

Changes in Environmental Management after Poland's Entry to the EU – the Example of the Dairy Sector

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Abstract

After Poland's entry to the European Union, Polish dairy companies were forced to change the way they functioned as far as ecologization was concerned. Efficient functioning of these organizations was possible only when environmental management had been properly implemented. This paper presents the results of research on environmental management of 32 companies conducting business activity in Poland. It was proven that in comparison to 2003, processes aimed at improving the environmental parameters of these companies were considerably intensified after Poland's accession to the EU. This resulted to a large extent from the need to adjust the organizations to EU regulations.

In this case, small enterprises were in the most difficult situation for a number of reasons. First of all, due to financial reasons, such enterprises did not try to implement any, of a number of activities, that could improve their functioning. Secondly, the surveyed units took actions aimed at economizing on water supplies, minimizing waste, and changing the heating system to gas heating in order to reduce the emissions of carbon dioxide. On the other hand, environmental management systems were implemented in large companies. However, such companies did not always notice the necessity of certification.

Keywords: dairy companies, environmental management system, ecologization of companies, environmental policy, ISO 14001, EMAS

Introduction

Nowadays, a systematic approach to environmental management is a very significant element of any organization wishing to achieve the objectives of sustainable development. This is the basis for EU environmental policy. The environmental policy, in turn, should be an integral part of organizational strategy. In addition, environmental manage-

ment should be an integral part of the comprehensive approach to the management of an organization. Thus, it is impossible to speak of a developing and competitive company nowadays if its economic targets are not strictly correlated with its pro-environmental targets.

The environmental policy of the EU imposes a specific code of conduct on member states. The indications of that can be seen at the microeconomic level. Because of the policy, processing companies, which significantly contaminate all of the components of the natural environment, should pursue pro-environmental policies in harmony with the

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principles of sustainable development. The dairy companies, discussed in this paper play a significant role in Polish industry. They have a 16% share in overall output sold and a 14% share in general employment in Poland. Furthermore, Poland is an important global supplier of milk and its products. Its share in world production of cow's milk is 2.3%. This share in the EU-25 is even bigger, at 8.5% [1]. However, the significant role that is played by dairy companies in the Polish economy results in an additional effect. This effect is the impact of this sector on the environment. In order to minimize it, the principles of environmental management must be implemented in the organizations. The main aim of such management should be to protect all components of the environment and minimize the adverse effects arising from the activity of production units.

Our paper presents selected aspects of research into the ecologization of dairy companies operating in the Wielkopolska Region. Moreover, it presents the changes in environmental management of such business entities that took place after Polish accession to the European Union.

Environmental Policy of the European Union

The Treaty establishing the European Community in its original version did not contain any references to environmental protection. Over time, as the state of the natural environment deteriorated due to, inter alia, human economic activity, legal regulations concerned with environmental protection began to intensify.

The consolidated theory of environmental policy is based on the hypothesis of *homo economicus*. According to this theory, human beings are individuals operating in a fully rational way on their own account. For this reason economics emphasizes the role of effective policy solutions and financial benefits related to them [2].

However, it is not an easy task to provide a definition for the national environmental policy. A number of definitions have been formulated in this respect. Some of them focus exclusively on taking actions and perceive the government as the sole driving force that is ready to formulate and establish environmental policy. Roberts came up with a more comprehensive definition [3]. He defined environmental policy as: "A set of principles to assist in making decisions about human resource management as far as capital and environmental services are concerned."

Environmental policy provides the framework for setting goals that are realized by means of appropriate instruments. The innovative and dynamic character of such instruments is a characteristic feature of EU policy. By implementing new instruments in a continuous way, the European Union is able to control the constantly growing number of activities in new areas related to environmental protection, such as climate change or genetically modified organisms. On the other hand, these instruments are strictly limited to formal and informal procedures that are introduced. These procedures are aimed at integrating environmental policy at all levels of administration [4].

Environmental policy was included in general economic policy due to the emergence of a new scientific discipline, i.e. sustainable economy. This discipline deals with recognizing the political and ideological aspects of the economy, formulating alternative paradigms in economics, focusing attention on the main entities and their response to the sustainability of activities in the economy, and with institutional changes that facilitate the implementation of the principles of sustainable development [5].

The overriding objectives of the European Union's environmental policy are derived from a general declaration of the Conference in Rio de Janeiro, which formulated 27 principles and conditions to be followed by countries wishing to pursue the idea of sustainability. Therefore, the primary objective of the environmental policy of the EU is to ensure, in the long-term perspective, such growth and continuous improvement of quality of life, which does not lead to deterioration of the environment and allows taking advantage of its resources and assets by future generations.

The Single European Act defined the following objectives of the communities in environmental protection: preserving, protecting, and improving the environment, taking actions to protect human health, and ensuring the reasonable and rational utilization of natural resources. This document also sets out rules of the European Union's environmental policy, which include, among others, the principle of prevention of contamination "at source," the "polluter pays" principle, and the principle of sustainable development [6].

