

"COOPERATIVE FARMING IN THE MODERN ERA: INNOVATIONS, CHALLENGES, AND OPPORTUNITIES"

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ABSTRACT

Cooperative farming has emerged as a key mechanism for improving agricultural productivity, sustainability, and social equity in the modern era. This paper examines the transformative role of cooperative farming in addressing challenges facing the agricultural sector, including resource scarcity, market volatility, and the impacts of climate change. By uniting farmers through shared resources, collective decision-making, and an integrated market approach, cooperative farming offers innovative solutions to traditional agricultural constraints.

The paper assesses key innovations in cooperative farming, such as digital resource-sharing platforms, precision farming technologies, and sustainable agricultural practices. These advances have increased operational efficiency, reduced environmental footprints, and improved profitability for smallholder farmers. However, the adoption of such innovations is often hampered by systemic challenges, including insufficient funding, management inefficiencies, and cultural barriers to collaboration.

This research highlights the economic and social benefits of cooperative farming, particularly in fostering rural development and empowering marginalized farming communities.

This study argues that cooperative farming, supported by innovative practices and strong policies, has significant potential to transform the agricultural sector. The findings highlight the need for collaborative efforts between governments, the private sector, and farming communities to unlock the full potential of cooperative farming in the 21st century.

Key words: Cooperative Farming, Agricultural Innovation, Sustainability, Rural Development, Precision Agriculture

MATERIAL AND METHOD

For the purposes of this research, a structured anonymous survey questionnaire was designed and used as the primary data collection tool. The quantitative data obtained from the survey responses were processed and analyzed using Microsoft Excel, while qualitative findings were interpreted and presented descriptively.

The study focused on agricultural cooperatives operating in the Republic of North Macedonia, aiming to examine their adoption of modern innovations, the challenges they face, and the opportunities they provide for sustainable agriculture. A total of 20 cooperative members participated in the survey, achieving a 100% response rate. The survey was conducted through direct, in-person distribution to ensure accuracy and completeness in data collection.

Once the data collection phase was completed, statistical processing was carried out to facilitate comprehensive analysis and interpretation. This research is highly relevant to current agricultural practices, offering practical insights into the functioning of cooperatives within a real and contemporary economic and social context.

INTRODUCTION

The agricultural sector remains the foundation of economic and social development worldwide, particularly in rural areas where it provides livelihoods for millions. However, modern agriculture faces a range of challenges, including dwindling natural resources, market unpredictability, climate change and the increasing demand for sustainable food systems. In this context, cooperative agriculture has re-emerged as a transformative model capable of addressing these multifaceted issues, while promoting economic resilience, social equity and environmental sustainability.

Cooperative agriculture, which involves the collective organisation of farmers to pool resources, share knowledge and access markets, has proven to be a vital mechanism for smallholder farmers to overcome structural barriers. In the modern era, this model is evolving, leveraging technological innovations such as digital platforms, precision farming and renewable energy solutions. These advances are reshaping the way cooperative agriculture operates, increasing productivity, reducing costs, and fostering sustainable practices.

Despite its potential, cooperative agriculture is not without challenges. Issues such as governance inefficiencies, cultural resistance to collective practices, and limited access to financial resources often hinder the adaptability and sustainability of agricultural cooperatives. Understanding these barriers and exploring opportunities for innovation are key to maximizing the benefits of cooperative agriculture in modern agricultural systems.

This paper attempts to analyze the innovations that drive cooperative agriculture, the challenges faced by agricultural cooperatives, and the opportunities they present for building resilient and sustainable agricultural systems. This research aims to contribute valuable insights into the evolving role of cooperative agriculture in the modern era.

INNOVATIONS, CHALLENGES, AND OPPORTUNITIES IN COOPERATIVE AGRICULTURE

Cooperative agriculture is evolving through technological innovations, addressing key challenges, and creating opportunities for sustainable and resilient farming systems.

