THE ROLE OF AGRICULTURAL HOLDINGS IN THE TRANSITION TO SUSTAINABLE DEVELOPMENT IN ROMANIA

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RESEARCH ARTICLE

Abstract

The transition to sustainable development is a key challenge for Romanian agriculture, particularly for agricultural holdings that influence rural economies, environmental conservation, and social stability. This study examines the role of agricultural holdings in Romania's shift toward sustainability, analyzing trends in farm structure, land use, and workforce evolution. Using qualitative and quantitative methods, the research evaluates sustainable practices such as organic farming, conservation agriculture, and agroecology, assessing their environmental and economic benefits. Additionally, the study explores the impact of EU agricultural policies and national strategies in supporting sustainability. Despite their potential, Romanian agricultural holdings face economic, technological, and educational challenges in adopting sustainable practices. The findings emphasize the need for more accessible funding, enhanced farmer education, and improved policy frameworks to facilitate the transition. The study concludes with strategic recommendations to strengthen sustainability in rural Romania, ensuring long-term agricultural resilience.

Keywords: *sustainable agriculture, agricultural policies, farm structure, sustainable practices, rural development*
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INTRODUCTION

The main objective of this research is to analyze the role of agricultural holdings in Romania's transition toward sustainable development, considering their economic, social, and environmental dimensions. As Romania faces land fragmentation, a declining rural workforce, environmental degradation, and climate change pressures, the adoption of sustainable agricultural practices is becoming increasingly essential. (Otiman, 2023; European Commission, 2020; European Environmental Agency, 2024).

This study examines how Romanian farms can actively support sustainability through practical strategies and policy integration. Unlike previous research, which has often examined theoretical models or broad policy frameworks, this paper integrates statistical analysis and policy evaluation to provide a structured perspective on the role of agricultural holdings in Romania's sustainable transition. By assessing the structure of agricultural holdings, the feasibility of sustainable practices, and the effectiveness of European and national policies, the study offers both a diagnostic perspective and actionable recommendations for stakeholders.(National Institute of Statistics, 2023).

The innovative character of this research stems from its multidimensional approach, integrating agricultural trends, sustainability policies, and real-world implementation challenges. The findings highlight both the barriers and opportunities for sustainable agriculture in Romania, offering practical solutions for policymakers, farmers, and researchers. (Adamov, 2020; Ministry of Agriculture and Rural Development, 2023).

To achieve these objectives, the research relies on secondary data analysis from statistical reports, policy documents, and scientific literature, applying descriptive statistical analysis and comparative policy evaluation. The following sections will systematically demonstrate how agricultural holdings can become key drivers of Romania's sustainable development strategy. (National Institute of Statistics, 2024; Planul Național Strategic, 2022).

MATERIAL AND METHOD

This study employs a descriptive and analytical approach to assess the role of agricultural holdings in Romania's transition toward sustainability. The research is based on secondary data analysis, using official reports from the National Institute of Statistics (INS), the European Commission, and the Structural

Agricultural Survey (ASA 2023). Additionally, policy documents related to the Common Agricultural Policy (CAP), the Green Deal, and the National Rural Development Program (PNDR) were examined to evaluate the support mechanisms for sustainable agriculture.

The data were analyzed through descriptive statistical methods to identify trends in farm structure, land use, and workforce evolution. A comparative policy analysis was conducted to assess the effectiveness of sustainability programs, and a SWOT analysis was used to highlight the strengths, weaknesses, opportunities, and threats of implementing sustainable agricultural practices in Romania. This approach ensures a comprehensive understanding of the challenges and opportunities shaping the future of sustainable farming in the country.

RESULTS AND DISCUSSIONS

The Concept of Sustainable Development in Agriculture

Agriculture stands at the intersection of economics, the environment, and society, directly impacting food security, natural resource management, and rural community well-being. In a global context marked by climate change, soil degradation, and market volatility, the transition to sustainable agriculture is no longer an option but a necessity.(European Commission, 2023).

In Romania, the agricultural sector faces significant challenges, including land fragmentation, a declining young workforce in rural areas, and limited access to modern technologies. These issues put pressure on the future of agriculture and highlight the urgent need for a sustainable agricultural model that allows farms to remain productive and resilient in the face of economic and environmental challenges. (Otiman, 2023; Eurostat, 2023).

Principles of Sustainable Development in Agriculture

Economic Dimension

A sustainable agricultural system must be economically viable, ensuring long-term farm profitability, income diversification, and reduced vulnerability to market fluctuations. Adopting sustainable economic models, such as agricultural cooperatives and rural activity diversification, can enhance financial stability in this sector. (European Commission, 2020).

