

# Agrotourism as an instrument of sustainable development of the rural economy: A case study of Central and Eastern Europe

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## ABSTRACT

This study investigates the factors influencing the success of agrotourism as a sustainable rural development strategy in Central and Eastern Europe (CEE). Using a mixed-methods approach, data were collected from 200 respondents, including agrotourism operators, community members, and policymakers, and analyzed with logistic regression. The findings highlight that tertiary education, community participation, farm size, sustainability practices, and tourist volume significantly impact success, while age shows a negative correlation. Specifically, 60% of tertiary-education operators leveraged innovative marketing and sustainable farming techniques, achieving higher success rates. Community participation emerged as the strongest predictor (odds ratio = 6.126), with farms engaging local communities, attracting an average of 820 tourists annually and generating notable revenue. Larger farms (mean size = 12.3 hectares) succeeded by offering diverse activities, while eco-friendly practices (mean sustainability index score = 3.8 out of 5) appealed to environmentally conscious tourists. Older operators (mean age = 45.2 years) faced challenges adopting digital tools, highlighting the need for tailored capacity-building programs. Additionally, the study explores the unique opportunities and challenges presented by mountainous terrain, which offers potential for ecotourism due to its natural beauty and biodiversity but requires targeted infrastructure investments and conservation efforts. The study recommends educational initiatives, community-based tourism promotion, financial incentives for sustainability, and improved infrastructure to enhance accessibility.

**Keywords:** Agrotourism, Central and Eastern Europe, Community participation, Mountainous terrain, Rural development, Sustainability

## 1. Introduction

The transition economies in Central and Eastern Europe (CEE) have undergone many changes since the fall of communism [1]. These changes have caused many problems in rural places, including less farming, older people, young people leaving, and insufficient industrialization. Growing crops is essential for many rural Central and Eastern Europe (CEE) people. Still, it is hard to compete with large-scale industrial farming from Western Europe [2]. Rural places face a lack of jobs, limited infrastructure access, and environmental damage are some of the social and economic problems. Agrotourism, a type of country tourism that mixes farming with tourism services, might be a good way to proceed [3], [4]. They can use it to make extra money, communicate with people in cities, and share information about their culture and past. Also, agrotourism fits with the idea of sustainable development since it promotes actions that are good for the environment and helps the local economy [5], [6]. This study aims to determine the importance of agrotourism for the long-term growth of CEE's rural economies. Enjoying agrotourism helps the economy, empowers people, and takes care of the land. Agrotourism has been significantly studied in Western Europe and other places with different cultures and economies.

In Central and Eastern Europe (CEE), mountainous terrain like the Carpathian Mountains is important for agrotourism. Tourists who care about the environment will enjoy these areas because they have beautiful scenery, a variety of ecosystems, and traditional farming methods. But because these places are high and far

away, they have problems, like being hard to get to and needing long-lasting infrastructure. Policies that aim to enhance transportation, encourage eco-friendly lodging, and protect local biodiversity can help these areas get the most out of agrotourism while protecting their fragile environments. The main goal of this study is to find out how agrotourism could help the rural economies of Central and Eastern Europe (CEE) grow sustainably. Some of the most important things that make agrotourism projects work are training the people who run them, getting people interested in the community, and using methods that are good for the environment. The research also examines how agrotourism supports environmentally friendly farming methods and promotes community-based tourism, which helps rural places grow economically and socially. To achieve the study's aims, the following specific objectives have been defined:

1. Evaluate agrotourism activities' economic, social, and environmental impacts.
2. Identify the determinants of agrotourism success using logistic regression analysis.
3. Provide policy recommendations to promote agrotourism as a tool for sustainable rural development.

The following research questions guide this study:

1. How does agrotourism contribute to rural communities' economic and social resilience in Central and Eastern Europe?
2. What are the key factors influencing the success of agrotourism initiatives in this region?

The study aims to fill in the gaps in our understanding of the role of agrotourism in transitioning economies by combining real-world data with theoretical frameworks. This work provides valuable information for policymakers, agrotourism operators, and rural communities that can help them better understand and use agrotourism tactics. Ultimately, the study hopes to lead to specific actions and policy changes that can help rural economies grow again, make communities healthier, and make them more sustainable.

