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Greening of Polish Agriculture and Public Expenditure – Empirical Research Results

Abstract. The aim of this article is to diagnose the factors determining the greening of agriculture in Poland and to assess the system of ecological payments for organic agriculture according to farmers' opinions and the degree to which current forms of financing for the greening of agriculture are utilised. The research method adopted in the article was a questionnaire survey conducted among organic farmers from all voivodeships in Poland. The research procedure involved comparing the survey results and performing a statistical analysis of the responses using the χ^2 independence test. As a result of the analysis, it was possible to assess the degree of subsidy utilisation by Polish farmers in stimulating ecological behaviour. The level of satisfaction of Polish farmers with support systems was also determined, and the greatest obstacles to the development of organic agricultural production were identified.

Keywords: public expenditures, greening, organic farming, renewable energy sources

JEL Classification: H59, Q14, Q38, Q42

Introduction

The increasing global imperative for sustainable agricultural practices, driven by population growth and the pursuit of socio-economic and environmental sustainability, requires more sustainable agricultural inputs. Enhanced seeds, fertilisers, labour and machinery, among other aspects of farming inputs, are now expected to align with sustainability goals (Sannou et al., 2025). Agriculture, the basis of a country's economic and social development, is constrained by natural climate conditions. Characteristic agriculture varies as different regions have diverse climate conditions (Shen et al., 2023). Agriculture is an especially important area of the economy because it provides society with essential food products. Agricultural production is closely related to resources, the state of the environment and climate and, at the same time, also affects the environment. These environmental conditions have been incorporated into the Common Agricultural Policy of the European Union. This is reflected in, among other things, promoting organic farming (Brelík et al., 2020).

Understanding the attitude of Polish farmers towards the greening of agriculture is undoubtedly very important. Identifying this attitude would allow for the adjustment of public authorities' actions in encouraging farmers to undertake pro-ecological activities such as investing in installations using renewable energy sources, engaging in ecological agricultural production or modernising farms with modern low-emission facilities.

The aim of this article is to identify the factors determining the greening of agriculture in Poland, to recognise the potential and expected ways of financing organic farms in Poland as perceived by farmers, to assess the system of ecological payments for organic agriculture and to evaluate the degree of use of current forms of financing the greening of agriculture

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(e.g. investments in renewable energy sources). In connection with the set aim, a survey was conducted among Polish organic farmers, which provided primary data for analysis. The process of greening agriculture consists of a number of decisions made by farmers, including the decision to undertake organic production, the decision to use renewable energy sources on the farm and the decision on how to manage the surplus biomass generated on the farm. The impact of public finances on farmers' decision-making in this area is a topic that has not been explored in domestic and foreign literature. This has been identified as a research gap.

The study covered organic farms in Poland in a specific proportion to the number of organic farms located in individual provinces. The time frame covered by the questions in the questionnaire was the period of receiving payments from the Rural Development Programme 2014-2020. The choice of this period was determined by the fact that it is a closed pool of financing and an assessment can be made for this period. The study assumed the hypothesis that public spending encourages Polish farmers to engage in pro-ecological behaviour. So far, no similar studies have been conducted in the indicated area, which would link public expenditure with the pro-ecological behaviour of farmers. It should be underlined that in Polish literature there is no similar research.

Problem Statement

Despite various government poverty reduction initiatives, poverty remains widespread and severe in rural areas of North-West Nigeria, where insecurity has further compounded socioeconomic challenges (UNICEF, 2023). Previous studies have mostly focused on income-based poverty, overlooking non-monetary aspects such as education, health and social well-being that are critical in rural settings (Alkire, Foster, 2021). Additionally, there is limited research on how armed banditry influences the Multidimensional Poverty Index (MPI) across different states in the North-West region. While Sokoto State experienced a decline in poverty intensity, Katsina and Zamfara States saw worsening poverty conditions, suggesting regional variations in poverty response to insecurity. Furthermore, rural communities have been disproportionately affected, as they lack the institutional support, security infrastructure and economic resilience of urban centres. Therefore, an empirical investigation is necessary to determine how armed banditry has altered multidimensional poverty in the region and to inform targeted policy responses.

An overview of the literature

Since the mid-1980s, ecological economics has been developing on the basis of a critique of the shortcomings of neoclassical environmental economics, which was initiated in the United States as ecological economics. In the autumn of 1987, the International Society for Ecological Economics (ISEE) was founded and, since 1980, the journal "Ecological Economics" has been published. Since then, several books in this field have been published, institutes of ecological economics have been established and several congresses have been organised (Rogall, 2010, p. 116). Ecological economics, as well as the concept of sustainable development, has given rise to the greening of agriculture and all the elements that contribute to the inclusion of the environmental aspect in agricultural production.

In recent decades, dangers related to changes in the structure and functioning of the agricultural landscape and its individual components have been noted. Mechanisation,

chemicalisation and changes in crop structure have a particularly significant impact (Richling and Solon, 2011).