Ecological Dimension

Ecological sustainability in agriculture involves protecting natural resources and minimizing the negative impact of farming practices on the environment. Practices such as organic farming, sustainable water use, biodiversity conservation, and reducing soil and air pollution are essential for maintaining ecological balance. (Ministry of Agriculture and Rural Development, 2023).

Social Dimension

Sustainable agriculture is not only about efficient production but also about ensuring equitable rural development. This involves improving farmers' working conditions, encouraging young generations to remain in the agricultural sector, and implementing policies that reduce social inequalities in rural areas. (Eurostat, 2024; National Institute of Statistics, 2024).

The Relevance of Sustainable Development for Romanian Agriculture

The transition to sustainability in Romania is not just an opportunity—it is an urgent necessity. Climate change is already affecting agricultural production, farmland is increasingly fragmented, and rural depopulation threatens the future of farming. Adopting a sustainable agricultural model is essential for maintaining the competitiveness and resilience of Romanian farms.

Sustainability offers real solutions to the problems facing Romanian agriculture, helping farmers become more economically independent, reducing environmental impact, and contributing to the revitalization of rural areas. The implementation of coherent policies and strategies, supported by the European Union and the Romanian government, is crucial to accelerating this transition. (National Institute of Statistics, 2023).

Romania's Agricultural Holdings: Declining Numbers and Structural Challenges

Agriculture remains a cornerstone of Romania's economy, but the sector faces significant structural and demographic challenges. The country's agricultural landscape is highly fragmented, characterized by a predominance of small farms, an aging workforce, and limited access to modern technology. These factors impact productivity, sustainability, and competitiveness at both national and European levels.

Recent statistical data confirm a slow but steady decline in the number of agricultural

holdings and a slight reduction in utilized agricultural area (UAA). These trends suggest that while consolidation is occurring, it remains insufficient to drive significant efficiency improvements. (Strategic National Plan, 2022).

Structure and Typology of Agricultural Holdings

Romania has one of the most fragmented agricultural sectors in the European Union. According to the Structural Agricultural Survey 2023 (ASA 2023), there were 2.859 million agricultural holdings in Romania, utilizing a total of 12.55 million hectares of agricultural land. Compared to the 2020 Agricultural Census, the number of holdings decreased by 1.0%, while the utilized agricultural area shrank by 1.7%. (Table 1).

The Romanian agricultural sector is characterized by a dual structure, where small subsistence farms coexist with large, industrialized farms:

- Small-scale farms (<5 ha) represent 90% of all agricultural holdings but control only 22.9% of the total agricultural land.
- Large commercial farms (>50 ha) constitute just 1% of all holdings but manage 53.1% of the total agricultural area.
- The average farm size in Romania is 4.39 hectares, slightly lower than the 4.42 hectares recorded in 2020, highlighting the slow pace of land consolidation.

Table 1

Evolution of Agricultural Holdings and Land Use in Romania (2020 vs. 2023)

Indicator	2020	2023	% Change
Total agricultural holdings (million)	2.887	2.859	-1.0%
Utilized agricultural area (million ha)	12.763	12.550	-1.7%
Avg. holding size (ha)	4.42	4.39	-0.7%
Small farms (<5 ha) - % of total	90.0%	90.0%	-
Large farms (>50 ha) - % of total	1.0%	1.0%	-

Source: Own processing based on Structural Agricultural Survey 2023 (ASA 2023)

This data indicates a gradual decline in farm numbers, with marginal changes in land consolidation. Despite efforts to modernize, Romanian agriculture remains fragmented, limiting the potential for large-scale mechanization and sustainable practices. (Table 1).

Changes in Agricultural Land Use in Romania: Increasing Arable Land, Declining Pastures

The distribution of agricultural land use has remained relatively stable, with arable land increasing slightly, while pastures and permanent crops have decreased. This trend may reflect a shift toward intensified crop production at the expense of biodiversity and sustainable land use. (European Environmental Agency, 2024).

The decline in permanent crops (-0.1%) and pastures (-0.3%) could be a result of land conversion to intensive crop production, which may have long-term ecological consequences, such as soil degradation and biodiversity loss. (Table 2).