Economists, apart from striving for the fullest realization of principles of sustainable development, are faced with a lot of other problems. One of them is the costs incurred in connection with introducing pollutants into the environment. These substances, which often are complex in their nature, react with each other and thus contribute to serious environmental threats such as climate change, and eutrophication. An optimal policy that controls the state of pollution by complex pollutants requires a compromise. This compromise needs to take into account the reduction of damage and the necessity to bear costs that are generated when various pollutants are introduced into the environment. In the 1980s, Ungern-Sternberg [7] suggested that economists should play a more active role in decisions about which emissions should be reduced and to what extent. Besides, scientists should determine the emission reduction targets and economists must find a way to achieve these targets at a minimum cost. However, in practice, emission targets are set at inefficient levels. For example, the Helsinki Convention established a 50% reduction for nitrogen and phosphorus to combat eutrophication in the Baltic Sea. Reduction targets set by the Kyoto Protocol are generally defined as the % of reduction in average annual greenhouse gas (GHG) emissions. From the point of view of an economist, there is no reason to expect that equal rate of reduction will contribute to a socially optimal outcome.

An important issue for EU environmental policy is the introduction of international environmental regimes. These are sets of standards, procedures, and expectations govern-

ing the protection of the environment. Their goal is above all to measure the effectiveness of pro-environmental actions, to implement relevant institutions, and provide characteristics for environmental problems. The main challenge for international regimes with regard to environmental protection is to find precise criteria by means of which improvement or deterioration of the environment can be defined [8].

A program named "Sixth Environment Action Programme, Environment 2010: Our Future, our choice" has been valid in the European Union since 2001. The priority areas of this program are: climate change, biodiversity, environment and health, sustainable resource, and waste management [9].

When it comes to Poland, the updated version of the Second National Environmental Policy was National Environmental Policy for 2003-06 and its 2007-10 outlook. The executive program for the Second National Environmental Policy for 2002-2010 also was binding.

The currently binding document is the adopted "National Environmental Policy for 2009-2012 and its 2016 outlook" [10]. This document indicates what actions are necessary to protect the natural environment in a proper way.

The activities that are planned in the field of environmental protection in Poland reflect the priorities in the European Union and the targets of the Sixth Environmental Action Programme of the European Community. The major areas of the environmental policy of the Community include:

- Actions to ensure the implementation of the principle of sustainable development.
- Adaptation to climate change.
- Protection of biological diversity.

Protecting the atmosphere and, more specifically, combating climate change is a difficult task for the Republic of Poland. The difficulties arise from the decision made by the European Council in spring 2007 to reduce carbon dioxide emissions in the area of the EU by 20% by 2020. In addition, the European Council decided that in 2020 the share of renewable sources in energy production shall be at least 20% and that energy efficiency shall increase by the same amount. The balance of primary energy in Poland is based on coal. Thus, protection of the atmosphere does not only signify protection of its resources against pollution, but also preventing climate change.

When one thinks about the protection of the atmosphere in Poland, renewable energy sources should be used in Poland on a larger scale. Their use should obviously take into consideration the potential of the country in this regard. Savings in industry, transport, and the housing construction sector are necessary and Poland's potential as far as these savings are concerned is still huge. Additionally, the energy industry also requires rapid modernization.

Each business entity utilizing the environment is required to ensure compliance with environmental requirements, in particular by:

- Organizing work in a proper way.
- Delegating functions related to ensuring protection of the environment to people with relevant professional qualifications.

- Making the staff, whose range of activities is related to environmental issues, familiar with requirements in this regard; providing proper vocational training is not necessary.
- Taking actions to eliminate or reduce environmental damage arising from failure to meet environmental protection requirements by workers, and taking appropriate measures to eliminate such incidents in the future [11].

National Environmental Policy has identified the medium-term objectives to 2016. One of the main objectives identified in this policy is propagating EMAS implementation by raising public awareness about the system and creating economic benefits for companies and institutions that participate in it. In addition, it is necessary to create mechanisms to stimulate companies and institutions to implement environmental management systems. These mechanisms include:

- introducing "green procurement" that will promote companies with environmental management certificates in public procurement procedures
- popularizing the EMAS logo, ISO 14001 standard, and CP logo among the public as signs of environmental quality of the company as the manufacturer of a specific product or provider of a specific service
- increasing the prestige of public institutions with a management system certificate by making the significance of such a system known to the public
- reducing the frequency of environmental protection controls and simplifying their procedures in business entities with an environmental management certificate
- reducing the costs associated with implementing environmental management systems [10].

An environmental management system compliant with the international standard ISO 14001 can help to implement the statutory requirements in organizations. This system is a voluntary commitment taken by business entities and institutions implement specific technical and organizational measures in order to reduce their environmental impacts [12]. The main objective of the environmental management system is to ensure that the organization:

- minimizes its environmental impact and prevents pollution
- is compliant with relevant legal requirements for environmental protection and other requirements applicable to the organization that relate to its environmental aspects
- continually improves its environmental impacts.