Rural areas, which in Poland occupy over 93% of the area, were identified in the last century with agriculture and the production of food or raw materials mainly for the needs of the food industry. Although the role of agriculture is not decreasing, as incomes are growing in relatively poor countries and with high elasticity of demand for food, these areas will increasingly perform many other important functions, such as economic (other than agricultural), social, cultural and mainly ecological, because the importance of the natural environment is systematically increasing. Due to their quantitative and qualitative potential, they already significantly participate in the implementation of the indicator goals resulting from the climate package and, in the near future, also the global climate agreement. It is thanks to the produced energy raw materials, and increasingly also energy, that the share of renewable energy sources (RES) in final energy consumption has significantly increased (Gradziuk P. and Gradziuk B., 2017, p. 73).

The problem of renewable energy sources is related to Polish agriculture. It is worth noting that the use of renewable energy by the modern economy determines the civilisational development of the state and its economy (Pająk et al., 2013). Agriculture is particularly predisposed to the use of alternative energy sources, especially due to its large space, dispersed reception, demand for relatively small capacities and unmet energy needs resulting from the difficulties encountered during the modernisation of transmission lines (Kuciński, 2006).

The effects of increased energy consumption cause a significant burden on the ecosystem and the environment. The growing demand for energy and concerns about climate change caused by the widespread use of fossil fuels have prompted several countries to switch to renewable energy in order to improve the quality of the environment (Filipiak et al., 2023). According to various models of RES development, by 2030 the main source of renewable energy in the EU will be solar energy. So far, the most important among RES has been biomass from agricultural areas, used mainly in heating, biogas plants and power generation (Pilżys, 2018).

The most important economic benefit of using biological renewable energy sources is the increase in local entrepreneurship and the creation of many new jobs (Pająk et al., 2013, p. 98). For many years, the Polish tradition and policy of promoting energy production from coal, subsidies for mining and low coal prices meant that renewable energy sources were not an alternative source of energy production. A gradual increase in the share of energy from renewable sources occurred in the 1990s (Mrozowska, 2016, p. 307). Renewable energy sources are playing an increasingly important role in the structure of energy supplies worldwide. Some renewable energy technologies have reached a level of competitiveness similar to fossil fuel-based technologies (Graczyk A. and Graczyk A.M., 2011, p. 122). Groups such as farmers or agricultural companies that control wind and biomass resources are generally absent from early policy debates, which indicates that this group does not identify itself and is difficult to mobilise. For example, when someone buys a solar water heater, they effectively become a renewable energy enthusiast and are part of the renewable industry (Mallon, 2006, p. 107). Poland is placed in a group of seven countries, along with Bulgaria, Croatia, Hungary, Portugal, Romania and Slovenia, which are characterised by negative growth rates of renewable energy production in agriculture and forestry (Janiszewska and Ossowska, 2018, p. 100). The countries with the largest production of

energy from renewable sources include Germany, Italy, France, Spain and Sweden (Frodyma, 2017, p. 39).

Referring to A. Klepacka's research, it can be expected that the production of wood biomass will become increasingly important in reducing the dependence of rural households on non-renewable fossil fuels, due to the potential for increasing the production of wood pellets and installing pellet furnaces (Klepacka, 2019, p. 80). The structure of energy generation from renewable sources in the EU shows that biomass has so far been the most significant, as it is generally available and can be used for direct combustion (e.g. wood, straw, sewage sludge) or processed into liquid fuels (e.g. rapeseed oil esters, alcohol) or gaseous fuels (e.g. agricultural fuel, biogas from sewage treatment plants, landfill gas) (Bańkowska and Gradziuk, 2017, p. 132). The energy contained in biomass is the least capital-intensive source of renewable energy. High energy efficiency during combustion and low greenhouse gas emissions mean that interest in biomass is constantly growing (Sadowska et al., 2007, pp. 414-416). Biomass is one of the most promising energy sources in the EU, especially in Poland. The arguments for the EU accession agreement indicate the need to increase renewable energy production, including raw materials based on the use of biomass (Jasiulewicz, 2020, p. 145). Typical agricultural biogas plants operate on a mixture of animal excrement (liquid manure, possibly manure) and plant materials (mainly corn silage) (Zapałowska, 2012, pp. 242-243).

An important element of the principle of sustainable development in Poland is to increase the share of renewable sources in the fuel and energy balance. This will enable the achievement of the goals set in the state's ecological policy regarding the reduction of pollutants affecting climate change (Słupik, 2007, p. 184). Considering natural conditions, agriculture is undoubtedly the privileged sector in the field of using solar energy in Poland. High demand for heat for drying agricultural crops occurs in the summer and aligns with the period of the strongest solar radiation (Ruszkowski, 1999, p. 65). The productive functions of agriculture are well described in scientific literature. This field interests both agricultural and economic sciences. For several decades, some external effects of agriculture have also been analysed, especially those related to the negative impact of agricultural production on the quality of the natural environment (Wilkin, 2008). The development of renewable energy can be supported by the state. Investments without regulations and support systems for their financing are unprofitable due to high investment costs, business risk and unit costs of energy production (Bartoszczuk, 2018, p. 144). Here, it is important to indicate the role of public finance in the ecologisation of Polish farms.