INNOVATIONS DRIVING COOPERATIVE AGRICULTURE:

Modern agricultural cooperatives benefit from advancements such as precision farming, automated irrigation, and digital platforms for resource management. Precision agriculture, using GPS-guided machinery and data analytics, enhances productivity and reduces waste. Blockchain technology improves supply chain transparency, while cooperative-led e-commerce platforms expand market access for small-scale farmers. Additionally, renewable energy solutions, such as solar-powered irrigation, contribute to sustainability.

CHALLENGES FACED BY AGRICULTURAL COOPERATIVES:

Despite these innovations, cooperatives face governance and operational challenges. Decision-making among members can be complex, leading to inefficiencies. Financial constraints limit investment in modern technologies, while fluctuating market conditions create economic uncertainty. Additionally, limited access to credit and bureaucratic hurdles in cooperative management can hinder growth. Balancing individual interests with collective goals remains a persistent challenge.

OPPORTUNITIES FOR RESILIENT AND SUSTAINABLE AGRICULTURE:

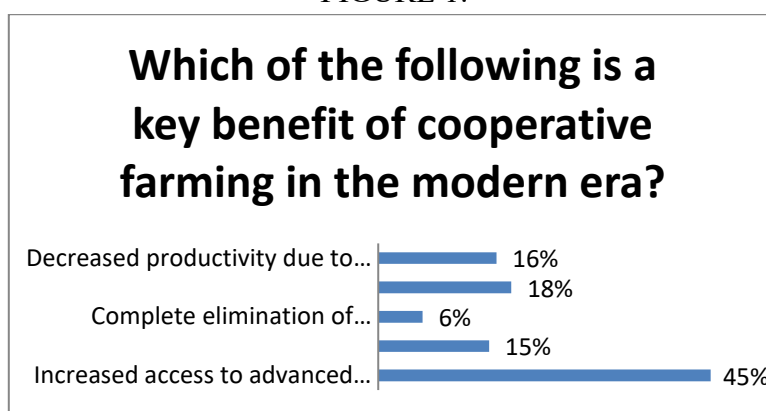
Agricultural cooperatives have significant potential to build resilient and sustainable farming systems. By pooling resources, cooperatives enhance farmers' access to technology, financial support, and training. Sustainable farming practices, such as agroecology and regenerative agriculture, can be widely adopted through cooperative models. Strengthening cooperative governance, improving financial mechanisms, and leveraging digital tools can ensure long-term success.

By embracing innovation and addressing challenges, agricultural cooperatives can play a crucial role in transforming production, ensuring economic stability for farmers, and fostering environmentally sustainable practices.

RESULTS AND DISCUSSION

The survey results provide insights into people's perceptions of the key benefits of cooperative farming in the modern era. Below is a detailed analysis of each response:

FIGURE 1:



Source: author's research

-Increased Access to Advanced Agricultural Technology (45%)

This response received the highest percentage (45%), indicating that nearly half of the respondents view technological advancements as the most significant benefit of cooperative farming. This is likely because cooperatives allow farmers to pool resources, making it easier to invest in modern machinery, precision farming tools, and sustainable agricultural innovations. Technology improves productivity, efficiency, and profitability, reinforcing the perception that it is a major advantage of cooperative farming.

-Reduced Need for Labor in Farming Operations (15%)

A smaller but notable percentage (15%) of respondents believe that cooperative farming reduces labor requirements. This could be due to shared resources and equipment, better labor allocation among cooperative members, and mechanization. However, this benefit is not as widely recognized as access to technology, possibly because cooperative farming still requires significant human effort for coordination and management.

-Complete Elimination of Financial Risks for Farmers (6%)

Only 6% of respondents selected this option, suggesting that people generally do not believe cooperative farming completely eliminates financial risks. While cooperatives can help mitigate financial challenges by providing collective bargaining power, access to credit, and risk-sharing mechanisms, they do not fully remove financial uncertainties such as market fluctuations, climate risks, or operational inefficiencies.

