Research article

AGRICULTURAL EDUCATION AS A KEY ELEMENT OF SOCIO-ECONOMIC DEVELOPMENT IN SUB-SAHARAN AFRICAN COUNTRIES

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Abstract. Agriculture in Sub-Saharan Africa (SSA) has historically played a central role in ensuring employment and food security in the region. However, under contemporary conditions, the agricultural sector faces profound contradictions: on the one hand, it remains the economic foundation; on the other, it is losing its workforce due to youth migration to urban areas and the laborers shifting to service sector and the extractive industries. Despite high unemployment rates, young people avoid agriculture, perceiving it as an unprestigious, low-paying, and technologically backward sector. The author argues that resolving this situation requires transforming agricultural education. The article emphasizes that modern agriculture is ceasing to be "traditional"—it now demands specialists with expertise in agronomy, biotechnology, logistics, management, and digital technologies. However, the current agricultural education system in SSA does not meet these challenges. To address these issues, the author proposes reforms to the education system, including shifting curricula toward a practice-oriented approach. An example is the Russian model of continuous agribusiness education, which begins in preschool agricultural clubs and extends to specialized universities. Digitalizing education could make agricultural professions more attractive to youth. Strengthening international cooperation between the SAA countries and the Russian Federation can also help African youth receive appropriate education. The development of agricultural education is one of the key conditions for ensuring sustainable progress in sub-Saharan Africa. Its transformation requires a systematic approach that unites government, business, and international partners.

Keywords: Sub-Saharan Africa (SSA), agricultural education, socio-economic development, food security, sustainable development, sustainable agriculture, unemployment

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INTRODUCTION

Historically, agriculture in Sub-Saharan African (SSA) countries has played a crucial role in ensuring employment and food security for the population. However, under current conditions, the region's agriculture faces numerous challenges, and its position is weakening due to the growing popularity of the service sector and extractive industries.

Agricultural production is experiencing a shortage of workers, even as high unemployment persists in many countries.

Youth, who make up the majority of African society, do not consider agriculture an attractive sector and are in no hurry to join the ranks of agricultural producers. Young people view work in the agricultural sector as hard, uninteresting, and not offering stable income. As a result of this loss of workforce, agricultural production fails to provide the population with the necessary food. SSA countries have the highest number of undernourished people in the world. According to FAO data[1], in 2023, 20.4% of the population in SSA was undernourished; the global average was 9.1%, with figures of 6.2% in Latin America and the Caribbean, 5.8% in Central America, 3% in Central Asia, 13.9% in South Asia, and 12.4% in Western Asia[2] (see *Fig.* 1).

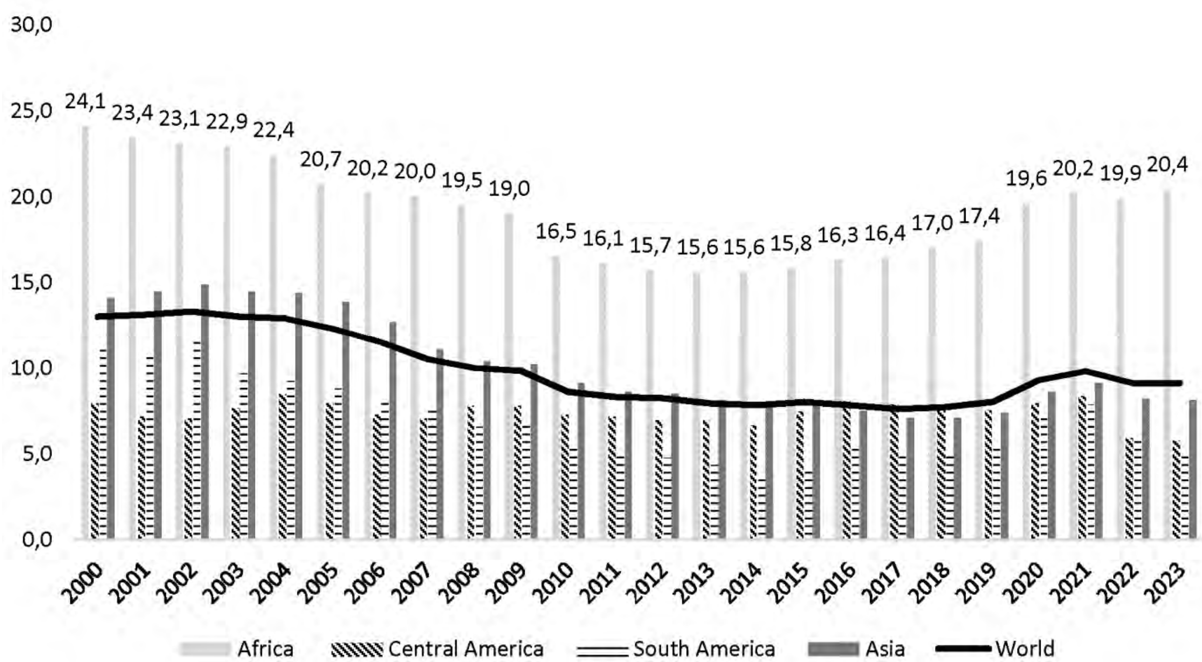

Fig. 1. **Prevalence of malnutrition in African countries and the world, % of population.**
Source: compiled by the author based on *FAOSTAT* data[3].