Therefore, organizations that have implemented an environmental management system not only meet the legal requirements for environmental protection, but also gain both economic and ecological benefits with regard to minimizing the negative impacts on the environment and preventing pollution [13]. In addition, these organizations strive to improve the environmental impacts of activities by improving the functioning environmental management system, which in turn contributes to further environmental impacts [14].

As early as 1993 in the European Union a regulation on the voluntary participation of industrial organizations in the system of environmental management and auditing was drafted. Nowadays, a third edition of this regulation is in force. The regulation helps organizations to implement and maintain the Eco-Management and Audit Scheme (EMAS). The Act of July 15, 2011 that defines the organizational framework of EMAS in Poland is currently binding [15]. This framework is consistent with the provisions of Regulation (EC) No. 1221/2009 of 25 November 2009 on the voluntary participation of organizations in a community eco-management and audit scheme (EMAS). The abovementioned regulation defines the principles of good governance in the organization with a view to environmental protection. The EMAS regulation is more focused on ensuring compliance with legal requirements concerning environmental protection, as well as on the environmental performance of the organization than ISO 14001. Furthermore, in the case of EMAS, organizations must speak openly with the public about their environmental performance and involve their employees more in activities connected to it [16]. Unfortunately, because of the reasons mentioned above, the eco-management and audit scheme is far less popular than the ISO 14001 standard. There are 35 registered organizations in Poland now.

In order to manage environmental performance in an effective way, environmental aspects need to be identified and evaluated. They are elements of the activity of an organization, its products, or services that may have adverse or beneficial impacts on the environment [17].

Material and Method

The aim of the research conducted in late 2010 and early 2011 was to obtain data on environmental management in dairy companies. Environmental management in a company are those aspects of the general management that relate to the development, implementation, and execution of environmental policy and objectives. Its characteristic feature is integration with the general management system of the organization. Environmental management defines the principles of supervision of any activities that have an impact on the environment, i.e. including the use of natural resources, industrial waste, and energy consumption [18].

The subjects of the study are small, medium-sized enterprises and large companies of the dairy sector located in the Wielkopolska Region. The data that was obtained in the last quarter of 2007 from the Central Statistical Office showed that there were 21 small enterprises, 27 medium, and 9 large companies for a total of 57. During preparation for the study, it was possible to determine that in fact, only 39 dairy companies operated in the Wielkopolska Region, and 18 entities from the list of statistical data did not exist or did not conduct business activity related to production in the dairy sector.

Primary material for the study was data obtained in direct interviews based on a questionnaire. The survey was

conducted with members of top and middle management, for example, with the heads of marketing and sales departments, managers of technical or environmental protection departments, as well as management representatives for quality. The questionnaire was divided into four parts. The part that played a key role for this paper was associated with the pro-environmental activities of the entities, as well as environmental management systems implemented in them. The last part of the questionnaire concerned the characteristics of the surveyed businesses in terms of employment, organizational form, the type of processing carried out, the most important sales market, annual sales volume, and changes in earnings and profitability with net sales in the last 7 years.

The general statistical sample of the surveyed population consisted of 39 companies, of which 32 entities (including 8 large companies, 18 medium-sized enterprises, and 6 small ones) were interviewed directly, and other companies refused to answer the questions because of trade secrets and the need to protect their business from competition. Therefore, the surveyed enterprises accounted for 82% of this population, which should be considered as a representative sample. However, it should be noted that the results cannot be referred to the whole dairy sector, but only to companies located in Wielkopolska.

Nearly 75% of surveyed companies were entities that were set up before 1989, and less than 10% of businesses have been operating in the market since 1996. 61.3% of the analyzed companies are cooperatives, and 25.8% are companies with limited liability. Only a few dairy businesses in the surveyed group were natural persons conducting business activity and partnerships. More than half of the surveyed entities were medium-sized enterprises, 19.3% small enterprises and 22.6% of respondents represented large companies. The surveyed enterprises and companies produced milk and milk drinks (74.2%), white cheese (67.7%), butter (54.8%), milk powder (22.6%), hard cheese and melted cheese (after 19.3%), as well as soft cheeses and ice cream (9.7% each). For 80% of the enterprises, the main market in terms of sales was the domestic market. The international market was the main market only for 19% of the analyzed businesses. For the majority of respondents, there was no foreign capital involved (less than 11%). Almost half of the surveyed businesses indicated that over the last 5 years earnings had increased slightly, and considerable increase was observed in 26% of them. The financial result of less than 10% of companies decreased during this period [19].

Research Results

In order to assess the situation of enterprises in terms of their ecologization and to demonstrate the changes that took place in Polish companies after Poland's accession to the European Union, the questionnaire related both to the current situation and to the period 7 years ago, before Poland's accession to the EU. The respondents answered questions related to factors that motivate undertaking pro-environmental actions, priorities of such actions, or barriers

to them. Based on their answers it was possible to determine the changes in environmental parameters and changes in environmental policy of the businesses. In addition, respondents assessed the activities of their organizations in relation to water and waste management and air protection. They also had the opportunity to comment on the environmental management systems deployed in their organizations. Finally, the respondents were asked to evaluate specific parameters according to their significance, i.e. a number from 1 (most significant) to 5 (least significant) was attributed to them.