## 2. Literature review

Agrotourism has gained a lot of attention to help rural areas grow because it can help with economic diversification, cultural protection, and long-term environmental sustainability. Folks can learn about farming, life in the country, and local practices. It allows people to meet, share information, and make money, which links businesses in cities and smaller towns.

### 2.1. Agrotourism as a tool for economic development

Tourism is essential for the socio-economic development of every country - it creates jobs, fills budgets, and attracts investment [7]. One crucial way to help rural economies grow is through agrotourism. This is especially true in places where the economy is stagnant or falling. To connect farming and tourism, Sgroi says that agrotourism turns farms into lively spots that bring people from cities looking for real country experiences [8]. Farmers can make more money by giving tourists tours of their farms, letting them do hands-on farming activities, and selling things on-site [9]. On top of that, agrotourism helps the local economy by providing extra jobs in craft, transportation, dining, and shopping. Different ways to make money are significant for rural areas in Central and Eastern Europe (CEE), where traditional farming often has trouble competing with bigger, more industrialized farms in Western Europe. Reference [10] asserts that environmental tactics and support from management can help the hotel business adopt green ideas. Reference [11] and reference [12] emphasize the importance of green innovation for promoting sustainable development. In addition, agrotourism makes rural communities' economies stronger by protecting them from outside shocks. Reference [13] pointed out that the money made from tourism can help rural areas deal with unplanned events like changes in farming prices, market downturns, or problems caused by climate change. For example, when crop yields or farming prices are low, the steady income from tourism activities can help people stay financially stable.

### 2.2. Agrotourism in Central and Eastern Europe (CEE)

Central and Eastern Europe (CEE) shows a lot of promise for agrotourism because it has a long history of farming, beautiful landscapes, and cultural history [14]. Some rural areas in Central and Eastern Europe are very special. They have traditional ways of farming, tasty foods, and handmade goods that can bring people from all over the world. One of the biggest problems is the difference in income between farmland and cities. This happened because the area went from communism to business. Many times, changes in the economy, foreign investment, and building new roads and bridges have helped towns but not helped rural areas. Another significant problem is outmigration, when educated young people from rural areas move to cities or other

countries to find better job opportunities [15]. Many rural places in CEE now have older people, fewer jobs, and less social life because of this population change. Unsustainable farming methods, such as using too many chemical fertilizers and only growing one crop, have impacted the land, killed off species, and polluted the water [16]. Traditional farming methods are less likely to last in the long run because of these environmental problems. Reference [17] say that combining the worlds of business and farming and giving more money could increase investment, raise output, and make the country more competitive.

Some researchers, like Cawley and Gillmor, say that agrotourism could help solve these problems because it promotes rural diversity, keeps local people, and encourages environmental care [18]. Communities in rural areas can make extra money through agrotourism projects, which makes them less reliant on traditional farming. By creating jobs and business opportunities available in tourism-related activities, agrotourism can help stop people from leaving rural areas and bring younger people back. Adding environmentally friendly farming methods to agrotourism also fits with global environmental goals and makes rural areas more appealing to ecotourism [19]. Attracting foreign tourists to the tourism market significantly improves the development of the tourism services industry [20].

### **2.3. Agrotourism and sustainable farming practices**

A significant component of agrotourism is sustainable farming, which keeps the environment safe and uses resources well [21], [22]. This makes country tourist spots more appealing overall. Farmers who run agrotourism businesses work in good ways for the environment. This helps protect the environment and attracts more people who care about the environment. More agrotourism businesses use green energy sources and farming methods like organic farming to show that they care about the earth. Fewer chemicals are used in organic growing, which is suitable for the land and the water. Changing and growing foods also keeps the soil healthy and naturally removes pests. Because they use less carbon and investment to run, renewable energy technologies like solar cells and wood heaters make these farms even better for the environment [23]. All these things help agrotourism spots become more eco-friendly, making them appealing to travelers who want to take care of the environment while they are away. Reference [24] examines how automated sales tunnels can be used in email and messenger marketing as a key digital marketing tool in the tourism and hotel industries. It emphasizes making an organized sales funnel that helps potential leads go from reading content to buying something for the first time and buying more things in the future. Because of globalization, Reference [25] says that "sustainability of agrarian sector development" means that globalization, business, the economy, society, the environment, and ideas all work together in a balanced way. Reference [26] shows the importance of environmental awareness in developing agrotourism. Studying the methodology and forms of innovative technologies to ensure sustainable development, the authors emphasize the effectiveness of applying innovative technologies to ensure sustainable development, namely the formation of environmental awareness through the prism of ecotourism. The authors consider ecotourism a powerful educational tool that forms ecological awareness.