Without attracting young people to the agricultural sector, it is unlikely that this situation can be reversed. At the same time, modern agriculture has the potential to become attractive to the younger generation. In a number of countries, it has evolved into a high-tech industry requiring specialists with unique knowledge and skills in agronomy, animal husbandry, information technology, production management, logistics, food processing, and other promising fields. However, SSA countries currently lack an adequate level of education to support the adoption of new technologies [Denisova, Kostelyanets 2022]. Therefore, the development of training in agricultural specialties becomes particularly important.

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[1] Food and Agriculture Organization of the United Nations.
[2] Suite of Food Security Indicators. *Food and Agriculture Organization of the United Nations.* https://www.fao.org/faostat/en/#data/FS (accessed: 25.01.2025)
[3] Ibid.

At the end of 2023, the African Union adopted a new Digital Agriculture Strategy[4], which places significant emphasis on improving education levels and digital literacy among agricultural workers. The document highlights the importance of promoting digital skills in schools and universities, as educational initiatives are key drivers of agricultural transformation. The strategy specifically emphasizes the crucial role of education in attracting youth to the sector, suggesting they could become the driver of agricultural development.

The present paper addresses the issue of promoting agricultural education among youth in SSA countries and attracting them to agricultural production. The study aims to assess the current state of education at various levels, identify the current status of agricultural education, and develop proposals to enhance its role in the socio-economic development of SSA countries.

AGRICULTURE IN THE ECONOMY OF SSA COUNTRIES AND CHALLENGES OF THE AGRICULTURAL SECTOR

Agriculture plays a vital role in Africa's economy, contributing about 15% to the continent's gross domestic product (GDP), according to the World Bank[5]. It not only ensures food security but also serves as the main source of income for millions of people, particularly in rural areas (49% of the SSA population, 13% in the Middle East and North Africa) [6].

In recent decades, the number of workers in agricultural production has been declining. This is a serious issue with multiple underlying causes. Agricultural workers are leaving the sector due to low income and constantly changing production conditions, opting instead to move to cities in search of stability. Other reasons include a lack of prospects with outdated technologies, limited access to social infrastructure (such as education and healthcare), and the natural decline of the workforce due to the aging of farmers and insufficient youth engagement.

There is virtually no replacement for departing workers, and the agricultural sector is experiencing a labor shortage that has serious consequences for both the sector and the broader economy. Primarily, this results in decreased agricultural output, leading to food shortages, rising food prices, and reduced food security. The lack of domestically produced goods increases dependence on imports and results in inefficient use of foreign currency. The decline in youth entering the agricultural sector slows rural development and lowers the living standards of families dependent on farming.

The agricultural sector in Africa faces numerous challenges that hinder food security. The main reasons why agriculture does not provide an adequate level of food sufficiency include:

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[4] AU Digital Agriculture Strategy (DAS) and Implementation Plan 2024 – 2030. *African Union*. https://faolex.fao.org/docs/pdf/au225158.pdf (accessed: 31.01.2025)

[5] Agriculture, forestry, and fishing, value added (% of GDP). *World Bank Group.* https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS (accessed: 31.01.2025)

[6] Employment in agriculture (% of total employment). *World Bank Group.* https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=ZG (accessed: 31.01.2025)

1) low productivity (use of outdated farming methods and limited adoption of modern technologies) [Morozenskaya et al. 2024];

2) climate change (droughts, floods, and other extreme weather events adversely affect agricultural production);

3) underdeveloped or non-existent rural infrastructure (poor roads, insufficient storage facilities, irrigation systems, transport, sorting and processing centers, and other critical infrastructure);

4) political factors (armed conflicts that virtually eliminate the possibility of economic activity, and political instability that discourages investment in agriculture and worsens the business environment) [Kostelyanets 2014];

5) social and cultural barriers (obstacles for women to engage in farming and the perception of agriculture as “non-prestigious,” which deters youth) [Ayoade 2011];

6) a lack of access to financing (difficulties obtaining loans and financial support for farmers, limited investment in the sector, and insufficient state support).

Thus, Africa’s agricultural sector fails to ensure food security due to a combination of the factors listed above. Many of these issues are directly linked to insufficient qualifications, low levels of education, or a complete lack of education among producers.

SOCIAL IMPORTANCE OF AGRICULTurAL EDUCATION

Another contemporary issue faced by SSA countries is the high level of unemployment in some of the nations of the macro-region (see *Fig.* 2).