Agriculture in Poland is undoubtedly an important issue in both economic and environmental aspects. Polish food has been characterised by high quality for years. As the first link in the supply chain, the Polish farmer is a very important market participant for the economy (Jarczok-Guzy, 2020). Both agriculture and the entire agribusiness are constantly changing. Subsequent paradigms related to globalisation or sustainable development are emerging and being modified. Maryniak and Stefko, following Zawajska and Coleman, stated that so far in the area of agriculture, four basic paradigms have been distinguished, referring to different models of regulations used by the state: dependent agriculture, competitive agriculture, multifunctional agriculture and global agriculture (Stefko and Łącka, 2017). In the face of climate change and the concept of sustainable development, ecological agriculture, also known as organic farming, is becoming particularly significant.

Research methods

The first stage of the research procedure was to obtain a database of addresses of organic farming producers in Poland. The table with data is available for public information and can be downloaded directly from the website of the Agricultural and Food Quality Inspection (<https://www.gov.pl/web/ijhars/dane-o-rolnictwie-ekologicznym>). The Table shows 21,194 organic producers. Due to the nature of the respondents, who are farmers, whose work requires special commitment and is related to the seasonality of crops, the study was conducted in the autumn-winter period to ensure the highest possible return rate of the surveys. It was decided to conduct the survey using a questionnaire sent by traditional mail together with a pre-addressed return envelope with a postage stamp. This method should ensure that the return rate of the surveys is at the desired level. A random sample selection was used, maintaining the proportion to obtain 1.3% of respondents from each voivodeship. The research sample was assumed to be 1.3% of the total number of farms. The calculation is illustrated in Table 1. A total of 276 questionnaires were sent by post in full sets with a return envelope inside and a postage stamp. In the period from 02.11.2022 to 28.02.2023, 91 completed valid questionnaires were received. The return rate in this case was 32.97%. This rate was assessed as satisfactory.

Table 1. Calculation of organic farms by voivodeships in Poland

Voivodeship	Number of producers included in the research sample
Dolnośląskie	10
Kujawsko-pomorskie	6
Lubelskie	26
Lubuskie	14
Łódzkie	8
Małopolskie	11
Mazowieckie	36
Opolskie	1
Podkarpackie	12
Podlaskie	44
Pomorskie	8
Śląskie	3
Świętokrzyskie	8
Warmińsko-mazurskie	44
Wielkopolskie	13
Zachodniopomorskie	31
Total	276

Source: own elaboration on the base <https://www.gov.pl/web/ijhars/dane-o-rolnictwie-ekologicznym>.

Of the 276 surveys sent, 91 respondents returned completed questionnaires. Ninety per cent of the research sample were individual farms. Nine per cent of respondents declared that they were running a business as a company or legal entity. The majority of the sample were also small farms employing up to five people (90% of the sample). The area of agricultural land cultivated by the surveyed farmers ranged from 10 to 50 ha, as declared by 58.5% of respondents. Farms with an area of over 50 ha constituted 24% of the sample. The vast majority of agricultural producers have been operating as certified organic farms for more than 10 years (74%). 11% of farms have been operating for more than five years. Most of the surveyed respondents were experienced organic producers. The surveyed farms were very

diverse in terms of the type of agricultural production – starting from animal production (34%), through cereal crops (27%), vegetable crops (13%), fruit growing (10%) and milk production (12%). Farmers in the research sample were distributed proportionally in terms of the range of sales of their products. Farms with a local sales market constituted 36% of the sample, those with a regional range 26% and those with a national range 30%. International sales of agricultural products were declared by 8% of the respondents. The majority of the respondents were men (66%). The age structure of the respondents indicates that the largest share in the study was held by people aged 36-80 – in total, 90% of the sample. People aged 61-80 constituted 35% of the sample, while in the previous age group (46-60) it was 29% of the respondents. In terms of the representation of voivodeships, the sample is distributed evenly with a slight advantage of respondents from the Warmian-Masurian voivodeship (18%) and the Podlaskie voivodeship (14%). This advantage is justified by the fact that there are many organic farms in these voivodeships. The detailed distribution of the sample is presented in Table 2.

