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INNOVATION IN A PRODUCER GROUP FOCUSED ON MILK PRODUCTION OF THE SILESIAN PROVINCE

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Abstract. *The aim of the work was to analyse the level of innovation in the group of milk producers and production efficiency. The work covered its scope with the producer group established in 2010, which brings together six producers of cow's milk. The farms are run based on a conventional production system. The source data used in the analysis covers the years 2010-2017. The analysis covered the number of implemented innovations, the type of innovation and the level of expenditures borne by producers for introducing the innovations. Based on the results obtained, the relative benefits achieved by the producer group resulting from the introduction of innovative solutions were determined.*
Keywords: *agricultural production, innovations producer groups.*

Introduction

Agriculture and rural areas play an important role in achieving the objectives contained in the Europe 2020 document, which includes a specific long-term programme of socio-economic growth of the European Union (European Commission, 2016). The programme has three interrelated priority areas such as: introduction of sustainable development, smart growth and social inclusion. At the same time, within it, a great emphasis was placed on promoting innovation. The introduction of innovative solutions in the agricultural sector is necessary for the sustainable development of agriculture and the achievement of food safety (Gródek-Szostak, Szeląg-Sikora, Sikora, & Korenko, 2017; Kuboń & Krasnodębski, 2010). In addition, along with the strong growth in global demand for food, there is a need to increase the volume of production produced by farmers.

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In the Polish agriculture, the majority of farms are small economic entities, most often managed by natural persons, in which the owner's and the family's own work have the largest share in the total structure of work inputs. These are farms, the income of which is too small to be the sole source of income for members of the farm. This means that the owners of this type of farms do not have free capital from income generated by agricultural production. The effect of this is the lack of funds for the implementation of innovative solutions. The situation is different in the case of large farms, the income from which makes it possible to invest fixed assets or to introduce ways of acting defined as carriers of innovation (Niemiec, Mudryk, Sikora, Szeląg-Sikora, & Komorowska, 2018; Sikora, Niemiec, & Szeląg-Sikora, 2018; Szeląg-Sikora & Rorat, 2018).

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Work methodology

The tests carried out to obtain information were made by using the interview method. Members of the producer group surveyed received an interview questionnaire in which they were asked to provide answers on innovations introduced to affiliated farms from 2010 to 2017. In addition, the research was supplemented with data enabling detailed characterization of the producer group in terms of production efficiency. The work assumes that the innovation is all the changes that occurred for the first time in the producer group in the analysed period, regardless of whether they were new (Gródek-Szostak, Szeląg-Sikora, Sikora, & Korenko, 2017; Carmen, Muñoz-Bullónv, Sanchez-Bueno, & Ricart, 2018; Zasada, 2011).

Direct surplus from plant / animal production (PLN thousand·ha^{-1}AL). It is the value of production that has been achieved from one hectare of crop or from one livestock per year. This value is reduced by direct costs that have been incurred to produce this production and at the same time increased by the amount of subsidies received from the European Union funds for plant products, land or livestock (Szeląg-Sikora, Niemiec, & Sikora, 2016).

Innovation in group for agricultural

Joining groups for agriculture has become a leading source of innovation (Carmen, Muñoz-Bullónv, Sanchez-Bueno, & Ricart, 2018; Szeląg-Sikora, Niemiec, Sikora, & Chowaniak, 2017). At the end of the twentieth century, the

mere official assumption or joining a working producer group was treated as a social innovation. Currently, the level of innovation of a group or organization is demonstrated above all by the quantity and scope of implemented technological and non-technological innovations (Kuboń, Sporysz, & Kocira, 2017). In accordance with the European Union's policy, innovations have always laid foundations for the development and operation of both business entities and public organizations. In order to increase the innovativeness of the EU and create a single innovation market, European Innovation Partnerships have been established - EIP (European Innovation Partnerships), which are based on cooperation of many public and social entities as well as private entities. The introduction of innovations on Polish farms has therefore become necessary due to EU requirements regarding adaptation of state agriculture to EU standards and principles of functioning in a competitive European market (European Commission, 2016). This applies not only to the implementation of product innovations but also to the organizational process and marketing (Downey, 1996; Kuboń & Olech, 2018). The variety of activities affects the situation that they usually go beyond the possibilities of individual farms; therefore, to implement them, it is important to establish cooperation between various entities both in agribusiness and beyond (Bechev, 2004; Kuboń, Sikora, Olech, & Szeląg-Sikora, 2018; Yook, Choi, & Suresh, 2018). Glasbergen (2018) argued that agricultural innovations are all emerging new ideas, concepts and ideas, the creation of which consequently affects the improvement of production processes, work carried out around the farm and household, and all kinds of machines that facilitate the work or increase its effectiveness. Innovations in the agricultural sector can be divided into two types. The first type of novelty in agriculture is simple innovations, which include, for example, the purchase of individual machines or tools. Most often, the implementation of simple innovations does not require the use of many different means of production, other treatments, additional calculations and development of projects. The introduction of the second type of activity, i.e. the so-called composite innovation, is a process requiring a more comprehensive operation in these areas. An example of this type of innovation is the introduction of a new crop for the first time on the farm. The complexity of such innovations is connected with forcing the farmer to apply new agrotechniques, and often to purchase new equipment for growing and harvesting this plant. However, this type of innovation has a greater impact on improving the conditions in which a farmer manages and operates the farm (Carmen, Muñoz-Bullónv, Sanchez-Bueno, & Ricart, 2018; Yook, Choi, & Suresh, 2018).