The starting point for the research was to determine whether dairy businesses took pro-environmental actions. Firstly, all medium-sized enterprises declared that they took such actions. Secondly, 87.5% of large companies showed implementation of environmental processes (the remaining units of this type declared implementation in the long-term perspective). Finally, 66.7% of small enterprises had such processes implemented.

The reasons for taking pro-environmental actions by dairy businesses were different (Fig. 1). Large companies and medium-sized enterprises identified the need to comply with legal requirements as the main reason for their actions. For large companies, a significant reason also was the possible reduction of production costs. For medium-sized enterprises, the main reason was increasing efficiency. For small enterprises, a legal compulsion to satisfy consumer requirements and the possibility of reducing production costs were on an equal footing in deciding on the implementation of environmental actions.

According to the Environmental Protection Act [11], the operation of installations and devices should not result in exceeding emission limits. Moreover, it is important that

the technology used in the newly launched or significantly changed systems and devices meets a number of requirements. These refer, first of all, to the use of substances of low potential risk, efficient production and use of energy, rational use of water and other raw materials, the use of non-waste and low-waste technologies, and the possibility to recycle generated waste. In addition, the requirements are concerned with the type, extent, and magnitude of emission. The abovementioned act also specifies the requirements to be met by manufacturers of specific products. When manufacturing products, entrepreneurs must reduce the consumption of substances and energy, as well as the use of substances that may adversely affect the environment throughout the product life cycle. It also is important to minimize the use of substances and technologies that hinder the repair of the product or its disassembly. In addition, it is of great significance to enable future use of product components in another product or its use for other functional purposes after it has been used up.

The respondents participating in the research were asked detailed questions about water and wastewater management. It was estimated that in the 7-year period the load of BOD₅ and COD had reduced most significantly and the load of nitrogen least significantly. In the two periods described in this paper more than 75% of companies/enterprises were reselling whey that was formed in the production of milk products to other businesses, and the rest of them used it again on their own account.

According to EU Environmental Policy, manufacturing companies should be guided by the overriding principle of economical exploitation of natural resources. The surveyed companies indicated the use of various methods to reduce water consumption (Table 1).

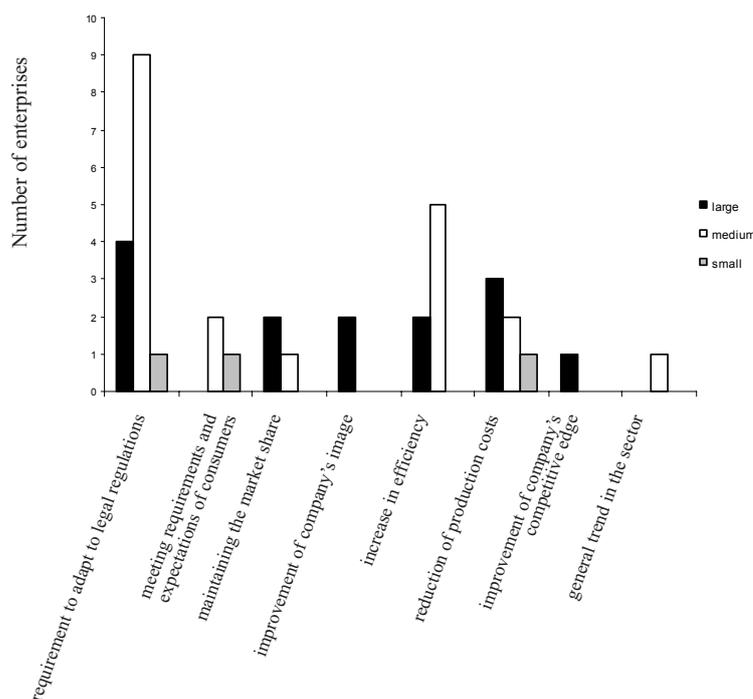


Fig. 1. Main reasons for taking environmental actions. Source: own study

Table 1. Methods to reduce water consumption by dairy processing companies in 2003 and 2010.

