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Ecologistics as an integral element of the sustainable development of farms in Poland

Ekologistyka jako integralny element zrównoważonego rozwoju gospodarstw rolnych w Polsce

Abstract. In the era of growing competitiveness and searching for ways to better use the available resources, their optimal use in Polish farms becomes the direction that determines their activities. The changing market and legal environment forces Polish farmers to look for new solutions. The law also dictates the methods of achieving the development of these entities. One of the basic trends indicated in the law is the development of all Polish entities based on the assumptions contained in the concept of sustainable development. Therefore, it seems reasonable to implement logistic and ecologicistic strategies on Polish farms. The article presents the basic issues related to the implementation of ecologicistic concepts in Polish farms and the factors determining their development. The article presents the current state of awareness in Polish farms related to the implementation of sustainable development in these entities based on logistic and ecologicistic tools.

Key words: ecologicistic, sustainable development, Polish farms, waste

Synopsis. W dobie rosnącej konkurencyjności i poszukiwania sposobów lepszego wykorzystania dostępnych zasobów, ich optymalne wykorzystanie w polskich gospodarstwach staje się kierunkiem determinującym ich działania. Zmieniający się rynek i otoczenie prawne wymuszają na polskich rolnikach poszukiwanie nowych rozwiązań. Prawo dyktuje również sposoby osiągnięcia rozwoju podmiotów rolniczych. Jednym z podstawowych trendów wskazanych w prawie jest rozwój na podstawie założeń zawartych w koncepcji zrównoważonego rozwoju. Zasadne wydaje się wdrażanie strategii logistycznych i ekologicznych w polskich gospodarstwach. W artykule przedstawiono podstawowe zagadnienia związane z wdrażaniem koncepcji ekologicznych w polskich gospodarstwach rolnych oraz czynniki warunkujące ich rozwój. Przedstawiono również aktualny stan świadomości polskich gospodarstw rolnych w zakresie wdrażania zrównoważonego rozwoju na podstawie narzędzi logistycznych i ekologicznych.

Słowa kluczowe: ekologistyka, zrównoważony rozwój, polskie gospodarstwa, odpady

Introduction

The turn of the 20th and 21st century is clearly associated with the statement that one of the basic factors influencing the achievement of revenues by enterprises is logistics with all its tools supporting management, flow of raw materials and related information [Ficoń 2001]. Moreover, the first two decades of the 21st century showed that the ever-growing competition on all markets means that also agricultural enterprises have to pay much more attention to processes directly related to logistics. We are talking here, among others about: procurement, distribution, transport and storage [Kuboń 2008].

It should be noted, however, that modern logistic concepts that comprehensively served supply chains consisting of farms, despite the changes taking place on the markets, still do not play a leading role in planning the strategy of Polish farms. This is due to the fact that the overwhelming majority of farmers in Poland conduct their production based on conventional supply and distribution systems. Their systems are made up of a group of independent wholesalers, retailers and brokers. This means that in most cases these entities function as independent links which are only loosely related to the logistic food chain. Due to this state of affairs, these farms have a limited ability to control the physical flow of raw materials and final products, which has been illustrated by the Figure 1 [Wajszczuk 2001, Kuboń 2008].

The Figure 1 illustrates a typical model of an integrated logistic chain with a non-integrated food chain. It should be emphasized that the lack of integration of Polish farms

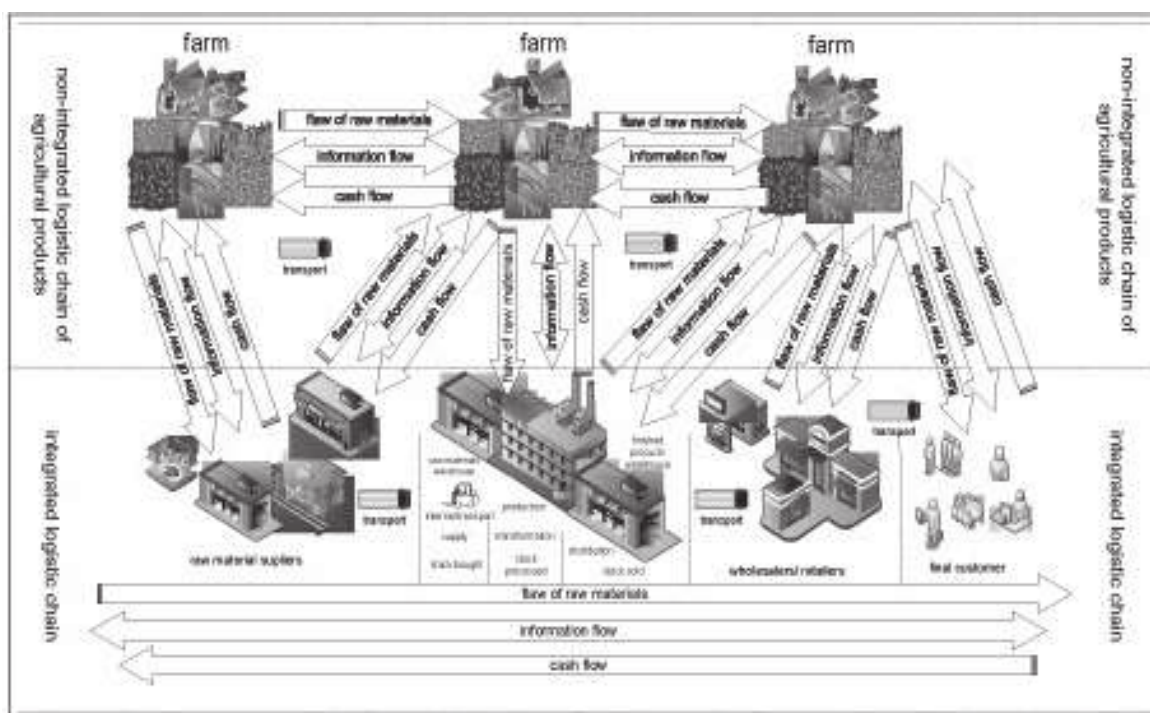


Figure 1. Integrated logistic chain in connection with a non-integrated food logistic chain
 Rysunek 1. Zintegrowany łańcuch logistyczny w połączeniu z niezintegrowanym łańcuchem logistycznym żywności

Source: own study based on [Andrzejczyk 2012b].

is the most common barrier to their development. This means that all actions should be taken to integrate Polish farms into integrated logistic chains in order to increase their competitiveness both on the domestic and international markets.