Table 2. Characteristics of the research sample

Criterion	Number	% investigated	Criterion	Number	% investigated
Structure by the legal form			Structure by the type of sales market		
Natural person running the business	82	90%	Local	33	36%
Partnership	2	2%	Regional	24	26%
General partnership	0	-	National	27	30%
Legal person	6	7%	International	7	8%
Another form	1	1%	Structure by the gender of farmer		
Structure by number of people working on the farm			Women	31	34%
Up to 5 people	82	90%	Men	60	66%
6 - 10 people	6	7%	Structure by the age of farmer		
11 - 20 people	3	3%	Up to 25 years	1	1%
21 - 50 people	0	-	26 to 35 years	8	9%
More than 50 people	0	-	36 to 45 years	24	26%
Structure by area of agricultural land			46 to 60 years	26	29%
Up to 1 ha	0	-	61 to 80 years	32	35%
1.1 ha to 3.0 ha	5	5.5%	Over 81 years	0	-
3.1 ha to 10 ha	11	12%	Structure by voivodeships		
10.1 to 20 ha	25	27.5%	Zachodniopomorskie	7	8%
20.1 to 50 ha	28	31%	Małopolskie	4	4%
50.1 ha to 100 ha	13	14%	Lubelskie	9	10%
Over 100 ha	9	10%	Mazowieckie	10	11%
Structure by the years of holding the ecological certificate of agriculture			Warmińsko-mazurskie	16	18%
Less than 1 year	0	-	Pomorskie	2	2%
1 to 3 years	7	8%	Podlaskie	13	14%
3 to 5 years	7	8%	Wielkopolskie	3	3%
5 to 10 years	10	11%	Dolnośląskie	5	5%
Over 10 years	67	74%	Podkarpackie	5	5%
Structure by type of agricultural production (number and % of responses)			Śląskie	2	2%
Cereal crops	54	27%	Lubuskie	5	5%
Vegetable crops	26	13%	Świętokrzyskie	3	3%
Fruit crops	20	10%	Kujawsko-pomorskie	3	3%
Animal production	68	34%	Łódzkie	4	4%
Milk production	25	12%	Opolskie	0	0%
Aquaculture	2	1%			
Other	6	3%			

Source: own elaboration.

Results of the research

The respondents' answers in the survey were divided into three groups of substantively coherent issues. The first of the examined areas was the potential of farms in terms of production and use of renewable energy sources on organic farms.

Among the surveyed farmers, 43% admitted that they use renewable energy sources on their farms. This response rate should be viewed positively, as it is desirable for as many entities as possible to use natural sources to produce energy or heat their farms from the perspective of sustainable development and greening.

Biomass is undoubtedly a renewable energy source, and farms produce it in many forms (straw, hay, animal waste, etc.). When asked whether they produce biomass on their farms, the vast majority of respondents declared that biomass is produced on their farms (65% of respondents). This result should also be viewed positively, as it is associated with the significant potential of the farms surveyed in terms of renewable energy production. In addition, 27% of the farms that produce biomass admitted that they have a surplus of this material on their farms.

In the next question, respondents who have a surplus of biomass indicated ways of using this surplus on their farms. Here, very interesting answers were obtained from the respondents. It turned out that the most frequently indicated way of dealing with the surplus of biomass is to store it for the following years (60% of responses). A large number of respondents declared that they transfer the surplus of biomass to other farms (32.5% of responses). These answers should also be assessed positively, as they show that valuable renewable resources are not being wasted. The only imperfection in the respondents' answers is the lack of indications of using the surplus of biomass for energy production. However, among the open responses (7.5% of indications), there were phrases such as animal feed, mulching crops or fertilisation.

In organic farms, the ecological method of soil fertilisation is of particular importance. Natural fertilisers are responsible for this stage of production. In connection with the above, the surveyed farms were asked what type of natural fertilisers are produced on their farms. The majority of the responses indicated the production of solid fertiliser (manure, bird droppings) – 64.5% of responses. 27.5% of responses indicated the production of liquid fertiliser (slurry, liquid manure), while 10 farms do not use natural fertilisers (8% of responses).

Next, respondents were asked to declare whether there is a surplus of natural fertilisers on their farms and how they use it. Farmers in as many as 82% of the sample unanimously indicated that there is no such surplus on their farms. The remaining 18% of the sample were asked to indicate ways of dealing with any surplus of natural fertilisers.

The vast majority of respondents indicated that they transfer the surplus of natural fertilisers to other farms. This response was given by as many as 95% of the sample. Again, there were no indications of the use of natural fertilisers for energy production, which means that none of the surveyed farms invest in biogas plants.

Referring to the previous question, farmers indicated what types of RES installations they use on their farms. Unfortunately, as many as 55% of respondents do not use this type of equipment. However, photovoltaic cells and solar panels have been employed. Almost a quarter of respondents indicated solar panels (23%) and photovoltaic cells (22%). This trend should be viewed very positively.

The second group of questions in the survey concerned the role of public finances in the functioning of the surveyed organic farms. The questions focused in particular on public expenditure, but also on non-financial support from the state in promoting organic food. Thus, in the first question, farmers commented on the use of information materials from the Ministry of Agriculture – both those promoting organic farming and the consumption of organic food. A large part of the respondents did not use these materials (81.3%), and 5.5% were unable to comment. Only 13.2% of respondents declared that they used this type of support.

The next questions concerned strictly public expenditure in the field of support for organic farming in Poland. One of the forms of support offered to farmers in Poland is subsidies from the Rural Development Programme. Since the research period fell in 2022, farmers were asked to evaluate the programme for the years 2014-2020, as this is a programme in which they could participate. The next edition of the programme, i.e. the years 2023-2027, will be assessed after its validity period. Of the farmers surveyed, as many as 78% indicated that they participated in the programme, while 22% did not utilise the subsidy.

