DOI https://doi.org/10.36719/3104-4727/4/4-9

Asli Gurbanova
Azerbaijan State Agrarian University
PhD in Economics
https://orcid.org/0009-0002-9339-9550
asli.gurbanova@gmail.com
Sevinc Garayeva
Azerbaijan State Agrarian University
https://orcid.org/0009-0003-4611-8200
qarayevasevinc705@gmail.com

Factors Ensuring Sustainable Development in Agriculture

Abstract

Sustainable agricultural development is essential for ensuring food security, conserving natural resources and mitigating the impacts of climate change. This article highlights the key drivers of sustainable agricultural development. It highlights the importance of adopting agroecological practices that promote soil restoration, biodiversity conservation and water use efficiency. These practices enhance the resilience of ecosystems and reduce dependence on harmful chemicals, thereby ensuring the long-term productivity of agricultural systems. At the same time, sustainable agricultural development requires empowering smallholder farmers through access to resources, markets and knowledge. The article notes that investing in rural infrastructure and promoting the development of farmer cooperatives can increase productivity, livelihoods and food security.

Keywords: *agriculture, sustainable development, investment, food security, biodiversity, economic growth*

Introduction

The ever-increasing demand of the world's population can result in the depletion of natural resources, economic crises, environmental stress, political and social problems. To prevent this, each country must determine its own development strategy and explore ways to preserve resources for future generations. Experts see the way out of the current situation in ensuring sustainable development.

The sustainable development model is a balanced, continuous and dynamic development model. This model is considered development that does not pose a threat to the full satisfaction of the needs of future generations. The development of the agricultural sector is of decisive importance in meeting the needs of the population in the country with food and consumer goods, as well as in meeting the needs of a number of industrial sectors of the country for raw materials. Taking into account the above, while solving the problems in the Republic of Azerbaijan with the aim of developing the national economy, reforms were envisaged in the agricultural sphere, and the reforms were primarily implemented on the basis of targeted state programs (Azerbaijan State Statistical Committee, n.d.).

Research

Assessing the sustainability of the agricultural sector is a difficult and complex issue, as it involves complex interactions between technology, environment and society. Also, the assessment of this activity covers various components, characteristics and priorities at different scales (global, national, regional, local).

The Pressure–State–Response (PSR) framework developed by the OECD has for the first time addressed the issue of systematic identification of indicators for environmental sustainability. This framework is based on the Coase concept, that is, various human activities create certain pressures on the environment and change the state of the environment. Society, in turn, responds to these

changes through environmental, economic and other programs. Environmental sustainability does not yet mean the sustainability of the agricultural sector as a whole. For this, there is also a need to assess social and economic sustainability indicators (Bernasovskaya & Viktorov, 2010).

Social sustainability is about people, and two main categories can be distinguished under this criterion. First, social sustainability at the local community level. This is related to the well-being of farmers and their family members. The indicators available in the literature are divided into three main categories: education, working conditions (working hours, workload and workforce), and quality of life (isolation and sociability). Second, social sustainability at the societal level. Indicators related to this dimension are also divided into three groups: multifunctionality (rural development, employment generation and ecosystem services), acceptable agricultural practices (environmental impacts and animal welfare) and product quality (food safety and quality processes). Unlike the other two criteria, social indicators are qualitative indicators. They are difficult to assess because they are often subjective. According to another approach, social indicators cover only two main topics: sustainability related to the local farming community and sustainability related to society as a whole ("Socio-economic Problems of Sustainable Development" Collective monograph ANAS, 2020).

Our legislation on agrarian reforms reflects the development of agrarian infrastructure enterprises, a number of tax breaks and financial assistance, regulation of the agrarian market, social protection of the rural population, training of specialists in the agrarian sector, scientific support of the agrarian sector, etc. (Khalilov, 2006). The reforms implemented in the agrarian sector set certain goals, and we can show the directions of those goals and the situation before and after the reform in the following table:

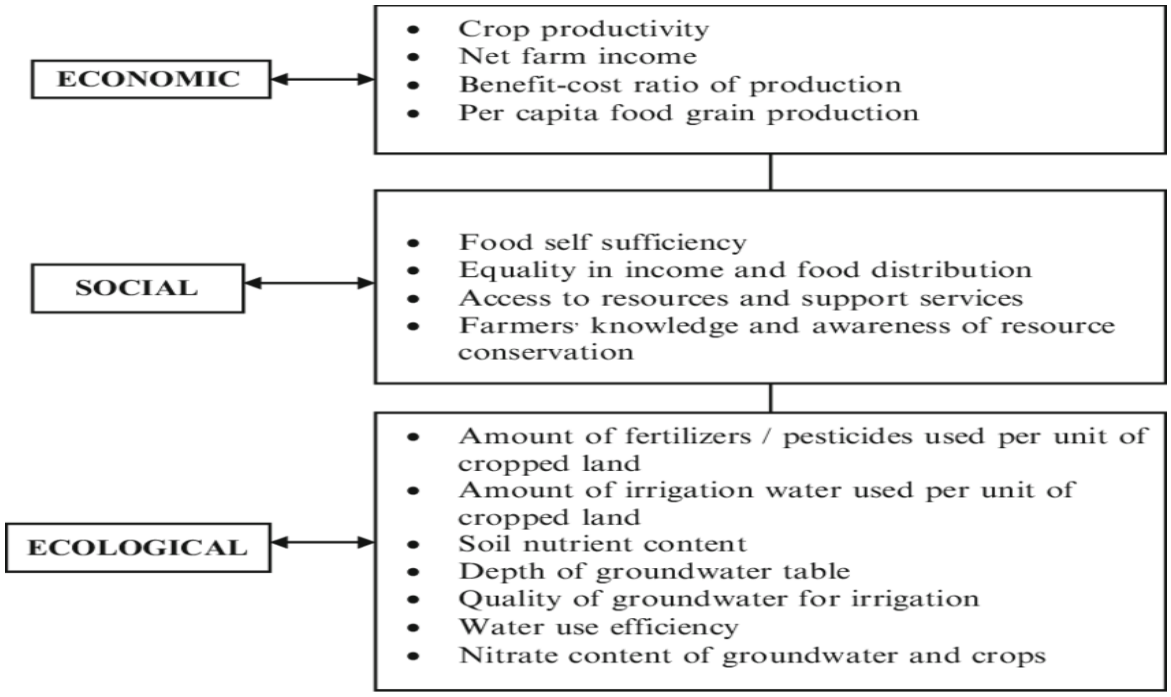
Table 1. Reforms implemented in the agrarian sector.

Directions	Before the reform	After the reform
Production	The purpose of production is determined centrally	Production decisions are freely made by farms
Prices	Centrally assigned	Liberalized
Finance	There are constant state subsidies and debts are often written off	Strict budget constraints Prevail
Factors of production, sales, processing	State-owned enterprises Monopoly	privatized, de-monopolized inhisarsızlaşdırılmışdır
Form of ownership of resources	State, collective	Privatized
Structure of farms	Large-scale collective organization	Small-scale personalized

Source: compiled by the authors

In the international literature, a system of indicators corresponding to the three components of sustainability is proposed for assessing the sustainable development of agriculture (Ismayilov, Abdullayev, Gurbanova, Huseynova, Zeynalova, Naghiyev, Seyidzade & Hasanov, 2018). It should be noted that, in addition to the presented indicators, numerous other indicators can also be used. These indicators are summarized as follows.

Figure 1. Proposed indicators for measuring the sustainability of agriculture.



Source: Zhen, Lin & Routray, Jayant. (2003). "Operational Indicators for Measuring Agricultural Sustainability in Developing Countries." *Environmental Management*, 32, 34–46. https://doi.org/10.1007/s00267-003-2881-1

Depending on the purpose of the assessment, the availability of data for the assessment, the amount of funding allocated for the assessment and other factors, a different set of sustainability indicators can be used in a specific case.

Country-specific sustainability issues are also considered within the framework of the Sustainable Development Goals (SDGs). For this purpose, the SDGs were established by the UN General Assembly in 2015. The SDGs consist of 17 interrelated goals designed to achieve a better and more sustainable future for all. These goals are included in the UN resolution *2030 Agenda* (Vasilyeva, 2012). Since the goals have a wide scope, specific sub-goals have been identified within each goal, and appropriate indicators are used to assess the achievement of each sub-goal. The SDGs cover many areas of activity (agriculture, industry, ecology, health, education, sociology, gender issues, employment, etc.). It should be noted that issues related to the assessment of sustainability in the agricultural sector are mostly considered under Goal 2. This goal is called End Hunger – "End hunger, achieve food security and improved nutrition, and promote sustainable agriculture" (Cai & Liu, 2025).