| Methods of reducing water consumption | Large companies | | Medium-sized enterprises | | Small enterprises | | |
|--|------------------|----------|--------------------------|----------|-------------------|----------|-----|
| | 2010 [%] | 2003 [%] | 2010 [%] | 2003 [%] | 2010 [%] | 2003 [%] | |
| Configuring all devices and appliances in an optimal way | 0.0 | 12.5 | 83.3 | 38.9 | 50.0 | 16.7 | |
| Reusing water that was used for washing crates | 12.5 | 0.0 | 11.1 | 0.0 | 16.7 | 0.0 | |
| Preventing excessive consumption of cooled water during breaks in production | 37.5 | 25.0 | 61.1 | 27.8 | 33.3 | 16.7 | |
| Reducing the number of rinse cycles in CIP systems by using computer control systems | 87.5 | 50.0 | 72.2 | 11.1 | 50.0 | 0.0 | |
| Improving washing vehicles by designing special washing stations | 50.0 | 25.0 | 61.1 | 22.2 | 33.3 | 16.7 | |
| Using pistol-handle hoses for washing | 62.5 | 50.0 | 72.2 | 22.2 | 50.0 | 16.7 | |
| Using the water from hoses to wash the production plant and vehicles | 75.0 | 50.0 | 55.6 | 44.4 | 33.3 | 16.7 | |
| Reducing the demand for cooling water in the UHT process by improving temperature regulation | 12.5 | 12.5 | 5.6 | 0.0 | 16.7 | 0.0 | |
| Replacing glass bottles with plastic bags | 25.0 | 12.5 | 61.1 | 27.8 | 33.3 | 0.0 | |
| Wastewater recirculation after cooling the sealant for milk cartons | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Using multiple-effect evaporators in powder milk production | 25.0 | 12.5 | 16.7 | 11.1 | 0.0 | 0.0 | |
| Reusing condensation water from evaporators for various purposes: | Fire protection | 12.5 | 12.5 | 22.2 | 11.1 | 33.3 | 0.0 |
| | Washing vehicles | 37.5 | 37.5 | 33.3 | 22.2 | 16.7 | 0.0 |
| | Washing devices | 12.5 | 12.5 | 22.2 | 11.1 | 16.7 | 0.0 |
| | Rinsing | 12.5 | 12.5 | 22.2 | 5.6 | 16.7 | 0.0 |
| Determining the proper amount of water and controlling for cheese production | 50.0 | 37.5 | 16.7 | 5.6 | 50.0 | 16.7 | |
| Using closed circuits for cooling water | 75.0 | 62.5 | 72.2 | 22.2 | 33.3 | 0.0 | |
| Using condensers and cooling towers | 37.5 | 25.0 | 33.3 | 0.0 | 0.0 | 0.0 | |
| Using dry-cleaning stages | 25.0 | 12.5 | 5.6 | 0.0 | 16.7 | 0.0 | |

Source: own study

87.5% of large companies showed that in 2010 they applied a limit to the number of rinses in CIP systems, and 75% of the organizations restricted their water usage by the use of water from the hoses that were used to wash the plant and vehicles. These businesses also made use of closed-circuit cooling water. 7 years earlier a significantly smaller number of large companies applied the methods of reducing water consumption. Among them, the most common was the use of closed circuit cooling water. For medium-sized enterprises in 2010, the majority of them (83.3%) utilized the optimal configuration of the devices for the purpose of reducing water consumption. In the earlier period, though, the most common way to reduce water consumption was to reuse water from hoses for washing plant and vehicles. The percentage of small enterprises that in their environmental policy included savings in water consumption was significantly lower than in other organizations. However, generally in each of the three groups the number

of activities related to saving water increased. Moreover, the percentage of enterprises using specific solutions aimed at efficient water management also increased. In other words, before Poland's accession to the European Union only a limited number of small enterprises implemented such solutions. The situation improved in this period of 7 years. What is more, medium-sized enterprises and large companies also intensified their efforts as far as water conservation was concerned.

Seven basic categories of waste could be distinguished in the surveyed sector. The task of the respondents was to evaluate which category of waste had been reduced most significantly in the period of 7 years (Fig. 2, number 1 in the picture stands for biggest reduction in amount of waste and number 5 for smallest reduction).

Businesses showed that the greatest reduction in waste generation could be observed in coal ash, due to the use of coal boilers, together with post-processing organic waste

Table 2. Methods for minimizing waste by dairy processing companies in 2003 and 2010.

| Method of minimizing waste | Average grade for 2008 | Average grade for 2003 | Percentage of entities not implementing waste minimization | |
|------------------------------------|------------------------|------------------------|--|---------|
| | | | in 2008 | in 2003 |
| Using reusable packaging | 3.8 | 3.6 | 53.1 | 50 |
| Recycling waste | 1.8 | 2.8 | 21.9 | 50 |
| Modifying technology | 2.2 | 2.4 | 37.5 | 65.6 |
| Improving the economy inside plant | 2.2 | 2.7 | 37.5 | 53.1 |
| Modifying products | 2.5 | 3.9 | 40.6 | 71.9 |

Source: own study

and packaging waste. Reducing the amount of coal ash was probably a consequence of the fact that the production plants were using gas boilers more and more frequently. Furthermore, the smaller amount of packaging waste resulted from the transfer of used packaging for recycling. The group of inorganic post-processing waste and other organic waste or rotting waste was reduced in quantity to the smallest degree over the years. This may show that there is a possible niche when it comes to managing this kind of waste in the dairy industry.