Currently, in Poland, about 60% of the total area of the country is used by farms, which, while conducting their basic activities, have a significant impact on the condition of the natural environment. Everyone knows that a Polish farmer produces food, but not everyone is aware that apart from food production, they are responsible for maintaining the cleanliness of the environment and its natural and landscape values for the next generations [Grabczyńska 2018].

The generation of waste is an inevitable consequence of the functioning of any society, both in the area of residence and in the place of professional activity, it also applies to rural areas. The dynamic economic development of Poland in recent years has contributed to an increase in the amount of waste generated in macrological systems operating at the level of Polish communes, and thus at the micrological level in the form of farms [Andrzejczyk 2012a]. Therefore, taking protective measures in rural areas for the benefit of the natural environment becomes a necessity, which results both from the newly emerging legal regulations in this area, but above all is an expression of the basic relationship that takes place between the farmer and the natural environment [Grabczyńska 2018].

Each economic development is accompanied by the improvement of micrological systems. A particular development of these systems can be seen on the example of Polish farms, which, using new technical and organizational solutions, together with the implementation of logistic concepts and the improvement of logistic processes taking place on these farms, achieve the assumed economic growth, thus changing the shape of Polish farms [Andrzejczyk 2012a].

Each farm in Poland uses the natural resources of the environment, influencing them both positively and negatively. It is believed that the positive effects of farming activities are expressed in the sustainable shaping of the rural landscape, including construction, checkered fields and open water, and in the protection of the traditional management system with extensive grasslands and wetlands with a variety of flora and fauna. It should be noted that on the other side there is agricultural activity which poses a potential threat to the environment contributing to its degradation [Grabczyńska 2018].

Due to the above, it seems necessary to use ecological tools in Polish farms. Ecological logistics, also known as recycling logistics [Andrzejczyk 2009], consists in managing the processes of moving damaged, incorrectly delivered, used, redundant products, classified as surplus stock and used disposable packaging. This management aims to recover as much as possible materials that are no longer needed, and then to reuse them in production or logistics processes, while minimizing the amount of waste that goes to the landfill. [Andrzejczyk 2012b]. It should be emphasized here that both the development of logistics itself at the turn of the 20th and 21st century, as well as the IT revolution that accompanied this development, also caused a change in the approach to the subject of waste. Today, waste that is the result of production is no longer treated only as an unnecessary element that needs to be disposed of. It often turns out that what is waste in one farm may be the starting material for the production of finished products elsewhere in another [Andrzejczyk 2012a].

This study is a starting point for the next article, which will compare the described ecologic systems related to the functioning of Polish farms in the aspect of the competitiveness of the Polish agricultural sector.

Purpose and method of research

The aim of the article is to identify the level of implementation of the concept of sustainable development of Polish farms based on the available ecologic tools. The article was prepared on the basis of an analysis of formal and legal documents and normative acts in force in the described area. The article uses the method of a critical literature review in the field of the definition of sustainable development, along with the available ecological tools and the possibilities of using these tools in Polish farms. In addition, the method of graphic modeling was used, with the help of which examples of models of logistic chain connections in the aspect of the functioning of Polish farms were indicated. Additionally, the survey method was used, which was carried out among Polish farms with an acreage from 1 to 100 hectares, located in Lower Silesia and in the Opolskie and Wielkopolskie Voivodeships. The aim of the survey was also to find out about the potential willingness of respondents to cooperate in the field of sending used packaging to appropriate points for processing and re-use. The conducted research was of a pilot nature. The sample was purposefully selected. The characteristics of the sample and the sampling method do not provide grounds for generalizing the results to all farms in Poland. However, on their basis, it is possible to make assumptions about the trends and awareness of Polish farmers regarding the use of ecology on their farms. The obtained results may also be an inspiration for further, in-depth research in this area.

Ecologistics as an element of the development of Polish farms

In the Action Program of the Ministry of Agriculture and Rural Development for 2015–2019, measures were outlined to increase the profitability and equalize the standard of living of Polish farming families and other rural residents compared to urban residents. This objective was to be achieved through the implementation of the activities resulting from the Program in such a way that they would ensure the security and food sovereignty of the country for Poles. Based on the above-mentioned assumptions, the Polish government took care of a stable situation in basic agricultural markets by improving economic processes in the food chain, as well as sustainable development of rural areas and effective land management. The above assumptions are reflected in the Strategy for Responsible Development of Polish Villages until 2020 with a perspective until 2030, as well as in other strategic documents prepared by the Ministry of Agriculture [Jurgiel 2018].

The Ministry of Agriculture takes a similar position in the discussion on the future Common Agricultural Policy (CAP) of the European Union, emphasizing that future measures under the European Union's CAP should be defined in such a way that will help improve the stability of farms and provide them with a constant level of income. It should also be noted that practically all member states notice the importance of farms for the existence of the entire economic community. This translates into the creation of the

future European Union budget, which assumes that the common agricultural policy of the European Union should remain a strong and properly financed European Union policy, especially in the face of growing challenges around the world related to the instability of agricultural markets, demographic changes, food security and limited natural resources, and recently also crises caused by epidemiological threats [Jurgiel 2018].

