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THE IMPACT OF ENVIRONMENTAL TAXES ON MITIGATION OF POLLUTION IN AGRICULTURE: THE THEORETICAL APPROACH

Astrida Miceikienė [1], Damian Walczak [2], Ieva Misevičiūtė [3]

[1]*Prof., Vytautas Magnus University, Lithuania, E-mail address: astrida.miceikiene@vdu.lt*

[2]*Prof., Nicolaus Copernicus University in Toruń, Poland, E-mail address: dwalczak@umk.pl*

[3]*Mg., Vytautas Magnus University, Lithuania, E-mail address: ievosmiseviciutes@gmail.com*

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Abstract
The research problem is based on the increasing global environmental pollution, reduction of the natural potential of countries, and the importance of exploration of effective measures for the solution of these issues. The research analyzes the impact of environmental taxes as an environmental policy instrument helping reduce environmental pollution and increase the natural potential of agriculture. Environmental taxes are one of the most important tools for the reduction of GHG emissions in the EU. The research aim is to theoretically substantiate the role and impact of environmental taxes on the mitigation of pollution in agriculture. Research results present that environmental taxes have generic and specific goals and are related to the conventional tax functions: fiscal, regulatory, and redistributory. The identified strengths, weaknesses, applicability, and limitations of the environmental taxes enabled the identification of the prospects of these taxes in terms of pollution mitigation. The classification schemes of the environmental taxes were prepared with the environmental taxes grouped by various attributes. Moreover, the environmental tax objects were identified and substantiated, in particular, those in agriculture. The possibilities and limitations of application of the environmental taxes to agriculture in the context of the implementation of the European Green Deal were described. The following theoretical methods were used in order to substantiate the problem's relevance: scientific literature analysis, comparative analysis, systemic analysis, document analysis, generalization analysis, and other common research methods. The bibliometric method was used in the analysis of the relations between environmental taxes goals and functions from the theoretical perspective.

Keywords: *Environmental taxes, Agriculture, Mitigation of pollution in agriculture.*
JEL codes: *Q14, Q58.*

Introduction

Researchers tend to refer to environmental taxes as one of the major fiscal policy tools. They are intended to mitigate the environmental pollution and urge the businesses to make the commitment and assume the measures that may contribute to the abatement of the greenhouse gas (GHG) emissions.

Agriculture is one of the economic activities that may be influenced by environmental taxes. With the productivity of the agroecosystems growing, the respective changes in agricultural production have been taking place and contributing considerably to the growing environmental pollution. In light of the growing attention to the environmental pollution in agriculture in the international documents, it has become increasingly necessary to analyse the causes behind the respective issues and possible consequences.

Provisions of the agreement under the Common Agricultural Policy (CAP) and Green Deal of the European Union (EU) aim at promoting environmentally friendly agriculture with low greenhouse gas (GHG) emissions, which would also be competitive and secure the sustainable use of natural resources and climate policy actions with the

view towards balanced territorial development of rural economy and communities and job creation and preservation.

Agriculture has recently been referred to as one of the major consumers of nature and its resources and the environmental polluter that causes negative agricultural externalities in relation to the nature and environment. These externalities could be mitigated by environmental taxes. However, scientific arguments and substantiation are needed in order to assess the role and effect of the taxes on the environmental pollution in agriculture.

Wide-scope analysis of the environmental taxes has been performed by the researchers; however, there are very few research findings pertaining to agriculture in this field. Based on the research studies analysed, the researchers have been found to usually consider the role of the environmental taxes in agriculture either in combination with other business sectors or at the macro level (Ghazouani et al., 2021; Esen et al., 2021 Hassan et al. 2018; Mackenzie et al., 2017). They also analyse the practice of individual countries or groups of countries: Slovakia (Inkábová et al., 2021), Spain (Gallego Valero et al. 2020), countries in Latin America (Boix, 2018); Ukraine (Varchenko et al., 2018), Sweden (Gren et al., 2021), and other. The latest research studies on the topic analysed are directed towards the link between environmental taxes and green growth. This is related to the current policy on the abatement of environmental pollution and implementation of the international agreements (Delgrado et al., 2022; Safi et al., 2021; Kotlán et al., 2021).

