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Environmental Impacts and Attitudes of Agricultural Enterprises for Environmental Protection and Sustainable Development

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Abstract: Recognising that implementing an agricultural enterprise impacts the state of the environment, its ecological stability, and the self- regulatory capabilities of ecosystems, the aim of this paper is to acquaint the professional and lay public about the attitudes of Slovakian agricultural enterprises towards environmental protection and sustainable development. The paper draws attention to present methods, techniques, and tools that enterprise management are applying for the purpose of meeting and overcoming environmental challenges. The data for this research were obtained from controlled interviews and a questionnaire survey conducted across more than 90 agricultural enterprises. Based on the data outcomes, research premises and formulated research hypotheses put forward are verified by using Friedman, Wilcoxon, Kruskal–Wallis, and Pearson chi-square tests. Discussion of the findings points out that although Slovakia is not yet one of the most polluting countries, promoting the application of environmental protection approaches for sustainable development is of the essence. The most important agriculturally related step, mitigating environmental degradation, is to promote changes in the moral values of agricultural enterprises and the society through enhanced environmental awareness and application practices.

Keywords: agriculture; agricultural enterprises; sustainable development; social responsibility; organic farming; green logistics; quality management

1. Introduction

In 1987, the World Commission on Environment and Development published a report, Our Common Future, in which the Commission pointed out that we must not take more from nature than can be reproduced without losing further productivity. For the first time, the report introduced and defined the term sustainable development that meets the needs of the current generation without compromising the ability of future generations to meet their needs [1]. According to the Global Footprint Network, humanity lives with ecological environmental debt, which means that people deplete natural resources faster than the biosphere can replace the resources [2]. Excessive consumption and waste accelerate the process of depletion of natural resources [3,4].

Compared to other countries of the European Union, the soil in Slovakia contains few nutrients, which leads to higher consumption of industrial fertilizers and consequent soil contamination [5]. Consumption of fertilizers in Slovakia is growing faster than in other V4 (Visegrad Group) or EU (European Union) countries, as stated by the Institute of Environmental Policy (IEP) at the Ministry of the Environment of the Slovak Republic. Approximately one-third of the territory of Slovakia is endangered by nitrates from intensive agriculture, as declared by the IEP in the proposal of the Envirostrategy 2030.

Theoretical Backround

One of the effective tools for sustainability is the consistent application of the concept of corporate social responsibility (CSR). The concept of CSR means a shift from focusing on profit to "triple-bottom-line": people, profit, planet [6]. The concept, developed by Elkington in 1994, considers not only economic growth but also the social and environmental spheres. The concept intends that economic interests do not conflict with social and environmental interests [7,8]. Companies promoting the concept of social responsibility strive for the sustainable development of the whole society. A socially responsible company aims not only to maximise profits, but its goals are based on the needs of the internal and external environment and include social and environmental aspects of the activity [9]. To meet environmental objectives, company management has a wide range of techniques, tools, and methods or strategic approaches with a focus on information management, knowledge, quality, logistics management, or environmental management [10].

Corporate social responsibility is institutionalized through ISO 14001, SA 8000 EMAS, and ISO 26000 standards, which aim to explain the nature of social responsibility and help companies apply their principles. The specific standards target various aspects of environmental protection in organisations and provide practical tools for those organisations that want to identify and manage the environmental impact of their behaviour and to sustain and improve environmental performance. Standards are essential for the accreditation of corporate environmental programs and for ensuring the required ecological credibility [11]. Certified firms must develop their people orientation and use techniques and tools to a higher extent in order to progress towards total quality [12].

Agricultural enterprises can demonstrate acceptance of environmental social responsibility by application of quality management. Many agricultural firms are now considering the environmental consequences of their activities as a means to obtain a competitive advantage. The shift is highlighted by the significant interest in standardised private codes such as those found in ISO 14000. These standardised codes are characterised by signatory firms voluntarily agreeing to abide by a given set of environmental management principles with monitoring conducted by an outside party. Government policy makers are also interested in the ability of such codes to address environmental concerns related to agriculture [13].

Quality management is the act of overseeing different activities and tasks within an organization to ensure that products and services offered, as well as the means used to provide them, are consistent. It helps to achieve and maintain a desired level of quality within the organization [14]. The quality management system framework allows maintaining, monitoring, and evaluating the continuous effect and execution of CSR principles and including CSR strategies in organisational policy [15].

The goal of sustainable development is to support and maintain prosperous small and medium-sized agricultural holdings, because the industrialization of agriculture leads to a reduction in the production of healthy food, problematic environmental protection, and combating the cultural diversity of rural areas. According to the evaluation report of the Ministry of Regional Development of the Slovak Republic, the area of utilized agricultural land was 1,910,654 ha, but the total area of registered agricultural land in the Organic Agricultural Production system was only 189,147 ha (10%) of the national usable area of agricultural land according to Land Parcel Identification System [5].

The tools of sustainability within the CSR activities also include outsourcing—leaving the selected processes or areas to a third party, which further manages them for the company. The essence of the

whole relationship is to get rid of activities that do not belong to the core of the business and transfer business risk and capital intensity to the third party for regular remuneration. Classic examples of such processes are warehousing, distribution, facility management, or bookkeeping. The most common reason for outsourcing is a lack of knowledge of management and a failure to perform certain activities such as some goods or services needed by a business or organisation from external sources, especially from foreign or non-union suppliers, to contracts for work, jobs, etc. [16].