-Government Control Over All Farming Decisions (18%)

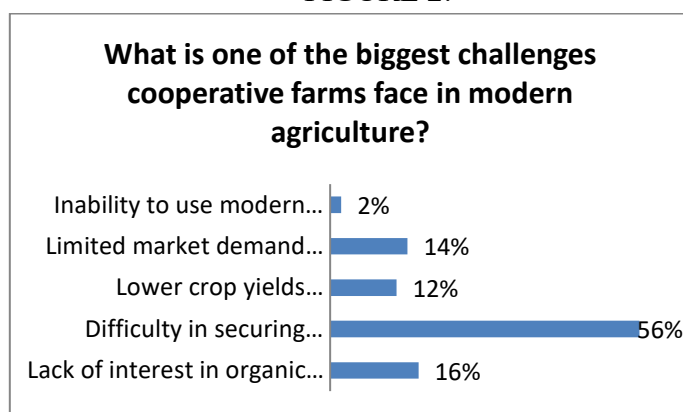
Surprisingly, 18% of respondents perceive government control as a key benefit. This response may reflect a misunderstanding of cooperative farming, as cooperatives are usually member-driven rather than government-controlled. However, government support through subsidies, policies, and agricultural programs may create the impression that state involvement plays a crucial role in the success of cooperatives.

-Decreased Productivity Due to Shared Resources (16%)

This response, chosen by 16% of participants, suggests that some people see shared resources as a drawback rather than a benefit. While cooperatives provide access to collective resources, improper management, conflicts among members, or inefficiencies in distribution may lead to lower productivity in some cases. This perspective highlights concerns about organizational challenges rather than the inherent advantages of cooperative farming.

The survey results indicate that the most widely recognized benefit of cooperative farming is access to advanced agricultural technology (45%), followed by government involvement (18%) and concerns about decreased productivity (16%). While reducing labor needs (15%) is seen as beneficial, eliminating financial risks (6%) is the least convincing advantage. These findings suggest that while cooperatives are valued for technological and economic benefits, challenges related to management and efficiency remain a concern for some stakeholders.

FIGURE 2:



Source: author's research

The survey results provide valuable insights into the key challenges faced by cooperative farms in modern agriculture.

-Difficulty in Securing Collective Decision-Making Among Members (56%)

This response received the highest percentage (56%), indicating that more than half of the respondents view decision-making as the most significant challenge in cooperative farming. Cooperatives rely on consensus among members, which can lead to conflicts, inefficiencies, and delays in decision-making. Differences in priorities, financial interests, and farming practices among members can make it difficult to implement strategies that benefit everyone. This finding highlights the need for strong leadership, structured governance, and effective communication within cooperatives.

-Lack of Interest in Organic Farming Practices (16%)

A notable 16% of respondents believe that a lack of interest in organic farming is a challenge for cooperatives. While organic farming has gained popularity, many cooperative members may be hesitant to adopt it due to higher costs, certification requirements, and uncertainty about market demand. This result suggests that some cooperatives struggle to align their members' farming practices with the growing consumer preference for sustainable and organic products.

-Limited Market Demand for Cooperative Farm Products (14%)

About 14% of respondents identified limited market demand as a major challenge. Cooperative farms may face difficulties competing with larger agribusinesses, securing contracts with retailers, and marketing their products effectively. Additionally, some buyers may prefer individually branded products over those from cooperatives. This finding emphasizes the need for cooperatives to enhance their branding, marketing strategies, and distribution channels to increase market reach.

-Lower Crop Yields Compared to Individual Farms (12%)

A smaller portion (12%) of respondents perceive lower crop yields as a challenge. While cooperative farming can provide shared resources and technology, variations in land quality, farming techniques, and management efficiency can impact yields. However, the relatively low percentage suggests that most people do not see productivity as a major disadvantage of cooperative farming.