International organisations, such as the OECD, FAO, European Commission, etc., also pay considerable attention to environmental taxes. Experts at the organisations explore the action of the environmental tax measures that are intended to improve the sustainability of the environment; the taxes that are the most effective in terms of abatement of the GHG emissions in agriculture (OECD, 2020), and the beneficial and harmful tax exemptions.

The global trends associated with mitigation of the consequences of climate change and abatement of environmental pollution suggest the need for more comprehensive investigation of the impact of environmental taxes on agribusiness in view of the goals of the European Green Deal and the UN Climate Change Conference in Paris.

In research studies, theoretical substantiation provides a systematic approach to the existing processes and phenomena. Hence, the present research, is intended to form a theoretical approach toward the role and impact of environmental taxes on the response to the mentioned problems in agriculture.

Research aim: to theoretically substantiate the role and impact of environmental taxes on the mitigation of pollution in agribusiness.

Materials and Methods. The following theoretical methods were used in order to substantiate the problem's relevance: scientific literature analysis, comparative analysis, systemic analysis, document analysis, generalization analysis, and other common research methods. The bibliometric method was used in the analysis of the relations between environmental taxes goals and functions from the theoretical perspective. The research described herein was conducted by Lithuanian and foreign researchers and published in peer-reviewed and international databases with an impact factor, such as Web of Science, Scopus, EBSCO, and Springer, were analysed.

The results of this research provide an opportunity for empirical research in this area.

Results

Environmental taxes are one of the environmental protection methods that enable control over the use of non-renewable resources. The rationale behind the environmental taxes is based on the aim to impose taxes on behavior that is harmful to the planet. The environmental taxes are therefore based on a simple principle that is often described in the literature as the "polluter pays" principle and are necessary as a part of the mitigation of climate change (Schmidtchen et al., 2021).

With the concern about climate change growing, a lot of European countries, such as Germany, Belgium, Great Britain, France,

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Austria, and Finland, have been prioritizing the environmental issues on the agenda. Environmental tax reforms have been implemented in almost all European countries already, and environmentally friendly technologies and other measures have been implemented very rapidly. Environmental taxes are referred to as one of the most appropriate measures to address this problem. Unfortunately, for example in Poland, Lithuania, and Latvia the environmental tax reforms have not yet been implemented (Soliwoda, M., Pawłowska-Tyszko, J., 2015;).

In their works, the researchers (Glazyrina, I., Glazyrin, V., & Vinnichenko, S., 2006) claim that the aim of the environmental taxes is to impel the polluters to pay under the "*polluter pays*" principle, with the costs of these externalities reflected in the price. Under the "*polluter pays*" principle, the majority of the European countries apply environmental taxes in proportion to the amount of pollutants emitted. This principle is discussed by many authors, and the intensive discussion in the research domain is evidence of the importance of this principle. The key idea behind the "*polluter pays*" principle is the solution to a dual problem: the problem of the polluter and the impact of externalities (Schmidtchen et al., 2021; Heine et al. 2020; Barrett et al., 2019). The "*polluter pays*" principle is expected to urge the polluter to shift from the consumption that causes pollution to more sustainable consumption, which would be less expensive.

According to a scientific article (OECD, 2021), the environmental taxes may directly solve the problem of disregard of the environmental impact by the markets, as the impact is included into the cost. The environmental pricing through taxes leaves the consumers and businesses the flexibility to decide on the most appropriate way of reducing of own "ecological footprint". A properly developed environmental tax leads to an increase in the cost of a product or activity so as to reflect the cost of the environmental damage caused by the consumer/business. This ensures that the consumers/businesses consider these costs when making respective decisions.

The opinion shared across different scientific literature is that environmental taxation is the key measure when transitioning to the decarbonised economy that favours sustainable development. Moreover, environmental taxes are used successfully when addressing diverse problems, such as waste disposal, abatement of water and air pollution. Tax experts and researchers (OECD, 2011) have identified the following differences between the environmental taxes and state regulations as well as the advantages of the taxes:

1) Ongoing incentive to reduce pollution. Target- or technology-based state regulations do not promote abatement of the environmental pollution once the target or technological standard has been achieved. The environmental taxes, to the contrary, provide the continuous incentive to reduce the emissions at all levels even after the pollution has been reduced considerably.