Therefore, it is extremely important to use logistic solutions more widely, both in production processes and in the so-called reverse logistics. This is due to the need to plan logistic processes in Polish farms in such a way that will allow these economic entities to survive [Andrzejczyk 2009]. Today, it is not enough for Polish farmers to be a loosely connected link in the logistics chain that supplies its products to recipients (Figure 1), because in the situation of uncertainty of demand and supply in the consumer goods market, it requires domestic economic entities to deal with such phenomena as: lack of recipients of agricultural produce, lack of labor, low prices for the offered products, rising prices for energy and labor, and recently frequent droughts. This presents farmers with the need to make choices that are economically difficult to make. Often a Polish farmer is faced with the choice of the profitability of running a production activity. In addition, the beginning of the 21st century imposed new requirements on farmers for environmental protection. All this means that Polish farms have to look for solutions that will keep agricultural production profitable. In connection with the above, it is worth asking the question: where and how is agricultural production located in the areas of logistics tools?

Answering the question above, it should be clearly emphasized that in each farm there are typical logistic processes, such as: transport, production, storage. Importantly, in the case of transport, storage and production in agriculture, attention should be paid to a completely different approach to these issues in a farm and in agribusiness enterprises, and even more so in a typical production enterprise. On the farm, activities related to transport and storage are often performed. A typical farmer, however, does not distinguish these activities, usually focusing on the production itself and its technology. On the other hand, in the case of agribusiness enterprises, there is considerable variation in seasonality, the type of required means of transport, the storage used, and the storage period. Manufacturing companies, however, carefully analyze all the processes taking place in it and in its environment. Therefore, when analyzing transport and storage, each type of enterprise should be considered separately. It should also be emphasized that often production companies distinguish between individual costs, while farms do not isolate given logistic processes, treating the costs of transport and storage as the costs of obtaining raw materials and production [Rokicki and Wicki 2010].

At the end of the 20th century, the ever-growing environmental problems resulting from the expansive human activity were noticed in the social, economic and ethical dimensions. Combined with the growing awareness of the society in this regard, at the beginning of the 21st century, in the management of enterprises, including Polish farms, an increasing influence of concepts aimed at solving these problems is observed. Undoubtedly, one of them is the strategy of sustainable development [World Commission on Environment and Development 1987]. The scope of all pro-ecological activities promoted in this concept has been extended to include social aspects in another concept, called corporate social responsibility, in which, inter alia, reference was made to human rights, with particular emphasis on preserving the principles of economic development

based on respect for natural resources in such a way that future generations would have access to it [Robinson 2004]¹.

It should be remembered that the development of Polish farms is strongly related to the development of the regions in which these farms are located. This means that the development of these regions should also be based on respect for the natural environment, which is reflected in the so-called eco-development also called sustainable development. The socio-economic structure of the population living in a given area is of great importance for the development of the region. Sustainable development in this case means conducting all economic activities in harmony with the natural environment, so as not to cause irreversible changes in nature that destroy the ecosystem. In a situation where the operation of agricultural holdings requires interference with the natural environment, the resulting environmental degradation should be minimal, and the related losses should be ecologically acceptable and economically and socially justified. To sum up, the sustainable development of regions, therefore, of Polish farms, should be based on the dependencies between such areas as society – economy – environment, which was illustrated by Figure 2 [Andrzejczyk 2009].

As we can read from the Figure 2, the development of each entity should be based on three pillars that take into account the needs of continuous process improvement, social needs and economic resources. This state of affairs means that when planning the development of Polish farms, we have to deal with a wide range of various scientific fields. It should be noted here that the area that binds these areas is undoubtedly logistics, by means of which we integrate many different types of economic processes. It is possible