Then, all farmers were asked to assess the support for organic farming guaranteed under the Rural Development Programme 2014-2020. The responses were very diverse. Only 24% of respondents gave a positive assessment of the subsidies from the programme, while 29% described the support as neutral. On the other hand, 33% expressed a negative opinion on the subsidies for organic farming in the programme, assessing them as bad (25%) or very bad (8%). 14% of respondents did not express their opinion.

Another form of support that farmers in Poland can count on is co-financing for the modernisation of farms, which allows them to develop their farms by purchasing installations that use renewable energy sources. In connection with this, the surveyed farms – those that had previously indicated in response to the question that they use renewable energy installations on their farms (43% of the surveyed, or 39 farms) – were asked to identify the sources of financing for their investments. The vast majority of those surveyed did not use public forms of co-financing for installations – 62% of farms. On the other hand, 33% opted to use state aid, and 5% contributed their own private funds to the state aid. Farmers who undertook investments in installations using renewable energy sources primarily financed their purchases with private funds. Despite the fact that the majority of those surveyed chose to finance these investments themselves, there are still a considerable number of farms that utilised public support, and these results should be viewed positively.

However, all farmers were then asked to assess the financial support offered to them under the Rural Development Programme 2014-2020 in terms of co-financing installations using renewable energy sources. Forty and half per cent of respondents did not express an opinion, which may be related to the fact that the majority of respondents did not utilise the subsidy itself. For the same reason, 17.5% of respondents assessed this type of support at a neutral level. Only 8% of farms expressed their satisfaction. As mentioned earlier, only 38% of respondents used the subsidy; the rest of the respondents did not undertake this type of investment on their farms. The opinions of those who used the support seem to be important, which is why an in-depth analysis of the statements was carried out, selecting the answers of only the group of respondents who used the support. The following connections were obtained: out of 15 people who used the support, nine did not express their opinion and only two assessed the support as good. On the other hand, four people showed a negative

attitude. These statements clearly indicate that farmers do not assess the support in the aforementioned scope positively.

From 2020, which marked the beginning of the COVID-19 pandemic, to 2022, when the war broke out on Poland's eastern border, the economy and agriculture in Poland faced various problems. Most of these issues have an impact on the economic and financial conditions of farms, especially organic ones. Therefore, in the next question, respondents were offered several different forms of public support that, in their opinion, would assist in the management of their organic farms. The proposed fiscal instruments cover not only the expenditure side but also the income side of public finances and are related to tax preferences. In addition to the author's proposal, respondents had the opportunity to express their own suggestions in the open item "other". Of the proposals, the most popular was the increase in the number of direct payments (39% of indications). This result can be justified by the statements of farmers in the previous questions, which concerned the level of assessment of financing under the Rural Development Programme, where the majority did not assess the subsidies positively. The second most frequently indicated proposal is relief for farmers using renewable energy sources on the farm, with 25% of responses advocating such a solution. This is a very high result and indicates that farmers would like to invest in renewable energy sources or have already invested and would like to be appreciated for these activities that are pro-ecological and fall within the concept of sustainable development, directly related to the greening of agriculture in Poland. The respondents were also interested in the introduction of simplified procedures for taking out preferential loans (10% of responses). They also expressed their acceptance for the deferral or cancellation of social contributions (8% of responses) and the shortening of the VAT refund period (7% of responses). The next question will show how many of the farmers surveyed use the flat-rate VAT refund and for whom such a solution would be beneficial. In the open-ended response option, as many as 15 people expressed their proposals.

As a result of the respondents' answers to the last question in this group, it turned out that the so-called "flat-rate farmers" constitute as much as 44% of the sample. That is why they indicated an interest in a shortened VAT refund period. An equally large part of the sample consists of active VAT payers (37%), who settle this tax in a slightly different way than flat-rate taxpayers, and in connection with the amendment to the Act on Value Added Tax from 2022, they can count on additional preferential terms for refunds of overpaid tax. The research sample included 9% of farmers exempt from VAT, and 10% did not demonstrate knowledge of the status of their farm's value added tax.

The last group of issues related to the topic of this paper is the obstacles to the development of organic farms in Poland, with particular emphasis on economic and financial factors. In the first question in this category, farmers were asked to indicate the forms of distribution of agricultural products produced on their farms. Knowledge of the distribution system of organic food products can help suggest solutions supporting organic farms. Among the surveyed farms, direct sales were most frequently indicated (37%). It turns out that many farmers still do not use intermediaries in trade and sell on their own. The offers of wholesalers and intermediaries are used by 29 and 28 farmers, respectively. Twenty farmers, i.e. 12% of the responses, decide to sell at the marketplace. Mail order sales (5%), online sales (4%) and sales to retailers (4%) are still sporadically used forms of selling organic food. Among other forms of sale, farmers declared: "to processing plants", "to other farmers", "no sale", "meat plants", "industrial processing" or "sale to processing plants".

Another economic factor that helps to characterise the market for organic agricultural products is the assessment of the level of demand for these products as formulated by the surveyed farms. Unfortunately, as many as 38.5% of the research sample assessed the level of products sold as low. 36.2% of respondents indicate an average level of sales. Only 20.9% are satisfied with the high level of sales of their products. At this point, it is necessary to remember the subjective nature of the respondents' statements, which could have arisen because they were asked about the level of sales on their farms. These doubts will be dispelled by the answers to the next question, where the respondents will assess the general level of demand for organic food in Poland.