The intensification and expansion of modern agriculture are amongst the greatest current threats to worldwide biodiversity. Over the last quarter of the 20th century, dramatic declines in both the range and abundance of many species associated with farmland have been reported in Europe, leading to growing concern over the sustainability of current intensive farming practices. Purportedly 'sustainable' farming systems such as organic farming are now seen by many as a potential solution to this continued loss of biodiversity and receive substantial support in the form of subsidy payments through EU and national government legislation [17]. The European Union (EU) is implementing the 7th Environment Action Program (EAP) in order to support economic development under sustainability. The 7th EAP is coupled with the EU 2020 Biodiversity Strategy. This new document sets targets for 2020 and a European vision by 2050, when the current environmental and biodiversity challenges will be overcome. One of the main objectives of the EU 2020 biodiversity strategy is to increase the contribution of agriculture and forestry to the conservation and restoration of biodiversity [18–20]. Most indicators of the state of biodiversity (covering species' population trends, extinction risk, habitat extent and condition, and community composition) showed declines, with no significant recent reductions in rate, whereas indicators of pressures on biodiversity (including resource consumption, invasive alien species, nitrogen pollution, overexploitation, and climate change impacts) showed increases [21]. Environmental approaches emphasise the need to apply the principles of biodiversity to preserve scarce genetic resources as well as traditional crops and woody plants, including indigenous livestock breeds. The Institute for Environmental Policy requires crop rotation in intensive agricultural areas and the promotion of biodiversity, which will prevent the loss of nutrients in the soil and will serve as pest prevention [5].

The current trend of the economy is leading to the unsustainable use of materials and energy, which is causing a radical loss of renewable and non-renewable resources. In addition, with the rapid development of economy, the scale of the logistics industry is also expanding rapidly, which brings great convenience to economy and trade, and becomes one of the pillar industries of national economy. However, with the development of economy and logistics, the problem of the ecological environment is becoming more and more prominent [22].

Reverse logistics is considered a key part of green logistics, as its main task is to meet environmental objectives. The main goal of green logistics is to recover waste in a way that is economically interesting and environmentally friendly as it prevents resource waste, reduces the consumption of raw natural materials, reduces the amount of stored waste, and reduces energy consumption, thus contributing to greenhouse gas emissions [23]. Garbage, resp. waste disposal leads to many environmental impacts. In addition to occupying valuable areas and rendering them unusable for many years, landfills contribute to increasing carbon dioxide and methane emissions. Chemicals and pesticides can enter and pollute groundwater, posing additional risks to the environment and human health [24]. The scope of reverse logistics is the collection, sorting, processing of used products, by-products, surplus stocks, and packaging material, while the main goal is to recover them in a way that is economically interesting and environmentally friendly, prevents wastage of resources, reduces the consumption of raw natural materials, reduces the amount of waste stored, and reduces energy consumption, thus contributing to the reduction of greenhouse gas emissions [23].

2. Materials and Methods

In light of the literature review, six research premises were formulated:

Premise No. 1: Following the seriousness of the threat to sustainability, agricultural companies perceive the most significant changes in the ecological environment.

Premise No. 2: Based on social trends, within the three pillars of the Corporate Social Responsibility, agricultural enterprises in Slovakia focus primarily on the environmental area.

Premise No. 3: To achieve sustainability, agricultural enterprises in Slovakia are implementing a quality management system, which also has a positive impact on the prosperity and economic development of the enterprise.

Premise No. 4: According to the managers of agricultural companies in Slovakia, the orientation of companies towards organic farming, integration into associations as well as the use of outsourcing are manifestations of the acceptance of social responsibility in the environmental field.

Premise No. 5: Based on the emphasised requirement to apply the principles of biodiversity within environmental approaches, we assume an active approach of agricultural enterprises in the Slovak Republic in this area.

Premise no. 6: In connection with the persistent insufficiency of waste recovery, the use of bioenergy, and the optimisation of agricultural production processes, we assume the efforts of agricultural enterprises in Slovakia to undertake an active approach to environmental protection through green logistics.

The research study was prepared based on primary and secondary sources of information. Secondary sources were obtained from publicly available materials, documents, and publications of domestic and foreign authors dealing with the subject matter.

To obtain primary sources of information and qualitative data and for the needs of processing the article, the controlled interviews and questionnaire were conducted among top managers of Slovak agricultural enterprises personally, through the Post, e-mail, and Google Forms. Only one respondent participated in research within each enterprise. A questionnaire is a research instrument that consists of a set of questions or other types of prompts that aims to collect information from a respondent. A research questionnaire is typically a mix of close-ended questions and open-ended questions. Open-ended, long-form questions offer the respondent the ability to elaborate on their thoughts [25]. The research itself was carried out from 2018 until 2020. The group of respondents was derived from the available databases of agricultural enterprises registered in the Slovak Republic: zas.sk, mprv.sk, infoma.sk, zoznam.sk, sppk.sk, polnoinfo.sk, agrofood.sk. Agricultural enterprises of all sizes, legal forms, and regions were contacted, which involved a deliberate selection. A deliberate sample is where a researcher selects a sample based on his/her knowledge about the study and population. The participants are selected based on the purpose of the sample, hence the name such that the selected sample might be representative. The selection sample size was defined using the Krejcie and Morgan [26] formula (N = 2,700,000 from the Albertina database, with the required confidence level at 95% (standard value of 1.96), the acceptable deviation rate d = 0.03, and the expected deviation rate r = 0.04).

In total, 24% of almost 400 addressed companies in the Slovak Republic participated in the survey. The share of the companies according to the region is shown in Table 1.

Table 1. Companies according to the region.

Region	% of Companies
Nitra	22.92
Trenčín	21.88
Košice	7.29
Žilina	7.29
Banská Bystrica	5.21

Source: own research.

Share of companies by size of enterprise is shown in Table 2.

Table 2. Companies according to the size.

Company Size	% of Companies
medium sized	25.26
small sized	52.63
micro sized	22.11

Source: own research.

Companies with more than 250 employees were not included in the group; this is understandable given the impact of changes not only in the industry but also in the whole economy, which have persisted since the period of transformation and later Slovakia's accession to the EU.

Share of companies according to the farm area is shown in Table 3.

Table 3. Companies according to the farm area.

Farm Area	% of Companies
up to 500 ha a.l.	43
up to 1000 ha a.l.	22
up to 2000 ha a.l.	16
more than 2000 ha a.l.	19

ha a.l.—hectare of agricultural land. Source: own research.

Share of companies according to their focus is shown in Table 4.

Table 4. Companies according to the focus.

Company Focus	% of Companies
crop production	84.38
animal production	69.79
agricultural product processing	35.42

Source: own research.