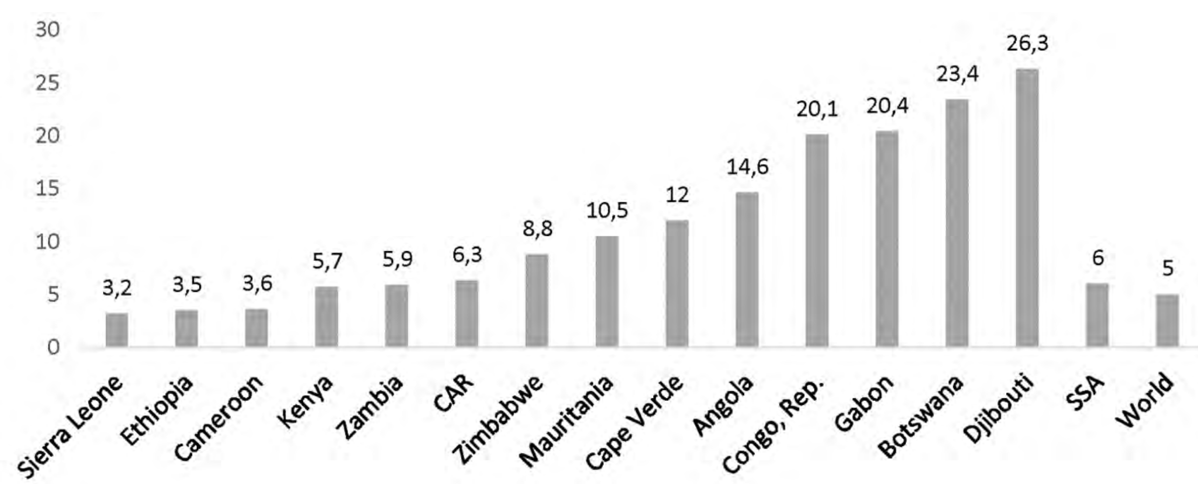

Fig. 2. **Unemployment, 2023, %.**
Source: compiled by the author based on data from the *World Bank Group*[7].

The high unemployment rates in some African countries are the result of a combination of factors that interact and create a complex economic environment. These include rapid population growth, high rates of urbanization, a shortage of jobs, and the consequences of economic and political instability, among others. Particular attention should be given to low levels of education and skills among the population.

[7] Unemployment, total (% of total labor force). *World Bank Group.* https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS (accessed: 24.01.2025)

Africa has the fastest population growth in the world. More than 60% of the continent's inhabitants are under 20 years old[8]. It is important to note that young people prefer to live in large cities and leave rural areas. The number of young people entering the labor market in cities significantly exceeds the number of available jobs. Many of them have a low level of education and qualifications and therefore do not have sufficient skills to work in modern industries. This creates a high level of youth unemployment. According to Russian researchers, "the continued high birth rates and population growth rates in Sub-Saharan Africa will ensure an increase in demographic weight in the coming decades" [Abramova 2010]. Given the above and observing the continuing population growth in Africa, it is necessary to focus on the fact that the issues of youth education, increasing the efficiency of the agricultural sector, and strengthening the continent's food security are more relevant than ever [Gribanova 2020]. These three factors are interconnected.

Agricultural education helps to gain knowledge about more efficient agricultural production and optimal use of resources. Putting such knowledge into practice will lead to an increase in the quantity and improvement of the quality of food. Education helps to change the diet towards its balance and diversity, which ultimately leads to improved health of the population and a decrease in the level of malnutrition. People who have received education in agricultural production find it easier to find work in rural areas, which reduces unemployment and urbanization, or create their own business, which contributes to the development of entrepreneurship in the agricultural sector. Both have a positive effect on food security.

Agricultural specialists are in demand for decision-making at both the small-scale community and national levels. With relevant knowledge, they can contribute to the development and adoption of effective agricultural policies, which are so important for modern African states.

In recent decades, humanity has had to adapt to changes occurring on the planet. The African continent is the epicenter of climate fluctuations[9], and the issue of responding to change is particularly acute there. With agricultural education, producers can apply optimal adaptive technologies that strengthen food systems.

Thus, agricultural education can not only have a direct impact on the level of agricultural productivity, employment, and food security but also contribute to improving the nutrition and health of Africans, developing agricultural entrepreneurship, and helping to adapt to changes [Gombo, Mukhametzyanov 2022].

AGRICULTURAL EDUCATION IN SCHOOL

One of the important aspects of the current state of the agricultural sector is its unpopularity among young people, who prefer prestigious jobs with stable, high incomes. Agriculture is associated with hard physical labor, outdated technologies, primitive tools, and low earnings. As a result, agricultural education is not in demand among youth and

[8] Median and average age in global comparison. *WorldData.info.* https://www.worlddata.info/average-age.php (accessed: 21.01.2025)

[9] Responding to climate change. *UN Environment Programme*. https://www.unep.org/regions/africa/regional-initiatives/responding-climate-change (accessed: 17.03.2025)

requires rehabilitation in their perception. The simplest way to promote the sector is to engage students from the earliest grades.