According to the Central Statistical Office, animal production is considered a process during which plant products are processed into animal products. Bovine production, which includes milk and beef livestock, is in a dominant position in animal livestock production. In the years 2000-2010 its share in total commodity

production was at the level of about 43% and showed a slight upward trend (Sikora et al., 2017). After Poland's accession to the European Union, the requirements for milk producers were tightened. These exacerbations were primarily related to the standards of obtaining milk and animal welfare. In 2004, about 737 thousand farms kept cows, while the total number of cows was 2.8 million. Due to the need to adapt to EU standards, the rate of concentration of dairy cattle stock has accelerated after 2002. In order to meet the sanitary and veterinary standards, the farmers had to modernize the production facilities, which brought high costs. As a result, some farms gave up milk production. After Poland's accession to the EU, the process of concentration and intensification of milk production began in Poland (Szeląg-Sikora, Niemiec, & Sikora, 2016; Zasada, 2011). The number of farms that maintained 1-2 cows, i.e. mainly the farms that produced milk for their own needs, decreased by as much as 57%.

Results and discussion

The surveyed group of agricultural producers obtained an entry in the Register of Agricultural Producers Groups of the Silesian Province in the product group: cow's milk on March 4, 2010. Farms in the producer group include the farms specialized in the production of cow's milk. It consists of six dairy farmers who together have about 290 dairy cows. During the year, about 1,700,000 litres of milk are obtained from all farms. On all the farms that belonged to the studied group, a similar degree of organization was observed, for both animal and vegetable production, which constitutes animal nutrition. In the entire production group, the largest area of agricultural land was taken up by grassland (meadows and pastures) and arable land, where the dominant crops for fodder for bred cattle were fodder plants (maize cultivated for green fodder) and cereals with a predominance of winter wheat. The average area of the holding in the group was about 57 ha of agricultural land and the stock of livestock 1.11 LSU·ha^{-1} UR (LSU - Livestock Unit).

Table 1 presents the balance of direct surplus. The average value of plant and animal gross production in the producer group was 10.41 in (PLN thousand·ha^{-1}AL). It should be noted that the average value of animal production was 8.07 (PLN thousand·ha^{-1}AL), which was more than three times higher than the average value achieved by the group from crop production, 2.38 (PLN thousand·ha^{-1}AL).

Table 1 ***Balance of direct surplus for the producer group under study (PLN thousand·ha^{-1}AL)*** *(own study)*

Specification	Parameter			
	min.	average	max	standard deviation
Final gross production				
plant	2.14	2.38	2.64	0.19
animal	6.53	8.07	9.84	1.74
Total	8.74	10.41	12.48	1.95
Direct expenditure on production				
plant	0.18	0.41	0.71	0.20
animal	1.46	2.26	2.80	0.49
Total	3.43	4.23	4.95	0.49
Direct surplus from production				
plant	1.78	1.97	2.24	0.19
animal	4.88	6.07	7.51	1.07
Total	4.94	6.22	7.78	1.20

When comparing all the farms included in the group, it can be noticed that the gross final production value in the case of crop production was less diverse than the value of animal production. The total gross output was affected, among others, by way of feeding dairy cattle (silage, fodder) and expenditures incurred additionally to improve the milk yield of cows. In both groups of expenditures, the highest costs were generated by animal feed, apart from which the purchase outlays were also added costs incurred for treatment and insemination, on average amounting to approximately PLN 2.26 thousand ha^{-1} AL. The maximum expenditures borne by the producer group amounted to PLN 4.95 thousand ha^{-1} of AL, of which over 56% were costs resulting from animal production.

The average value of direct surplus obtained from crop production and direct payments per 1 ha AL in the producer group was at a similar level for all the farms included in its composition. It did not exceed 2.24 (PLN thousand·ha^{-1}AL). Similarly, as in the case of gross final production, slight deviations between the surplus values obtained on the farms resulted from small differences in the type of crops cultivated.

Innovations implemented on the farms belonging to the studied producer group have been divided into three areas. These are innovations introduced in the plant production field, livestock production and innovations related to the economics and organization of the farms.

