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## Support of Eco-innovation Projects in Agriculture: Case of Poland

**Abstract.** The study attempts to investigate Polish practices to support the eco-innovation in agriculture that ensure the sustainable development of the sector. The specificities and barriers to eco-innovative activities of agricultural enterprises were defined. The paper focuses on the analysis of the supporting mechanism of eco-innovation in Polish agriculture both on national and EU's levels. Using the factor and SWOT analyses, the author determines the effectiveness, opportunities and challenges of Polish support of agri-ecological innovation. The relationships between the eco-innovative indicators and the level of support for farmers are also shown.

**Key words:** eco-innovation, agriculture, support, Poland

### Introduction

Nowadays, development through innovation is crucial both for economic growth and long-term economic sustainability. Innovative development is one of the main factors providing international competitiveness of an agricultural sector of national economies, but eco-innovation in agriculture is currently a neglected area. As a whole, agriculture is a sensitive sector of the economy which faces various problems among which economic crisis, flagging rural development, climate change and environmental degradation. These problems have been observed in all countries all over the world, moreover, they do not depend on the level of economic development. Thus, agriculture requires a balanced government policy and state support. Now we can see the increasing role of the adoption of eco-innovation for environmental protection, sustainable development, implementation of international treaties as well as for the provision of international competitiveness. Therefore, the EU current growth strategy – Europe 2020 – stresses the importance of eco-innovation in agriculture. Under the new EU framework, known as the Innovation Union, the EU implements a complex approach to this sphere via reforming the Common Agricultural Policy (CAP) towards the ecologization of agriculture, realizing the Rural Development Policy and creating the European Innovation Partnerships that will promote knowledge transfer for agricultural productivity and sustainability.

The Polish government also regards eco-innovation as part of the growth strategy of the national economy, but researchers noticed that in practice, however, these goals are not treated as priorities, and the institutions supporting the development of agriculture consider environmental issues to be of secondary importance (Kassenberg, 2015). But nowadays Poland has a wide range of possibilities for both conducting a research and introducing eco-innovation projects in agriculture. Thus, the goal of presented paper is to make an attempt to investigate Polish practices to support the eco-innovation in agriculture that ensure the sustainable development of the sector.

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## Objectives

The main objective of the paper is to investigate the support of eco-innovation activities in Polish agriculture under the European Innovation Partnership. Poland has a well-developed agriculture sector, which is one of the fastest growing sectors of national economies among the UE members, and in the frame of the Common Agricultural Policy (CAP) and the European Innovation Partnership the country receives the most funds, a significant portion of which is aimed at the eco-innovative development of agriculture. But nowadays, according to the Eco-Innovation Scoreboard, Poland is on the penultimate position among the EU members with the result of 59 points in 2015 (Eco-innovation index..., 2016). Only Bulgaria is rated worse.

Analyzing the results of the eco-innovation index in terms of individual groups of indicators it can be noted that the relatively strongest area of Polish innovation is the area of social and economic effects resulting from the introduction of eco-innovation (20<sup>th</sup> position) and the achieved results (23<sup>rd</sup> position). In the other three areas – expenditures on eco-innovation, eco-innovation activity and achieved environmental effects Poland takes the 26<sup>th</sup> position (Wskaźniki..., 2016).

Polish disadvantageous position in the eco-innovation ranking could be explain by many factors especially various kinds of barriers, among which are the lack of financial provision of agricultural producers and consumers, insufficient awareness of farmers' benefits from adoption of eco-innovation projects, low state support of eco-innovation, low level of funding for R&D activities, mental opposition to the innovation changes.

Thus, other objectives of presented research are:

- to explore the barriers to the adoption of eco-innovation and analyse the mechanism of support for eco-innovation projects in Polish agriculture;
- to determine the problems and possibilities of the eco-innovative development in Polish agriculture.