Reference [27] asserts that agrotourism and environmentally friendly farming styles work hand in hand. Their research shows that farms that let people visit for agrotourism are more likely to use eco-friendly methods than farms that only grow foods for farming. Agrotourism experiences that are good for the environment are in higher demand because people who visit these farms value their accuracy and cleanliness [28]. This line-up is significant for Central and Eastern Europe (CEE) because farmers have a history of using harsh and industrial farming methods that impact natural resources. As agrotourism companies in Central and Eastern Europe use green practices, they not only help the environment but also take the lead in making rural economies greener and more vigorous. Reference [29] uses their unique language to discuss "entrepreneurial potential," which can also be used elsewhere. This focus on sustainability makes agrotourism better for the earth and makes farm businesses more financially stable. Over time, sustainable farming methods often save farmers money because they do not have to rely on as many expensive chemicals and energy sources [30]. They also bring in a broader range of tourists, including those willing to pay more for eco-friendly and ethical travel experiences. Because of this, healthy farming is both a practical and strategic part of agrotourism businesses that do well.

### **2.4. Community-based tourism and agrotourism**

People are encouraged to participate in essential tasks such as devising plans and choices and ensuring everyone gets their fair share of benefits. Some groups that work together in community-based agrotourism are farms, local businesses, and cultural organizations. They aim to maximize tourism's economic, social, and cultural benefits. It can be a great deal of fun for people in the community to plan events and activities that celebrate the

history and traditions of the area. Festivals like harvest festivals, farmers' markets, and art fairs are great ways to bring in money from tourists and show off the unique culture of rural areas [31]. Farmers, artists, and small businesses in the area can also work together to improve the tourist experience [32]. For example, an agrotourism farm could work with a nearby bakery to serve traditional bread made from grains grown on the farm. Or the farm could work with nearby crafters to show off and sell one-of-a-kind gifts. When different types of businesses work together, the tourism offer is better, and everyone shares the money that agrotourism brings to the community.

People in many rural parts of Central and Eastern Europe (CEE) have worked together and done things as a group for a long time. This is because they used to work and live in countries with socialist governments. The community can use their skills to make agrotourism networks that help each other and work well together [33], [34]. For example, towns in the country can work together on marketing or create agrotourism routes that connect many farms and attractions, giving tourists many different things to do. Many people in the community cannot do as well in the tourism industry as possible because they do not have enough money, training, or access to experts. It is also harder for community-based agrotourism to grow because of issues with facilities like bad road links and slow internet. To fix these issues, policymakers and development groups must fund programs, make infrastructure changes, and run skill-building programs for people.

## 2.5. Factors influencing agrotourism success

Researchers have found that an operator's age and level of schooling significantly impact on their ability to think of new ideas and adapt to changing market needs [35], [36]. For instance, younger business owners are often more open to using social media, digital marketing tools, and other new technologies in their daily work. In the same way, educated people can handle the tricky parts of running a business better, understand consumer trends better, and farm in better ways for the environment, making their agrotourism goods more appealing overall. Operators can have agrotourism experiences that are active and competitive because of these traits, which bring in a wide range of tourists [37]. Reference [38] shows that digital marketing tools can help promote tourist spots in a world where there is a lot of competition and spots are becoming more alike. It says that marketing a place well needs a plan, just like marketing goods and services, and that old-fashioned and new digital tools can be used. Websites, email marketing, social media marketing (SMM), search engine optimization (SEO), content marketing, and search engine marketing (SEM) are some of the most important tools [39]. Reference [40] explores the possibilities of scaling a business to increase sales and profits, focusing on the conditions for scaling a company, the main paths and conditions for expansion.