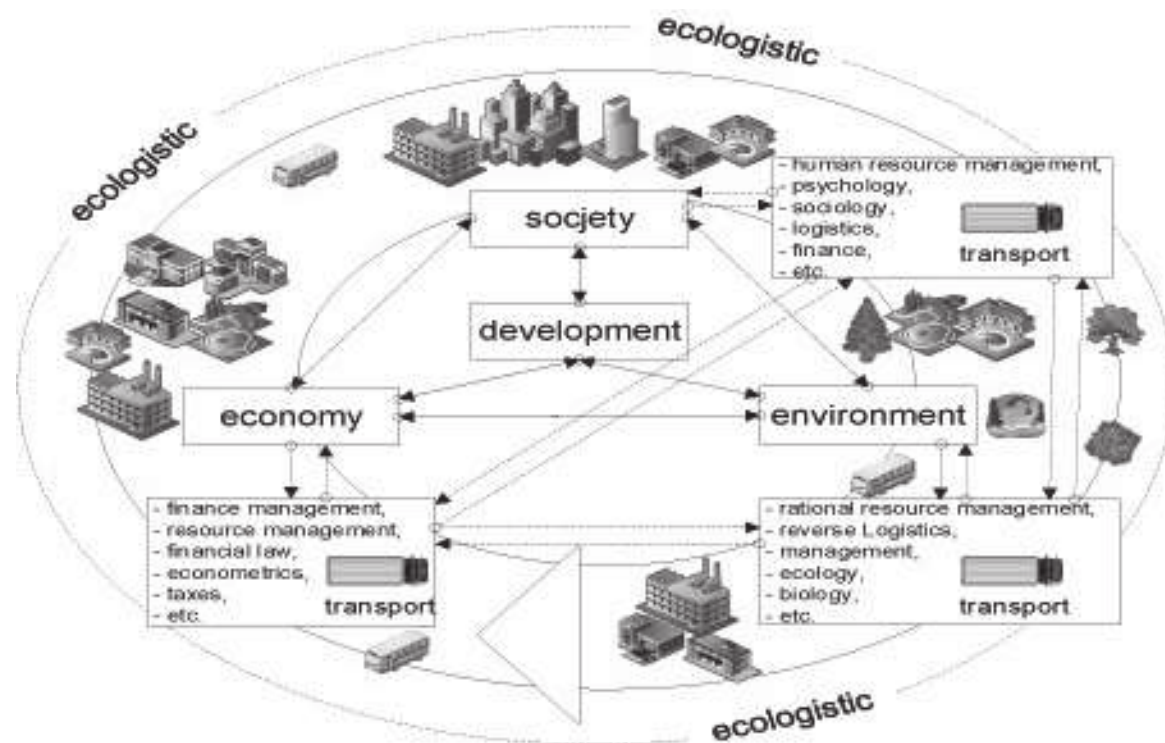


Figure 2. Interdisciplinarity of sustainable development
Rysunek 2. Interdyscyplinarność zrównoważonego rozwoju

Source: [Andrzejczyk 2020].

because logisticians pay attention to many aspects related to the proper management of resources, taking care to meet, for example, the 7W principle, also known as the 7R principle, that is: right product, right quantity, right condition, right place, right time, right customer, right price.

It should be clearly emphasized that one of the first concepts in which the search for pro-ecological solutions was started are precisely logistics concepts in which logistics processes were discussed, and more precisely, transport, later production, warehouse processes, etc. Over the years, pro-ecological activities in logistics have been extended to the pro-social sphere. Ultimately, the common scope of these activities was defined as logistics social responsibility [Carter and Jennings 2002].

The logistics social responsibility concept is a young concept whose scope is constantly developing. New issues are constantly being included, e.g. of an ethical nature, working conditions, philanthropic attitudes, waste, etc. [Carter and Jennings 2002]. Therefore, many research centers, domestic and foreign, make many attempts to develop comprehensive methods of assessing the implementation of this concept, both in enterprises and entire supply chains. The attempts to develop such a method so far are of a more general nature and do not exhaust all the possibilities of this concept [Murphy and Poist 2002]. Both the foreign and Polish literature on the subject clearly lack research results showing the degree of logistics sustainability according to the indicated concept at the level of specific industries, not to mention the application of this concept in Polish farms [Murphy and Poist 2002, Andrzejczyk 2009].

The problem above can be solved by the application of the concept of ecologistics, otherwise known as recycling logistics. It is based on managing the processes of moving products: damaged, incorrectly delivered, used, redundant, classified as excess inventory and used disposable packaging. It should be emphasized that this management aims at the highest possible level of recovery of products/materials that are theoretically unnecessary, and in the next stage – their reuse in both production and logistics processes. What is extremely important, this task is carried out with the maximum minimization of the amount of new waste. Currently, when designing logistics and production flows, it is also planned to recover resources after the end of the product life. The current trends are aimed at closing the circulation of the raw material into a closed circuit. It is assumed that products that end their useful life will be completely eliminated from the landfill. This applies to both the entire used object and its parts [Andrzejczyk et al. 2020].

“The basic model of ecologistics is the ecologic supply chain (Figure 3), in which reverse logistics is an extremely important element, with its help it is possible to rationally and effectively recover all kinds of waste. The primary goal of recovering unwanted raw materials is to subject them to treatments that minimize their negative impact on the environment. It should be noted that products that were once considered waste are now a source of raw materials.” [Andrzejczyk et al. 2020]. In the case of Polish farms, for example, heaps of stones collected from the field, which are now sold as building blocks of all kinds of ponds, constitute a valuable source of resources that were a problem in the past, and today in many cases are an object for which more and more customers are competing. Another example of products that were previously considered mainly waste are animal by-products, which are now used in many cases as materials for the production of modern and efficient fertilizers.

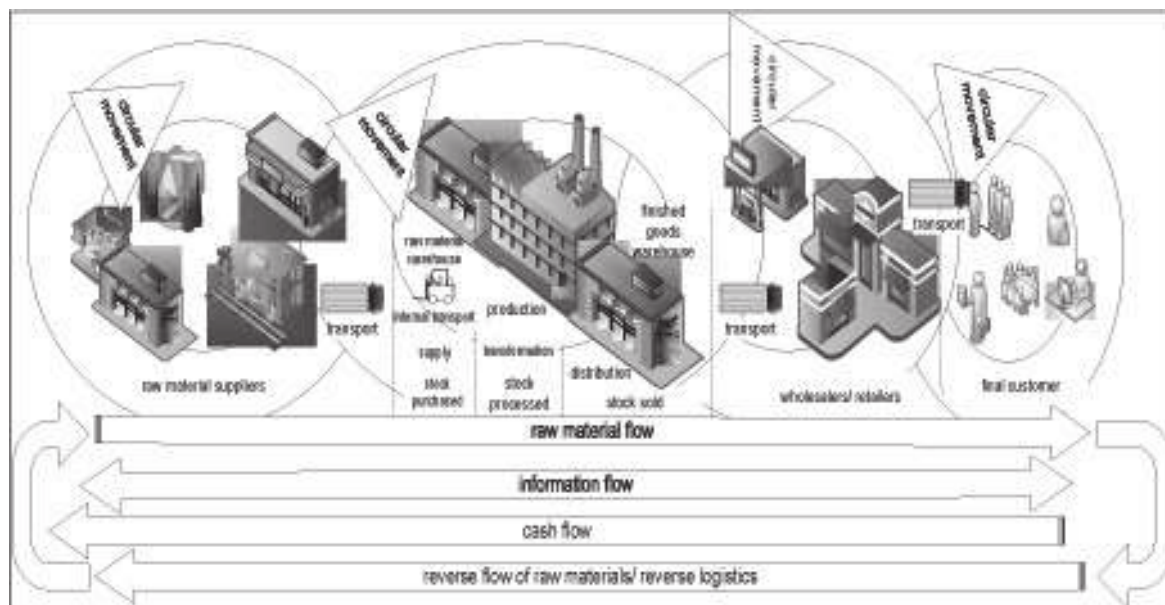


Figure 3. Model of the logistics chain
 Rysunek 3. Model łańcucha logistycznego
 Source: [Andrzejczyk 2020].