There are many examples of how children are introduced to agriculture in elementary school. In 2010, the Food and Agriculture Organization of the United Nations developed and implemented the School Gardens project aimed at training younger schoolchildren in agricultural practices and producing food on school grounds with student participation[10]. The project's main goal is to promote healthy eating using food grown by the students themselves, develop life skills (such as growing plants and animals and preparing nutritious meals), and provide environmental education from an early age.

The curriculum includes gardening, environmental studies, and home economics. Gardening classes teach students how to grow plants, harvest crops, and store and prepare food. Young students participate in all the processes, see agriculture "from the inside," and perceive it as a vital life activity rather than something "non-prestigious" or "boring." Basic agricultural education not only provides initial theoretical knowledge but also ensures its practical application: students often work in school gardens, grow plants, care for animals, harvest produce, and perform other agricultural tasks. Several initiatives modeled on the School Gardens project have been developed and implemented.

In South Africa, the National School Nutrition Programme (NSNP) supports the development of school gardens to grow food locally, combat malnutrition, promote environmental education, and support sustainable natural resource management[11]. Under this program, the organization "Food and Trees for Africa" (FTFA) runs a significant initiative called School Gardening to support food security[12]. The project targets preschool, primary, and secondary school students. FTFA helps integrate agricultural education into existing school curricula across South Africa for schools interested in running their own gardens. One successful example is an elementary school in Pretoria, which not only provides early agricultural education but also transformed a vacant urban lot into a garden for growing herbs and vegetables. The school produces food for its own use and for sale[13]. In Ghana, the Organic School Project also trains students in crop cultivation and organic farming. The produce grown by the students is used to supplement their own diets[14].

Educational initiatives can also be found in Nigeria (Toddler's Garden), Tanzania (Games with Seeds), Mozambique (Children's Agro Club), Kenya (Farmer's Tales), and other countries, where children aged 3–7 receive early agricultural education.

There are successful examples of older students receiving specialized agricultural education. In South Africa, the Harry Oppenheimer Agricultural High School, which serves students in grades 8 through 12, has been operating since 1982 and allows students to specialize in agriculture. Its curriculum includes modules such as Agricultural Sciences

[10] A new deal for school gardens. *Food and Agriculture Organization of the United Nations.* https://www.fao.org/4/i1689e/i1689e00.pdf (accessed: 16.12.2024)
[11] Ibid.
[12] *Food and Trees for Africa.* https://trees.org.za/education/ (accessed: 18.12.2024)
[13] A new deal for school gardens. *Food and Agriculture Organization of the United Nations.* https://www.fao.org/4/i1689e/i1689e00.pdf (accessed: 16.12.2024)
[14] Ibid.

and Agricultural Management Practices[15]. A similar secondary school exists in Nigeria—the Ibadan Grammar School—where livestock farming is a mandatory subject and crop production is offered as an elective[16]. Many schools have extracurricular agricultural clubs, and students often take part in environmental projects [Malabe, Wakawa, Gwary 2019].

In Kenya, agricultural education at the primary and secondary levels is supported by two platforms: the Young Farmers Clubs of Kenya (YFCK)[17] and the 4-K Clubs of Kenya[18]. The former are more common in secondary schools. These school-based clubs aim to teach students modern agricultural practices, sustainable land use, and entrepreneurship. Participants—typically students aged 12–18—gain hands-on experience in crop cultivation, animal husbandry, and managing small-scale farming projects. Schools allocate land plots for training farms where students can experiment with innovative methods such as drip irrigation and organic farming.

The 4-K Clubs in Kenya are youth agricultural organizations designed for schoolchildren and young people in rural areas to develop skills in agriculture. Schools and communities provide plots for practical activities where youth grow crops, care for animals, and implement innovations such as solar-powered irrigation systems—an environmentally friendly irrigation method that runs on solar energy[19]. Kenya has around 4,000 4-K clubs with approximately 200,000 members.

These examples show that agricultural education at the primary and secondary levels does exist in SSA countries. However, due to the complexities of organizing educational programs that address agricultural specifics, there are only a few hundred such schools—far from enough to cover the number of students who could continue into agricultural careers after completing their education[20]. Challenges include training teachers, developing curricula, and providing necessary materials, facilities, land, equipment, and animals. These schools are difficult to establish in urban areas because they require adjacent land for demonstration farming.