2) Improve the competitiveness of low-emission alternatives. The environmental taxes increase the demand for low-emission alternatives such as public transport and cycling where the environmental taxes are imposed on the automotive fuel. This helps achieve the economy of scale making these alternatives more promising and does not require any direct subsidies.

3) Strong incentive to innovate. The environmental taxes increase the polluter's expenses and, therefore, urge the companies to create innovations and implement clean technologies. These incentives disappear where the environmental pollution abatement measures based on other regulations are used. The developed innovations reduce the business costs that are associated with solutions of environmental challenges in the long-term perspective.

The literature analysis has suggested that the researchers have different approaches to the function of environmental taxes. Based on the analysis conducted, the present research identifies the environmental tax practices by identifying their weaknesses, strengths, opportunities, and limitations of application (Table 1).

Table 1. Weaknesses, strengths, opportunities, and limitations of application of environmental tax practices

Strengths	Contribute to abatement of the environmental pollution	Contribute to mitigation of the climate change consequences	**Opportunities**
	Promote sustainable economical development	Contribute to the implementation of the European Green Deal goals	
	Increase the state revenue	Contribute to a fairer tax burden after the environmental tax reform is implemented	
	Have a positive effect on the state tax structure		
	Increase the effectiveness of the use of the environmental resources	Create the possibility to reduce the tax burden on the business entities that reduce the environmental pollution	
	Promote sustainable use of natural resources		
Weaknesses	Lack of arguments and research on the impact of the taxes	Fair tax burden may become distorted due to the complexity of identification of the impact	**Limitations of application**
	Negative political attitudes in certain countries	May lead to the relocation of high-polluting businesses to countries with lower environmental tax rates or without any environmental taxes	
	Higher risk of tax evasion		
	Lower business competitiveness between countries and industries		
	High administrative and tax implementation costs		

**Source: compiled by the authors according to Miceikiene et al., 2022; Ghazouani et al., 2021; Safi et al., 2021.*

Same as any other taxes, environmental taxes have generic and specific goals that are associated with the conventional tax functions: fiscal, regulatory, and redistributory. The generic goals are associated with the fiscal function, while the special goals – with the regulatory and redistributory functions. Fig. 1 presents the links between the generic goals, tax functions and goals of the environmental taxes.

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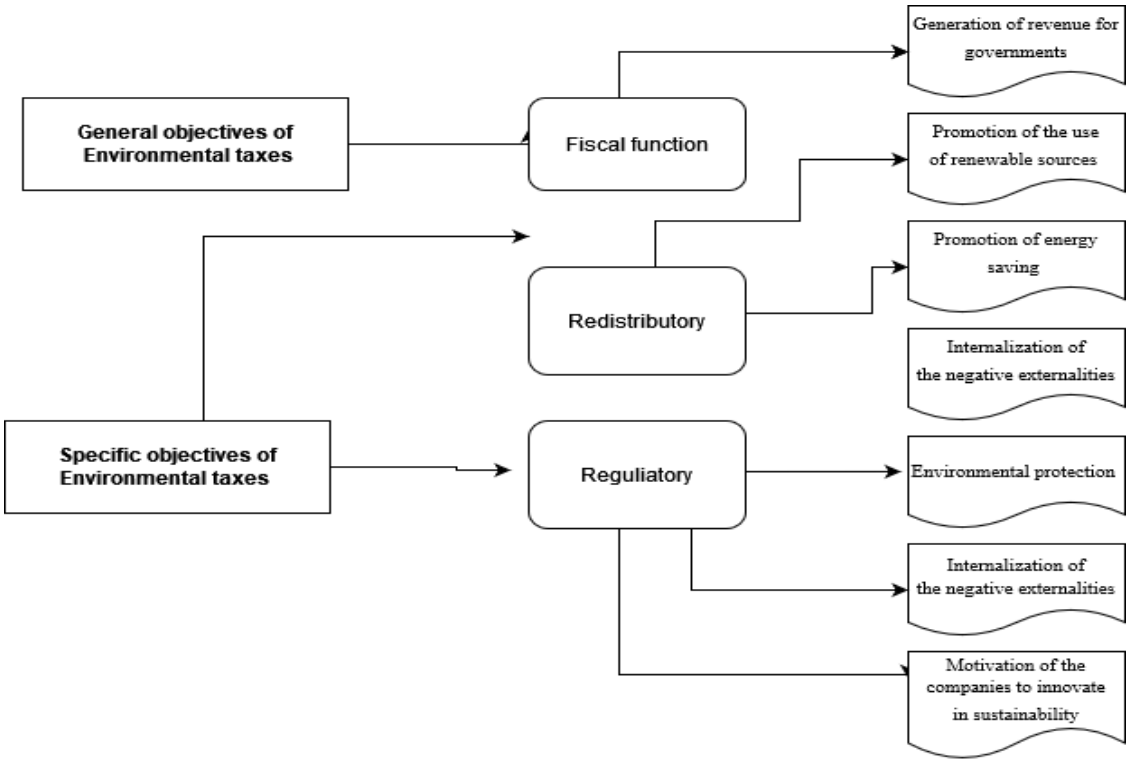