The finding agrees with the data in the Green Report of the Ministry of Agriculture and Rural Development that most individual farm companies (95.2%) farm an area of up to 500 ha a. l.

The following analyses were used to evaluate quantitative and qualitative statistical features: classification analysis, relational analysis, and structural–genetic analysis. The synthesis was used as a logical methodological principle of supplementing the analysis, not only as a composition of individual phenomena or processes, but also as a creation of new units. For results evaluation, statistical hypothesis testing and nonparametric tests of mathematical–statistical methods were applied:

- Friedman: perception of the importance of selected Green Logistics activities,
- Wilcoxon: evaluation of the significance of influences from the external environment; perception of the importance of green logistics activities,
- Kruskal–Wallis determination of the dependence between the company's capital participation and its targeted focus on the environmental area; the relationship between the perception of the importance of principles and their implementation in practice,
- Pearson's chi-square test: quality management and its impact on prosperity and economic development.

The Friedman test is used to detect differences in treatments across multiple test attempts. The Wilcoxon signed-rank test is a non-parametric statistical hypothesis test used to compare two related samples, matched samples, or repeated measurements on a single sample to assess whether the

population mean ranks differ. Kruskal–Wallis is a non-parametric method for testing whether samples originate from the same distribution. Pearson's chi-square test is a statistical test applied to sets of categorical data to evaluate how likely it is that any observed difference between the sets arose by chance. For data processing, we used MS EXCEL and IBM SPSS Statistics.

3. Results

The research sought to present and evaluate the attitudes of agricultural enterprises in the Slovak Republic for the need to maintain sustainability, as well as the methods, techniques, and tools that management applies in the interest of environmental protection and in accordance with environmental challenges.

By conducting a verification survey, we found that more than 62% of the farms surveyed consider the sustainability of the farm as a priority area (Figure 1).

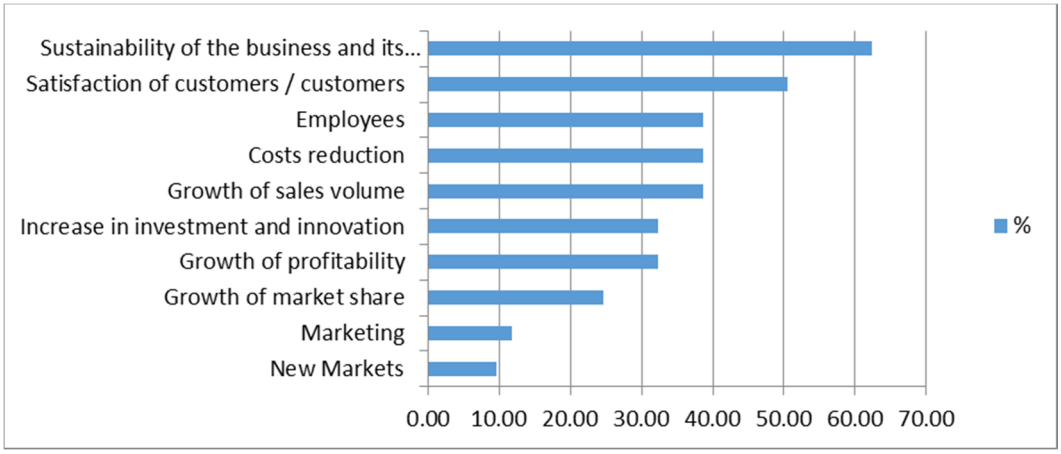

Figure 1. Areas of interest of companies within CSR (Corporate Social Responsibility) (Source: own research).

Research premise No. 1: In line with the seriousness of the threat to sustainability, farms perceive changes in the ecological environment as the most significant.

In the first phase, we examined the influence of external macroeconomic and sectoral environment factors on farm management decisions.

The initial assumption was formulated in accordance with the severity of the threat to sustainability. As we found out, agricultural enterprises do not perceive changes in the ecological environment as the most significant changes (Table 5).

Table 5. Evaluation of the significance of impacts from the external environment.

Significance of the Impact of Changes [%]	Significant	Weak	Insignificant
Environment			
political	41.3	44.6	14.1
economic	89.0	11.0	0
social	60.9	38.0	1.1
technological	84.6	14.3	1.1
legislative	77.2	19.6	3.3
ecological	72.8	25.0	2.2

Source: own research.

Attitudes, approaches, and subsequent decision-making of managers are significantly influenced by the development of the external environment. The results of the research show that the managers of

the surveyed agricultural holdings consider changes in economic and technological development to be the most significant impacts from the external environment.

By evaluating the significance of impacts from the external environment using the Wilcoxon test (Figure 2), it was found that the second group with an analogous level of *p*-values related to legislative and environmental changes. Changes in the third group, which includes social and political changes, had the lowest impact on the examined group of enterprises, but the achieved average values were still high. It can be stated that changes in all segments of the external environment have a significant impact on the decision-making of managers of the surveyed agricultural holdings.

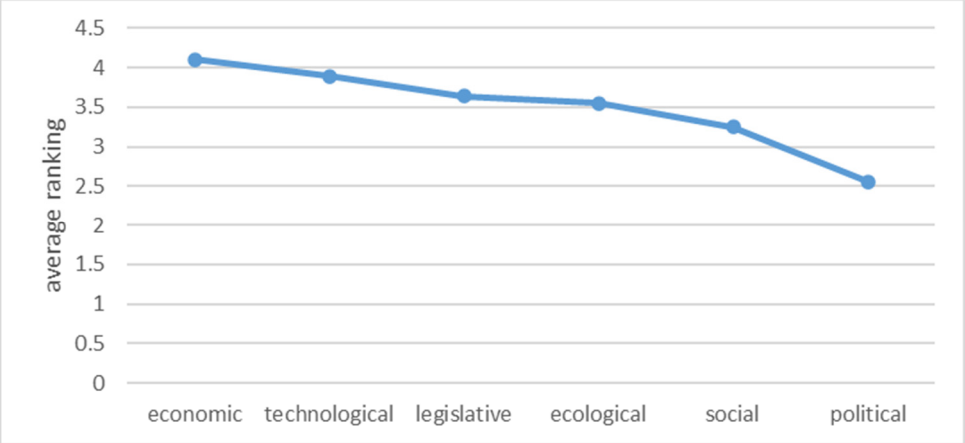

Figure 2. Results of the Wilcoxon test: Evaluation of the significance of influences from the external environment (Source: own research).

