Review Article

Theoretical Approaches to the Sustainable Development of the Agricultural Sector: The Case of Azerbaijan

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Abstract | Agriculture has served as a fundamental pillar of civilization, significantly contributing to food security, economic growth, employment, and commerce. However, traditional practices-characterized by high resource use and environmental degradation-threaten sustainability both globally and in Azerbaijan. This paper explores theoretical approaches to the sustainable development of agriculture, emphasizing the transition from mechanized farming (Agriculture 1.0) to smart agriculture (Agriculture 4.0) with a focus on Azerbaijan's unique agro-ecological context, and the necessity of aligning agricultural practices with Sustainable Development Goals. A four-pillar framework for sustainable agriculture, emphasis being placed on agronomy, ecology, economy, and society, is distilled through qualitative-content and comparative analysis of scientific literature, policy documents, and case studies. Key principles such as environmental education, economic efficiency, social equity, and food security are discussed, along with specific strategies relevant to Azerbaijan's agricultural sector. On the basis of this framework, some targeted policy recommendations for Azerbaijan, as implied by the literature review, have been proposed, which can facilitate the transition toward Agriculture 4.0. The study concludes that sustainable agriculture is a comprehensive approach that balances economic productivity with environmental conservation and social well-being, ensuring long-term viability for future generations.

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Introduction

Agriculture underpins human civilization by supplying food, driving economic growth, and sustaining rural livelihoods. Yet, conventional farming in Azerbaijan and globally has intensified resource depletion, soil degradation, and greenhouse gas emissions, challenging the sector's long-term viability (FAO, 2017). As Azerbaijan's population grows and climate variability intensifies, food security and rural resilience face mounting risks. Despite numerous studies outlining sustainable practices, there remains a gap in region-specific frameworks that integrate Azerbaijan's agro-ecological conditions with global sustainability benchmarks.

Sustainable agriculture seeks to balance productivity with environmental conservation and social well-being by enhancing resource utilization, protecting biodiversity, and guaranteeing fair livelihoods. Advances in technology, from mechanized farming (Agriculture 1.0) to automation (Agriculture 2.0) and digital innovations (Agriculture 3.0) to cutting-edge smart agriculture (Agriculture 4.0), offer tools for accurate resource management and prompt decision-making (Ertaş, 2020; Pakdemirli et al., 2021). Sustainability in Azerbaijan must also account for regional heterogeneity. For instance, drip irrigation may be optimal in arid Aran zones, while agroforestry suits mountainous regions. Thus, national strategies should integrate site-specific practices with global sustainability benchmarks.

This paper addresses these gaps by proposing a novel four-pillar framework for sustainable agriculture tailored to Azerbaijan's specific needs. While grounded in established sustainability principles, our framework introduces an applied dimension by operationalizing agronomic, ecological, economic, and social indicators adapted to local agro-ecological zones. Through qualitative content analysis of international and national literature, policy documents, and case studies, critical enablers for transitioning to Agriculture 4.0 are identified, best practices are synthesized alongside local constraints, and actionable policy recommendations are proposed to enhance resilience, resource efficiency, and social equity in Azerbaijan's agricultural sector.

Materials and Methods

Materials

The present study investigates theoretical approaches to sustainable agriculture through a systematic review of both international and Azerbaijan-specific sources. Research articles from peer-reviewed journals, books, and conference proceedings sourced from Scopus and Web of Science (2000–2024) were gathered using keywords like "sustainable agriculture," "Agriculture 4.0," and "Azerbaijan". Inclusion criteria were: (1) empirical or theoretical focus on sustainability in crop or livestock systems; (2) explicit discussion of agronomic, ecological, economic, or social dimensions; and (3) availability of full text in English or Azerbaijani. The articles lacking methodological detail or those published before 2000 were excluded from research.

Methods

The systematic literature review was conducted through comprehensive searches in the Scopus and Web of Science platforms, employing a set of predefined keywords (e.g., "sustainable agriculture," "Agriculture 4.0," "Azerbaijan") combined with Boolean operators to ensure coverage of relevant studies published between 2000 and 2024. Following retrieval, two researchers independently screened titles and abstracts against the inclusion criteria namely, a clear focus on one or more dimensions of sustainable agriculture (agronomic, ecological, economic, social), methodological transparency, and availability in English or Azerbaijani. Discrepancies in study selection were resolved through discussion until consensus was reached. Ultimately, 42 full-text articles meeting these criteria were included in the review, providing a robust empirical and theoretical foundation for subsequent thematic analysis.