The study also analyzed the type of actions undertaken by businesses in the dairy industry to minimize the amount of waste generated (Table 2). The most important of them in 2010 was the use of recycling and modifying technologies, as well as improving the economy inside the plant. Seven years earlier, waste reduction was usually achieved by modifying the technology. In both periods, the least popular ways to minimize the amount of waste were the use of reusable packaging and modification of products. Between 2003 and 2010, the percentage of dairy business that did not implement any actions in order to reduce waste production also had decreased. However, the businesses used reusable packaging only to a limited extent.

In addition to the priority action, which was to minimize the amount of waste generated, the surveyed entities found other methods of final waste disposal (Table 3).

The most widely used method of waste disposal in 2010 was minimizing the amount of waste and recycling. In 2003 most companies/enterprises in the dairy industry allocated waste for animal feed. Minimizing the quantity of the waste and depositing it in waste stockpiles was less popular in that period. In individual cases, waste combustion process was utilized and the percentage of business entities not making use of this method did not change during a period of 7 years. The percentage of entities that declared that they did not implement measures to minimize waste and that did not allocate waste for recycling or for farming purposes, e.g. as fertilizer decreased in the same period. Concurrently, the percentage of organizations not depositing waste in stockpiles or allocating it for animal feed or selling it for road construction increased.

As far as environmental management was concerned, the results of the survey showed that the dairy companies implemented measures to protect the atmosphere, which have brought tangible benefits in the form of a reduction in air pollutants (Fig. 3).

The biggest quantitative reduction could be observed in cases of carbon monoxide and dioxide. The primary cause of this was the modification of systems related to obtaining energy. The smallest changes were connected to reducing the amount of hydrocarbons and nitrogen oxides produced. This may be due to shortcomings in the implementation of

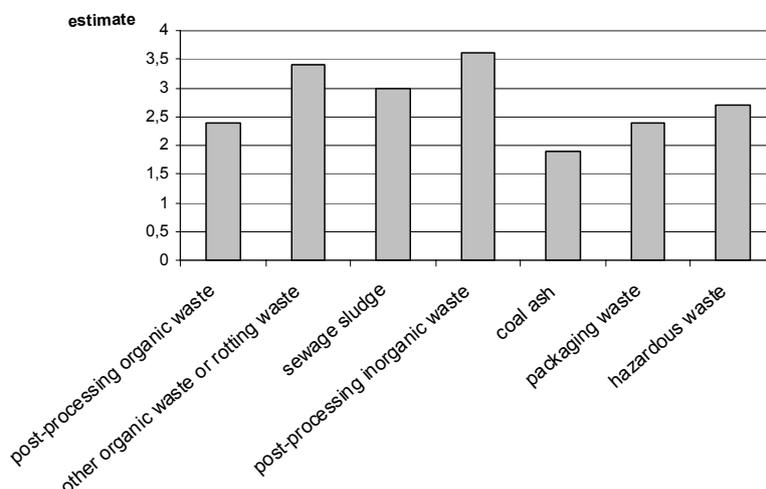


Fig. 2. Waste reduction by dairy processing companies in 2010 compared to 2003.

Source: own study

Table 3. Evaluation of methods of waste disposal by dairy processing company in 2003 and 2010.

| Waste disposal method | Average grade for 2003 | Average grade for 2010 | Percentage of business entities not implementing the specified method of waste management | |
|-------------------------------------|------------------------|------------------------|---|---------|
| | | | in 2008 | in 2003 |
| Minimizing quantity | 1.9 | 2.6 | 28.1 | 31.2 |
| Recycling | 2.1 | 3.3 | 12.5 | 18.7 |
| Depositing in waste stockpiles | 2.9 | 2.6 | 46.9 | 43.7 |
| Waste combustion | 4.7 | 4 | 75.0 | 75.0 |
| Allocating waste for animal feed | 2.5 | 2.2 | 31.2 | 21.9 |
| Use in farming, e.g. as fertilizers | 3 | 3.3 | 59.4 | 65.6 |
| Selling, e.g. for road construction | 3.4 | 3.1 | 65.6 | 62.5 |

Source: own study

modern technological solutions, which according to companies' beliefs did not produce tangible economic benefits.

The businesses submitting questionnaires also evaluated the major sources of air pollutants in their plants (Fig. 4).

A considerable percentage of the representatives of the surveyed businesses pointed out that boilers used in their companies were no longer coal-fired. However, in spite of this, the primary source of air pollution, according to them,

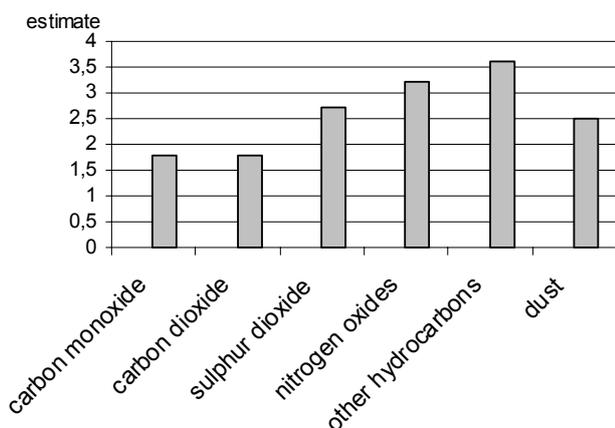


Fig. 3. Evaluation of air pollution reduction by dairy processing companies in 2010 compared to 2003.