Figure 1. Links between the environmental tax goals and functions

**Source: compiled by the authors.*

In order to perform a comprehensive integrated analysis of the function and specifics of application of the environmental taxes in agriculture, it is important to classify these taxes by attributes.

The researchers and international organisations analyse the environmental taxes by their respective area of problem solution: conservation of natural resources, waste reduction, energy saving, etc. (OECD, 2020; Shahzad, 2020; Miceikiene et al., 2022).

Researcher Miller (2015) identifies two types of the environmental taxes: direct and indirect. Direct taxation is associated with higher administrative costs of tax collection. Their rate structure is closely associated with the ability-to-pay principle. Direct taxes may be increased gradually, and the level of progress of different groups of revenue may be established so as to comply with the ability-to-pay principle. A greater share of the burden of the progressive taxes is carried by those polluting more who have the ability to pay the taxes, while the persons and businesses polluting less carry a lower tax burden. They do not cause the distribution of resources. Direct taxes have high elasticity if progressive tax rates are established. Indirect taxation is described as a simpler method in terms of tax collection. In this case, however, there are fewer possibilities to distribute the tax burden between those polluting less and those polluting more.

The environmental taxes have an impact on the taxpayer's behaviour and impel the taxpayers to perceive the negative impact of their activity, in particular, in relation to biodiversity, natural resources, and health. These taxes urge the taxpayers to conserve water resources, soil, air and nature by making efforts to limit waste, and reduce energy consumption and emission of pollution. According to the statistics framework jointly developed by the Eurostat, European Commission, Organisation for Economic Cooperation and Development (OECD), and International Energy Agency (IEA) in 1997, environmental taxes are *"those whose tax base*

consists of a physical unit (or similar) of some material that has a negative, verified and specific impact on the environment".

The analysis of the classification of the environmental taxes has suggested that the findings of the tax type analysis are directly associated with the goals set for the respective types of taxes. The goals of environmental taxes have been analysed individually by different researchers (Shahzad, 2020; Csikosova et al., 2021; Doğan et al., 2022; Tan et al., 2022). The present research systematizes the classification scheme of the environmental taxes and links them with the respective goals (Fig. 2).