Farms that produce a variety of things, like different kinds of crops, animals, or handcrafted goods, offer extra draws that make the trip more enjoyable for visitors. This variety not only appeals to more people but also lowers financial risks by spreading out sources of income across more than one activity. Other things that make the farm appealing to tourists are its natural and aesthetic features, such as its well-kept landscapes, organic farming methods, and local plants and animals. Reference [41] examines how well tour companies and travel agents work in Ukraine's tourism market by investigating how voucher costs, sales volume, and the number of tourists served are related. Regional research helps find more essential trends, shows where improvements are needed, and helps business owners plan to attract tourists and sell more vouchers better.

Using social media, forming partnerships with travel agencies, and joining regional tourism networks are all good ways for operators to reach potential tourists and build a brand that people will remember [42]. In a competitive market, it is essential to ensure people know what makes the farm special, like its environmentally friendly practices, cultural history, or beautiful scenery. For a place to attract tourists, especially international or city visitors who count on these services, it is necessary to have good road connections, reliable transport, and enough internet access. Also, having on-site services like clean rooms, dining areas, and bathrooms improves the tourist experience and encourages people to return [43]. Reference [44] examines new, socially focused ways to combine urban transport, logistics, and tourism.

Reference [45] examines how new financial technologies can help Kazakhstan's agriculture become more competitive and grow. They focus on making it easier to get loans and getting the government to help farmers. It stresses using up-to-date digital and money-related tools to support new ideas and boost output in the agricultural and manufacturing sectors. Policy and institutional backing are also critical to the success of agrotourism [46]. Aid in the form of loans with low interest rates or subsidies can help farmers get past problems they face at the start, like the cost of building infrastructure or selling their services [47]. Operators can learn the skills and facts they need to run tourist businesses in a way that is good for the environment and follows the

rules set by the government through workshops and training programs. Reference [48] says that Ukraine's farming industry needs new changes driven by investment to become more competitive and help the country get back on track after the war. It stresses the importance of states having policies specific to each country and using new models to encourage long-term growth and the integration of global markets.

Agrotourism is becoming more recognized as an essential tool for rural development. However, many studies still need to be done, especially in Central and Eastern Europe (CEE). Existing studies have taught us a lot about agrotourism's general pros and cons. Still, they do not detail what makes it work in CEE's unique social, economic, and cultural setting. Another significant gap is that there are no complete ways to measure agrotourism's environmental, social, and financial effects in countries like CEE that are in change. Many people agree that agrotourism has the potential to make money, protect culture, and encourage people to be good stewards of the environment. Agrotourism is a great way to help rural places grow. It protects culture, makes economies more potent, and keeps the earth safe, among other things. It looks like an auspicious way to deal with some of the biggest problems in rural development in CEE, such as crop yields going down, people leaving the area, and insufficient industry diversification. Agrotourism initiatives rely on many factors for their growth and success, including the character of the project managers, government backing, community involvement, and environmentally conscious practices. Agrotourism can be a powerful driver of long-term growth in the region if approached in this holistic way. The method of monitoring tourism enterprises proposed by Yakushev et al. allows for increasing their financial and economic security [49].

### 3. Research method

#### 3.1. Research design

A mixed-methods approach is used in this study to look at the factors that affect the growth of agrotourism businesses in Central and Eastern Europe (CEE). This is done by combining quantitative survey data with econometric modelling. The quantitative part is based on a structured survey given to 200 people in rural communities, along with agrotourism operators and local government leaders. This wide range of respondents ensures that the data shows a lot of different ideas and feelings about agrotourism. Economic analysis, specifically logistic regression, explores the connections between various factors and the two possible outcomes, success or failure, to determine what makes agrotourism work. The study's design allows for descriptive and inferential analysis of the local agrotourism industry.

#### 3.2. Survey instrument

A structured questionnaire was designed as the primary tool for data collection, carefully crafted to capture a broad range of variables relevant to agrotourism. The questionnaire is divided into four main sections:

Table 1. Survey instruments

Category	Description
Demographic characteristics	Collects data on respondents' age, education levels, and household size to evaluate socio-economic influences on agrotourism operations.
Economic indicators	Gathers information on income levels and income diversification to assess economic viability and resilience.
Sustainability practices	Focuses on eco-friendly farming methods, waste management, and other sustainability-related practices to enhance environmental appeal.
Tourism-related factors	Captures tourism-specific data such as annual tourist numbers, seasonal variations, and marketing strategies.