HIGHER AGRICULTURAL EDUCATION

Higher agricultural education is fairly widespread in SSA countries [Gavrilova 2024b]. However, determining the exact number of agricultural universities is difficult due to the absence of a continental database and varying classifications of educational institutions. Based on open sources, the total number of agricultural institutions—

[15] *Harry Oppenheimer Agricultural High School*. https://web.archive.org/web/20170731090958/http://hoahs.co.za/ (accessed: 11.12.2024)
[16] *Ibadan Grammar School*. https://ibadangrammarschool.org/ (accessed: 14.12.2024)
[17] *Young Farmers Clubs of Kenya*. https://ask.co.ke/product-categories/ (accessed: 19.12.2024)
[18] *4-K Clubs of Kenya*. https://4-kclubs.go.ke/ (accessed: 17.12.2024)
[19] Solar-Powered Irrigation Systems: A clean-energy, low-emission option for irrigation development and modernization. *Global Alliance for Climate-Smart Agriculture, GACSA*. https://openknowledge.fao.org/server/api/core/bitstreams/52160f7e-6106-41d1-b170-fb230a4e7071/content#:~:text=Solar%2Dpowered%20irrigation%20systems%20(SPIS,GHG)%20emissions%20from%20irrigated%20agriculture (accessed: 17.03.2025)
[20] Hood L. Agriculture training in South Africa badly needs an overhaul. Here are some ideas. *The Conversation*. 08.11.2017. https://theconversation.com/agriculture-training-in-south-africa-badly-needs-an-overhaul-here-are-some-ideas-85272/ (accessed: 26.12.2024)

universities, faculties, and colleges—can be roughly estimated at 160 to 200. However, to obtain accurate data, the creation of a pan-African register of educational institutions is necessary.

Table 1. **Leading agricultural universities in Africa**

Rank in Africa among agricultural universities	Rank in Africa among universities	Rank in the world	University (country)	Brief description
1	4	430	University of Pretoria (South Africa)	The Faculty of Natural and Agricultural Sciences is a leader in the number of researches, innovations, and training of personnel for agribusiness
2	8	805	University of Nairobi (Kenya)	Leading center in East Africa for training and research in plant science and veterinary science.
3	7	1295	Makerere University (Uganda)	Strong programs in sustainable agriculture and environmental management.
4	11	932	University of Ghana (Ghana)	A wide range of programs and research on food security and sustainable development
5	3	422	Stellenbosch University (South Africa)	One of the oldest and most prestigious agricultural science departments in Africa, renowned for its practice-oriented teaching and research programs.
6	13	1006	University of Ibadan (Nigeria)	A leading university in West Africa, renowned for its research in crop, livestock and forestry.
7	34	1681	University of Zambia (Zambia)	Conducts research programs aimed at improving the efficiency of food production and the sustainability of agriculture
8	53	2634	Sokoine University of Agriculture (Tanzania)	Leading center for training specialists for East and Southern Africa, with emphasis on veterinary science, forestry, and environmental management.
9	35	2130	Ahmadu Bello University (Nigeria)	Research in crop production, livestock production, and agricultural economics
10	6	610	University of KwaZulu-Natal (South Africa)	Training of specialists in agronomy, soil science, and environmental management

Source: TOP 20 Agricultural Universities in Africa: Shaping the Future of Agribusiness. *Agricultural Business insights.* 22.07.2024. https://agribusinessspace.com/2024/07/22/top-20-agricultural-universities-in-africa-shaping-the-future-of-agribusiness/ (accessed: 12.05.2025); 14131 universities from 183 countries ranked across 246 topics. *Edurank.* 02.03.2025. https://edurank.org/ (accessed: 12.05.2025)

As demonstrated by Russia's experience in compiling a registry of general and specialized universities, such a measure helps identify not only quantitative but also qualitative imbalances in the higher education system[21].

African agricultural universities that shape the future of the agrarian sector through innovation and sustainable practices are assessed using rankings that take into account education quality, scientific output, technological implementation, industry partnerships, infrastructure, and alumni success. The rating of the leading and most prominent agricultural universities or universities offering agricultural programs (see *Table* 1) is based on an analysis of academic standards, funding levels, practical training components, global reputation, and impact on local communities.

An analysis of the positions of Africa's leading agricultural universities in global rankings shows that even the best institutions occupy modest positions internationally. Only two universities—Pretoria and Stellenbosch (both in South Africa)—are among the world's top 500, ranking 430th and 422nd, respectively. Other leading agricultural universities on the continent rank significantly lower. Furthermore, major specialized institutions such as the University of Zambia, Sokoine University of Agriculture (Tanzania), and Ahmadu Bello University (Nigeria) fall outside the global top 1000. This indicates that Africa's agricultural universities, on the whole, lag behind even average global standards in terms of education quality, research activity, and innovation potential.

Although some programs and research areas are strong, African agricultural universities generally hold low positions in international rankings, reflecting their limited capacity to train highly qualified professionals and advance modern agricultural technologies. This confirms that the existing agricultural education system on the continent is failing to meet growing challenges and is in urgent need of large-scale modernization.