Source: own study

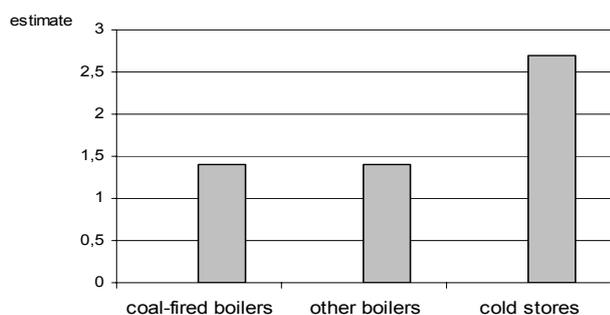


Fig. 4. Evaluation of principal sources of pollution by dairy processing companies.

Source: own study

was still coal-fired boilers. Moreover, an important source of air pollution also was cold stores. They were responsible for a considerable amount of nitrogen oxide emissions. This aspect of air pollution will probably be a problem in the future, since companies are not motivated by legal requirements, which is the case for carbon emissions. Hence, companies in the first place upgrade infrastructure to reduce carbon emissions and innovations associated with the use of modern refrigeration systems are pushed to the sidelines.

The respondents representing the surveyed businesses were asked to identify the most important ways of reducing emissions to the atmosphere (Table 4).

In 2010 the most important way of reducing pollutant emissions into the atmosphere was the use of advanced combustion technology and the purchase and installation of gas boilers. The least popular among dairy companies was desulphurization of fuels, flue gases, and reducing the flame temperature. Seven years earlier methods of reducing emissions to the atmosphere were much less common. The use of low calorific value fuels reducing SO_2 formation, as well as maintenance of the potential sources of fugitive emissions, were the key methods of reducing emissions mentioned by the respondents. In 2003 spray scrubber, dry injection, fuel desulphurization, or modern combustion technology were used only to a limited extent. In 2010, compared to 2003, among actions aimed at minimizing the amount of air pollution the importance of gas installations, capturing systems in order to reduce the emission point, and modern combustion systems increased. Despite the positive developments in the implementation of methods to reduce emissions to the atmosphere, there still is not a satisfactory number of companies that use such methods. In 2010, over 90% of respondents did not use denitrifying appliances, reduce the flame temperature, desulphurize flue gas and fuels, use modern combustion technology, spray scrubbers, or dry injection. A positive fact is that the percentage of companies using most methods for reducing emissions increased in 2010 in comparison to 2003. This applies particularly to installing gas heating. It should be noted that none of the companies surveyed identified any other ways to reduce emissions of pollutants into the atmosphere.

Table 4. Evaluation of methods of reducing emission by dairy processing company in 2003 and 2010.

| Method of reducing emission | Average grade for | | Percentage of entities not reducing emissions by specified means | |
|---|-------------------|------|--|------|
| | 2010 | 2003 | 2010 | 2003 |
| Reducing dust by cyclone filters | 2.6 | 2.7 | 65.6 | 71.9 |
| Using sleeve filters | 2.5 | 3.7 | 87.5 | 90.6 |
| Conversion to gas heating | 1.2 | 3.2 | 28.1 | 75.0 |
| Using spray scrubber or dry injection | 4.0 | 5.0 | 93.7 | 93.7 |
| Using the leak detection and repair (LDAR) programme in ammonia refrigeration systems | 2.5 | 2.8 | 68.7 | 81.2 |
| Continuous maintenance of potential sources of fugitive emissions | 2.2 | 2.5 | 43.7 | 46.9 |
| Installation of automatic venting systems | 2.8 | 3.1 | 68.7 | 75.0 |
| Conversion to heating with another fuel with low sulphur content | 2.0 | 2.8 | 78.1 | 84.4 |
| Applying capture systems to reduce point emissions | 1.5 | 3.2 | 87.5 | 87.5 |
| Using low calorific fuel (reducing SO ₂) | 2.7 | 2.0 | 78.1 | 87.5 |
| Desulphurization of fuel | 4.0 | 5.0 | 93.7 | 96.9 |
| Applying modern combustion technology | 1.0 | 5.0 | 96.9 | 96.9 |
| Desulphurization of flue gases | 4.5 | 4.5 | 93.7 | 93.7 |
| Reducing the flame temperature | 4.3 | 4.5 | 90.6 | 93.7 |
| Reducing excess air | 3.0 | 3.2 | 71.9 | 75.0 |
| Using denitrifying appliances | 4.0 | 4.3 | 90.6 | 90.6 |