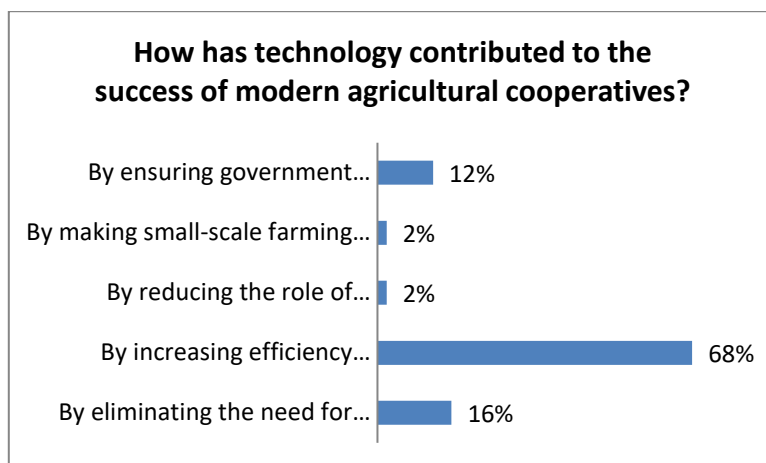
-Inability to Use Modern Irrigation Techniques (2%)

Only 2% of respondents believe that cooperatives struggle with irrigation access. This suggests that most cooperatives have sufficient access to modern irrigation technologies, likely due to shared investment in infrastructure. It also indicates that water management is not a widespread concern compared to decision-making or market demand.

The survey results highlight that the most pressing issue for cooperative farming is difficulty in collective decision-making (56%), followed by challenges related to organic farming adoption (16%) and market demand (14%). While crop yields and irrigation are concerns, they are perceived as less significant. These findings emphasize the importance of improving governance,

fostering collaboration, and enhancing market competitiveness to ensure the success of cooperative farming in modern agriculture.

FIGURE 3:



Source: author's research

The survey results provide insights into how technology has contributed to the success of modern agricultural cooperatives.

-By Increasing Efficiency Through Precision Agriculture Tools (68%)

The overwhelming majority (68%) of respondents believe that precision agriculture tools have significantly improved efficiency in agricultural cooperatives. This response highlights the crucial role of modern technology, such as GPS-guided machinery, automated irrigation systems, drones, and data analytics, in optimizing farming operations. Precision agriculture helps cooperatives reduce waste, enhance productivity, and improve resource management, making it the most widely recognized technological contribution.

- By Eliminating the Need for Traditional Farming Knowledge (16%)

A notable 16% of respondents believe that technology has reduced reliance on traditional farming knowledge. While modern innovations have certainly changed agricultural practices, this perception may reflect a misunderstanding. Traditional farming expertise remains valuable, especially in understanding local soil conditions, climate patterns, and crop behavior. However, technology has made it easier for farmers with less experience to manage operations effectively.

-By Ensuring Government Subsidies for All Cooperatives (12%)

Around 12% of respondents think that technology ensures government subsidies for cooperatives. While technological advancements can help cooperatives meet subsidy eligibility criteria-such as implementing sustainable farming methods or improving productivity-subsidies are primarily influenced by agricultural policies rather than technology itself. This response suggests that some people associate technological advancements with increased government support.

-By Reducing the Role of Farmers in Production (2%)

Only 2% of respondents believe that technology has minimized the role of farmers in agricultural production. While automation and smart farming tools have streamlined many processes, human

decision-making, management, and oversight remain essential. This low percentage indicates that most people recognize that technology supports rather than replaces farmers.

-By Making Small-Scale Farming Obsolete (2%)

Similarly, only 2% of respondents believe that technology has made small-scale farming obsolete. In reality, many small-scale farmers benefit from technological advancements, particularly through cooperatives that allow them to access shared resources. The low percentage suggests that respondents understand that modern agricultural technology is adaptable to various farm sizes rather than exclusively benefiting large-scale operations.