Results and Discussion

Agriculture has historically been a cornerstone of human development, ensuring food supply and contributing significantly to economic growth and social stability. In the context of Azerbaijan, agriculture not only supports rural livelihoods and employment but also serves as a key driver of national income, food security, and trade. As emphasized by Aliyev *et al.* (2012), the agricultural sector should be recognized not merely as a production system but as a strategic component of macroeconomic and social stability. This multifunctional role enables agriculture to act as a supplier of raw materials, a stabilizer of rural employment, and a guarantor of food sovereignty.

However, the environmental costs of conventional agricultural practices have become increasingly visible. Intensive land use, excessive irrigation, and the over-application of synthetic fertilizers and pesticides have led to significant ecological degradation. In Azerbaijan, these practices have contributed to soil salinization, water resource depletion, and biodiversity loss. Additionally, the expansion of cultivated lands has placed pressure on natural ecosystems, while methane emissions from livestock farming exacerbate greenhouse gas accumulation and accelerate climate change (Nesirov *et al.*, 2022). Both present agricultural output and the ability of future generations to meet their food needs are directly threatened by these results.

Given the sector's strategic importance and its vulnerability to environmental degradation, it is imperative that agricultural development be aligned with the principles of sustainable development. This alignment requires not only the modernization of production techniques but also a paradigm shift toward sustainability that integrates ecological responsibility, economic viability, and social inclusiveness. In this regard, the challenge for Azerbaijan is not limited to increasing output, but also ensuring that growth is achieved in a way that conserves natural resources and promotes long-term resilience.

This study argues that understanding the role and evolution of agriculture in Azerbaijan must be situated within a broader global context of agricultural transformation. The historical trajectory from traditional to mechanized and eventually smart agriculture-commonly referred to as Agriculture 1.0 to 4.0-demonstrates how technological advancement can address challenges of resource efficiency, environmental impact, and food system sustainability. However, such transitions must be adapted to the country's specific agro-ecological conditions and socio-economic structures.

Therefore, sustainable agricultural development in Azerbaijan should be approached as a strategic necessity, not as an alternative model. It requires comprehensive policy integration, targeted support mechanisms, and active stakeholder engagement. As the following sections will explore, this transition must be supported by a framework that incorporates environmental education, economic incentives, social justice, and technological innovation principles that are essential to building a resilient and sustainable agricultural future.

A comprehensive understanding of sustainable agriculture requires first situating it within the broader historical context of agricultural development. According to Harvard University researchers, humans' first exposure to agricultural activities began about 10,000 years ago, with the transition from foraging to farming (Weiss *et al.*, 2004). The following developmental phases occurred in later eras in line with the introduction of agricultural advancements and industrial transformations (Ertaş, 2020; Gagliardi *et al.*, 2022; Pakdemirli *et al.*, 2021; Zambon *et al.*, 2019):

- Agriculture 1.0: Mechanization in agriculture. The onset of the Industrial Revolution in the 18th century marked the beginning of mechanized agriculture. This phase was characterized by a shift from human and animal labor to machine-based production. James Watt created the steam engine in 1765, which powered plows, threshers, and other farming tools, enabling quicker and more effective farming operations. Mechanization significantly increased labor productivity and expanded the scale of agricultural operations, but it also initiated a trend of increasing reliance on non-renewable energy sources.
- Agriculture 2.0: Automation in agriculture. Automation in agriculture was made possible by the Second Industrial Revolution, which supplied internal combustion engines and electricity. Steam-powered machinery was gradually replaced by tractors and harvesters powered by gasoline and diesel. This era enabled mass food production through more efficient land cultivation, planting, and harvesting techniques. However, it also led to monoculture practices and higher levels of input use, including synthetic fertilizers and pesticides-developments that would later raise sustainability concerns.
- Agriculture 3.0: Digitalization in agriculture. Emerging in the latter half of the 20th century, Agriculture 3.0 brought digital technologies into the farming process. The integration of computers, sensors, telecommunications, and satellite data enabled more precise management of agricultural activities. Innovations such as automated irrigation systems, greenhouse climate controls, and GPS-guided machinery allowed for more data-driven and site-specific decision-making. These technologies laid the foundation for smart farming but were often accessible only to large-scale producers, especially in developing countries like Azerbaijan.
- Agriculture 4.0: Smart agriculture. The current phase, Agriculture 4.0, represents a convergence of digital, physical, and biological systems. It uses robotics, drones, the Internet of Things (IoT), artificial intelligence, machine learning, and Global Navigation Satellite Systems (GNSS) to track and improve all facets of farming, from supply chain logistics to crop and soil health monitoring. Unlike previous stages, Agriculture 4.0 emphasizes not only productivity but also resource efficiency, climate resilience, waste reduction, and sustainability. Smart greenhouses,

soilless farming (hydroponics), and precision irrigation systems have emerged as practical applications of this paradigm.