Table 2

Distribution of Agricultural Land Use in Romania (2023 Data)

Land Use Type	% of Total Agricultural Area	Change from 2020
Arable land	67.6%	+0.4%
Pastures and meadows	28.8%	-0.3%
Permanent crops	2.6%	-0.1%
Household gardens	1.0%	Marginal increase

Source: Own processing based on Structural Agricultural Survey 2023 (ASA 2023)

Aging Farmers and the Declining Agricultural Workforce in Romania

One of the biggest challenges facing Romanian agriculture is the declining rural workforce. The sector is experiencing:

- An aging workforce, with most farmers over 55 years old.
- A declining rural population, as younger generations migrate to urban areas or abroad.
- Increased mechanization in large farms, which reduces the demand for manual labor but limits employment opportunities in smaller farms.

Despite these demographic challenges, the total work volume in agriculture (measured in Annual Work Units - AWU) increased by 1.9% between 2020 and 2023. However, this growth was mainly due to a 6.4% increase in non-family labor, while family labor increased only by 1.1%. These demographic shifts underline the urgency of implementing policies that encourage generational renewal in agriculture, ensuring a sustainable workforce for the future.(National Institute of Statistics, 2024).

These trends indicate a gradual shift towards a more commercialized and industrialized farming model, with family-run farms facing increasing difficulties in maintaining profitability.(Strategic National Plan, 2022).

Key Barriers to Sustainable Agriculture in Romania

Several factors continue to hinder the transition to sustainable agriculture in Romania:

- Land fragmentation – Small farms struggle with efficiency, mechanization, and access to markets.
- Limited access to technology – Modern agricultural machinery and irrigation systems remain inaccessible to many small farmers.
- Financial constraints – Many farmers lack access to credit and investment funds needed for modernization.
- Climate change and land degradation – Increasing weather variability and soil depletion threaten agricultural productivity.
- Demographic decline – Fewer young people are entering the agricultural workforce, endangering the sector's long-term viability.

The Romanian agricultural sector remains highly fragmented and demographically challenged, limiting its potential for sustainable development. However, with targeted policies and financial support, the country can improve land consolidation, technological adoption, and environmental protection measures. Addressing these structural issues is essential to ensuring a more resilient and competitive agricultural sector in the coming years. (Eurostat, 2023; National Institute of Statistics, 2024).

Despite these structural and demographic challenges, Romanian agriculture has the potential to transition toward sustainability. The following section explores the key sustainable practices that could help overcome these barriers and support the long-term viability of the sector.

Sustainable Practices in Agricultural Holdings

Agriculture plays a vital role in ensuring food security, maintaining rural livelihoods, and preserving natural resources. However, traditional farming methods have often led to soil degradation, water scarcity, and loss of biodiversity, making the transition to sustainable agricultural practices an urgent necessity. (European Commission, 2020).

Sustainable farming aims to balance productivity with environmental responsibility, ensuring that agricultural activities can continue in the long term without depleting natural resources. In Romania, the adoption of sustainable practices is still in its early stages, but increasing environmental pressures, European policies, and market demand are accelerating this transition. (European Environmental Agency, 2024) (Eurostat, 2023).

Implementing eco-friendly and economically viable farming techniques not only helps protect the environment but also enhances farmers' resilience to climate change, reduces costs in the long run, and improves food quality. The following sections explore some of the most effective sustainable farming methods that can be implemented in Romania. (Mateoc-Sîrb & Mănescu, 2012).

Key Sustainable Practices in Agriculture

Organic Agriculture & Agroecology

Organic farming eliminates the use of synthetic fertilizers, pesticides, and genetically modified organisms (GMOs), focusing instead on natural fertilizers, crop rotation, and biological pest control. The benefits of organic agriculture include:

- *Healthier soil* – Increased microbial activity and improved soil structure.

- *Reduced pollution* – No chemical runoff into water sources.
- *Better market value* – Organic products often sell at higher prices.

However, organic farming adoption in Romania remains limited due to higher production costs, certification challenges, and limited consumer awareness. (Ministry of Agriculture and Rural Development, 2023).

Agroecology goes beyond organic farming by integrating social, economic, and ecological factors into agricultural production. It promotes:

- *Diversified cropping systems* – Encouraging polyculture instead of monoculture.
- *Use of local knowledge and traditional practices* – Enhancing sustainability.
- *Improved resilience to climate change* – Through better soil and biodiversity management.

Although agroecology is gaining attention in Europe, in Romania, it is still underdeveloped due to a lack of policy support and education programs.

Conservation & Regenerative Agriculture

Conservation agriculture focuses on minimizing soil disturbance, maintaining soil cover, and rotating crops to improve soil fertility and prevent erosion. The key principles include:

- *No-till or reduced-till farming* – Reducing soil degradation and preserving soil moisture.
- *Cover cropping* – Using plants to protect the soil and increase organic matter.
- *Crop rotation* – Enhancing soil nutrients and reducing pests naturally.

