENIE ROLNICTWA I OBSZARÓW WIEJSKICH W WYMIARZE REGIONALNYM

STRESZCZENIE: Postęp techniczny ostatnich co najmniej 250 lat doprowadził do gruntownego przewartościowania struktur społecznych i gospodarczych, tak poszczególnych krajów, jak i całego świata. Jedną z podstawowych konsekwencji tych zmian – poza oczywistymi pozytywami – jest przyspieszone tempo zużycia zasobów naturalnych, przybierające miejscami charakter wręcz dewastacji przyrody i środowiska. W tych warunkach powstaje kluczowe pytanie o przyszły model rozwoju gospodarczego w tym także rolnictwa i obszarów wiejskich. Ideą, która od przełomu lat siedemdziesiątych i osiemdziesiątych XX w. zyskuje na znaczeniu jako przyszły kierunek zmian jest zrównoważenie rozwoju rolnictwa oraz konsekwentnie obszarów wiejskich. Celem niniejszych badań jest próba określenia poziomu zrównoważenia rolnictwa i obszarów wiejskich w układzie ponadnarodowym, a konkretnie analiza porównawcza na przykładzie odpowiednich regionów w Polsce i w Ukrainie. W opracowaniu wykorzystano dwie metody badawcze: metodę punktową oraz metodę rangowania (rang). Łącznie badanie zostało oparte na 20 zmiennych. Przeprowadzone badania pozwoliły na szereg ustaleń w zakresie równoważenia rolnictwa i obszarów wiejskich w układzie regionalnym (międzynarodowym).

SŁOWA KLUCZOWE: zrównoważone rolnictwo, zrównoważone obszary wiejskie, środowisko, Polska, Ukraina