Source: own study

Despite the introduction of many pro-environmental actions, the surveyed dairy companies, in general, have not implemented environmental management systems (EMSs). Only two large organizations were in the process of implementation of an EMAS system. Moreover, four large companies implemented an environmental management system in accordance with the requirements of ISO 14001 and intended to have it certified in the near future. Small and medium-sized enterprises declared that even in the distant future, they would not seek to implement EMAS, and among medium-sized organizations only one was in the process of implementing an environmental management system compliant with ISO 14001, while two other organizations planned to implement this system in the near future. The reasons for not taking actions in order to implement the EMS were mainly: lack of funds (medium-sized organizations), lack of time (large organizations), and not noticing the necessity of taking such actions (small organizations). For large companies, an important motivating factor for the implementation of EMS was improving their image, creating an effective and transparent system of governance, improving the functioning of the plant, and obtaining the certificate. Large companies indicated that during the implementation of EMS the highest costs incurred by them were related to investment and renovation, purchase of new machinery and equipment, and technology and devices. They financed their expenses primarily with EU funds and

their own financial resources. Other sources of funds were bank loans and the Ecofund. The main barriers to the implementation of EMS were high costs and the time-consuming nature of such actions. The main beneficial effect associated with these actions was increasing management efficiency and reducing production costs, as well as improving the functioning of the enterprise, increasing its efficiency, and improving product quality. According to the respondents, the positive consequences of the implementation process could have been even better if there had been greater involvement of employees participating in the implementation of EMS in the process. No adverse consequences were noted. In comparison to 2003, an increase in employee awareness of environmental policy and its implementation could be observed. The management of surveyed businesses provided conditions for continuous improvement of EMS by informing employees about the objectives and tasks of individuals (2010) and creating proper teamwork (2003). The effectiveness of the system was most frequently verified by means of internal audits (2010), as well as proper management reviews (2003). The vast majority of large companies employed a specialist for environmental protection. For medium-sized enterprise, only half of them has such an employee and for small enterprises only one in three. In 2003, in all surveyed organizations it was not so common to employ a specialist for environmental protection. Most large companies and medium-sized enterprises

indicated that they were monitoring environmental indicators. The number of such organizations rose slightly in 2010 in comparison to the previous period (2003). Only 30% of small enterprises indicated that they monitored environmental indicators. In comparison to 2003 nothing had changed in this respect when it comes to small organizations. In almost all entities surveyed, an external body (usually the regional inspectorate for environment protection) carried out systematic controls of environmental standards, both in 2003 and in 2010.

Conclusions

Dairy companies/enterprises located in the Wielkopolska Region base their development strategy *inter alia* on the guidelines of EU environmental policy. The guidelines dictate business conduct that is consistent with the principles of sustainable development. In order to efficiently and effectively carry out environmental policy it is necessary to properly manage the way the environment is used, shaped, and protected. Environmental management in the dairy sector is associated with activities undertaken in the field of waste management and water and wastewater management, as well as air protection. Without proper organization and control, as well as planning and motivating employees, it is difficult to achieve the intended objectives and improve the functioning of organizations.

Most of the organizations implemented actions for the environment, and their importance in the management of the company increased in comparisons to the period when Poland was not a member of the European Union. The most common reason for taking such action was legal compulsion, but the possibility of reducing production costs and increasing efficiency also was important.

With regard to water and wastewater management, mainly large and medium-sized organizations showed specific actions, especially when it comes to implementation of projects aimed at conserving water resources.

In the case of waste management and atmosphere protection, the authors did not make any distinction in terms of size of the organization as in their opinion this should not have any effect on the overall inference. Currently, the priorities in waste management are minimizing the amount of waste by recycling and technological changes, as well as internal improvements in the plants. Seven years earlier dairy firms devoted most of their waste for animal feed, and only in the second row tried to prevent waste from occurring. Compared to 2003, nowadays there are fewer organizations for which depositing waste in stockpiles or combusting it in installations intended for this purpose is the main method for waste management.

When it comes to air protection, most attention is given to reducing carbon monoxide and dioxide emissions. This has been achieved by replacing coal-fired boiler rooms by gas-fired ones. However, still there are too few companies that have introduced such changes and for many organizations the main source of air pollution is the coal boiler.

In 2003 there were more activities related to the reduction of SO₂, as the problem of global warming seemed to be less important than acid rain. Despite greater involvement of organizations in reducing emissions into the atmosphere, still their actions are not diversified and intensified enough.

The possibility of increasing the role of the systems approach to environmental management in the functioning of dairy companies also is associated with increased awareness of both managers and junior staff. The actions that have been carried out so far could contribute to reducing the negative influence of such organizations on the environment to a larger extent in the future. In addition, employees can consciously and effectively manage the significant environmental aspects arising in these organizations. It also is important to change the perception of environmental protection, as an unnecessary burden hindering the proper functioning of the company. Moreover, it is necessary to change the approach to environmental management, which is a chance to develop the organization in an effective way and not be an obstacle in achieving the primary goal, which is maximizing profit.

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