## Research methods and material

There are many different approaches to analysing eco-innovation in agriculture. Proposed study focuses on the specific features of supporting policy used to map interactions in agri-ecological innovation under the European Innovation Partnership as well as the linkages to the eco-innovative performance of practitioners and policy-makers. It is also important to identify the barriers that affect, reject and diffuse eco-innovations in agriculture. Using the factor and comparative analyses on data for special indicators, we estimated the effectiveness, opportunities and challenges of Polish support of agri-ecological innovation, and determined the directions eco-innovation policy in agriculture. At the same time, specific analyses was paid to deepening the understanding of certain areas of agri-ecological innovation, such as institutional linkages, financial support, the main constraints to the adoption of innovations in agriculture. The correlation analysis was used to find the relationships between the eco-innovative indicators and the level of support for farmers. The SWOT analysis allowed to identify the key factors determining the effectiveness of Polish support of eco-agricultural projects.

Data used for the analyses is taken from the database of the Central Statistical Office in Poland, the Ministry of Agriculture and Rural Development of the Republic of Poland,

and the Eurostat official statistics. Information base of paper is based on Polish laws and regulations in innovation, agricultural, and environmental policies, regulatory framework of the EU, scientific publications.

### **Specificities and barriers of eco-innovative activities in Polish agriculture**

The reducing of negative impact of economic activities on the environment is the most important task for both government and farmers, and should include the implementation of environmental and resource-saving technologies in agriculture, provision of environmentally friendly rural development, adoption of eco-innovation projects, promotion of eco-innovative activities, and, consequently, the transition to sustainable development of agriculture as a whole.

A lot of studies indicate that the most significant barriers to eco-innovation in Poland are mainly of an economic nature, including high cost of implementation, difficult access to capital, uncertain return on investment and the weak system of economic and fiscal incentives encouraging eco-innovation (Eco-innovation in Poland, 2015; Rynek..., 2010; Klinecicz, 2013). No debt, eco-innovative development of agriculture and environmental projects adopted by the farmers require significant financial costs. The problem is that environmental innovation is a subject of fundamental uncertainty: only a part of eco-innovations will be successful in terms of solving the environmental problems as originally articulated (Buddelmeyer, 2010). However, farmers are finding it more difficult to get support from their government, especially to gain access to financial and credit support of their eco-innovation projects because of large-scale, long-term and high risks of implementation of eco-innovation projects in agriculture. Than farmers usually do not have free running costs to finance the expensive eco-innovation projects. In addition, they are reluctant to adopt new eco-innovations because of the lack of the motivation, especially financial motivation. Thus, virtually the only way out of this situation is to introduce a mechanism of the state support of eco-innovative activities based on existing instruments of financing the innovative development of agriculture. That is why it is advisable to reorient from the direct budget financing of eco-innovation projects to the indirect government and fund support of the eco-innovative development of agriculture. Moreover, the scientists point that if the model of intensive high production farming is supported, the result will be a deepening rift between the necessity to preserve sustainable agricultural production and the environmental consequences that result from high-income farming activities (Kassenberg, 2015).

The eco-innovative activities in Polish agriculture are connected with a meaningful group of administrative barriers. The study confirms the opinion presented in different sources (Kassenberg, 2015; Jasiński, 2013). that the insufficient cooperation between the administrative institutions supporting the development of agriculture, public entities responsible for achieving environmental protection goals, and the farmers leads to the avoiding the eco-innovative activities by farmers and to the reducing the number of the adopting eco-innovation projects. In addition, the continuous changes in legal regulations (several times during the 2004-2016) and poor integration of the objectives of agricultural and environmental policies are slowing down the eco-innovative development in agriculture.

In the case of Poland, the progress in the eco-innovative development of agriculture meets with some specific barriers, the biggest of which is the mentality and habits of the rural population (Popławski, 2015). But in addition to the mentioned problems it can be pointed also a problem of the ageing of the rural population, and, therefore, the opposition of it to the adoption of new technologies and new approaches to the farming.