The agricultural education programs at the aforementioned institutions in SSA cover areas such as animal husbandry, agronomy, agricultural engineering, soil science, agribusiness, and other agricultural fields, addressing all aspects of agricultural functioning. It can be said that Africa does possess the "educational base" for training specialists in agriculture. for However, it is important to note that, according to UN forecasts, Africa's population will reach 2.5 billion by 2050[22]. The continent is also demographically "young"—60% of its population is under the age of 25. Each year, millions of young people reach the age for higher education. Even assuming that there are around 200 higher education institutions (or faculties) on the continent training agricultural specialists, it is clear that the current capacity of Africa's agricultural education system does not match the scale of its demographic challenges. The system needs significant expansion. African countries must invest more in educational sovereignty.

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[21] Russia wants to create a register of multidisciplinary and specialized universities. *Izvestia*. 12.02.2025. (In Russ.). https://iz.ru/1837858/2025-02-12/v-rossii-khotiat-sozdat-reestr-raznoprofilnykh-i-spetcializirovannykh-vuzov (accessed: 12.05.2025)

[22] Guengant JP. Africa 2050: African Demography. 2013. P. 20. *IRD*. https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers13-07/010059333.pdf (accessed: 12.05.2025)

ADDITIONAL PROGRAMS IN AGRICULTURAL EDUCATION

In addition to long-term education for children and youth at various levels—from primary to higher education— short-term programs focused primarily on adults are also practiced in SSA countries. According to the World Bank, agricultural extension is the process of helping farmers become aware of and adopt improved technologies from any source in order to increase production efficiency, income, and overall well-being[23]. The most well-known initiative supporting this process is the system of agricultural extension services.

In Nigeria, advisory services are regulated by the federal government, and extension offices operate in each of the country's 36 states. In 2023, about 7,000 civil servants were employed as extension agents[24]. The knowledge extension centers are linked to research institutes and agricultural universities. The system is designed to diagnose problems in agriculture, seek solutions, test technologies, and promote the most effective ones for large-scale adoption by farmers.

In Malawi, there are 8 agricultural development divisions that cover 28 districts. In 2023, approximately 1,700 extension workers served around 4 million farmers [Agwu et al. 2023: 14].

In South Africa, agricultural and advisory services are provided in all nine provinces. In 2023, there were 2,700 government consultants, and about 1,500 individuals worked in private advisory offices. However, their coverage of farmers was uneven. In Eastern Cape, one extension agent served 1,000 small-scale producers; in Mpumalanga, the ratio was 1:2,700; and in KwaZulu-Natal, it was 1:723 [Agwu et al. 2023: 26]. Many universities and colleges in South Africa offer a variety of programs of different durations aimed at improving the qualifications of agricultural workers at all levels.

In Kenya, the main provider of agricultural advisory services is the Ministry of Agriculture and Livestock Development (MoALD) [25], which operates across all 47 counties in the country.

In addition to government involvement, some extension services are provided by non-governmental organizations (NGOs), which offer farmers technical support, assistance in obtaining loans, resource provision, and training in specific agricultural production technologies. Their goal is to enhance the professionalism of producers and integrate them into their supplier networks.

In almost all countries, extension centers face similar challenges. The most critical issue is the lack of qualified personnel, resulting in one specialist often being responsible for hundreds of farmers. Another common problem is insufficient funding for these services from both government and private investors. A third obstacle is the poor coordination between numerous service providers, both public and private, which often leads to duplication of efforts and conflicting approaches[26]. In addition, outdated

[23] Agricultural extension. *World Bank*. https://documents.worldbank.org/pt/publication/documents-reports/documentdetail/956441468763806805/agricultural-extension (accessed: 15.12.2024)

[24] Nigeria: In-depth Assessment of Extension and Advisory Services. Developing Local Extension Capacity (DLEC) Project. *Feed the Future*. 2017. https://digitalgreen.org/wp-content/uploads/2024/07/Nigeria-In-Depth-Assessment.pdf (accessed: 24.12.2024)

[25] *The Ministry of Agriculture and Livestock Development*. https://kilimo.go.ke/ (accessed: 25.12.2024)

[26] Nwobilor I. Digital Technologies and the Right to Education in Africa. *Paradigm Initiative*. 30.08.2023. https://paradigmhq.org/digital-technologies-and-the-right-to-education-in-africa/ (accessed: 22.11.2024)

extension methods and the lack of digital technology integration reduce the effectiveness of services. The work of advisory centers is also constrained by outdated infrastructure, bureaucracy, and political instability [Sennuga, Alo, Sokoya 2021].

TACKLING THE WORKFORCE CRISIS THROUGH EDUCATION REFORMS AND INTERNATIONAL INITIATIVES

Despite educational programs of varying levels and intensities, international assistance, and numerous government initiatives, the agricultural sector in SSA countries—as demonstrated above—still fails to ensure an adequate level of food security. Agriculture continues to face systemic problems that limit its productivity.