Research premise No. 2: Based on social trends, agricultural holdings in the three pillars of the CSR focus primarily on the ecological area.

The results of a controlled interview with farm managers on addressing social issues show that it is difficult for farms to get people involved in agricultural production. Agriculture is not attractive to the young generation. In the economic field, there is a clear interest in sustainability by reducing costs and striving for higher production efficiency, such as restructuring the crop and livestock production sector or diversification, which more than 90% of companies surveyed consider it important to maintain the viability of production.

Research shows that companies favour economic sustainability, even though there is currently a priority and a global concern for the environment and its protection. In relation to the environment, the social responsibility of selected companies is reflected in a responsible approach to compliance with laws, standards, regulations and ordinances, EU regulations, the Ministry of Agriculture and Rural Development of the Slovak Republic, compliance with good agricultural practice, but also specific measures implemented by companies:

- quality management system;
- investment in new and energy-saving technologies;
- companies merge into associations or use outsourcing as a tool for sustainability.

As part of the research, we used the Kruskal–Wallis test to determine the dependence between the company's capital participation and its targeted focus on the environmental area (Table 6).

Table 6. Kruskal–Wallis Test.

Kruskal–Wallis Test	
Chi-Square	18.7328
DF	2
Pr > Chi-Square	<0.0001

Source: own research.

The following hypotheses were formulated:

Hypothesis 1 (H1). *There is no dependence between capital participation and the targeted focus of companies on the environmental field.*

Hypothesis 2 (H2). *There is a dependence between capital participation and the targeted focus of companies on the environmental field.*

Based on the determined *p*-value, we can say that due to the confirmed existence of a dependence between the identification mark and the answer to the question, capital participation in the company is a factor influencing the focus of companies on the environmental domain.

Research premise No. 3: Agricultural enterprises in Slovakia are implementing a quality management system that has a positive impact on the prosperity and economic development of the enterprise in order to achieve sustainability.

In the interest of the sustainability of agricultural production, one of the measures is the introduction of a quality management system. The quality management systems that are applied in the examined group of companies include ISO 9001, HACCP, ISO 22000, standards of the State Veterinary and Food Administration of the Slovak Republic, the Central Agricultural Inspection and Testing Institute, and standards for certification of BIO products "ECO-agriculture".

Although there is a global societal interest in sustainable development, the promotion and strict adherence to the principles that support the achievement of this goal confirm the result of the survey only for livestock farms and enterprises that perform other non-agricultural activities or services; Figure 3.

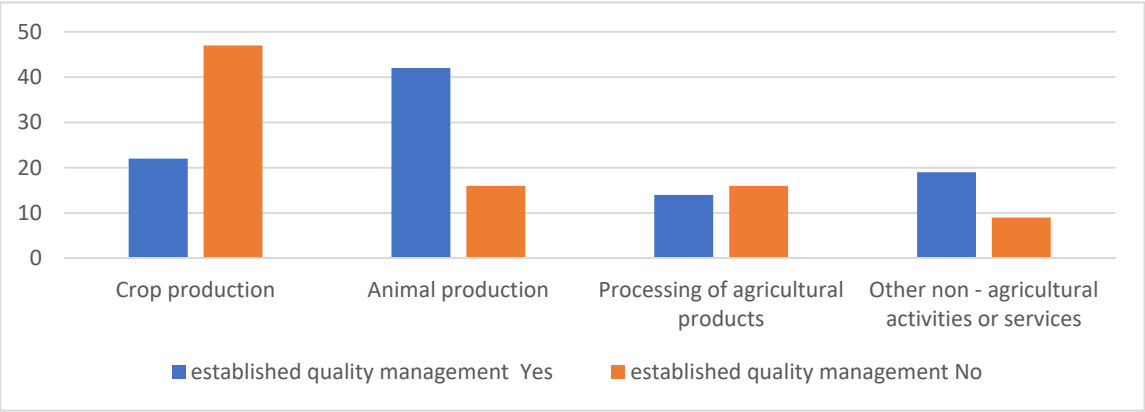

Figure 3. Application of the quality management system according to the branch of production, in percentage (Source: own research).

In addition to the expected socially responsible behaviour of companies and the related application of quality norms and standards, we also assumed a positive impact on prosperity and economic development, thus ensuring sustainability. A Chi-square test was used to determine the statistical

relationship between the implementation of the quality management system and economic development (Table 7).

Table 7. Chi-square test: Quality management and its impact on prosperity and economic development.

	Value	df	Asymp. Sig (2-Sided)
Pearson Chi-Square	2.234	3	0.525
Likelihood Ratio	2.271	3	0.518
Linear-by-Linear Association	0.390	1	0.532
N of valid cases	80		

df—degrees of freedom, Asymp. Sig (2-Sided)—Asymptotic 2-sided significance. Source: own research.

The following hypotheses were formulated:

Hypothesis 3 (H3). *There is no statistical relationship between the implementation of the quality management system and economic development.*

Hypothesis 4 (H4). *There is a statistical relationship between the implementation of the quality management system and economic development.*

Table 7 shows that there is no statistical dependence between the monitored features. The implementation of quality management systems does not have a statistically demonstrable impact on the prosperity and economic development of agricultural holdings. The result is largely surprising. However, we assume that it is influenced by the fact that most of the addressed business entities do not apply a quality management system. In the sample, less than half of enterprises (32.29%) use this system. Research shows that the introduction of quality management in Slovak agricultural enterprises is not yet one of their strengths.

Research premise No. 4: Acceptance of social responsibility in the environmental field is reflected in the orientation of companies to organic farming, integration into associations, and the use of outsourcing.