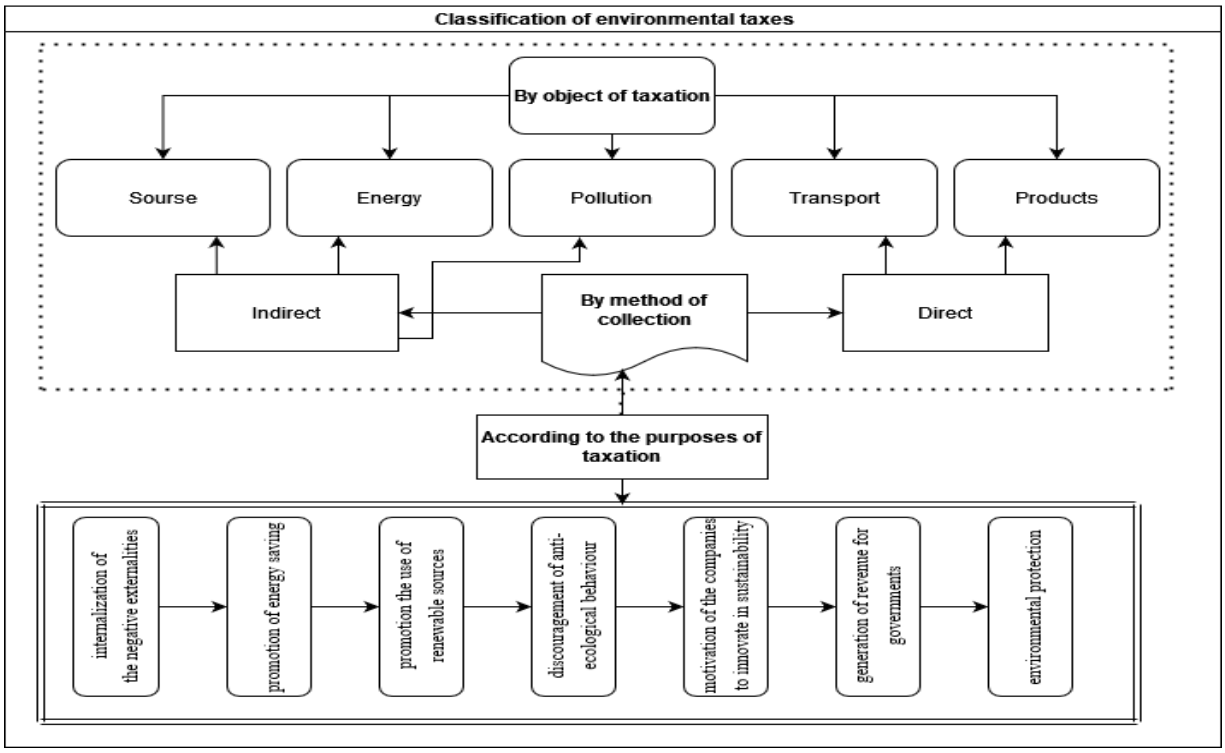

Figure 2. Classification scheme of the environmental taxes

**Source: compiled by the authors according to Shahzad, 2020; Csikosova et al., 2021; information by the European Commission.*

According to Eurostat, energy taxes amounted to 77.5% of the total environmental tax revenues in the EU in 2020, which was much higher than the other two main categories: transport (18.95%) and pollution, product and resource taxes (3.55%).

According to the researchers (Don Fullerton, Leicester, Smith, 2008), the environmental tax revenues are not sufficient enough to change the constraints of the environmental tax policy, and the environmental taxes should primarily be based on the economically effective implementation of the environmental goals. The OECD recommends that, in the design of the environmental taxes, the tax base should be focused on the polluter or polluter's behaviour (OECD, 2011), and identifies the following key elements:

1. In an ideal case, the scope of application of the environmental tax should correspond to the scope of the environmental damage.
2. Tax rates should be commensurable to the damage made.
3. The tax should be credible and its size – predictable so as to encourage improvement of environmental protection.
4. The environmental tax revenues should help consolidate the fiscal information or reduce other taxes.
5. The effect of the distribution of the environmental taxes should be addressed by using other policy measures.

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6. The issues of competitiveness should be assessed comprehensively as coordination and transitional relief may become an effective response.

7. Clear communication is very important for society to accept environmental taxation.

Each country has its own environmental tax system. Irrespective of the above, the key taxable objects are:

1. Emission of nitrogen monoxide (NO) and nitrogen dioxide (NO_2) from vehicles with internal combustion engines.

2. The emission of sulphur dioxide (SO_2) is the main cause of acid rain and results from the combustion of petroleum products and coal.