If we call the activity applied before sustainable agriculture traditional agriculture, then traditional agriculture actively uses water and energy resources, as well as non-renewable resources, does not limit the use of synthetic fertilizers and pesticides in pest control and in the feeding process, which leads to soil degradation and pollution with chemicals, leads to soil erosion and depletion of minerals in the soil due to failure to follow proper agronomic and land reclamation rules, tends to reduce biodiversity because it focuses more on monocultures and productive varieties, and does not take into account social and environmental aspects because more attention is paid to economic efficiency in the production process, and the activity is focused on increasing quantity and profit (Hamadani, 2021; Wu, 2024). It is our opinion that the distinctions between conventional and sustainable farming practices should be categorized based on the following criteria: economic sustainability, biodiversity preservation, environmental effects, and resource use. Chizari *et al.* (1999) considers the transition to methods aimed at reducing the use of chemicals, conserving natural resources and using organic materials as the initial transition to sustainability.

Sustainable agriculture systematically balances productivity, ecological integrity, and social well-being, aiming to meet current and future generational needs through resource-efficient practices. A. Nuriyev that "agriculture is a very important economic sector that society needs for sustainable economic growth and development" is once again confirmed (Nuriyev, 2017). It is clear that in this respect sustainable agriculture is distinguished from traditional agricultural systems. Huseynov (2003) noted, the sustainability of agriculture should serve to neutralize destructive tendencies in agriculture and increase efficiency (Hüseynov, 2003; Гусейнов and Салахов, 2016).

In their textbook, authored by local researchers (Mustafayeva *et al.*, 2022) they state that "Meeting society's present demands for food and textiles without sacrificing the capacity of future generations to meet their own needs is the aim of sustainable agriculture" and divide it into five types-agronomic, social, ecological, microeconomic, and macroeconomic sustainability (Mustafayeva *et al.*, 2022). Fikratzade and Aliyev (2022) interpret this as "optimal use of natural resources in terms of ensuring food security" Fikratzade and Aliyev (2022). It is worth noting that although they did not directly comment on the sustainability of agriculture, academician Z. Samadzadeh, prof. E. Guliyev, prof. B. Atashov, prof. I. Ibrahimov, prof. N. Javadov have expressed their views on the conceptual foundations, economic mechanisms and practices of this sustainability in the monographs they authored.

According to foreign researcher Donmez, sustainable agriculture embodies a system of crop and livestock production that, in addition to meeting human food and fiber needs, improves the quality of the ecological environment and ensures the protection of the economic foundation on which agriculture is based (Dönmez *et al.*, 2024). Menalled presented this concept in his approach as a planned activity that meets the future need for food, energy and natural resources, along with protecting soil, water and biodiversity (Menalled *et al.*, 2008). According to Dantsis *et al.* (2009), it is a resource-conserving, environmentally responsible strategy that is both commercially competitive, socially beneficial, and economically viable. Turhan defines sustainable agriculture as a method that seeks to balance the ecological, social, economic, and agronomic aspects of agricultural production (Turhan, 2005). According to another source, sustainable agriculture is a term used for growing food using methods that nourish society, the environment, and the economy (Kubaş and Aydın, 2022). Hess (1991) defined it not only as a production system that protects human health and the environment, but also as a unity of systems that includes the balanced use of technology and sound business management (Aydın Eryılmaz and Kılıç, 2018). The UN specialized agency Food and Agriculture Organization (FAO) holds that "sustainable agriculture must meet the needs of present and future generations, while ensuring profitability, environmental health, and social and economic justice" (Fikrətzadə and Əliyev, 2022). Schaller (1993) noted that the concept of agricultural sustainability does not fit into a precise definition, linking it to the way of thinking and the use of farming practices, and stated that there is no final answer (Schaller, 1993). However, the researcher analyzed sustainable agriculture in two directions- profitability of activity and reliability of food production. It is believed that

the main reason for the difference in the numerous definitions given to sustainable agriculture stems from the paradigms related to social equity, food sufficiency, environmental protection and socio-economic living conditions in determining sustainability both between and within generations. In our opinion, a complex strategy, sustainability in agriculture seeks to strike a balance between the preservation of environmental quality, economic efficiency, and the food needs of current and future generations. In order to address the ecological and social issues brought about by traditional agriculture, sustainable agriculture is thus characterized as a cohesive strategy that balances the agronomic-amorative, ecological, social, and economic aspects of agricultural production. By preserving agricultural output and acknowledging the finite character of natural resources, sustainable agriculture seeks to guarantee their sustainable use. Furthermore, this approach sees the creation of a long-term agricultural production model without disrupting the natural balance and the improvement of the quality of life of those involved as its main goals.