Some scholars have conducted in-depth research in recent years by establishing various models to assess the sustainable development of the agricultural sector in various countries and regions. Among them, the sustainable development goals related to the agricultural sector have been an important reference point in establishing sound evaluation systems. Thus, it can be said that sustainable agriculture is socio-economically favorable (Maharram, Salahov, Bagirova, Mammadova & Ismayilova, 2022).

Aspects such as healthy structure, stable function, safe service and sustainable development of the rural ecological system have been applied in the scale of the rural ecological health model. In addition, a reliable policy has been developed in South Africa as an indicator of sustainable development related to the agricultural sector, such as the elimination of unemployment and hunger. In addition, in terms of sustainable development of agriculture, the system included in the agro-ecological resources, the economic-social system and various agricultural systems have also been

taken into account (Fu, 2025).

In addition, regional sustainability was assessed by combining four separate subsystems: regional population, resources, environment and socio-economics. The sustainable agricultural development index can be divided into two parts. All the existing studies mentioned above show the importance and difficulties of assessing the sustainable development capacity of agriculture (Measurement of Sustainable Development, 2012). In addition, many scholars have conducted in-depth discussions on ways to achieve sustainable agricultural development; for example, precision agriculture, the development of microorganisms as bio-fertilizers, reducing the use of organic fertilizers and pesticides, multifunctional agriculture. Assessing the sustainable development capacity of agriculture is a significant and complex system and touches on all aspects of the economy (Ignatyev, 2014).

Sustainability of irrigation water use. Seventy to seventy-two percent of Azerbaijan's fresh water resources are formed outside the country's borders. The Kura and Araz rivers, the country's main water arteries, are subject to pollution with various chemical elements and compounds, as well as organic substances, before entering the country's territory. The permissible concentrations of oil products, phenols, copper, bismuth, titanium, manganese and other elements in the waters of these rivers at the border lines are exceeded. The degree of pollution in the Araz River, which enters Azerbaijan from the territory of Armenia, is higher than in other rivers. River waters are also subject to pollution of various origins within the country (He, 2024).

In general, for 2020, 31% (1,476.7 thousand hectares) of the agricultural land areas (4,780.1 thousand hectares) in Azerbaijan are irrigated lands. Sixty-one percent of the total crops in the country and 66% of perennial crops fall on irrigated lands. One of the most important issues in terms of sustainable water use in agriculture is the irrigation methods used. Information on the irrigation methods used in Azerbaijan is presented in Chart 1.

Chart 1. Types of irrigation used in the country in 2022.

Source: Ministry of Agriculture, EKTIS database

As can be seen from the graph, the most widespread irrigation types in Azerbaijan are flooding and furrow irrigation (ditch irrigation). The combined share of these two irrigation types is more than 89%. However, along with these traditional irrigation methods, modern irrigation methods are also used. The share of the use of modern irrigation methods is approximately 11%. Traditional irrigation methods are used for most plants and plant groups in the country. The plants where modern irrigation

methods are most commonly applied are soybeans, berries and sugar beets. The share of tea, fruits and grapes in the use of modern irrigation methods is also high. It should be noted that the most widely used method among modern irrigation methods in the country is drip irrigation. The share of this irrigation type in the total use of modern irrigation types is 65% (Mendoncha, 2025).

Another important aspect of sustainable use of irrigation water is the management and regulation of irrigation systems. Currently, issues related to the regulation of irrigation systems in the country are entrusted to the Water User Associations (WUAs). The main tasks of WUAs include the preparation of an operational plan for land reclamation and irrigation systems in the service areas, planning their restoration and reconstruction, installation and operation of metering devices, drawing up water distribution schedules, resolving disputes arising during water distribution, ensuring the payment of the association's expenses, including water fees, concluding contracts for water withdrawal, preparing annual budgets and reports, etc. (Baghirova, Mammadova, Hasanova & Aliyeva, 2025).

Azerbaijan is a member of the international Convention on Biological Diversity and has joined the Convention on Biological Diversity (CBD) in order to expand international cooperation in the field of conservation of genetic resources of biodiversity. In accordance with the requirements of the Convention, the *National Strategy and Action Plan for the Conservation of Biodiversity in Azerbaijan (2006–2010)* and the *National Strategy for the Conservation and Sustainable Use of Biological Diversity in the Republic of Azerbaijan for 2017–2020* (2015) were adopted (https://e-qanun.az/framework/11513). The Institute of Genetic Resources also operates in the country. A.Genbank was established under the Institute in 2004 for the medium- and long-term conservation of genetic resources. The Genbank mainly stores national genetic resources of plant samples (Huseynov, Salahov, Bagirova, Mammadova & Ismayilova, 2022).