3. Waste management (household, commercial, industrial, construction, and other waste).

4. Noise and pollution resulting from aircraft take-off and landing.

5. Energy products (gasoline, diesel, natural gas, coal, electricity generation from fuel, etc.) emit CO_2 during combustion.

6. Soil and water pollution sources (pesticides, artificial fertilisers, acids, etc.).

7. Soil manipulation and natural resource mining as well as their irrational use.

8. GHG emissions from animal husbandry.

9. Products depleting the ozone layer.

Analysis of specifics of application of the environmental taxes in agriculture is very important field. The European countries have been expressing an increasing concern about the environment and public health. Hence, the policy makers have been under growing pressure to draft tax laws that promote the conservation of the environment. The tax provisions that promotive agricultural production have, till present, been inevitably leading to development of agriculture, bringing substantial changes to the natural landscape. The environment pays a high cost as a result of these changes due to the soil transformation, biodiversity loss, pollution due to exhaust emissions, and agrochemical liquid waste.

According to researchers (Balafoutis, Beck, Fountas, Vangeyte, Wal, Soto, ... & Eory, 2017), agriculture is one of the economy sectors that have considerable impact on climate change and contribute, either directly or indirectly, to the GHG emissions. A downward trend in GHG emissions has been observed in agriculture. This practice, however, must not influence the efficiency of a farm or economy in a negative way; otherwise, this would limit its implementation due to the high global demand for food and feed and competitive environment in this sector.

According to the researchers (Miller, 2015), the income tax policy has two indirect channels of secondary environmental impact. The first channel influences the scope of agricultural activity within the economy as the use of land has significant environmental consequences. For example, a tax policy may affect a person's willingness to start a new farm or prompt the best option to abandon farming. It may also affect the person engaged in farming. The second channel influences the farming practice. A tax policy may impact the farmers' decisions related to production and, in certain cases, may have a positive environmental effect.

Researchers often describe the comparative environmental impact of small farms and large farms. This kind of research usually provides the comparison that is usually based on differentiation between the practices at the farms of different sizes (Pacini, Wossink, Giesen, Vazzana, Huirne, 2003). Large farms are usually considered to have a higher level of mechanisation and be capital-intensive, while smaller farms are referred to as more favourable for sustainable agriculture (Tavernier, Tolomeo, 2004). However, the description of environmental consequences is not always clear as agricultural systems are fairly complex and vary depending on their products and regions. An organic product or activity in one location might be considered as non-organic in another location. For example,

organic farming is essentially considered to be superior to the conventional practices. However, if an organic farm is located in a drier region, it will require more irrigation than usual. Hence, organic farming could cause negative externalities.

According to researcher (Miller, 2015), there are numerous research studies related to application of taxes and the effect thereof on the environmental outcomes. Carbon dioxide tax is at the forefront of these discussions. The discussions are mostly focused on the identification of whether the tax policy is capable of reducing the GHG emissions without a negative impact on the economic growth (Bosquet, 2000). The widely used carbon dioxide tax influences the farms by increasing the costs of use of the raw materials that emit carbon dioxide, e.g., fuel and synthetic fertilisers. The carbon dioxide tax, same as the fuel tax, indirectly implies an agricultural equipment tax and causes a secondary effect related to higher equipment costs of the farm. This means that the farm will be likely to replace mechanisation with manual labour. Nonetheless, according to a recent study of the farms' response to changes in the energy prices, the farm capital expenditures are not likely to decrease significantly in case of an increase in the farm equipment maintenance costs (Lambert, Gong, 2010). In their study, Lambert and Gong have determined that the demand for farm equipment is most usually inelastic in relation to higher fuel costs. Other researchers have also found that the growth in the pesticide and fertiliser costs has slowed down (Bosquet, 2000; Falconer, Hodge, 2000). Hence, the tax on carbon dioxide emissions is not likely to lead to transition of production to less labor-intensive production methods, such as IPM. This may also have a negative impact on the fresh farmers due to higher production costs.