Farmers, as experts in the field of organic food production, unfortunately once again indicated a low level of demand for organic food in Poland (53%). Only 13% indicated a high demand, and 32% of the sample assessed it as average. Taking into account the answers to the previous question, the opinions of farmers in both areas are unfortunately duplicated. A rather pessimistic view of the development prospects of the organic food market in Poland emerges here, along with the associated threat of a decrease in interest in organic farming by potential organic farms.

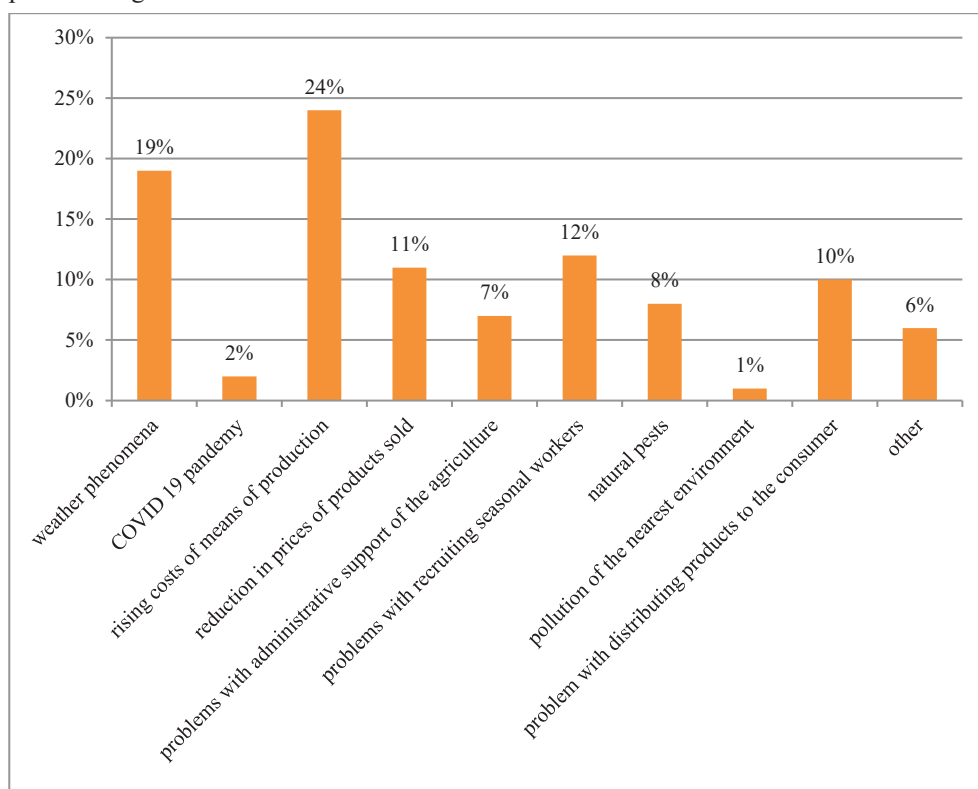


Fig. 1. The biggest obstacles to the development of an organic farm in the opinion of respondents

Source: own elaboration.

In reference to the rather pessimistic situation in the market for organic agricultural products, in the next question, farmers were asked to indicate the greatest obstacles that, in their opinion, hinder the development of their organic farms. The most important problem, in the respondents' view, was the rising costs of means of production (24% of responses), i.e. the economic factor. The second obstacle, as indicated by the farmers, was significant weather phenomena (19% of responses). Unfortunately, this is a factor on which humans have no direct influence. However, it should be remembered that some of the unusual weather phenomena occurring in Poland may be related to climate warming and global issues that are anchored in the concept of sustainable development. The following obstacles ranked as follows: problems with obtaining seasonal workers (12% of responses), reduction in the prices of sold products (11%), problems with the distribution of products to consumers (10%), natural pests (8%) and the COVID-19 pandemic (2%) (Figure 1).