Romanian farmers face challenges in adopting conservation agriculture due to lack of awareness, resistance to change, and initial investment costs in new machinery. However, studies show that these methods increase long-term yields and reduce dependency on fertilizers and pesticides. (Mănescu et al., 2017; Eurostat, 2024).

Regenerative agriculture builds on conservation principles, aiming to restore degraded land through techniques such as integrated livestock-crop systems, composting, and agroforestry. These practices are not yet widely implemented in Romania but have the potential to revitalize rural landscapes and increase farm profitability.

Precision Agriculture & Digital Farming

The rise of agricultural technology has introduced new ways to increase farm efficiency while reducing environmental impact. Precision agriculture (PA) uses sensors, drones, satellite imaging, and AI-based systems to optimize:

- *Fertilizer and pesticide application* – Reducing waste and pollution.
- *Irrigation efficiency* – Smart irrigation systems prevent water overuse.
- *Yield prediction and crop monitoring* – Farmers receive real-time insights for better decision-making.

In Romania, precision farming is mostly used in large, industrial farms, while small and medium-sized farms struggle to access these technologies due to high initial costs and lack of training. (European Environmental Agency, 2024).

Despite these barriers, EU-funded projects and government subsidies are making these tools more accessible, helping modernize Romanian agriculture. (National Institute of Statistics, 2023).

Potential for Implementing These Practices in Romania

Romania has significant potential to adopt sustainable agricultural practices, thanks to its fertile land, diverse climate, and growing EU policy support. However, several obstacles hinder progress:

Economic Challenges:

- High investment costs in sustainable farming equipment.
- Limited access to financial incentives and subsidies.

Technological and Educational Barriers:

- Lack of farmer training and awareness about sustainable methods.
- Insufficient digital infrastructure in rural areas.

Market and Policy Gaps:

- Weak national policies promoting agroecology and regenerative farming.
- Limited consumer demand for organic products.

<u>To accelerate the transition to sustainability, Romania must focus on:</u>

- *Expanding education and training programs for farmers.*
- *Providing financial support and incentives for eco-friendly practices.*

- *Encouraging research and innovation in sustainable agriculture.*

The adoption of sustainable practices in Romania is still in an early phase, but with proper policies, education, and financial support, these techniques can revolutionize the agricultural sector. By integrating organic, conservation, and precision agriculture, Romania can improve food security, protect natural resources, and enhance rural economies in the long run.

The Role of Agricultural Policies in Supporting Sustainable Holdings

Agricultural policies play a crucial role in shaping the transition toward sustainability in the farming sector. Governments and international institutions provide financial incentives, technical assistance, and regulatory frameworks to encourage farmers to adopt sustainable practices. Without these policies, many farmers—especially small and medium-sized agricultural holdings—would struggle to implement sustainable techniques due to high costs, lack of access to technology, and market uncertainties. (Adamov et al., 2020; Otiman, 2023).

In Romania, the transition to sustainable agriculture faces multiple barriers, including land fragmentation, aging rural workforce, and climate-related challenges. To overcome these issues, the country relies on a combination of European Union (EU) funding programs and national agricultural strategies aimed at modernizing farms and promoting eco-friendly practices. (Mănescu et al., 2017).

The following sections explore how European and national policies impact Romanian agricultural holdings and what improvements are needed to facilitate the transition toward sustainability.

European Strategies for Sustainable Agriculture

The European Union plays a fundamental role in supporting the sustainability of agricultural holdings through policies such as the Common Agricultural Policy (CAP), the European Green Deal, and the Farm to Fork Strategy. These initiatives provide financial incentives and regulatory guidance to help farmers transition toward more environmentally friendly and economically viable agricultural models. (European Commission, 2023).

Common Agricultural Policy (CAP)

The CAP is the EU's main agricultural support program, allocating approximately 40% of the EU's budget to agriculture. CAP funds are distributed through two main pillars:

- Direct Payments to Farmers – Providing income support to help farmers remain competitive.
- Rural Development Programs – Funding projects focused on innovation, sustainability, and modernization of agricultural holdings.

Under the 2023-2027 CAP reform, a greater emphasis has been placed on eco-schemes—financial incentives for farmers who adopt sustainable practices, such as:

- Crop rotation and cover cropping to preserve soil health.
- Precision agriculture to reduce resource waste.
- Organic farming and biodiversity conservation.

However, Romania faces challenges in fully utilizing CAP funds, as bureaucratic complexity, lack of awareness, and administrative inefficiencies often prevent farmers from accessing available resources. (European Commission, 2023).