With agriculture being a capital-intensive industry, the tax policy intended to handle capital expenditures plays an important role in the net revenues of the farm. Although the scope of requirements on capital investments differs depending on the product, management process, and size of operation, it has direct influence on who is engaged in farming and how. It is claimed in the literature that the demand for capital expenditures of farms (and the majority of other expenditures) is essentially inelastic to price changes, which shows that the farmers do not rush to change their practices (Gliessman, 2006).

Technological progress in the area of smart sensing technologies (Mukhopadhyay, 2012) and geographic information systems as well as the precision farming technology enable the farmers to accurately select respective combinations of agrochemicals. The above technologies are a highly promising area for the new capital investments that reduce the burden of modern agriculture on the environment. Nonetheless, these technologies are expensive and often unaffordable to the farmers. Hence, the policy that promotes establishment of larger farms also facilitates implementation of new technologies.

Based on the environmental tax goals and types analysed previously, the taxation objects of the environmental taxes in agriculture have been identified (Nausėdienė, 2021).

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Table 2. Environmental taxes objects in agriculture

Environmental taxes types	Environmental taxes objects in agriculture
Energy	Energy products for agricultural equipment. Energy products for stationary agricultural machines (grain dryers, etc.) Greenhouse gas emissions
Transport	Imports or sales of motor vehicles Registration of motor vehicles Road taxes Vehicle insurance
Pollution	Measured/estimated GHG emissions into the air (fermentation in livestock digestion, etc.) Diffuse sources of pollution (mineral fertilisers and pesticides) Waste Noise
Resources	Water abstraction Collection of biological resources Wood cutting
Products	Agricultural production

**Source: (Nausėdienė, 2021).*

Fuel used in agriculture for plant and livestock growing, plant protection measures and fertilisers are the major polluters used in agriculture. Lower use of fertilisers and pesticides and reduction of the GHG emissions in agriculture are one of the key climate change mitigation measures provided for under the European Green Deal. Fuel used in agriculture contributes considerably to the GHG emissions. The measures for reduction of fertilisers and GHG emissions shall be implemented under the new CAP 2021–2027. For the purpose of abatement of the pollution caused by family farms, the taxation objects are fertilisers, plant protection measures, fuel, and the processes of livestock production, in particular, digestion of the ruminants, and the manure handling processes.

Assessment of these sources of pollution in the context of environmental taxes requires a comprehensive analysis of the extent of the effect of the environmental taxes on the reduction of the sources of pollution in agriculture. The majority of the pollutants used in agriculture have not yet been subjected to taxation, although a few countries have been debating on the fertiliser and pesticide taxes as well as the elimination of tax exemptions for diesel fuel.

Conclusions

1. The environmental taxes contribute to solving several societal challenges: ensuring food security, management of natural resources in a sustainable manner, reduction of dependence on non-renewable resources, mitigation of and adaptation to climate change, creation of jobs, and maintenance of competitiveness.
2. The introduction of the pro-environmental reliefs in the existing taxes, also, should be considered. It could be specific allowances for the purchase of environmental technologies.
3. Same as in the case of any other taxes, the environmental taxes have generic and specific goals and are related to the conventional tax functions: fiscal, regulatory, and redistributory. The generic goals are associated with the fiscal function, while the special goals – with the regulatory and redistributory functions. The links between the environmental tax goals and functions were provided.
4. The identified strengths, weaknesses, applicability, and limitations of the environmental taxes enabled identification of

the prospects of these taxes in terms of pollution mitigation.

The information also enabled the authors to form the prospects of the application of the taxes to business, including agriculture.

5. The key elements of the formation of the environmental taxes were identified. The elements are related to the scope of application, size, implementation of the functions, and the role in the formation of the environmental policy.

6. The classification schemes of the environmental taxes were prepared with the environmental taxes grouped by various attributes. Moreover, the environmental tax objects were identified and substantiated, in particular, those in agriculture.

7. The possibilities and limitations of the application of the environmental taxes to agriculture in the context of the implementation of the European Green Deal were described. For mitigation of the pollution caused by family farms, the key taxation objects identified are fertilisers, plant protection measures, fuel, and the processes of livestock production, in particular, digestion of the ruminants, and the manure handling processes.

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