This comprehensive survey instrument addresses all critical dimensions of agrotourism, providing a robust dataset for subsequent analysis.

#### 3.3. Variables description

The study identifies a set of dependent and independent variables in Table 2 to facilitate the econometric analysis.

Table 2. Description of dependent and independent variables in agrotourism success analysis

Variable	Type	Description
Dependent Variable	Binary	Success of agrotourism operations (1 = success, 0 = failure), based on financial performance, tourist satisfaction, and community engagement.
Age of Operator	Continuous	Measured in years, indicating the influence of age on innovation and management capacity.
Education Level	Categorical	Categorized as primary, secondary, or tertiary education, representing the knowledge and skills of operators.
Farm Size	Continuous	Measured in hectares, indicating the scale of operations and capacity to host tourists.
Community Participation	Binary	1 = active participation in community-based tourism initiatives, 0 = no participation.
Tourist Volume	Continuous	Annual number of tourists visiting the farm, reflecting the scale and popularity of the venture.
Sustainability Practices Index	Continuous	A composite score based on eco-friendly farming and operational practices.

### 3.4. Logistic regression

Based on the listed independent factors, the study uses logistic regression analysis to figure out how likely it is that agrotourism will work. This model is used because it is good at figuring out how categorical outcomes are related to multiple predictor factors, and the dependent variable is binary. It looks like this:

$$\text{Logit}(P) = \beta_0 + \beta_1(\text{Age}) + \beta_2(\text{Education}) + \beta_3(\text{Farm Size}) + \beta_4(\text{Community Participation}) + \beta_5(\text{Tourist Volume}) + \beta_6(\text{Sustainability Index}) + \epsilon$$

Where P is the probability of agrotourism success,  $\beta_0$  is the intercept,  $\beta_0, \beta_1, \dots, \beta_6$  are coefficients for the independent variables, and  $\epsilon$  is the error term. The regression analysis identifies the significance, strength, and direction of the relationships between predictors and the success of agrotourism ventures.

### 3.5. Validation tests

The following validation tests are done on the logistic regression model to ensure reliability and strength: Hosmer and Lemeshow Test checks how well the model fits by comparing the dependent variable's actual and predicted values. A good fit is shown by a p-value that is not significant. The Variance Inflation Factor (VIF) checks whether two or more independent factors are multicollinear. If the VIF number is less than 10, multicollinearity is not a problem. The Pseudo R<sup>2</sup> measure shows how well the model can explain things; higher numbers mean the model is better at making predictions.

## 4. Results

The survey data highlights several important socio-economic and operational attributes of agrotourism participants in Central and Eastern Europe (CEE), providing a detailed picture of the sector's current state.

Table 3. Descriptive statistics

Characteristic	Value
Average Age (years)	45.2
Education (% with tertiary)	60%
Average Farm Size (hectares)	12.3
Community Participation (% active)	72%
Average Annual Tourist Volume	820
Sustainability Practices Index (Mean)	3.8

The average age of those who responded is 45 years, which puts most workers in the middle-aged group. This shows they have a mix of knowledge and flexibility, which helps them run their business well. However, people over 65 may struggle to use new technologies and try new things, like eco-tourism or digital marketing. This could make them less competitive in the modern tourist market. 60% of those who answered have a college education, which shows that agrotourism operators have a lot of human capital. They learn the skills they need to run complicated businesses, find new ways to make money and use methods that appeal to modern tourists, such as eco-friendly and hands-on activities. For example, operators with more schooling are more likely to use digital marketing and farming methods that are better for the environment.

The average size of a farm, 12.3 hectares, shows that it can host a variety of agrotourism activities. Larger farms usually have the space and money to offer various activities, such as picking crops, petting farm animals, and going on guided trips.

An average of 820 tourists visits the farms annually, showing that people in the area are very interested in rural tourism. With these many tourists, agrotourism could be used as an extra source of income, especially in rural places where agricultural income is not stable. The average score for workers on a 5-point scale is 3.8, which means they are somewhat firmly committed to going green. This fits with a trend in tourism worldwide that values being environmentally friendly. The findings lay a solid foundation for further analytical exploration through logistic regression and targeted policy recommendations. The logistic regression analysis yielded the following results, shown in Table 4.