Table 2 ***The level of introduced innovations in the studied producer group in the years 2010-2017*** *(own study)*

Singular	Specification	Innovation	
		Number	(%)
1.	Plant production		
1.1.	New fertilizers	6	23.1
1.2.	New species and varieties	6	23.1
1.3.	New plant protection products	4	15.4
1.4.	New machines and tools	9	34.6
1.5.	New comprehensive technologies	1	3.8
1.6.	Total plant production	26	100
2.	Animal production		
2.1.	Increasing the livestock population	7	6.9
2.2.	Purchase of breeding animals	74	73.3
2.3.	New content feeds and mineral supplements	5	5.0
2.4.	Maintenance of own feed	2	2.0
2.5.	Purchase of a milking machine or cooler	3	3.0
2.6.	New hygiene products	3	3.0
2.7.	Modernization of livestock rooms	7	6.9
2.8.	Total animal production	101	100
3.	Economics and organization		
3.1.	Increased area of farms	3	21.4
3.2.	Change in the cropping pattern	3	21.4
3.3.	Using loans	5	35.7
3.4.	Introduction of new accounting and calculation systems	1	7.1
3.5.	Introduction of new computer technology	2	14.3
3.6.	Total economics and organization	14	100

For the first time, fertilizers, new species and plant varieties, plant protection products, new machines and tools as well as complex technologies that were not previously used were considered as the innovations applied in crop production in the studied producer group. The analysed results (Table 2) show that the largest number of implemented innovations concerns the use of new equipment (machines, tools). The farmers, despite the high prices of machines, most often decided to increase the common machine fleet, realizing that the use of new machines and equipment in the production process would significantly improve the conditions of functioning and management of the whole group. The farmers eagerly benefited from financial support, EU subsidies earmarked for this purpose. Being associated in the producer group, they also had greater opportunities to negotiate advantageous prices compared with farmers running individual farms. From 2010 to 2017, in plant production, more than 34% of innovations referred to the emergence of a producer group with new machines and

devices, while only 3.8% were innovations for which we recognize the use of new comprehensive technologies. Looking at the structure of plant production innovations, it should be noted that over 23% of the changes in the producer group under study concerned new varieties and plant species as well as the use of new fertilizers. The surveyed agricultural producers declared that they were trying to exchange seeds regularly and use better quality fertilizers. Relatively often, their farms also supplied new plant protection products (15.4%). It can be concluded that this behaviour of farmers was dictated by the desire to achieve the highest possible yields of high quality, which in turn was to translate into the achieved profit. The next section (Table 2) in which innovations appeared was animal production. In this case, they concerned: increasing the livestock population, buying new breeding animals, buying new concentrated feeds and mineral additions from the outside, maintenance of their own feed, purchase of milking machines, coolers, hygiene products and the modernization of livestock rooms. Among those listed, the purchase of breeding arts was significantly different. Innovation of this kind accounted for as much as 73.3% of all introduced as part of animal production, while the increase in livestock constituted only 6.9% of innovation. On this basis, it should be concluded that the farmers did not significantly increase the number of holdings held by their farms, because it would generate too high costs. In order to achieve better breeding results, the surveyed members of the producer group declared that they modernized the livestock rooms at their disposal, but the analysis shows that this change accounted for less than 7% of all innovations in animal production. The changes in animal nutrition were also at a similar level (5%). In economics and organization, the most common changes related to the use of loans (35.7%). The farmers more willingly than before decided to take out a loan and invest the borrowed money into the development of the farm (purchase, machinery, land, modernization). Acting in the producer group, they received more favourable terms on the credit agreement than acting alone. Decisions on taking out loans were also often made due to the possibility of receiving subsidies for interest on loans taken out for trading purposes on general terms. The data provided indicate that 14.3% of innovations related to the organization of agriculture were the introduction of new computer techniques. Computers in the studied producer group are used to keep records of economic and financial operations. New computer techniques are used by the group members in the planning process of technological, economic and financial processes taking place on their farms. The results presented in Table 2 indicate that the most innovations in the analysed period were introduced in the animal production field (71.6%), followed by crop production (18.4%) and the least in the field of economics and organization (9.9%).

Conclusions

The analysed farms involved in dairy cattle breeding in order to conduct dairy production were associated in a producer group to strengthen their position in the market, improve organizational and production processes taking place in individual farms and increase the chances of receiving support from EU funds. The obtained results confirmed that membership in the producer group was profitable for the owners of farms, among others thanks to easier access to innovation. Agricultural innovations introduced in the producer group were first of all new technical solutions that allowed its members to more rationally manage the resources belonging to the group and to reduce the amount of used means of production, applying solutions that do not cause adverse effects on the environment. In the producer group under study, new activities were also implemented, through which biological progress on the farms was increased. Such innovations included: introducing new plant varieties for cultivation, yielding higher yields and being more resistant to diseases, pests and unfavourable natural conditions. Implementation of breeding progress on the farms took place through the purchase of new, more efficient dairy cows, as well as activities aimed at increasing the level of animal welfare, among others modernization of livestock rooms. The number of introduced changes since establishing cooperation among the owners of the surveyed farms by creating a producer group and the impact of changes in the functioning and organization of these agricultural enterprises indicated in the above work allows recognizing innovation as one of the measures of the efficiency of institutional structures in agriculture. In addition to entrepreneurship, willingness to cooperate, a sense of community, possessing agro technical knowledge and knowledge of markets and risk, innovation is a feature that gives an opportunity to create a market system tailored to the expectations of both producers and consumers.

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