The survey results indicate that the most widely acknowledged impact of technology on agricultural cooperatives is increased efficiency through precision agriculture tools (68%). While eliminating the need for traditional knowledge (16%) and ensuring government subsidies (12%) were recognized to some extent, very few respondents (2%) saw technology as reducing the role of farmers or eliminating small-scale farming. These findings emphasize that technology is viewed primarily as an enabler of efficiency rather than a replacement for traditional farming methods or small-scale agricultural operations.

CONCLUSION

Cooperative agriculture in the modern era plays a vital role in improving agricultural productivity, sustainability, and economic stability for farmers. By leveraging technological innovations such as precision agriculture, digital platforms, and renewable energy solutions, cooperatives enable stakeholders to improve efficiency, reduce costs, and expand market access. These advances support more sustainable agricultural practices and promote resilience to climate change and economic volatility.

However, agricultural cooperatives face significant challenges, including complex decision-making processes, financial constraints, and market fluctuations. Governance issues, differences in member priorities, and limited access to credit often hinder cooperatives' efficiency and growth. In addition, adapting to rapidly evolving technologies requires continued investment in education and infrastructure, which may not always be feasible for all stakeholders. Overcoming these challenges requires strong leadership, supportive policies, and collaboration among farmers, policymakers, and industry stakeholders.

Despite these obstacles, cooperative agriculture presents numerous opportunities for building sustainable agricultural systems. By pooling resources, farmers can access modern equipment, technical expertise, and financial support that would otherwise be unavailable to individual producers. Cooperatives also facilitate knowledge sharing and collective bargaining, strengthening their competitive position in the global marketplace. Furthermore, the cooperative model fosters community development and economic empowerment, making it a key component of rural development strategies.

Cooperative agriculture remains a powerful mechanism for addressing contemporary agricultural challenges. By embracing innovation, improving governance, and fostering collaboration,

cooperatives can foster long-term sustainability and resilience in the agricultural sector, ensuring a more secure and prosperous future for farmers in general.

REFERENCES

1. Bijman, J., & Iliopoulos, C. (2014). Farmers' cooperatives in the EU: Policies, strategies, and organization. *Annals of Public and Cooperative Economics*, 85(4), 497-508.
2. Chaddad, F. R., & Cook, M. L. (2004). Understanding new cooperative models: An ownership-control rights typology. *Review of Agricultural Economics*, 26(3), 348-360.
3. Cook, M. L. (1995). The future of U.S. agricultural cooperatives: A neo-institutional approach. *American Journal of Agricultural Economics*, 77(5), 1153-1159.
4. Fulton, M., & Giannakas, K. (2001). Organizational commitment in a mixed oligopoly: Agricultural cooperatives and investor-owned firms. *American Journal of Agricultural Economics*, 83(5), 1258-1265.
5. Gijssels, C., & Bussels, M. (2014). Farmers' cooperatives in Europe: Social and historical determinants of cooperative membership in agriculture. *Annals of Public and Cooperative Economics*, 85(4), 509-530.
6. Grashuis, J., & Su, Y. (2019). A review of the empirical literature on farmer cooperatives: Performance, ownership and governance, finance, and member attitude. *Annals of Public and Cooperative Economics*, 90(1), 77-102.
7. Hendrikse, G. W. J., & Bijman, J. (2002). Ownership structure in agrifood chains: The marketing cooperative. *American Journal of Agricultural Economics*, 84(1), 104-119.
8. Hueth, B., & Marcoul, P. (2009). Incentive pay for CEOs of agricultural cooperatives. *Review of Agricultural Economics*, 31(4), 653-670.
9. Kalogeras, N., Pennings, J. M. E., van der Lans, I. A., Garcia, P., & van Dijk, G. (2009). Understanding heterogeneous preferences of cooperative members. *Agribusiness*, 25(1), 90-111.
10. Karantininis, K., & Zago, A. (2001). Endogenous membership in mixed duopsonies. *American Journal of Agricultural Economics*, 83(5), 1266-1272.
11. Kareska K, (2024) Good agricultural practices in the function of sustainable agriculture, 4th International Conference on Scientific and Academic Research (ICSAR), Konya/Turkey.
12. Kareska K, 2024 "Integration of advanced technologies in modern agribusiness" Lambert Academic Publishing", ISBN (978-620-7-47232-1)
13. Kareska.K. (2024) Integrating smart technologies in agriculture: A Blueprint for "Smart Villages" - Challenges and Opportunities, *International Journal of Current Researches in Sciences, Social Sciences and Languages*, Volume: 04 Issue: 02 , 2024, p.91-102
14. Kareska K, (2023) New trends in agribusiness, *Agricultural Economics eJournal* Vol 4, Issue 117,
15. Kareska K, (November 20-21, 2023) SWOT Analysis of the Tobacco Industry in the Republic of North Macedonia, 4th, International Conference on Engineering and Applied Natural Sciences ICEANS 2023: Konya, Turkey, *International Journal of Advanced Natural Sciences and Engineering Researches* E-ISSN: 2980-0811, Vol 7 No.10, DOI: <https://doi.org/10.59287/as-ijanser.396>
16. Katz, J. P., & Boland, M. A. (2002). One for all and all for one? A new generation of cooperatives emerges. *Long Range Planning*, 35(1), 73-89.