Despite the need to protect the environment and the call for state aid to be included in the support system, organic production is slowly developing. The results of the survey confirm that only 19.79% of farms are engaged in organic farming, and it should be emphasised that these are smaller farms that manage an area of 300 to 680 ha. Research respondents involved in organic farming carry out activities such as:

- adhering to best sowing practices (crop rotation, farm-wide crop levelling),
- environmentally friendly tillage practices, traditional crops, and the use of green manure.

In connection with environmental protection, the companies also mentioned other safer practices:

- use of organic sprays,
- prevention of erosion by sowing procedures,
- application of agri-environmental schemes,
- reduction of the use of chemical preservatives,
- compliance with land management conditions and good agricultural and environmental conditions,
- limited fertilisation on sensitive land,
- participation in agri-environmental non-project support within the Rural Development Programme SR 2014–2020.

The companies cooperate with The Central Control and Testing Institute in Agriculture and with the controlling organisation Naturalis SK; they are involved in the commitment of agroenvironment to plant production and animal welfare.

Outsourcing is used by almost half of the surveyed companies—46.88% (Figure 4). Among the logistical activities, respondents mention the transport and management of hazardous waste. In addition to the above activities, agricultural enterprises outsource services in the field of mechanization, technical services or agricultural work.

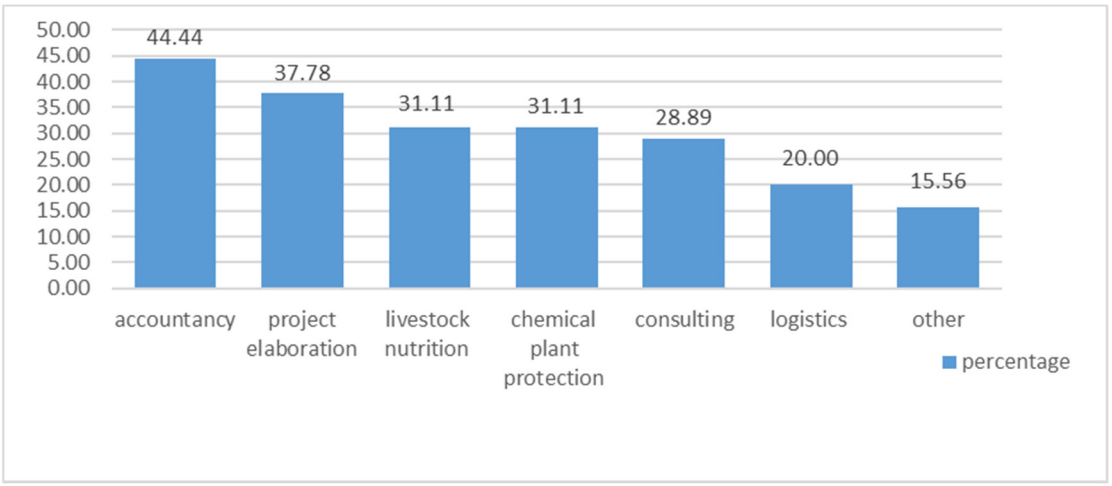

Figure 4. Outsourced activities (Source: own research).

Membership in various associations is not used by even half of the companies (48.96%) in the surveyed group.

In terms of supporting sustainability, membership in the Chamber of Agriculture and Food is important for 74.7% of managers of the selected group, in commodity and breeding associations for 36.3%, in the Agrarian Chamber of Slovakia for 30.8%, and in the Association of Agricultural Cooperatives for 20.9%. In total, 58.7% of respondents are members of sales and 30.4% of production associations. The low share of companies in supplier and processing associations is understandable given the focus of the examined companies, which is primary production (Figure 5).

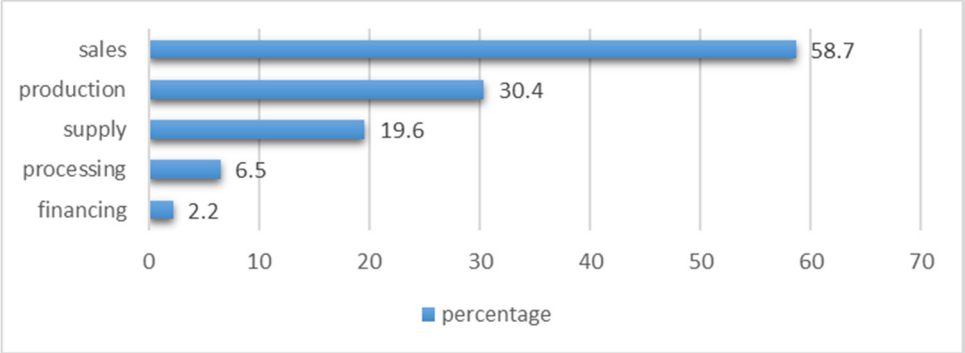

Figure 5. Key focus of associations (Source: own research).

Research premise No. 5: Based on the emphasised requirement to apply the principles of biodiversity in environmental approaches, we assume an active approach of agricultural enterprises in this area.

Regarding the application of biodiversity principles, in 57.29% of cases the response of managers was negative.

Although such a result could lead to critical conclusions, the positive trend is that managers are addressing this issue and are aware of its importance. We verified this statement using the Kruskal–Wallis test (Table 8). We assumed that awareness of the importance of this issue has a positive effect on its management by managers.

Table 8. Kruskal–Wallis Test: The relationship between the perception of the importance of principles and their implementation in practice.

Kruskal–Wallis Test	
Chi-Square	57.6178
DF	3
Pr > Chi-Square	<0.0001

Source: own research.

The following hypotheses were formulated:

Hypothesis 5 (H5). *There is no assumption that awareness of the importance of this issue has a positive effect on its management by managers.*

Hypothesis 6 (H6). *There is an assumption that awareness of the importance of this issue has a positive effect on its management by managers.*

The results of the Kruskal-Wallis test confirm our assumption. If managers are aware of the importance of issues, this has a positive effect on the application of the principles of diversity in practice.

Research premise No. 6: In connection with the persistent insufficient waste recovery, the use of bioenergy, and the optimisation of agricultural production processes, we assume the efforts of agricultural enterprises in Slovakia to take an active approach to environmental protection through green logistics.