### **Analysis of national and EU's support of eco-innovation in Polish agriculture**

Institutional support of the eco-innovative development of Polish agriculture is carried out at EU's and national levels and is outlined in the strategic documents, which define the priorities of economic development for the coming decade. The EU's growth strategy Europe 2020 has set the ambitious objectives for Member states in the middle-term period. The innovation and environmental protection are among the most important goals to be reached by 2020 (Europe 2020..., 2010). Poland also has adopted its own national targets in the field of eco-innovation in agriculture. The medium-term National Development Strategy 2020 is based on the EU's strategy and foresees, firstly, the smart growth based on knowledge and innovation, secondly, the sustainable growth through the support for an effective, more competitive, resource-saving and environment-friendly agriculture (Strategia..., 2012).

It should be noticed that the main directions and instruments in state support policy were taken within the framework of the CAP and the EU now funds the most of the innovation projects in Polish agriculture toward ecologization, improving competitiveness and sustainability. Facing these challenges the EU pursues three objectives through the CAP (Agricultural...):

- Securing viable food production;
- Ensuring sustainable management of natural resources and climate action;
- Contributing to a balanced territorial development.

Now in Poland eco-innovation defined projects in agriculture are financed mainly by two funding streams: Research and innovation framework – Horizon 2020 (providing the research & innovation), and the Rural development policy (innovation).

Under the Horizon 2020 eco-innovation projects are expected to help with the following (Agricultural...):

- Improving production efficiency and coping with climate change, while ensuring sustainability and resilience;
- Providing ecosystem services and public goods;
- Empowering rural areas and supporting policies and rural innovation;
- Fostering sustainable;
- Developing a sustainable and competitive agri-food industry;
- Support market development for bio-based products and processes.

All of these directions foresee the implementation of eco-innovation projects in agriculture which will be co-financed from national funds and the EU funds available in this period.

It should be noticed that the EU nearly doubled its efforts with an unprecedented budget of nearly 4 billion euros allocated to Horizon 2020's Societal Challenge 2 'Food

security, sustainable agriculture and forestry, marine and maritime and inland water research, and the bioeconomy” (Agricultural...). Aside from Societal challenge 2, several parts of Horizon 2020 are of interest to eco-innovation in agriculture.

In synergy, the EU has set “Fostering knowledge transfer and innovation in agriculture, forestry and rural areas” as the first priority for Rural development policy 2014-2020. Rural Development Programmes will finance agricultural eco-innovation through several measures which can support the creation of operational groups, eco-innovation services, investments or other approaches. The sources of financing of eco-innovation projects in Poland consist of two groups on EU’s and national levels and are presented in Table 1.

Table 1. Sources of financing of eco-innovative activities within the Rural development policy in Poland

Rural Development Programme for 2014-2020	Polish national sources of funding of eco-innovative activities
Cooperation	National Centre for Research and Development
Knowledge transfer and information actions	Polish Agency for Enterprise Development
Technical Support	Regional Operational Programmes
Other activities and operations within the Rural Development Programme 2014-2020	Operational Program Development of Knowledge Education PO Intelligent Development PO Eastern Poland

Source: author’s own elaboration.

Currently, the evaluation of the effectiveness of the Rural Development Programme 2014-2020 is not possible, since the Programme now is still going on. Therefore the study is based on EU’s rural development policy for the previous period. We investigate support measures under the Rural Development Programme for 2007-2013 and analyze their impact on the development of eco-innovative activities of Polish agricultural enterprises in the mentioned period. Figure 1 shows the proportion of funds shared between Polish voivodeships within the Rural Development Programme for 2007-2013. It is necessary to emphasise on the unequal distribution of funds, which was one of the major determinants of the eco-innovative development of agricultural sector in every voivodeship. A similar tendency is observed in the case of the Rural Development Programme for 2014-2020.

The greatest number of agricultural enterprises which adopted eco-innovations was concentrated in Western Pomerania and Warmian-Masurian voivodeship. Also, these voivodeships were occurred by the largest share of agri-environmental payments. In general, the Rural Development Programme for 2007-2013 foresaw about 2 mln 300 thousand euros to implement measures related to the environmental protection.