One major factor is the gap between education and practice. In many institutions, instruction remains theoretical, with methods being taught that are not adapted to local conditions, let alone the altered climate and other evolving circumstances. Graduates often complete their studies without acquiring practical skills for working in agriculture. Another issue is the outdated information still presented as core material in educational institutions [Conn 2017]. The digital transformation of education is proceeding at an inadequate pace, hindering the modernization of the learning process [Gribanova, Ulanova 2022].

Attention should also be paid to the educational gap. Even if students receive basic agricultural education at the primary level, only a small portion have the opportunity to continue it at secondary and higher levels due to various factors. The lack of developed curricula, infrastructure, trained teachers, and modern equipment all stem from insufficient funding and other constraints [Kpaka et al. 2022].

SSA countries need to implement reforms in their education systems [Gavrilova 2021]. As a first step, it would be useful to conduct a comprehensive study to determine what kinds of specialists, and in what numbers, will be in demand in all areas of agricultural production in the coming years. This would involve analyzing the current state of agricultural production by type and quantity, assessing current worker productivity, and developing an optimal agricultural production plan that would eliminate the food deficit. The gap between current and required production levels would help identify the workforce deficit. At the state level, it would then be possible to allocate training quotas among educational institutions and guarantee employment for young graduates upon completion of their studies. The example of the USSR is relevant here, where targeted education programs were widely implemented with guaranteed employment upon graduation.

RUSSIAN EXPERIENCE OF OVERCOMING THE WORKFORCE CRISIS IN THE AGRO-INDUSTRIAL COMPLEX‘ AND PROSPECTS FOR COOPERATION WITH AFRICA

The Russian education system offers examples of how to bridge gaps between educational levels [Tarabrina 2019]. One such example is the model of continuous agribusiness education, which involves training at multiple interconnected levels [Voronchikhina, Filimonyuk 2018]. The first level is preschool education, where children learn the basics of agriculture through extracurricular activities, observe the cultivation of crops, and learn to care for animals. At higher levels of education—in middle and high school and in specialized secondary and higher institutions—students can study more advanced and modern methods for running efficient and profitable agricultural production using technologies of the Fourth Industrial Revolution. Drones, soil, water, and air sensors, and modern agricultural machinery undoubtedly attract the interest of young people and challenge the outdated notion that the sector is backward and farmers are poor [Gavrilova 2024a].

The Russian Federation is currently actively planning to modernize its agricultural education system. A recent study identified a shortage of 200,000 professionals in the agro-industrial complex (AIC)[27], prompting the development of a new federal project, "Personnel for the AIC."[28]

Initial steps have already been taken to address the shortage of agricultural workers. In 2024, 50 pilot agro-technology classes were launched across eight regions, currently enrolling around 1,000 students. Some regions have independently initiated similar classes. By the end of 2025, nearly 600 agro-technology classes will be operating in 63 regions, with the number expected to reach 18,000 by 2030[29]. There are plans to further expand agro-technology classes in rural areas. The emerging unified concept of agricultural workforce training will include both secondary and higher education institutions. The proposed Russian model of seamless, continuous agricultural education could serve as a blueprint for developing similar systems in SSA countries.

Joint programs for training qualified agricultural personnel at Russian universities may become a promising direction for future cooperation between the Russian Federation and SSA countries [Morozenskaya, Kalinichenko 2023]. Active work is already underway in this area. For example, in 2023, the Russian chemical holding company PhosAgro—one of the largest fertilizer producers—and the leading Russian agrarian university, the Timiryazev Agricultural Academy, signed cooperation agreements with universities in Egypt, Zambia, Uganda, and other countries during the Russia–Africa Economic and Humanitarian Forum[30].

The Russian Federation is increasing the number of state-funded university placements for African students: at the first ministerial conference of the Russia–Africa Partnership Forum, it was announced that the number would rise to 4,800 for the 2025/2026 academic year[31]. It is also worth noting that over the past five years, interest among African students

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[27] Kulistikova T. The shortage of personnel in the agro-industrial complex exceeds 200 thousand people. *Agroinvestor*. 28.01.2025. (In Russ.). https://www.agroinvestor.ru/markets/news/43666-defitsit-kadrov-v-apk-prevyshaet-200-tysyach-chelovek/ (accessed: 31.01.2025)

[28] Federal project "Personnel in the AIC". National project "Technological support of food security." *Government of the Russian Federation*. (In Russ.). http://government.ru/rugovclassifier/924/about/ (accessed: 20.04.2025)

[29] Oksana Lut spoke about the priority tasks of developing agricultural science and education. *Agrarian News*. (In Russ.). https://agronovosti.ru/oksana-lut-rasskazala-o-prioritetnyh-zadachah-razvitiya-agrarnoj-nauki-i-obrazovaniya/ (accessed: 01.02.2025)

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in studying agriculture in Russia has grown significantly[32]. According to a survey conducted by Rosselkhozbank, 17% of students at Russian agricultural universities believe their knowledge would be most useful in African countries, and one in three students (34%) expressed a desire, at varying levels of confidence, to complete an internship in Africa. Among the preferred countries for work, students named South Africa, Ethiopia, Tanzania, Egypt, Algeria, Morocco, Cameroon, Zimbabwe, and Uganda[33].