The conclusions from interviews and questionnaires are as follows: almost 70% of companies (66 responses) use bioenergy and participate in their production by growing crops exclusively for energy purposes (cereals, oilseeds, maize, fodder, clover, alfalfa, and perennial grassland), by burning waste, producing agro-pellets, using biomass for heating, solar collectors to heat water for business purposes, and the use wind as an energy source, thus helping to reduce the use of energy from non-renewable sources. In addition to the necessary contributions to the recycling fund, agricultural enterprises invest in cesspools and technologies that are effective in the storage and disposal of organic liquid fertilizers through the Rural Development Programme project support 2007–2013, which is important for the protection of groundwater. Farms also apply the optimisation of plant protection through more accurate and high-quality machines for nutrition and plant protection, introduce the right sowing procedures, and the right technological processing procedures. They are striving for accurate animal and plant nutrition, trying to minimise waste in the collection, storage, and processing of finished products by adhering to technological discipline, using modern purifiers and sorters, improving technological processes, optimising technical parameters, and using new technologies that minimise negative impacts on the environment.

According to managers, the promotion of green logistics on farms in order to maintain sustainability concerns: separation, removal, disposal and storage of hazardous waste, reduction of dust emissions, fuel savings through GPS(Global Positioning System) built into agricultural technology, fuel storage, and strict compliance with the Nitrates Directive and handling of organic fertilizers. Respondents also report groundwater monitoring and watercourse treatment. Farms are active mainly in the field of waste management in animal production.

Representatives of agricultural enterprises evaluated the importance of individual activities in the field of green logistics. Their answers are shown in Table 9.

Table 9. Perception of the importance of green logistics activities.

Importance [%] Activities	Very Important	Important	Irrelevant
Fuel savings	62.1	34.7	3.2
Disposal of organic fertilizers	53.2	42.6	4.3
Waste separation and storage	80.2	19.8	0
Collection and disposal of hazardous waste	55.3	43.6	1.1
Compliance with the Nitrates Directive	46.8	46.8	6.4
Reduction of dust emissions	38.9	56.8	4.2

Source: own research.

Using the Friedman test, we examined which activities the company managers considered important and how important they saw them (Table 10). The following activities were assessed: waste sorting and storage, disposal of hazardous waste, reduction of dust emissions, fuel savings, compliance with the Nitrates Directive, management of organic fertilizers.

Table 10. Friedman test: Perception of the importance of selected Green Logistics activities.

Friedman Test	
N	**87**
Chi-Square	132.116
df	6
Asymp. Sig.	0.000

Source: own research.

The validity of the formulated hypotheses was verified:

Hypothesis 7 (H7). *Respondents consider the selected activities of green logistics to be equally important.*

Hypothesis 8 (H8). *Respondents do not consider the selected green logistics activities to be equally important.*

Since the value of p (asymptotic significance) is 0.000, and it is valid $p < \alpha$ (0.000 < 0.05), the null hypothesis is not true. This means that respondents do not consider selected green logistics activities to be equally important.

Using a post-hoc test, we determined which activities differed in terms of importance.

Hypothesis 9 (H9). *Respondents consider two green logistics activities to be equally important.*

Hypothesis 10 (H10). *Respondents do not consider two green logistics activities to be equally important.*

As Figure 6 shows that, the emphasis on waste separation and appropriate storage, as well as on fuel savings, which are presented in the first group, represents a significant shift for businesses in promoting the principles of green logistics and sustainable development.

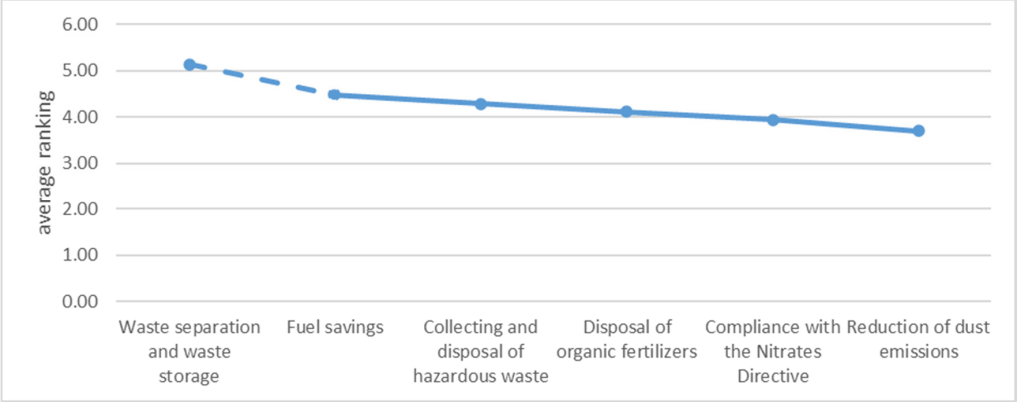

Figure 6. Results of the Wilcoxon test: Perception of the importance of green logistics activities. (Source: own research).

4. Discussion

The first research premise was formulated in accordance with the seriousness of the sustainability threat: Following the seriousness of the threat to sustainability, agricultural companies perceive the most significant changes in the ecological environment. As we found out, agricultural enterprises in Slovakia did not perceive changes in the ecological environment as the most significant. After the transformation into a market economy, the agricultural sector of the Slovak Republic focused on economic growth and a consumer, which had and is still having a significant impact on the environment. Sustainable agri-food systems are needed to provide economic benefits for rural dwellers, to ensure socially appropriate solutions to the food and nutrition security challenges, and also to limit the negative environmental effects of agriculture [27]. The first premise was not confirmed.

