

VOCATIONAL TRAINING IN AGRICULTURE – THE KEY TO A SUSTAINABLE AGRICULTURAL SECTOR

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***Abstract:** A sustainable agricultural sector depends not only on technology and resources but also on the knowledge and skills of the people working within it. Vocational training plays a crucial role in equipping agricultural workers with the competencies needed to adapt to modern challenges such as climate change, digitalization, and evolving market demands. Our research explores the current state of vocational education in agriculture, identifying gaps in training, access, and curriculum relevance. It analyzes the role of agricultural schools, on-the-job training, and lifelong learning programs in building a capable and resilient workforce. The study also looks at the importance of public policy and private sector involvement in promoting educational initiatives tailored to the real needs of the agricultural sector. Through a mix of case studies and statistical analysis, the paper aims to highlight how strategic investment in human capital through vocational training can contribute to productivity, sustainability, and long-term food security.*

Key words: vocational training, agricultural education, human capital, lifelong learning.

INTRODUCTION

In the context of global challenges such as climate change, population growth, soil degradation, and evolving consumer demands, the agricultural sector is undergoing a profound transformation [3]. Sustainable agriculture is no longer just about increasing crop yields or reducing chemical inputs; it now involves a comprehensive approach that integrates environmental stewardship, economic viability, and social equity [1, 3]. One of the most critical yet often underemphasized components of this transition is the role of human capital - specifically, the vocational training of those who work the land and manage agricultural enterprises [9].

Historically, agriculture has relied heavily on generational knowledge and traditional practices passed down within rural communities [1]. While these methods hold cultural and practical value, they are increasingly insufficient in addressing the technical and organizational demands of modern farming. Emerging technologies such as precision agriculture, digital farm management systems, climate-smart practices, and new forms of market access (e.g., e-commerce for producers) require new skill sets. As a result, the agricultural workforce must be supported not only through access to equipment and funding but also through structured, relevant, and continuous training.

Vocational education provides a bridge between conventional farming and modern, innovation-driven agriculture [6]. It offers practical, hands-on learning that empowers farmers, agronomists, and rural workers to implement updated techniques, adopt sustainable practices, and respond more effectively to environmental and economic pressures. However, significant disparities persist in terms of accessibility, curriculum alignment with real-world agricultural needs, and the integration of lifelong learning models into rural areas [8].

By focusing on practical education and continuous skills development, vocational training can act as a catalyst for innovation, efficiency, and inclusive growth within agriculture [7]. This study argues that a well-trained agricultural workforce is essential for ensuring food security, protecting natural resources, and fostering socio-economic development in rural communities. Investing in vocational training is not an optional

enhancement - it is a strategic necessity for the sustainability of agriculture in the 21st century [1].

MATERIALS AND METHODS

This study adopted a mixed-methods approach to examine the current state of vocational training in agriculture and its impact on sustainability, workforce adaptability, and rural development. Both qualitative and quantitative research methods were employed to provide a comprehensive understanding of how vocational education contributes to the modernization of the agricultural sector.

RESEARCH RESULTS

Understanding the impact of vocational training in agriculture requires a multidimensional analysis that goes beyond surface-level statistics. This section presents the core findings of the study, exploring how vocational education systems interact with the realities of modern agriculture [6]. Access to vocational training in agriculture is a fundamental component of developing a skilled and adaptable workforce capable of meeting the challenges of modern farming. As agriculture becomes increasingly influenced by technological innovations, environmental regulations, and market-driven demands, the need for specialized training is more critical than ever [2]. Vocational training offers practical, hands-on education that equips individuals with technical knowledge, problem-solving abilities, and operational skills relevant to crop production, livestock management, agri-business, and sustainable farming practices.

However, access to such training remains uneven globally. In many countries, particularly in rural or underdeveloped regions, agricultural education infrastructure is limited. Geographic isolation, lack of funding, insufficient qualified instructors, and poor awareness among rural populations often hinder participation in vocational programs. Young people in rural communities may not have easy access to institutions, and working adults frequently lack the flexibility to attend training due to economic or time constraints [7].

Moreover, where vocational training is available, it may not always align with current agricultural needs. Outdated curricula, lack of digital training tools, and minimal integration with local agricultural enterprises reduce the effectiveness of such programs. Stronger public-private partnerships are needed to ensure that training is relevant, accessible, and capable of producing job-ready graduates.

Efforts to expand access must include mobile training units, e-learning platforms, and targeted government policies that support both initial and continuing education for agricultural workers. Prioritizing inclusivity - ensuring that women, minorities, and older farmers have equal opportunities - is also essential.