Ecologistics and sustainable development of farms in Poland – the as-is

As already mentioned, the purpose of this article is to define the current level of knowledge in Polish farms on the application of the concept of ecologistics in the process of development of these entities. In order to achieve the intended goal, in selected groups of farms, research was carried out on a sample of 100 farms located in southern Poland. The research was aimed at determining the current potential of using logistic concepts and their related ones, with particular emphasis on ecologic concepts. Based on the logistic concepts presented above, the adopted objective of the study, related to the positioning of ecology in the integrated logistic chains of agricultural products produced on Polish farms, was carried out using the method of analysis and criticism of the literature and logical inference based on the obtained results of research conducted on a sample of Polish farms agricultural areas, which were divided according to the size of the cultivated land (Figure 4). The largest group of the researched farms were farms managing from 5 to 10 hectares, then farms with an area of 10 to 20 hectares, both these groups accounted for almost 50% of the respondents.

It should be noted that among the farmers who were tested, as many as 45% believe that they do not use any logistic tools in managing their farm. Even more farms do not use the tools available in the ecologic concept (Figures 5 and 6).

On the basis of the conducted research, it can be observed that large farms much more often use logistic and ecologic solutions than smaller ones (Tables 1 and 2). This state of affairs is most often due to the fact that small farms are most often family projects passed on from the great-grandfather, along with all the benefits of livestock. Therefore, such farms do not develop while remaining in stagnation. In the case of large farms, continuous develop-

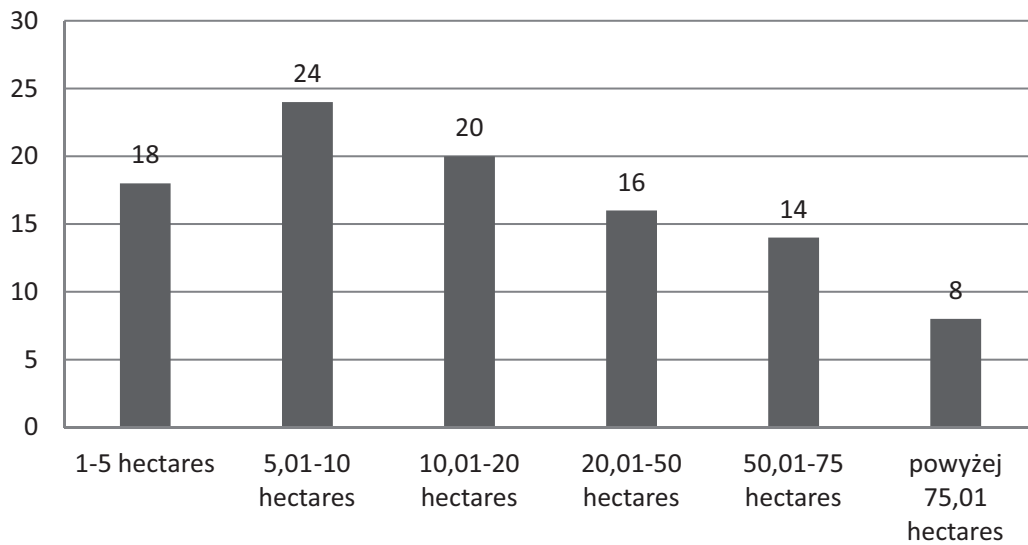


Figure 4. Size of the researched farms
Rysunek 4. Wielkość badanych gospodarstw

Source: own study.

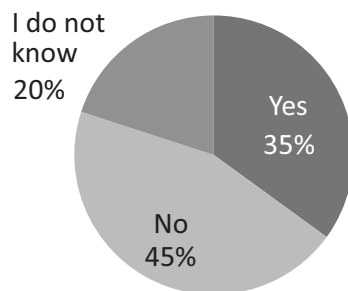


Figure 5. Share of farms where logistic tools are used

Rysunek 5. Udział gospodarstw, w których używane są narzędzia logistyczne

Source: own study.

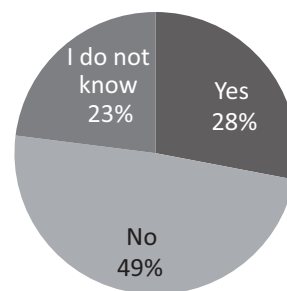


Figure 6. Share of farms where ecologic tools are used

Rysunek 6. Udział gospodarstw, w których stosowane są narzędzia ekologiczne

Source: own study.

Table 1. Share of farms where logistic tools are used [%]

Tabela 1. Udział gospodarstw, w których używane są narzędzia logistyczne [%]

Does your farm use logistic tools?	Farm size [hectares]					
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01
Yes	4	5	6	7	8	5
No	8	14	10	7	4	2
I do not know	6	5	4	2	2	1
Total	18	24	20	16	14	8

Source: own study.