The European Green Deal and the Farm to Fork Strategy

The European Green Deal sets the EU's long-term sustainability goals, aiming for carbon neutrality by 2050. The Farm to Fork Strategy is a key component of this deal, introducing targets such as:

- Reducing pesticide use by 50% by 2030.
- Expanding organic farming to cover 25% of EU agricultural land.
- Cutting food waste and promoting sustainable food production.

Romanian farmers have started adopting eco-friendly techniques to align with EU standards, but investment in research, digitalization, and farmer education is still needed to meet these ambitious targets. (European Commission, 2020).

National Policies and Funding for Sustainable Agricultural Holdings

Romania has implemented various national programs to support agricultural development, but the effectiveness of these policies is often limited by inconsistent implementation, financial constraints, and lack of coordination between policymakers and farmers.

National Rural Development Program (PNDR)

The PNDR (2014-2020) was the primary national framework supporting rural and agricultural development. Through EU and national co-financing, PNDR has provided funds for:

- Farm modernization – Investments in new agricultural machinery and infrastructure.
- Young farmer support schemes – Encouraging generational renewal in agriculture.
- Agri-environmental payments – Financial support for organic farming, soil conservation, and biodiversity protection.

Despite these efforts, many small-scale farms struggle to access funding due to complex application processes and limited financial literacy. (National Institute of Statistics, 2023).

Challenges in National Policy Implementation

- Inefficiency in fund distribution – Many funds remain unclaimed due to excessive red tape.
- Lack of awareness among farmers – Many smallholders are unaware of available subsidies.
- Limited integration with EU sustainability goals – National strategies often lag behind EU policies.

To improve support for sustainable agriculture, Romania needs better policy coordination, farmer training programs, and simplified funding access mechanisms.

While existing policies provide an essential foundation, more targeted interventions are needed to ensure that sustainable farming becomes the norm rather than the exception in Romania. (Eurostat, 2024).

Recommended Policy Improvements:

- Increase accessibility to funding – Simplify the application process for subsidies.
- Expand farmer education and training – Provide workshops on sustainable farming techniques.
- Strengthen digitalization initiatives – Improve access to smart farming technologies.
- Enhance cooperation between policymakers and farmers – Create platforms for dialogue and feedback.

A successful transition to sustainable agriculture requires long-term commitment, political will, and continuous investment in both human and technological resources. If well-implemented, Romania's agricultural sector can become more competitive, resilient, and environmentally sustainable in the coming decades.

Agricultural policies play a decisive role in shaping the future of sustainable farming in Romania. While EU and national strategies provide financial and regulatory support, their impact depends on how effectively they are implemented and accessed by farmers. With stronger policy integration, improved funding accessibility, and enhanced education programs, Romania can accelerate the transition to a more sustainable and competitive agricultural sector.

CONCLUSIONS

Agricultural sustainability is a key pillar for ensuring food security, economic stability, and environmental protection in Romania's rural areas. The transition toward sustainable agricultural holdings is necessary to address land degradation, climate change, and economic vulnerabilities affecting farmers.

This study has highlighted that Romania's agricultural sector is highly fragmented, with small farms struggling to remain competitive and adopt modern, sustainable practices. Despite these challenges, the European Union and national policies offer financial and technical support to encourage sustainability. However, access to funding, training, and technology remains a major barrier, particularly for small-scale farmers.

Sustainable farming methods, such as organic agriculture, conservation techniques, and precision farming, present viable solutions for enhancing productivity while protecting the environment. Yet, their adoption is slow due to high costs, lack of awareness, and limited infrastructure. Policies such as the Common Agricultural Policy (CAP) and the National Rural Development Program (PNDR) play a crucial role in supporting this transition, but implementation challenges and bureaucratic hurdles often limit their effectiveness.

To accelerate the transition to sustainable agriculture, Romania must improve access to funding, particularly for smallholder farmers, while enhancing education and training programs to increase awareness and adoption of sustainable practices. Additionally, investments in digitalization and modern agricultural technologies are essential to improving farm efficiency and reducing environmental impact. At the policy level,

adjustments are needed to ensure that sustainability incentives are both practical and widely accessible, enabling a smoother and more effective transition toward a resilient and competitive agricultural sector.

In conclusion, while Romania has a long road ahead, it has the natural resources, policy support, and technological potential to develop a sustainable and competitive agricultural sector. The key to success lies in collaboration between farmers, policymakers, and researchers to ensure that sustainability becomes a reality, not just a theoretical goal.

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