The history of sustainable agriculture dates back to the 1960s, when world food production increased significantly - by 145%. As a result of his research, Y. Tufan presents these principles as follows (Tufan *et al*., 2023):

- Environmental education. Sustainable agriculture encourages society, as well as individuals and companies, to use natural resources (soil, water, air) in a conscious manner, preventing soil erosion, conserving water resources, reducing chemical pollution, and supporting biodiversity.
- Economic efficiency. Sustainable agriculture aims to increase farmers' incomes and promote them economically. In this regard, agricultural activity should provide farmers with a number of advantages in terms of productivity and profitability.
- Social equity. Sustainable agriculture should shape the social environment and establish justice, protect the rights of farmers and workers, support local communities, and increase the social benefits of agriculture.
- Food security. Sustainable agriculture should ensure the continuity and security of sufficient and quality food production to meet people's nutritional needs.

In our opinion, in the context of the economic realities of our country, it is appropriate to take into account the following principles for the realization of this concept:

- Respect for ecological values and efficient use of resources. Within the framework of this principle, ensuring the protection of natural resources and biodiversity, using good agricultural practices (GAP), giving preference to organic fertilizers to maintain soil fertility and complying with crop rotation requirements, using methods that do not harm the ecosystem balance and have high efficiency indicators (biological control, drip irrigation system, etc.), avoiding wasting resources and managing waste (composting plant residues) should be taken into account.
- Meeting food needs and adapting to natural conditions. Carrying out agricultural production in accordance with climate and soil structure, as well as agro-economic norms, producing healthy products with high nutritional value and facilitating access to food, developing agricultural methods that adapt to natural conditions against the background of such phenomena as climate change, droughts and floods, belong to this principle.
- Socio-economic coordination and equality. The realization of this principle is possible by forming additional incentive mechanisms for small producers, implementing incentive programs to attract women and youth to agricultural production, facilitating sales channels and stimulating labor, supporting the social development of the village and expanding employment opportunities, and establishing a mechanism for cooperation and cooperatives of producers.
- Using smart agricultural technologies (artificial intelligence, drones, and sensors), applying drought and stress-resistant seeds, using alternative irrigation, hydroponics (soil-free cultivation), vertical farming, expanding skill-based education for sustainable agriculture, and sharing producers' sustainable agricultural practices are all ways to create innovative production and make efficient use of human capital.
- Accountability and public participation. Within the framework of this principle, reports on financial and sustainability activities should be regularly submitted to the public, it should be transparently demonstrated that sustainable agricultural methods do not harm the environment, the activities of agricultural producers, including the

effective use of granted benefits and aids, should be constantly monitored, a data system related to financial and sustainability activities should be formed, and the participation of state and municipal authorities, civil society organizations and other stakeholders should be ensured.

Conclusions

Sustainable agriculture in the context of Azerbaijan requires a multidimensional and context-sensitive approach that goes beyond the conventional triad of ecological, economic, and social components. Given the sector's unique characteristics its reliance on natural factors, seasonal cycles, and the non-overlapping nature of production and harvesting agriculture demands a broader conceptual framework. This study proposes that sustainable agriculture be examined through four interrelated dimensions: the bio-ecological, economic, socio-cultural, and innovation aspects. The inclusion of the bio-ecological dimension is particularly critical, as agriculture is inherently linked to both ecological systems and biological processes, such as plant growth cycles, soil health, and livestock management. These biological elements not only shape agricultural productivity but are also directly impacted by farming practices, necessitating a perspective that integrates both ecological preservation and biological interdependence.

By synthesizing literature, policy documents, and case evidence, the study highlights how technological modernization (e.g., Agriculture 4.0), institutional support, and community engagement can collectively facilitate the shift toward sustainable agricultural systems in Azerbaijan. Furthermore, the findings underscore the importance of designing policies that are locally relevant but aligned with international sustainability standards. Going forward, improving resource efficiency, guaranteeing long-term food security, and fostering rural development will require the application of integrated, multi-stakeholder initiatives based on this enlarged framework. Therefore, in order to preserve social justice, economic viability, and environmental resilience for future generations, sustainable agriculture is not just a policy choice—it is a national necessity.