Table 2. Share of farms where ecologicistic tools are used [%]

Tabela 3. Udział gospodarstw, w których stosowane są narzędzia ekologiczne [%]

Does your farm use ecologicistic tools?	Farm size [hectares]					
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01
Yes	2	5	7	5	6	3
No	10	12	11	7	6	3
I do not know	6	7	2	4	2	2
Total	18	24	20	16	14	8

Source: own study.

ment can be observed. These entities, in order to survive on the market, must transform into the type of organization that must be adapted to the integrated supply chain.

When analyzing the above tables, it can also be noticed that Polish farms are not very eager to look at ecology and while the tools of logistics itself are already used, those that allow to protect the natural environment to a much lesser extent. Which will be even more visible in the results presented below.

From the obtained results, one can draw a conclusion that the majority of Polish farms have been developing in the last 10 years (Figure 7). Unfortunately, most of the surveyed entities do not apply the sustainable development strategy (Figure 8). Which coincides with the fact that a Polish farmer uses logistic tools, but not necessarily ecologicistic ones.

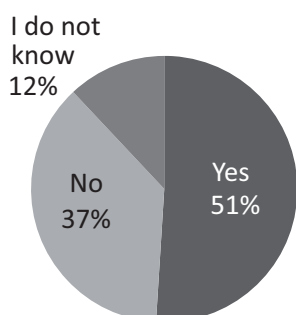


Figure 7. Share of farms which recorded development in the last 10 years

Rysunek 7. Udział gospodarstw, które odnotowały rozwój w ostatnich 10 latach

Source: own study.

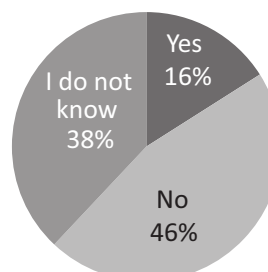


Figure 8. Share of farms in which the concept of sustainable development is applied

Rysunek 8. Udział gospodarstw, w których stosowana jest koncepcja zrównoważonego rozwoju

Source: own study.

From Tables 3 and 4 it can be concluded that Polish farms are developing. Unfortunately, almost 40% of them report problems in this respect, and 12% are unable to identify themselves (Table 3). This state of affairs results from the constantly changing market environment of these farms. Farmers are also not helped by the legal system, which somehow forces them to apply the concept of sustainable development, and as can be read from Table 4, the Polish farmer does not readily use it, because only 16% of Polish farms use this strategy.

Table 3. Share of farms which recorded development in the last 10 years [%]

Tabela 3. Udział gospodarstw, które odnotowały rozwój w ostatnich 10 latach [%]

Has your farm been developing in the last 10 years?	Farm size [hectares]					
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01
Yes	9	12	10	9	7	4
No	7	9	5	6	6	4
I do not know	2	3	5	1	1	0
Total	18	24	20	16	14	8

Source: own study.

Table 4. Share of farms where the concept of sustainable development is applied [%]

Tabela 4. Udział gospodarstw, w których stosowana jest koncepcja zrównoważonego rozwoju [%]

Is your farm developing based on the concept of sustainable development?	Farm size [hectares]					
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01
Yes	1	3	5	2	3	2
No	10	12	10	5	5	4
I do not know	7	9	5	9	6	2
Total	18	24	20	16	14	8

Source: own study.

To the question about the farm generate municipal waste, half of the respondents answered affirmative (Figure 9). On the basis of the interviews conducted, it can also be concluded that Polish farmers distinguish between municipal waste and industrial and hazardous waste. Farmers are also aware that among the products they produce, they have also those that should be classified as hazardous waste (Figure 10).

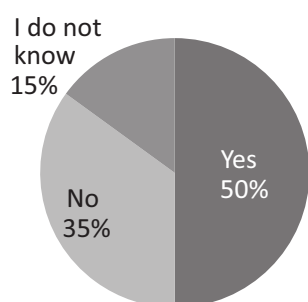


Figure 9. Share of farms producing municipal waste

Rysunek 9. Udział gospodarstw wytwarzających odpady komunalne

Source: own study.

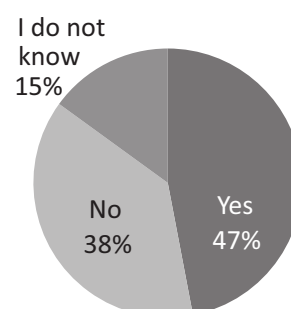


Figure 10. Share of farms producing hazardous waste

Rysunek 10. Udział gospodarstw wytwarzających odpady niebezpieczne

Source: own study.

What is extremely important, the number of farmers who are aware of the harmfulness of the produced waste is still growing (Tables 5 and 6). It can also be noticed that they do not avoid issues related to it, which is reflected in their interest and exploration of the topic in this regard. Only 15% of the surveyed people showed complete ignorance of the subject. It should be noted here that the larger the farm, the greater the knowledge of issues related to the area in question.

Table. 5. Share of farms generating municipal waste [%]

Tabela 5. Udział gospodarstw wytwarzających odpady komunalne [%]

Does your farm produce municipal waste?	Farm size [hectars]					
	1–5	5,01–10	10,01–20	20,01–50	50,01–75	more than 75,01
Yes	10	11	11	8	5	5
No	7	9	8	4	5	2
I do not know	1	4	1	4	4	1
Total	18	24	20	16	14	8

Source: own study.

Table. 6. Share of farms producing hazardous waste [%]

Tabela 6. Udział gospodarstw wytwarzających odpady niebezpieczne [%]

Does your farm produce hazardous waste?	Farm size [hectars]					
	1–5	5,01–10	10,01–20	20,01–50	50,01–75	more than 75,01
Yes	5	8	10	6	10	8
No	7	13	8	6	4	0
I do not know	6	3	2	4	0	0
Total	18	24	20	16	14	8

Source: own study.