Improving access to vocational training in agriculture is not merely a matter of education policy; it is a strategic investment in food security, rural development, and environmental sustainability. When farmers are equipped with up-to-date skills and knowledge, they are better prepared to innovate, adapt, and contribute to a resilient agricultural sector [3].

Figure 1 provides an overview of the evolution of the number of enterprises that offered continuous vocational training (CVT) in Romania, between 1999 and 2020. The indicator reflects the concern of enterprises for the development of employee skills, which is essential in a modern and sustainable agricultural sector.

In 1999, only 3,492 enterprises offered CVT, which represented a small percentage of the total of 31,688 enterprises investigated (calculated as the sum of those that offered and those that did not offer training). The situation changes drastically in 2005, when the

number of enterprises offering CVT increases to 17,630, while only 2,499 do not offer training. This jump probably signals a series of government measures or European initiatives that stimulated the development of vocational training. After 2005, however, the data show an oscillating and ultimately downward trend. In 2010 and 2015, the number of enterprises offering CVT remained significant (11,165 and 13,586), but in 2020 it fell to only 9,154. At the same time, the number of enterprises not offering CVT increased significantly: from 2,499 in 2005 to 43,178 in 2020. This trend reversal is worrying, suggesting a decrease in interest in training or structural difficulties (financial barriers, lack of qualified personnel, managerial disinterest).

By definition, CVT involves actions planned, organized and financed at least partially by the employer, in the form of courses or alternative activities (practical training, conferences, quality circles, etc.) [4]. The decline in the number of enterprises investing in CVT may have negative implications for the competitiveness and adaptability of employees to technological and market changes. The results highlight the need for a coherent policy to stimulate continuous training in agriculture and other essential sectors.



Figure 1. Enterprises that provided continuing vocational training

Source: [http://statistici.insse.ro/\[10, 11, 12\]](http://statistici.insse.ro/[10, 11, 12]).

A significant issue identified is the misalignment between vocational curricula and the actual needs of modern agriculture. Analysis of program syllabi revealed that many institutions still focus on outdated methods, with minimal emphasis on digital farming technologies, climate-smart agriculture, or entrepreneurial skills. Vocational training is not only essential for youth but also for the current workforce [5].

Another critical factor influencing the effectiveness of vocational training is policy support and private sector involvement. Countries with clear strategies for vocational agricultural education, supported by dedicated funding streams, demonstrate better integration between training programs and market needs [15]. In Romania, despite national strategies acknowledging the importance of vocational education in agriculture, implementation remains weak [13]. Budget constraints, institutional inertia, and lack of stakeholder coordination hinder program development. By contrast, in the Netherlands and Germany, agricultural vocational education benefits from strong public-private cooperation [14]. Agribusinesses play an active role in curriculum design, internship placements, and even co-funding of training centers. These models result in higher employment rates, better-trained graduates, and innovation diffusion in rural economies.

The graph (Figure 2) provides a clear picture of the evolution of participation in continuing professional training (CPT) courses in Romania, between 1999 and 2020, with

a breakdown by gender (male and female). CPT, by definition, involves the participation of employees in courses organized outside the workplace, in a formal setting, with a planned program and supported by qualified trainers.

The analysis shows a significant increase in participation until 2015, followed by a slight decrease in 2020. In 1999, only 167,585 men and 90,204 women participated in such courses. By 2005, the number of participants had almost doubled, with 333,190 men and 220,009 women, indicating an increase in interest and probably a better educational offer.

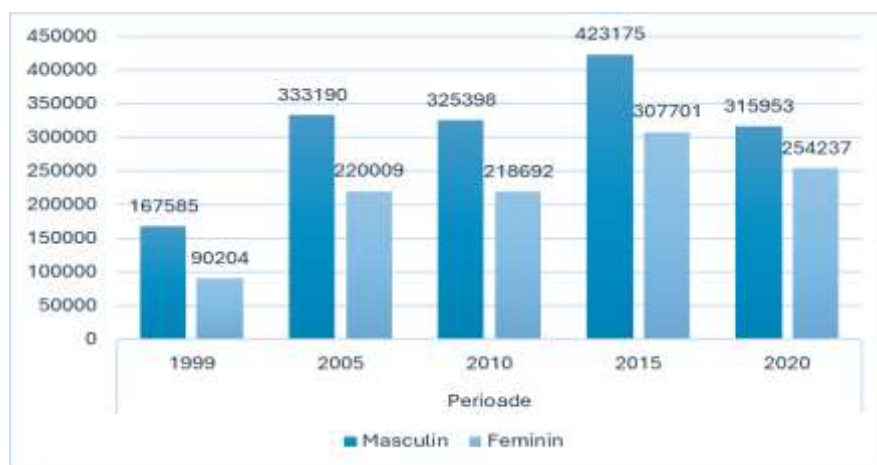


Figure 2. Participants in continuing professional training courses

Source: [http://statistici.insse.ro/\[10, 11, 12\]](http://statistici.insse.ro/[10, 11, 12]).