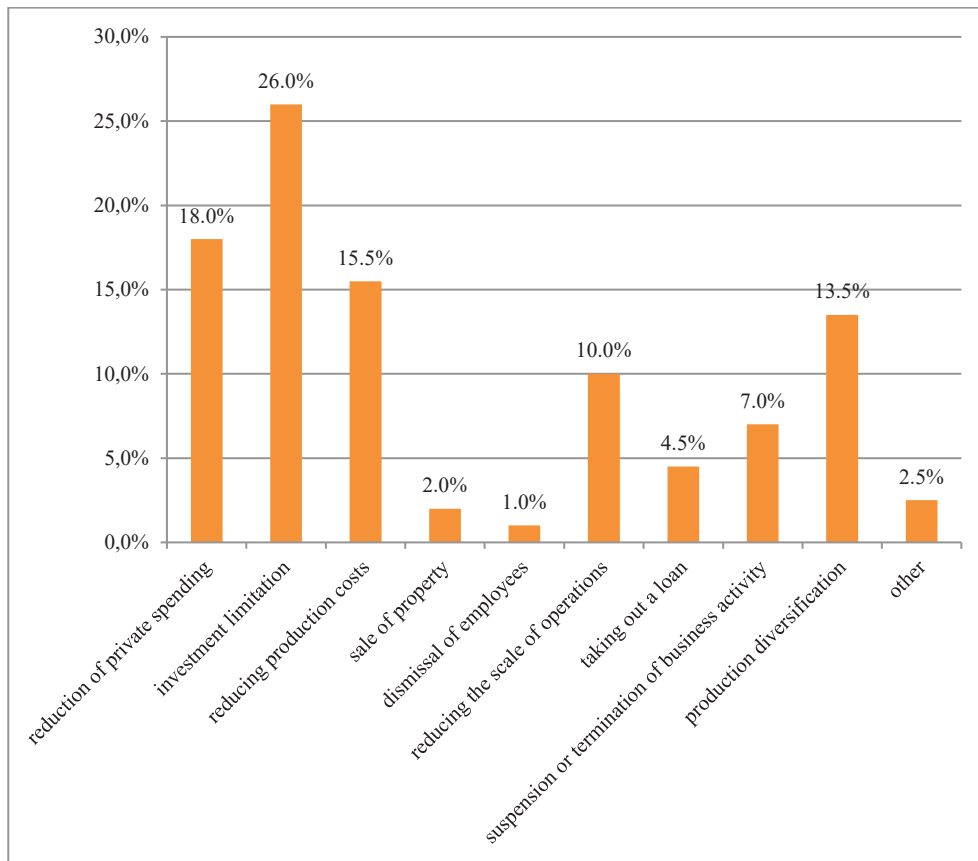


Fig. 2. Methods of coping with obstacles in the development of organic farms in the opinion of respondents

Source: own elaboration.

Having already acquired knowledge about the biggest ecological problems of farms in Poland, in the next question farmers were asked to indicate ways to reduce these obstacles.

Among the options proposed by the author, the most frequently indicated option was investment limitation (26%). This result seems quite rational, because the first action in the face of financial problems, even in a company, is to refrain from investing. In second place, the respondents indicated limiting private expenses (18%) and production expenses (15.5%). The latter option may result in lower yields, and consequently worsening the financial situation of the farmer in the long term. Another way that may help in the difficult situation of the farm is diversification of production (13.5%) or reduction of the scale of activity (10%). It should be mentioned here that diversification of production in each farm can bring many benefits in the overall calculation, and also contribute positively towards environmental protection if only it is practiced in accordance with the principles of sustainable agriculture. Only 15 people out of 91 respondents would decide to suspend or terminate their activity, and 5 people would decide to sell their assets (Figure 2).

Research conducted by the author several years earlier in a similar scope showed that organic farmers indicated low demand for organic food as the greatest barrier to undertaking organic production (42.5% of indications). In turn, they identified excessive bureaucracy (20.2% of indications) and poorly developed distribution channels for this food (18.7% of indications) as the greatest obstacle to the development of the organic food market (Jarczok-Guzy, 2018a, pp. 22-23).

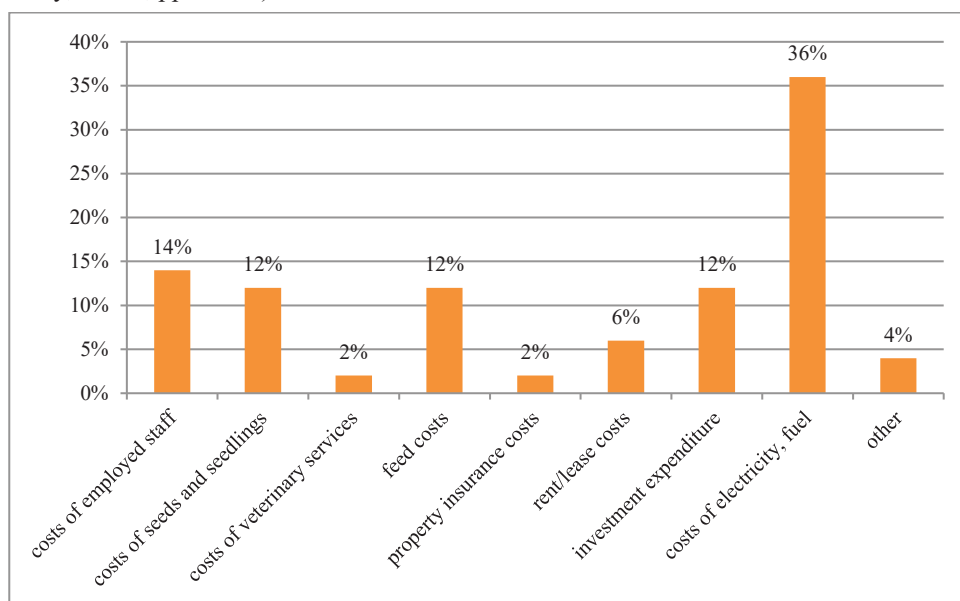


Fig. 3. Costs according to the largest share in the surveyed farms

Source: own elaboration.