Pursuant to the amendment to the Act on Waste, farmers who farm over 75 hectares of agricultural land are subject to mandatory entry in the BDO (waste database), i.e. the Product and Packaging Database and Waste Management. If the farmer produces other waste and the waste company collects the above-mentioned packaging waste directly from the farm, he is obliged to keep records of waste on an ongoing basis. In connection with the above, farmers were asked whether their farms are subject to the necessity to obtain an entry in the BDO register and whether they know the criteria that oblige them to obtain such an entry. To the great surprise of the respondents, despite the freshness of the introduced regulations, most of the surveyed farmers know the requirements in this regard (Figures 11 and 12.). In the entire survey, only 17% of farmers do not know whether they must be registered in the above-mentioned system, and 13% do not know the related criteria at all.

It should be emphasized that despite the fact that the regulations on BDO entered into force on August 13, 2019, Polish farmers show high awareness of this issue (Tables 7 and 8). This state of affairs may result from the fact that non-compliance with these stand-

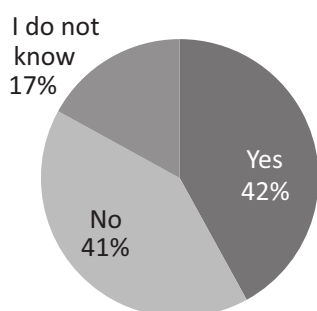


Figure 11. Share of farms requiring an entry in the BDO register

Rysunek 11. Udział gospodarstw wymagających wpisu do rejestru BDO

Source: own study.

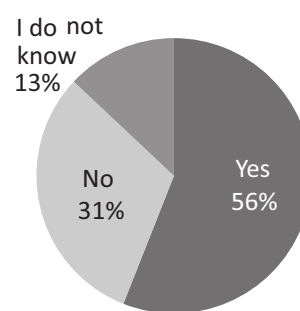


Figure 12. Share of farms with known criteria for the necessity to obtain an entry in the BDO register

Rysunek 12. Udział gospodarstw o znanych kryteriach konieczności uzyskania wpisu do rejestru BDO

Source: own study.

ards may result in high penalties, as anyone who runs a business without the required entry in the BDO Register may be subject to an administrative fine of PLN 5000 to PLN 1,000,000 [Obwieszczenie Marszałka Sejmu...]. However, the amount of possible fines is not a sufficient argument for some farmers. This is especially true for small entities that are not yet trained to analyze changes in the law that directly affect them.

Table. 7. Share of farms requiring an entry in the BDO register [%]

Tabela 7. Udział gospodarstw wymagających wpisu do rejestru BDO [%]

Is it necessary to obtain an entry in the BDO register (Database on products and packaging) in your farm?	Farm size [hectares]					
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01
Yes	3	6	8	9	9	7
No	9	13	9	5	4	1
I do not know	6	5	3	2	1	0
Total	18	24	20	16	14	8

Source: own study.

Table. 8. Share of farms with known criteria for the necessity to be entered in the BDO register [%]

Tabela 8. Udział gospodarstw o znanych kryteriach konieczności uzyskania wpisu do rejestru BDO [%]

Do you know the criteria that require an entry in the BDO register (Database on products and packaging)?	Farm size [hectares]					
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01
Yes	9	13	9	9	9	7
No	7	6	8	5	4	1
I do not know	2	5	3	2	1	0
Total	18	24	20	16	14	8

Source: own study.

Therefore, the question arises how do Polish farmers deal with waste? Therefore, the authors of the study asked Polish farmers what they do with the waste that occurs in each of them. We are talking about fertilizer bags. The obtained results show that only 31% of farmers hand over this waste to the appropriate recipient (Table 9).

Table 9. Manners of handling fertilizer bags in Polish farms [%]

Tabela 9. Sposoby obchodzenia się z workami nawozowymi w polskich gospodarstwach [%]

Which of the following methods of handling fertilizer bags are used on your farm?	Farm size [hectars]						Total
	1-5	5,01-10	10,01-20	20,01-50	50,01-75	more than 75,01	
Delivery to special farm waste collection points	1	3	6	7	8	6	31
Disposal in municipal containers for mixed waste	3	5	4	4	2	1	19
Use as packaging in trade with individual recipients of agricultural produce	4	8	5	3	2	1	23
Re-use in field work	2	3	2	0	2	0	9
Burying in the ground	2	1	0	0	0	0	3
Burning	6	4	3	2	0	0	15
Total	18	24	20	16	14	8	100

Source: own study.

The rest of the activities are against the legal standards and the principles of sustainable development. For example, it should be stated that 15% of farmers explicitly admit to burning this type of waste, and 3% to burying it in the ground. A large group of farmers are those who throw fertilizer bags into mixed municipal waste. This state of affairs generates further questions regarding, for example, issues related to other waste, e.g. what happens to used tires for agricultural machinery, or what happens to containers for plant protection products?

Summary and conclusions

The paper presents the results of a pilot study assessing the degree of application of the logistics strategy in selected Polish farms in terms of the concept of sustainable development with an emphasis on the ecologic concept. Based on the conducted analyzes of the literature and surveys conducted in one hundred different types of farms, it can be concluded that Polish farmers are interested in the use of logistic concepts and less in the use of ecologic tools, and even less in typical strategies related to the sustainable development of these entities. This state of affairs occurs despite the fact that these strategies are closely related. It should be emphasized that the level of logistics in Polish farms is in a phase of slow implementation. This process may be accelerated by the changes taking place in Polish legislation. However, a much greater stimulus determining Polish farmers' willingness to use ecologic tools, and thus create their development with concepts

taking into account sustainable development, will be the dynamically changing market on which Polish farms operate, which will autonomously force a change in the strategy in farm management. Because their recipients will set new requirements both in terms of individual main processes carried out on the farm, and in social, economic and, above all, ecological dimensions. It should be emphasized here that the Polish farmer is slowly noticing that the way he conducts his agricultural activity is changing. Today, the winner is the farmer who has access to information and modern technologies that will enable him to integrate into the logistic chain.