The sustainable economic development model applied in the republic today is a strategic development path based on market principles, free entrepreneurship, consideration of national interests, deepening international and regional cooperation and the realization of social and humanitarian directions based on sustainable economic progress (Ministry of Agriculture, n.d.).

Conclusion

The sustainable economic development model applied in the republic today is a strategic development path based on market principles, free entrepreneurship, consideration of national interests, deepening international and regional cooperation and the realization of social and humanitarian directions based on sustainable economic progress.

As can be seen from the conducted research, the agricultural sector, while being the main provider of food security on a global scale, acts as one of the areas of activity that has a destructive impact on individual elements of the environment. From this point of view, in order to achieve sustainable development in the agricultural sector, it is necessary to approach the issue from two aspects: on the one hand, reducing the negative impacts of agricultural activity on the environment, as well as eliminating these impacts, and on the other hand, mitigating the impact of climate change occurring at the global level on the agricultural sector, as well as considering the possibilities of the sector's adaptation to these impacts. In general, from the point of view of achieving sustainable development of agriculture, all three aspects of sustainability (ecological, economic and social) should be kept under control. Among these, the ecological environment, more precisely, the sustainable use of air, soil and water resources, as well as the protection of biodiversity, are of greater importance.

The activities currently carried out by the state to protect soil and water resources should be further expanded and improved. These include measures such as controlling the use of fertilizers and pesticides, expanding the use of modern irrigation systems, stimulating compliance with agrotechnical rules, etc. In short, state regulation in the field of using natural resources for the production of agricultural products should be strengthened and awareness-raising measures should be expanded.

References

1. Azerbaijan State Statistical Committee. (n.d.). *Agriculture statistics*. https://www.stat.gov.az/source/agriculture/az/1.2.xls
2. Baghirova, T., Mammadova, A., Hasanova, N., & Aliyeva, Z. (2025). Adoption of digital technologies in Azerbaijan's agricultural sector: A comparative global perspective. *Pakistan Journal of Agricultural Research*.
3. Bernasovskaya, L. I., Viktorov, A. D., & others. (2010). *A systematic approach to the forecasting of the region's sustainable development*.
4. Cai, B., & Liu, Y. (2025). Automotive industry development versus environment and policy: An integration of system dynamics and life cycle assessment. *International Review of Economics & Finance, 103*, 104382.
5. Mendoncha, H. F. (2025, May 6). Climate risk, central bank mandates and inflation. *Review of Economics and Finance*.
6. Fu, T. (2025, June 2). Economic and financial solutions to growth sustainability. *Review of Economics and Finance*.
7. He, F. (2024). *Review of Economics and Finance*. Capital University of Economics and Business.
8. Huseynov, M., Salahov, E., Bagirova, T., Mammadova, A., & Ismayilova, T. (2022). Opportunities and problems of application of index insurance model in Azerbaijan. *Fresenius Environmental Bulletin, 31*(10).
9. Ignatyeva, M. (2014). The essence of the concept "Sustainable development." *Izvestiya Vuzov. Mining Journal, (2)*, 21.
10. Ismayilov, Ch., Abdullayev, A., Gurbanova, G., Huseynova, Kh., Zeynalova, E., Naghiyev, F., Seyidzade, M., & Hasanov, A. (2018). *Improving human resources for sustainable development: The Azerbaijani model*.
11. Khalilov, Sh. B. (2006). *Ecogeographic problems of Azerbaijan*.
12. Measurement of sustainable development. (2012). Within the UN Development Account project. http://www.unece.org/stats/document.2012.10geviron.html
13. Ministry of Agriculture. (n.d.). *EKTIS database*.
14. Socio-economic problems of sustainable development. (2020). *Collective monograph*. ANAS.
15. Vasilyeva, A. S. (2012). Five-factor model of sustainability of socio-economic development. *Creative Economy, 6*(4).
16. Zhen, L., & Routray, J. (2003). Operational indicators for measuring agricultural sustainability in developing countries. *Environmental Management, 32*, 34–46. https://doi.org/10.1007/s00267-003-2881-1

Received: 16.04.2025
Accepted: 02.08.2025