Table 4. Logistic regression

Variable	Coefficient ( $\beta$ )	Std. Error	Odds Ratio	P-value
Age	-0.015	0.005	0.985	0.002**
Education (tertiary)	1.245	0.230	3.475	0.000***
Farm Size	0.078	0.012	1.081	0.015*
Community Participation	1.812	0.315	6.126	0.000***
Tourist Volume	0.005	0.002	1.005	0.045*
Sustainability Index	0.624	0.145	1.867	0.000***

Note. Significance levels: \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

Table 5. Statistical validity tests

Test	Purpose	Result
Hosmer-Lemeshow Test	Goodness-of-Fit	$p = 0.18$ (Good Fit)
Variance Inflation Factor (VIF)	Multicollinearity Check	All VIF $< 5$ (No Issue)
Pseudo $R^2$	Model Explanatory Power	0.43 (Moderate)

The statistical confirmation tests show that the logistic regression model is reliable. The Hosmer-Lemeshow test ( $p = 0.18$ ) shows a good fit, which means that the model correctly describes the connection between factors and the success of agrotourism. If the Variance Inflation Factor (VIF) is less than 5, there isn't significant multicollinearity. This means that the predictors, like schooling, community involvement, farm size, and sustainability practices, are separate and add something new to the model. The model can explain 43% of the variation in the success of agrotourism, which means it has modest explanatory power (Pseudo  $R^2 = 0.43$ ).

In Table 4, the age coefficient is negative (-0.015,  $p = 0.002$ ), which means that older owners are less likely to be successful in agrotourism than younger ones. Younger people are more flexible, open to new ideas, and comfortable using digital tools like social media and online marketing, which may explain this. Ecotourism and digital promotion are two trends that younger operators are more likely to follow. These are important for attracting modern tourists. For example, a young agrotourism business in Poland could use Instagram and Facebook campaigns to promote unique farm experiences, which led to a considerable rise in tourist engagement and bookings [50].

The coefficient of 1.245 ( $p = 0.000$ ) and odds ratio of 3.475 show that education is essential for the success of agrotourism. People who have gone to college or university have a better chance of success because they know more about running a business, keeping customers happy, and using environmentally friendly methods [51]. These workshops attracted eco-friendly tourists and brought in a lot of extra revenue. This shows how important school is for giving business owners the skills to make their goods and services stand out, take good care of

their resources, and cater to guests. Policymakers should put a lot of effort into training programs for people who live in rural areas. For example, they could offer classes and certifications in tourism and sustainability.

A good predictor for farm size (0.078,  $p = 0.015$ ) shows that bigger farms are more likely to work for agrotourism. This is because bigger farms can host more events, like guided walks, farm-to-table meals, and fun things like horseback riding or hiking. Smaller farms may not be able to grow as big, but they can still be successful if they focus on unique products or work with other farms in the area to give visitors a fuller experience. With a coefficient of 1.812 ( $p = 0.000$ ) and an odds ratio of 6.126, there is a strong link between agrotourism success and community participation. Agrotourism is generally better when communities work together because they share resources and information. In Romania, for instance, towns have set up agrotourism networks that work together [52]. In these networks, different farms work together to make things easy for tourists who want to stay on the farms, eat traditional food, and watch cultural performances.

The statistics for tourist volume is minimal (0.005,  $p = 0.045$ ), but it shows a link between the number of tourists and the chance of success. Farms that get more visitors make more money, which can be used to improve buildings and services. To get more tourists, there is a need for good marketing plans and easy-to-use facilities, like roads that connect. Rural agrotourism can significantly benefit from spending money on regional facilities like better roads, signs, and internet access. Many people can be brought in by advertising on social media and through tourist boards. With a coefficient of 0.624 ( $p = 0.000$ ) and odds ratio of 1.867, the sustainability practices measure shows how important it is to run a business in a good way for the environment. Sustainable farming methods, like organic farming, using renewable energy, and saving water, bring in people who care about the environment and lower the farm's costs. These efforts brought in visitors who cared about the environment and won the farm a green tourism certification, which made it easier to sell. Policymakers should use subsidies, grants, or licenses to encourage sustainable practices. Working together with environmental groups can also help farms make the change to more environmentally friendly practices.