The last question regarding the obstacles to developing one's own organic farm concerned the cost structure in these farms. The respondents quite unanimously indicated the costs of electricity and fuels as those that have the largest share in the cost structure in their farms. 69 people and 36% of indications indicate a high rank of the problem. Therefore, taking into account the increase in electricity prices in 2023 and the opinions of farmers, their

statements here are very justified. However, it is necessary to remember the actions of the Polish government, which at the beginning of 2023 mitigated the effects of the increase in electricity prices for individual groups of recipients, with particular emphasis on farmers, by introducing an increased limit of electricity consumption to 3000 kWh [<https://www.tauron.pl/zamrozenie-pradu>]. And this factor is the biggest financial problem for Polish farmers, probably not only organic ones. However, the above-mentioned government interventions should be indicated here as an example of the positive impact of state policy on the functioning of organic farms. The costs that received much fewer percentage points in the indications were the costs of employed staff (14%), the costs of seeds and seedlings (12%), the costs of feed (12%), investment expenditure (12%), lease costs (6%) and the costs of veterinary services (2%) and property insurance costs (2%) (Figure 3).

Discussion/Limitation and future research

According to research by Brelik, Gołębiewska and Franc-Dąbrowska the area of arable land occupied by organic farms in individual European Union countries varies and ranges from less than 0.5% in Malta to about 25% in Austria. Poland with a share of slightly over 3% belongs to countries with a low share of such area. In addition, the number of organic producers who actually produce and deliver to the market has decreased in recent years. This indicates that some of these farms were not involved in production for the market, but only collecting subsidies. Therefore, a better organisation of support is needed to ensure subsidies for those farms that provide organic food in real terms. Co-financing is also needed to promote organic food and educate consumers, because in order to produce, demand must be guaranteed. The growing consumer awareness has been reflected in market results for several years. The area of ecological land in the EU has increased in all the countries except for Poland and the UK, and therefore, the ecological products find the buyers. That is why it is generally expected in the EU that the area of ecologically used land will grow in the coming years. The organic sector responds to the growing demand for sustainable food production, and as such it perfectly fits into the objectives of the CAP (Brelik et al., 2020). Another study, made for Chinese agriculture revealed that subsidy policies should be implemented and the development of organic agriculture should be encouraged. The survey results showed that economic benefits have a significant impact on organic agricultural production behavior. The adoption of organic production technology has led to increased costs, yet income has not increased enough in the short term to compensate for the loss of income. The government can reduce the production costs for farmers and guide their organic production behavior through financial subsidies, encouraging farmers to join the new business market and facilitating the development of local brands and the certification of organic products (Zhou and Ding, 2022).

The biggest limitation in the conducted study is the specificity of agricultural activity. Individual variables were selected and compared with features from the metrics in an attempt to check the relationship between selected features. The sets of selected variables are presented in Table 3. Independence tests were performed for the significance level $\alpha = 0.01$.

Table 3. Results for χ^2 test

No.	Feature X	Feature Y	χ^2	Df	$\chi^2_{0.01}$
1.	Obstacles to farm development	Age of farmers	9.919516	32	53.4858
2.	Receiving subsidies for organic farming	Farm area	8.682939	5	15.0863
3.	Receiving subsidies for organic farming	Age of farmers	4.128820	4	13.2770
4.	Using renewable energy sources	Age of farmers	2.894839	4	13.2770
5.	Using renewable energy sources	Farm area	5.761194	5	15.0863
6.	Support for farmers for investments in renewable energy	Age of farmers	5.578519	16	31.9999
7.	Assessment of support for organic farming	Age of farmers	6.280502	12	26.2170
8.	Assessment of support for organic farming	Farm area	8.339647	20	37.5662

Source: own elaboration.

The calculations carried out clearly show that no dependencies were detected in any of the adopted sets of features. The biggest obstacle to conducting research on a group of farmers is limited access to them and the specifics of their work. They are reluctant to participate in research. It would be beneficial to conduct the author's research on a larger research sample and check the results in 2 years when the next perspective of Rural Development Programme funding ends.

Conclusions

The conducted study provided knowledge on the attitude of Polish organic farmers towards pro-ecological activities and allowed us to learn about the assessment of the financing system for greening agriculture in their opinion. The most important conclusions provided by the analysis of the obtained results can be presented as follows:

- Farms are reluctant to use renewable energy sources on their farms.
- Biomass is generated in many organic farms.
- Most organic farms do not use installations using renewable energy sources.
- Most organic farms benefited from subsidies under the Rural Development Programme 2014-2020.
- Farmers who decided to invest in installations using renewable energy sources mostly finance purchases from private funds.
- The most expected form of support for organic farms by farmers is an increase in the amount of direct payments.
- The biggest obstacle to the development of organic farms in Poland is the rising costs of means of production.

These conclusions contribute to the confirmation of the adopted hypothesis. Organic farmers directly admitted that they expect an increase in the amount of financial support.

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