The year 2015 marks the peak of participation, with 423,175 men and 307,701 women involved in CVT courses. This explosion can be explained by European policies supporting skills development or national retraining programs. At the same time, the gap between men and women remains visible, although it is slightly decreasing over time.

In 2020, participation decreases for both sexes (315,953 men and 254,237 women), most likely influenced by the COVID-19 pandemic and related restrictions, but also by structural difficulties such as insufficient digitalization or limited access in rural areas. The fact that men participate in consistently higher numbers than women may signal additional access barriers for female employees in certain fields or social responsibilities that limit the time dedicated to training. These data highlight the need for educational policies tailored by gender, economic sector and region, to ensure equitable and continuous participation in vocational training.

Expanding access to vocational education for underrepresented groups - such as women, small-scale farmers, and youth in remote areas - is vital for fostering equitable rural development. As agriculture continues to face mounting global pressures, investing in inclusive, high-quality vocational training systems becomes an essential pillar in building a resilient and sustainable agricultural future.



Figure 3. Average duration of continuing professional training courses

Source: [http://statistici.insse.ro/\[10, 11, 12\]](http://statistici.insse.ro/[10, 11, 12]).

Figure 3 illustrates the evolution of the average number of hours of continuous professional training (CPT) per participant, differentiated by gender (male and female), for the years 1999, 2005, 2015 and 2020.

In 1999, the highest values of the average duration of training are recorded: 68.2 hours for men and 81 hours for women. This notable difference suggests that, during that period, women benefited from longer training sessions, possibly in the context of specific integration or retraining programs. Subsequently, in 2005, the values decrease considerably: to 48 hours for men and 38.3 hours for women. This change indicates a general reduction in the duration of training sessions, perhaps as a result of a change in educational policy or a shift towards shorter and more focused courses. Also, the reversal of the ratio (with men benefiting from more hours than women) signals a possible change in training priorities or differentiated access to training. Between 2015 and 2020, the average duration of CVT courses continues to decrease slightly, stabilizing around 36–41 hours. In 2020, the average is 36 hours for men and 37 hours for women, indicating that the gender gap in training duration has narrowed significantly. This balance may be the result of more equitable policies or the standardization of training programs.

Overall, the trend is clearly downward, which could reflect a preference for shorter but more frequent learning formats or a decrease in investment in professional development. However, it is essential that the reduction in duration does not affect the quality and efficiency of the training provided.

CONCLUSIONS

Vocational training in agriculture has emerged as one of the most strategic tools in ensuring the sustainability, adaptability, and productivity of the agricultural sector in the face of modern challenges. This research has revealed both the strengths and limitations of current vocational education frameworks, emphasizing the urgent need for reform, investment, and inclusion. As agriculture evolves due to climate change, digitalization, labor shortages, and shifting market dynamics, so too must the systems that educate and train its workforce. Participation of both men and women in vocational training has improved, women continue to face structural barriers, including limited time availability, social expectations, and underrepresentation in technical roles. Designing training programs with inclusive strategies - flexible schedules, child care support, and targeted recruitment - can improve women's access to skill development and leadership

opportunities in agriculture. Statistical data, such as the decline in average training hours and fluctuation in the number of enterprises offering continuous professional development, highlights a risk: while more people may participate in training, the intensity and depth of instruction may be weakening. This suggests a need to not only increase participation but also ensure the quality and relevance of learning experiences.

In conclusion, vocational training in agriculture is more than a technical necessity - it is a developmental imperative. By equipping farmers and rural workers with the knowledge and skills to face a fast-changing environment, vocational training helps safeguard food security, boost rural economies, and protect the natural resources on which agriculture depends. For these reasons, decision-makers must view agricultural vocational education not as a peripheral activity, but as a central pillar of sustainable development strategy. The future of agriculture depends on the strength of its human capital—and that begins with education.

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