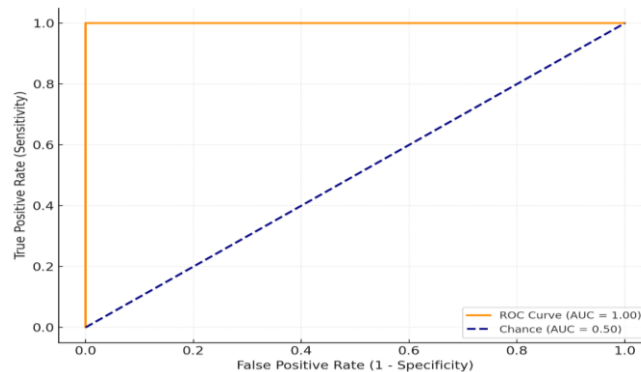


Figure 1. ROC curve for logistic regression model

The better ROC curve, with an AUC of 1,00, shows that the logistic regression model is great at telling the difference between agrotourism businesses that do well and those that don't. As you can see, the model can find promising ventures right (high sensitivity) and not find false positives (low false positive rate). The strength of the chosen factors as strong signs of success is shown by an AUC of 1. Such as participating in the community (odds ratio: 6.128) and using sustainable methods (odds ratio: 1.867). The model is correct because of these results, which also show how important these factors are for making policies and taking steps to improve agrotourism.

## 5. Discussion

There are a lot of different things that affect how well agrotourism works in Central and Eastern Europe (CEE). These factors include schooling, community involvement, environmentally friendly practices, farm size, number of tourists, and the operators' racial or ethnic background. This shows that the factors found are essential worldwide and give policymakers and practitioners new knowledge that is very useful. This study shows that education is a key factor in how well agrotourism works, with operators with a college education doing better [53]. People with college degrees have set up classes and eco-farm programs in Slovenia that appeal to specific groups, such as tourists who care about their health and families who want to give their kids educational opportunities. In the same way, Austrian farms that hold events to teach people about environmentally friendly farming say they make more revenue and get more visitors because the owners know how to read the market and how people act.

The logistic regression study found that community involvement had the highest chance of predicting success. To make agrotourism models that last, people need to work together. By including a range of local goods and services, community-based tourism projects make the trip better for tourists and help the local economy [54]. In Romania, villages have come together to create agrotourism networks [55]. This model has made it much easier for visitors to get involved and ensures everyone gains from the economy. In the same way, community-based tourism projects in Vietnam's Mekong Delta have combined homestays with local cultural activities. This has made tourists happier and the economy more stable during seasonal changes.

It is better for the environment around the farm and on the farm itself to use renewable energy, grow organically, and dump less trash. Ecotourism has grown by 40% on farms in the Netherlands that use organic growing methods and clean energy sources [56]. Sustainability norms also pay more attention to these farms, which help them sell their goods. As part of Costa Rica's plans for ecotourism, the country wants to create agrotourism businesses that can last. Many people from rich countries come to these places because they are willing to pay more for eco-friendly events. The importance of emotional intelligence in helping intellectually disabled kids cope with stress and succeed in inclusive classrooms is highlighted by this study. Fostering emotional resilience, particularly among marginalized groups and youth, might be equally important in the context of agrotourism and rural development for assuring equitable participation, social cohesiveness, and the long-term viability of community-based projects [57].