Research premise No. 2: Based on social trends, agricultural enterprises in Slovakia focus primarily on the environmental area within the three pillars of the CSR. Already in 2001, the concept of CSR was incorporated into the article, "Promoting a European framework for Corporate Social Responsibility", European document Green Paper (2001), and defined as a concept whereby "companies integrate social and environmental concerns into business operations voluntarily [28]. Nowadays, developing empowering strategies based on health, safety, and the environment is one of the most important issues of management in organisations [29]. In the environmental field, responsible business is manifested by the enforcement of environmental policy in order to minimise environmental impacts, reduce the material and energy intensity of processes, resource protection, waste management, application of environmental processes management systems, such as minimising waste production, waste reuse by recycling, reducing CO_2 emissions through the usage of ecological products and services (transport), compliance with ISO 14000 and EMAS environmental standards, protection of natural resources, use of alternative energy sources, and so on. Research has shown that companies have a priority focus on economic sustainability, although there is currently a global interest and priority in the field of the environment and its protection. Corporate social responsibility forms the basis of the objectives of the Europe 2020 strategy and makes a significant contribution to meet the objectives of the pact in the European Union relating to sustainable development and highly competitive social market economics [30]. The concept of social responsibility provides a framework for integrating environmental criteria into management decisions. The benefits of implementing the conception are moral as well as economical. Moral benefits, such as the conservation of natural resources and support for the development of human capital, do not bring immediate benefits, but in the long run, can have a positive impact on the management and financial resources of the organisation [31]. The second premise was also not confirmed.

Research premise No. 3: In order to achieve sustainability, agricultural enterprises in Slovakia are implementing a quality management system, which also has a positive impact on the prosperity

and economic development of the enterprise. Consistent and predictable results are achieved more effectively and efficiently when activities are understood and managed as interrelated processes that function as a coherent system. The quality management system consists of interrelated processes. Understanding how results are produced by this system enables an organisation to optimise the system and its performance [32]. The quality management systems in the examined group of companies include ISO 9001, HACCP, ISO 22000, standards of the State Veterinary and Food Administration of the Slovak Republic, and the Central Agricultural Inspection and Testing Institute and standards for certification of BIO products "ECO-agriculture". In the Slovak Republic, the most frequently applied quality management standards are ISO (International Organization for Standardization) 9001: 2008, ISO 14000: 2004, Analysis of critical control points/HACCP, ISO 22000: 2005, British Trade System/BRC, International Food standard/IFS, and Good Manufacturing Practice [33]. We assumed the implementation of quality norms and standards and we assumed a positive impact of this on prosperity and economic development. The result shows that companies implement quality standards into their activities. However, the implementation of quality management systems does not have a statistically significant impact on the prosperity and economic development of agricultural holdings. Implementation of the standards used to be a competitive advantage but today is a necessary standard. Reviewing the implementation of ISO standards is important because it can provide new insights into their benefits in terms of quality and environmental management [34]. We can say that the third premise has been partially confirmed.

Research premise No. 4: Acceptance of social responsibility in the environmental field is reflected in the companies' orientation towards organic farming, integration into associations, and the use of outsourcing.

The results of the survey confirm that only 19.79% of enterprises are engaged in organic agricultural production. It should be emphasized that these are smaller farms managing an area from 300 to 680 ha. The companies cooperate with the Central Control and Testing Institute in Agriculture and with the control organisation Naturalis SK; they are involved in the commitment of the agroenvironment in plant production and animal welfare. According to the FAO (Food and Agriculture Organization) report and several expert studies to which the FAO report refers, cattle reared under natural conditions have significantly better digestion and therefore lower methane emissions. Animal production, especially ruminants through their digestive system, produces large amounts of greenhouse gases (especially nitrogen oxides, which have 296× greater impact on the climate than CO_2 and methane, which has 23× greater impact than CO_2, but the way the animals are bred is important [35].

The method is also important in plant production. Vegetables grown in greenhouses have several times higher ecological footprints than vegetables grown naturally in the field [36].

One of the arguments against organic farming is that due to its lower yield per cultivated area, it cannot provide enough food for all the inhabitants of the Earth. However, according to the conclusions of an international meeting on agro ecology under the auspices of the United Nations Organization, as well as several studies, a gradual global transition to organic land management could secure food for 9 billion people by 2050. In addition, the negative impact of agriculture on climate change and fertile soil degradation would be halted [37].

A Slovenian study comparing conventional and organic cereal cultivation shows that pesticides, herbicides, fungicides, and fertilizers multiply the ecological footprint of cereal cultivation [38].

The social goal is to expand organic agricultural production from the current 9.5% to at least 13.5% of agricultural land by 2030 [39].

In the 2014–2020 programming period, Organic Agricultural production support is maintained within the Rural Development programme of Slovakia for the period 2014–2020. Due to its important ecological and environmental benefits, a separate Action Organic Farming was approved in which the conditions and focus of support are specified, e.g., for conversion to and maintenance of organic farming [40].

Outsourcing is becoming a tool for sustainability in the agricultural sector. It is used by 46.88% of companies in the sample for livestock nutrition, chemical plant protection, and logistics. Regarding logistics activities, respondents report the transport and management of hazardous waste. In addition, agricultural enterprises outsource mechanization services, technical service, and agricultural work. Outsourcing is a typical globalisation trend and will therefore continue in newer forms and offers opportunities for new uses of services. Especially in connection with the need of agricultural technology using, outsourcing or associations are an advantageous solution. The renewal of technology in agriculture does not reach the required level. To improve the age structure of the agricultural technology, investments in new technology to the amount of around 300 million euros per year are needed [41].

The use of machines associated with high-performance potential is relatively low under Slovak agricultural conditions. According to the Director of Agricultural Technical and Testing Institute, farmers should consider new forms of machinery use in the framework of cooperation, including, for example, outsourcing or associations [42].

Membership in various associations is not used by even the half of the companies that took part in the survey. From the sustainable development supporting point of view, they consider their membership in the Slovak Chamber of Agriculture and Food, in commodity and breeding associations, the Agrarian Chamber of Slovakia, and the Association of Agricultural Cooperatives to be important. In total, 58.7% of respondents are members in sales associations and 30.4% in production associations. In Austria and Germany, there are special organisations, the so-called "machinenring", which can flexibly move technology as needed between "their own" companies. Although membership in various associations is not used by even half of the companies in the survey (48.96%), in comparison with the results of foreign surveys, for example, Hungary (3%) or the Ukraine (0.4%), our result is many times higher [43].