In 2024, RUDN University began training 121 specialists for Ghana at the request of its industrial partner, the Jospong Group of Companies. Ninety-one students will study agronomy and thirty will study ecology. The students plan to return home after graduation to help develop their country's agricultural sector[34].

Russian companies such as PhosAgro and Uralchem are integrating educational programs into their operations in Africa. For example, they train farmers in sustainable agricultural practices, fertilizer use, and soil assessment using the online platform Pro Agro Lectorium. These companies are also participating in the AFRILAB project, a network of soil laboratories in 48 African countries, in partnership with the FAO, enabling local specialists to analyze soil and fertilizer quality [Sviridov, Andreeva 2024].

CONCLUSION

Agricultural education in Sub-Saharan African countries is a crucial tool for overcoming the food crisis, youth unemployment, and the technological backwardness of agriculture. Despite the historical role of the agricultural sector, its potential is hindered by systemic problems: climate change, outdated production methods, labor shortages, and low productivity. Youth, who make up the majority of the population, are turning away from agricultural work, perceiving it as "non-prestigious" and low-paying, which exacerbates the labor shortage and reliance on food imports. Solving these problems requires transforming agricultural education into a bridge between traditional practices, modern technologies, and market demands.

An analysis of the current state of Africa's workforce training system reveals a gap between education and practice: curricula are often not adapted to present-day conditions, graduates lack practical skills, and extension services suffer from a shortage of qualified personnel and funding. However, the region already has successful initiatives that demonstrate a path forward. These examples show that education can significantly improve perceptions of agriculture if it combines theory with practice, adapts to local conditions, and introduces learners to the use of modern digital technologies.

The Russian Federation is developing a concept for training agricultural personnel based on a model of continuous agribusiness education. In this context, the development

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of international cooperation between the Russian Federation and SSA countries in training agricultural specialists is highly relevant. The introduction of Russian continuous agribusiness education programs is possible, provided they are adapted to the conditions of specific African countries. The recommended reform should cover educational programs at all levels, primarily through the introduction of a practice-oriented approach. Education must also be adaptable to changing climatic conditions and market trends and incorporate the latest scientific and technological advancements into the learning process.

The transformation of agricultural education must shift the public perception of agriculture itself. It should be shown that the modern agricultural sector offers opportunities for efficient, profitable, and technologically advanced entrepreneurship that is appealing to people of all ages. The training of agricultural professionals must become an integral part of sustainable development, addressing youth unemployment, low productivity in the agricultural sector, and insufficient food security.

The experience of the Russian Federation—where reforms in agricultural education are already yielding positive results—demonstrates that systemic change is possible even under difficult conditions. For Africa, this is not just an opportunity—it is a necessity that will shape the future of millions of people.

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Научная статья

АГРАРНОЕ ОБРАЗОВАНИЕ КАК ВАЖНЫЙ ЭЛЕМЕНТ СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО РАЗВИТИЯ СТРАН СУБСАХАРСКОЙ АФРИКИ

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Аннотация. Сельское хозяйство стран Субсахарской Африки (ССА) исторически занимает одно из центральных мест в обеспечении занятости населения и продовольственной безопасности данного региона. Однако в современных условиях аграрный сектор сталкивается с проблемой: оставаясь основой экономики, он теряет кадры из-за миграции молодежи в города, оттока работников в сектор услуг и добывающую промышленность. Несмотря на высокий уровень безработицы, молодежь избегает работать в сельском хозяйстве, воспринимая агросектор как низкооплачиваемую и технологически отсталую отрасль. Выход из этой ситуации автор статьи видит в трансформации аграрного образования. Современное сельское хозяйство перестает быть технологически отсталым, оно требует специалистов с навыками в агрономии, биотехнологиях, логистике, управлении и цифровых технологиях. Однако текущая система аграрного образования в ССА не соответствует этим вызовам. Для их преодоления автор предлагает проведение реформы в системе образования с изменением образовательных программ в сторону практико-ориентированного подхода. Примером может служить российская модель непрерывного агробизнес-образования, где обучение начинается в дошкольных кружках и продолжается вплоть до специализированных вузов. Цифровизация образования сделает аграрные профессии привлекательными для молодых людей. Содействовать африканской молодежи получить соответствующее образование может укрепление международного сотрудничества стран ССА с Российской Федерацией. Развитие аграрного образования является одним из ключевых условий обеспечения устойчивого прогресса в странах Африки к югу от Сахары. Его трансформация требует системного подхода, объединяющего государство, бизнес и международных партнеров.

Ключевые слова: Субсахарская Африка, аграрное образование, социально-экономическое развитие, продовольственная безопасность, устойчивое развитие, устойчивое сельское хозяйство, безработица

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