The preliminary visual analysis of the statistical databases suggests the positive relation between some economic indicators related with the eco-innovative activities of agricultural enterprises and the level of support for farmers under the Rural Development Programme for 2007-2013. The correlation analysis (with the correlation index of 0.65 as a result) confirmed the assumed hypothesis that there exists a significant positive relationship between the share of agri-environmental payments in Polish voivodeships and the number of agricultural enterprises which adopted the eco-innovations.

Thus, according to the analysis, the development of the environmentally friendly economic activities in Polish agriculture is more dependent on the level of payments within the framework of the EU Rural Development Programme, than on the funds under the

Polish national agriculture and rural development policy. This is not surprising because the results of previous evaluation of the realization of agri-ecological measures [Horin 2014] showed that just due to the implementation of the EU Rural Development Programme Poland was able to provide financial support for the environmental development of agriculture and rural areas as well as Polish farmers has received financial motivation for the implementation of eco-innovation projects into the business.

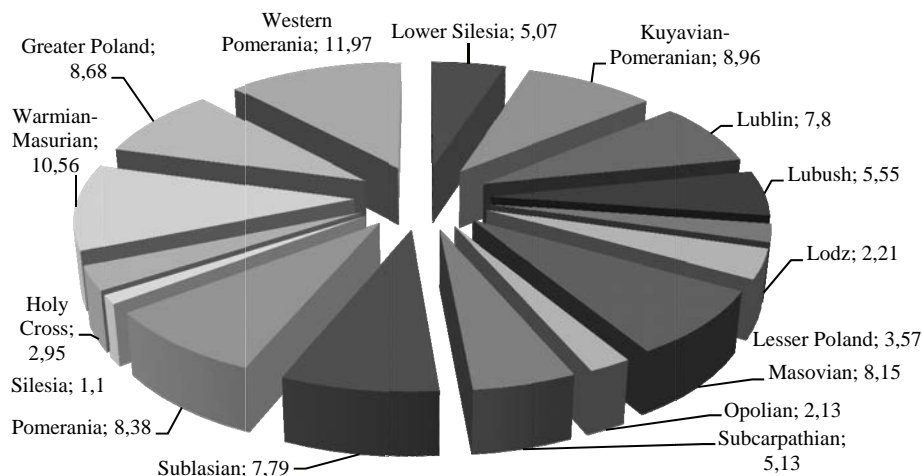


Fig.1. Allocation of funds provided by the Rural Development Programme for 2007-2013 for agri-environmental measures, %, per voivodeship of Poland

Source: own calculated on the basis of the official statistic data available from : <http://www.minrol.gov.pl/pol/>.

According to factor analysis, based on the data of Central Statistical Office of Poland, the main features of eco-innovative activities of agricultural enterprises are the following:

- 1) Most eco-innovative projects are introduced by the large enterprises which employing more people;
- 2) The participation of micro-enterprises in the adoption of eco-innovation projects is small but it slowly increases every year;
- 3) In the period of favourable economic conditions the farmers, being supported by the government, often decide to incur additional costs related to the adoption of new eco-innovation technology or product.

SWOT analysis was constructed to support the policy-makers in determining and strategic planning the goals, directions and methods of eco-innovative development and funding eco-innovation in Polish agriculture. The presented in table 2 analysis allows to evaluate the strengths, weaknesses, opportunities and threats of eco-innovative progress in Polish agriculture, and in future will help to identify the most effective policy instruments and investments to promote the innovative behaviour and practices in an agricultural sector of the Polish economy.