The same conclusion that agricultural enterprises in most cases are still unable to form effective functioning associations (in potato, fruit growing, dairy sector, etc.) follows from the Green Report 2018 of the Ministry of Agriculture and rural development of the Slovak republic. Given the above results and the efforts of companies to apply the principles of CSR, we consider the fourth premise to be partially confirmed.

Research premise No. 5: Based on the emphasised requirement to apply the principles of biodiversity within environmental approaches, we assume an active approach of agricultural enterprises in this area. Despite some local successes and increasing responses worldwide (including the extent and biodiversity coverage of protected areas, sustainable agricultural and forest management, policy responses to invasive alien species, and biodiversity-related aid), the rate of biodiversity loss does not appear to be slowing [21]. Agricultural intensification has led to a widespread decline in farmland biodiversity measured across many different taxa. The changes in agricultural practices affect many different aspects of the farmland habitat, but agricultural industry, policy, and much previous research have tended to be concerned with specific sectors or practices (e.g., pesticide use or cereal husbandry). The loss of ecological heterogeneity at multiple spatial and temporal scales is a universal consequence of multivariate agricultural intensification and, therefore, future research should develop cross-cutting policy frameworks and management solutions that recreate heterogeneity as the key to restoring and sustaining biodiversity in temperate agricultural systems [44]. Although one of the main objectives of the EU 2020 biodiversity strategy is to increase the contribution of agriculture and forestry to the conservation and restoration of biodiversity, up to 57.29% of companies in the surveyed group do not implement the principles of biodiversity. The surveyed companies that are committed to the protection of biodiversity naturally meet the requirements and challenges of the Institute for Environmental Policy. A significant part of the common agricultural policy (CAP) focuses on implementing environmentally friendly practices, which have been evaluated in many studies. However, these analyses do not usually consider spatial spillovers that may concern pollution and biodiversity, as well as participation in policy schemes. Most studies evaluate national environmental policies on a macroeconomic level, focusing

on cities. However, the majority of natural resources are in rural districts, and environmental policy is mainly implemented at a local level, where most of the budgets for environmental protection are decided [45]. Regarding the application of the principles of biodiversity, there was negative response of managers in 57.29% of cases. Despite the non-favourable result, managers understand the issue of biodiversity and they are aware of its importance. Those who expressed a positive opinion aimed to take an active approach to individual activities to promote biodiversity in their businesses. Based on these findings the fifth premise was partially confirmed.

Research premise No. 6: In connection with the persistent insufficiency of waste recovery, the use of bioenergy and the optimisation of agricultural production processes, we assume the efforts of agricultural enterprises in Slovakia to undertake an active approach to environmental protection through green logistics. A case study by Torquati and his research team also talks about the benefits of using biogas energy in dairy farms in favour of sustainable rural development, increasing farm incomes from traditional sources and reducing the overall environmental impact of the energy sector [46].

Almost 70% of the enterprises in the survey use bioenergy and participate in their production by growing crops exclusively for energy by:

- waste incineration,
- agro pellet production,
- recovery biomass in heating,
- solar collectors to heat water for business needs
- wind as an energy source.

In addition to contributions to the recycling fund, agricultural enterprises invest in cesspools and technologies efficient in the storage and removal of organic liquid fertilizers, optimise plant and animal production, use new technologies and technological processes, try to minimise waste, save fuel, dispose of fertilizers responsibly, comply with directives, reduce dust emissions or legally collect and dispose of waste. They contribute to reducing the use of energy from non-renewable sources. Although the results of the research confirm the responsibility of agricultural holdings according to the Ministry of Agriculture and Rural Development Green Report, i.e., the output of agricultural processes, biomass has a much greater energy potential compared to its need (approximately 3.3 percent of national energy consumption).

Reasons for the insufficient use of biomass potential in Slovakia mentioned in the Green Report [47] are insufficient information for potential producers and consumers about the possibilities of the efficient use of biomass and low level of energy awareness by decision-makers. Insufficient motivation to use biomass results from the persistent consequences of energy price distortions and the lack of systemic legislative and financial support. From a logistics point of view, it is also important to support local food production, especially because of the transport impact on global warming. In the United Kingdom, there is an initiative to label food by the number of kilometres passed during its production and import into shops—the so-called Food Miles [48]. Agricultural enterprises in Slovakia show several deficiencies. The last (sixth) assumption was partially confirmed. Many organisations carry out green innovation for sustainable development, but not all are successful.

5. Conclusions

The aim of the paper is to acquaint the professional and lay public about the attitudes of agricultural enterprises regarding environmental protection and sustainable development. The primary data served as a basis for the verification of research premises. In relation to the environment, agricultural holdings apply appropriate management approaches. The management adaptation to the current situation in the external environment of companies is reflected in biological management, compliance with farming practices and procedures for environmental protection. Based on a summary of the survey results, it is important to realise that support for the application of environmental approaches is essential.

According to the analysis of the Institute of Economics of the Slovak Academy of Sciences, Slovakia does not belong to the countries that damage the environment the most [49]. In order to retain this, the most important thing is to support changes in the moral society values through education and training in the field of environmental protection. The right kind of knowledge adds value [50]. Environmentally responsible behaviour should be a natural part of education and training so that ethical conduct will become completely natural for us.

The benefit of this article is to enrich the information base for agricultural enterprises, institutions dealing with problems of agricultural production, and also educational institutions on the possibilities of maintaining environmental sustainability, by presenting the theory of possible solutions: corporate social responsibility, organic farming, biodiversity, organic logistics, associations, outsourcing, and quality management.

The work place of all three authors is Slovak University of Agriculture (SUA) in Nitra. Scientific and research activities under the "Green University" label at the SUA are associated with cognition of biological, technical, economic and social phenomena and laws, ensuring better utilization of the biological potential of plants and animals, and production of safe food while protecting nature and the environment with respect to the transformation processes in society and the rural development. In light of the above, all research papers serve as educational material for university students.

The practical benefit of the article is to provide the professional public with the results of a survey on the approaches of agricultural enterprises to the presented problems and the use of methods and tools aimed at overcoming obstacles to sustainability. The presented results provide a space for realizing the importance of applying environmental approaches, not only in the agricultural sector, but across society.

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