Not without significance is the ever-growing pressure of society to increase the safety of the flow of food products in the supply chain. This is related to, for example, new epidemiological threats that force agricultural entities to maintain transparency, and this in turn will force the implementation of the principles of logistics, ecologistics and sustainable development to an ever greater extent. Based on the above, it can be concluded that even small farms should assume the independent implementation of the above-mentioned ones in their development strategies. However, in a situation where they are not able to cope with it on their own, they will have to form groups that will cope with it. Thus, becoming responsible suppliers of products for both large enterprises and individual consumers.

Considering the analysis of the literature on the subject and the results obtained on the basis of questionnaire surveys of Polish farms, it can be concluded that the aim of the presented article has been achieved. It can be inferred that although many Polish farms still do not use logistic tools in creating their development, and thus do not implement the concept of sustainable development of these farms, there are many entities among Polish farms that know and use the indicated tools in their strategies that are also based on sustainable development. It can also be noticed that farms run by the younger generation are more willing to use modern farm management solutions. Young farmers see the need to integrate their chains with global sales networks and are aware of the dwindling natural resources. Polish farmers experience it, for example, in the form of a lack of access to an adequate amount of water as a result of the prevailing droughts. Therefore, they have to adapt to the type of production that will take this into account. It seems logical that the development of Polish farms will require the use of logistic and ecologicistic tools, and this translates into the need for a wider use of the concept of sustainable development in this sector.

References

- Andrzejczyk P., 2009: Istota i znaczenie ekologii odpadów komunalnych [The essence and importance of municipal waste ecology], *Logistyka* 5, 24–28 [in Polish].
- Andrzejczyk P., 2012a: Logistyka zwrotna jako istotny element makrologistyki poziomu lokalnego na przykładzie wybranych gmin Dolnego Śląska – cz. I [Reverse logistics as an important element of macrologistics at the local level on the example of selected communes of Lower Silesia – part I], *Logistyka* 4, 71–73 [in Polish].
- Andrzejczyk P., 2012b: Znaczenie logistyki zwrotnej dla zrównoważonego rozwoju region [Importance of reverse logistics for sustainable development of the region], *Prace Naukowe Uniwersytetu Ekonomicznego we Wrocławiu, Problemy rozwoju regionalnego* 244, 450–459 [in Polish].

- Andrzejczyk P., Rajczakowska E., Fajfer P., 2020: Podstawy logistyki w przykładach i ćwiczeniach [Basics of logistics in examples and exercises], Instytut Logistyki i Magazynowania, Poznań [in Polish].
- Carter C.R., Jennings M.M., 2002: Logistics Social Responsibility: An Integrative Framework, *Journal of Business Logistics* 23(1), 145–180.
- Ficoń K., 2001: Logistic processes in an enterprise [Procesy logistyczne w przedsiębiorstwie], Impuls Consulting, Gdynia [in Polish].
- Grabczyńska M., 2018: Odpady w gospodarstwie rolnym [Waste in a farm], Kujawsko-Pomorski Ośrodek Doradztwa Rolniczego, WFOŚiGW w Toruniu, [electronic source] <https://www.kpodr.pl/wp-content/uploads/2019/02/broszura-3-grabczy%C5%84ska.pdf> in Toruń, [access: 30.03.2020] [in Polish].
- Jurgiel K., 2018: Priorytety Ministerstwa Rolnictwa i Rozwoju Wsi na lata 2018–2019 w aspekcie Programu Działań Ministerstwa Rolnictwa i Rozwoju Wsi na lata 2015–2019 oraz Paktu dla obszarów wiejskich na lata 2017–2020 (2030) [Priorities of the Ministry of Agriculture and Rural Development for 2018–2019 in terms of the Action Program of the Ministry of Agriculture and Rural Development for 2015–2019 and the Pact for rural areas for 2017–2020 (2030)], Ministerstwo Rolnictwa i Rozwoju Wsi, Warszawa [in Polish].
- Kuboń M., 2008: Koszty infrastruktury logistycznej w przedsiębiorstwach rolniczych [Costs of logistic infrastructure in agricultural enterprises], *Inżynieria Rolnicza* 12, 10(108), 125–136 [in Polish].
- Murphy P.R., Poist, R.F., 2002: Socially Responsible Logistics: An Exploratory Study, *Transportation Journal* 41(4), 23–35.
- Obwieszczenie Marszałka Sejmu Rzeczypospolitej Polskiej z dnia 16 kwietnia 2020 r. w sprawie ogłoszenia jednolitego tekstu ustawy o odpadach [Announcement of the Marshal of the Sejm of the Republic of Poland of April 16, 2020 on the announcement of the written text on waste], *Dz.U.* 2020 poz. 797, 875, 2361 [in Polish].
- Robinson J.B., 2004: Squaring the Circle? Some Thoughts on the Idea of Sustainable Development, *Ecological Economics* 48(4), 369–384.
- Rokicki T., Wicki R., 2010: Transport i magazynowanie w rolnictwie jako element logistyki [Transport and storage in agriculture as an element of logistics], *Wiś Jutra* 1, 41–42 [in Polish].
- World Commission on Environment and Development, 1987: *Our Common Future*, Oxford University Press, New York.

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