Bigger farms can have more events and guests. The results show that farms with more money and land can offer more activities, like teaching workshops, guided tours, and fun places to play. In Hungary, bigger farms with more activities, like picking fruit, making cheese, and petting animals, get more visitors than smaller farms with fewer things to do. Smaller farms can still be successful, though, if they focus on a niche market. Digital marketing tools like social media and online booking sites are increasingly necessary for attracting tourists, and younger operators are likelier to use them. Reference [58] helps us understand multilayer innovation transmission through cognitive modeling, complementing our research on agrotourism and rural development. Its focus on system-based input across the "enterprise-region-state" structure matches our desire to include community-driven, sustainable practices into rural economic growth initiatives. On the other hand, older workers often have trouble with these tools, which shows how important it is to have programs that build people's skills. Even though the number of tourists does not significantly impact business, it shows how important marketing and infrastructure are for bringing people in. Farms that attract more tourists are better able to improve their services and facilities, which creates a good feedback loop. A useful psychometric model for detecting occupational stress in agrotourism stakeholders may be found in the reference [59], which explains the development of a Stress Reaction Inventory for Ukrainian eye care personnel. A better knowledge of the effects of stress on rural tourist operators might lead to better sustainability results and a healthier workforce in Central and Eastern Europe, like how stress affects healthcare workers' happiness on the job. The study sheds insight into the variety and complexity of mental health issues that impede rehabilitation and quality of life in alcohol-dependent people by studying depressive syndromes. To help rural communities thrive in the face of economic and social challenges, it may be essential to pay close attention to mental health issues, such as patterns of substance-related depression, within the framework of agrotourism for sustainable rural development [60].

Policymakers and other interested parties can use the study's results to help agrotourism in Central and Eastern Europe (CEE) be more successful and last longer. First, training programs should be made to help operators of all ages. Training programs in digital marketing, business management, and environmentally friendly farming methods can help younger and older farmers maximize their technological advantages and close the gaps in new technologies. Second, community-based tourism marketing is important for getting farms to work together. As seen in Romania and Vietnam, cooperative networks and shared infrastructure projects can improve tourists' experiences, add new services, and help many rural communities. Third, incentives for sustainability can help the environment even more and bring in people who care about the environment. Giving grants, subsidies, and licenses for using eco-friendly methods, like what has worked in Costa Rica and the Netherlands, can help a lot of farmers start using sustainable farming methods. Lastly, improving facilities is important for making things easier to get to and bringing more tourists. Investments in transport connections, like improving roads and building digital infrastructure, have been shown to increase tourism in rural areas. Stakeholders can deal with local issues and get the most out of the economic, social, and environmental benefits of agrotourism by combining these tactics and following the best practices around the world.

Even though the study's results are strong, some problems need to be thought about. First, the fact that only 200 people were asked may make the results less generalizable since a broader range of people from different regions might have shown more subtleties. Second, the model explains 43% of the variation in the success of agrotourism. However, results are also likely affected by things that cannot be measured, such as how the market changes and government policies. Lastly, the focus on CEE makes it harder to make comparisons with situations outside of Europe, which could give a more global view. In the future, researchers should look at bigger sample numbers, more predictors, and longitudinal analyses to see how agrotourism success changes over time. Getting rid of these problems can help make policies and plans even better, leading to more complete and effective answers for rural development.

## 6. Conclusions

Agrotourism has been a big part of long-term rural growth. It gives people in rural areas of Central and Eastern Europe (CEE) many ways to deal with the social, economic, and environmental problems they face. This study shows that for agrotourism businesses to succeed, they need to educate people, involve the community, and use good ways for the environment. As agrotourism promotes cultural preservation, economic diversification, and environmental care, it brings life back to rural economies and strengthens them against global and regional challenges.

Higher education gives operators the skills to improve, handle, and expand their services, and getting involved in the community makes the benefits of agrotourism even greater by letting people share resources and work together. Adopting sustainable farming methods also makes agrotourism more appealing to people who care about the environment and fits in with global trends towards eco-tourism, which brings in more tourists who care about the environment. While this potential exists, it can only be fully realized through specific policies and interventions. To close the technology and knowledge gaps, policymakers should prioritize programs that build people's skills, especially for older operators. Investing in rural infrastructure, like better road connections and internet platforms, is essential for attracting tourists and selling more goods. Also, encouraging eco-friendly farming and tourism practices through grants, certifications, and training will help many people use them, making the industry even more appealing and ensuring its long-term success.

Agrotourism in Central and Eastern Europe (CEE) can help turn rural areas into places where new businesses can start, the environment is protected, and the culture is alive. Stakeholders can make this sector reach its full potential by focusing on its strengths, such as education, teamwork, and sustainability. This will not only help rural areas grow but also be a model for other areas to follow for sustainable growth. With the proper rules and funds, agrotourism could be a key part of restoring rural areas in CEE, helping people, businesses, and the environment for a long time.

### Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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### Author contribution

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