Table 2. SWOT analysis of eco-innovation in Polish agriculture

<p style="text-align: center;"><b>Strengths</b></p> <ul style="list-style-type: none"> <li>- Access to the funds within the framework of the EU programmes</li> <li>- The priorities of agri-ecological methods of farming in the state support programmes</li> <li>- Attraction of foreign direct investment for new eco-innovation projects; high investment attractiveness of particular sectors of agriculture</li> <li>- Great potential for organic food production</li> <li>- Wide range of higher educational and research institutions which work in the field of ecologization of agriculture and rural development</li> </ul>	<p style="text-align: center;"><b>Weaknesses</b></p> <ul style="list-style-type: none"> <li>- Slow development of mechanisms for knowledge transfer and cooperation between farmers and scientific research and advisory services</li> <li>- Insufficient awareness of the needs of agri-ecological innovation and improvement of knowledge</li> <li>- Low level of farmers' income</li> <li>- Low level of eco-innovative motivation of farmers</li> <li>- Low shares of expenditure both on R&amp;D and on eco-innovative activities of agricultural enterprises</li> <li>- Slow development of organic food market</li> </ul>
<p style="text-align: center;"><b>Opportunities</b></p> <ul style="list-style-type: none"> <li>- Increasing of the environmental awareness and knowledge of farmers</li> <li>- Organic farming</li> <li>- Reducing of gas emissions, among others, by promoting investments to reduce power consumption, increase production and use of renewable energy sources as the result of the rational use of fertilizers</li> <li>- Development of the innovative forms of cooperation and relationships between the farmers, the farmers and consumers, the farmers and supporting institutions</li> <li>- Cross-border cooperation with the neighbouring countries in the matters of realization of eco-innovation projects</li> </ul>	<p style="text-align: center;"><b>Threats</b></p> <ul style="list-style-type: none"> <li>- Increased competition, especially with agricultural producers from Eastern Europe</li> <li>- Non-sufficient professional competence of farmers</li> <li>- Low level of R&amp;D expenditure</li> <li>- Reduction of the expenditure on eco-innovative projects in agriculture</li> <li>- Deepening of the economic inequality in the development of some voivodeships due to their uneven funding within the eco-innovation programs</li> <li>- The ageing of rural population, and, therefore, the opposition of it to new technologies</li> </ul>

Source: author's own elaboration based on the materials of the Ministry of Agriculture and Rural Development of the Republic of Poland, Horizon 2020, the EU Rural Development Programme for 2014-2020, Rural Development Programme for 2007-2013, and on author's own study.

## Conclusions

In this paper we examine the organizational and economic mechanism of Polish support the eco-innovation projects in agriculture. There is no doubt that the adoption of the environmental technologies in the agricultural sector, implementation of EU's and national laws in the field of ecologization, cooperation between the farmers and policy-makers will lead to sustainable development as well as the provision of international competitiveness of the economy as a whole. But the eco-innovation in Polish agriculture meets the number of constraints, which have mainly economic, administrative and mental character. The study indicated that the most significant barriers are the following: high cost of the adoption of eco-innovation projects; difficult access to capital for farmers; uncertain return on investment; weak system of economic and fiscal incentives; insufficient cooperation between the administrative institutions, public entities, and the farmers; continuous changes in legal regulations; poor integration of the objectives of agricultural and environmental policies; mentality, habits, and aging of rural population.

Evaluation of the institutional support of the eco-innovative development of Polish agriculture showed that supporting policy is carried out at EU's and national levels which both declared the innovation and environmental protection as the most important goal to be reached in the medium-term outlook. The sources of eco-innovation financing foresee the

joint financing from national and EU's funds mainly under the Horizon 2020 and the Rural development policy. The estimation of effectiveness of the Rural Development Programme showed the unequal share of funds between Polish voivodeships, that has determined the differences in the adoption of eco-innovation projects by the farmers from different regions of the country. Therefore, the analysis confirmed the positive relationship between the share of agri-environmental payments in Polish voivodeships and the number of agricultural enterprises which adopted the eco-innovations. Also, it was found that the development of the eco-innovation activities in Polish agriculture is more dependent on the payments within the framework of the UE's support programs than on the funds under the Polish national supporting policy. For the future implementation of more effectiveness supporting measures, we defined the strengths, weaknesses, opportunities and threats of eco-innovation in Polish agriculture.

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