17. LeVay, C. (1983). Agricultural cooperative theory: A review. *Journal of Agricultural Economics*, 34(1), 1-44.
18. Ling, K. C. (2014). Marketing operations of dairy cooperatives. United States Department of Agriculture, Rural Development, Research Report 224.
19. Nilsson, J. (1999). Co-operative organizational models as reflections of the business environments. *LTA*, 1(99), 5-25.
20. Ortmann, G. F., & King, R. P. (2007). Agricultural cooperatives I: History, theory and problems. *Agrekon*, 46(1), 40-68.
21. Ortmann, G. F., & King, R. P. (2007). Agricultural cooperatives II: Can they facilitate access of small-scale farmers in South Africa to input and product markets? *Agrekon*, 46(2), 219-244.
22. Parnell, E. (1996). Reinventing co-operation: The challenge of the 21st century. Plunkett Foundation for Co-operative Studies.
23. Reynolds, B. J. (1997). Decision making in cooperatives with diverse member interests. United States Department of Agriculture, Rural Business-Cooperative Service, Research Report 155.
24. Richards, T. J., Klein, K. K., & Walburger, A. M. (1998). Principal-agent relationships in agricultural cooperatives: An empirical analysis from rural Alberta. *Journal of Cooperatives*, 13, 21-34.
25. Sexton, R. J., & Iskow, J. (1988). Factors critical to the success or failure of emerging agricultural cooperatives. Giannini Foundation Information Series No. 88-3.
26. Soboh, R. A. M. E., Lansink, A. O., Giesen, G., & van Dijk, G. (2009). Performance measurement of agricultural marketing cooperatives: The gap between theory and practice. *Review of Agricultural Economics*, 31(3), 446-469.
27. Staatz, J. M. (1987). The structural characteristics of farmer cooperatives and their behavioral consequences. United States Department of Agriculture, Agricultural Cooperative Service, ACS Research Report No. 18.
28. Valentinov, V. (2007). Why are cooperatives important in agriculture? An organizational economics perspective. *Journal of Institutional Economics*, 3(1), 55-69.
29. Zeuli, K. A., & Cropp, R. (2004). Cooperatives: Principles and practices in the 21st century. University of Wisconsin Extension, Cooperative Extension Publication A1457.
30. Kareska, Katerina (2025), "The Future of Agriculture: Evaluating the Effectiveness of Cooperative Farming in Transition Economies", in the process of publication
31. Kareska, Katerina (2025), "Analyzing the Impact of Cooperative Farming Models on Rural Economic Development", in the process of publication
32. Kareska, Katerina (2025), "Economic and Social Benefits of Cooperative Farming: A Case Study Approach", in the process of publication