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Novelty Statement

This study proposes a four-pillar framework for sustainable development in Azerbaijani agriculture. Along with the traditional ecological, economic, and social aspects, it includes a bio-ecological dimension (plant growth, soil health, and biological interactions). The framework provides practical ways to apply Agriculture 4.0 technologies (artificial intelligence, Internet of Things, drones) to specific Azerbaijani agro-ecological zones (e.g., drip irrigation in the Aran region, agroforestry in mountainous areas). It also offers solutions such as policy recommendations based on local data, incentive programs for small farmers, and strategies to cope with climate change

Author's Contribution

Elay Zeynalli: Responsible for conceptualizing the study, supervising the research, analyzing the results, leading the discussion, and reviewing and editing the article.
Mehman Karimov and Parvin Muxtarova: Drafted the original manuscript, contributed to the review and editing process, and wrote the conclusion.
Elcin Nesirov and Narmin Masimli: Managed the materials and methodology, handled data curation, and compiled the references.
All authors contributed significantly to this research.

Data availability

The requested data will be provided by the corresponding author.

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Generative AI or AI-assisted Technology Statement

The author(s) declare that no Genrative AI was used in the creation of this manuscript.

Conflict of interest

Regarding the publication of this article, all authors declare that they have no conflict of interest.

References

Alıyev, İ., Hüseynov, S., and Əsədov, A. (2012).

Milli iqtisadiyyat: Modernləşmə və davamlı inkişaf. "Avropa" nəşriyyatı.

Aydın-Eryılmaz, G. and O. Kılıç. 2018. Türkiye'de Sürdürülebilir Tarım ve İyi Tarım Uygulamaları. Kahramanmaraş Sütçü İmam Üniversitesi Doğa Bilimleri Dergisi. https://doi.org/10.18016/ksudobil.345137

Chizari, M., J. Lindner and M. Zoghie. 1999. Perceptions of extension agents regarding sustainable agriculture in the Khorasan Province, Iran. J. Int. Agric. Ext. Educ., 6(1). https://doi.org/10.5191/jiaee.1999.06102

Dantsis, T., A. Loumou and C. Giourga. 2009. Organic agriculture's approach towards sustainability; its relationship with the agro-industrial complex, a case study in Central Macedonia, Greece. J. Agric. Environ. Ethics, 22(3): 197-216. https://doi.org/10.1007/s10806-008-9139-0

Dönmez, D., M.A. Isak, T. İzgü and Ö. Şimşek. 2024. Green horizons: Navigating the future of agriculture through sustainable practices. Sustainability, 16(8): 3505. https://doi.org/10.3390/su16083505

Ertaş, B., 2020. A Tarım 4.0 İle Sürdürülebilir Bir Gelecek. Icontech Int. J., 4(1): 1-12. https://doi.org/10.46291/ICONTECHvol4iss1pp1-12

FAO, 2017. The future of food and agriculture trends and challenges. Rome: Food and Agriculture Organization of the United Nations.

Fikrətzadə, F. and P. Əliyev. 2022. Azərbaycan respublikasinda aqrar sahənin dayanıqlı inkişaf prinsipləri baxımından tənzimlənməsi. Kənd təsərrifatı iqtisadiyyatı, 3(1): 9-32.

Gagliardi, G., A.I.M. Cosma and F. Marasco. 2022. A decision support system for sustainable agriculture: The case study of coconut oil extraction process. Agronomy, 12(1): 177. https://doi.org/10.3390/agronomy12010177

Hamadani, H., S.M. Rashid, J.D. Parrah, A.A. Khan, K.A. Dar, A.A. Ganie, A. Gazal, R.A. Dar and A. Ali. 2021. Traditional farming practices and its consequences. (eds. Içinde, G.H. Dar, R.A. Bhat, M.A. Mehmood and K.R. Hakeem), Microbiota Biofert., 2: 119-128. Springer International Publishing. https://doi.org/10.1007/978-3-030-61010-4_6

Hüseynov, M., 2003. Aqrar sahənin dayanıqlı inkişaf problemləri.

Kubaş, A. and N. Aydın. 2022. Sürdürülebilir tarım algısı. Balkan Near Eastern J. Soc. Sci., 8(4): 56-62.

Menalled, F., T. Bass, D. Buschena, D. Cash, M. Malone, B. Maxwell, K. McVay, P. Miller, R. Soto and D. Weaver. 2008. An introduction to the principles and practices of sustainable farming. Montana State University, pp. 1-4.

Mustafayeva, R., A. Hətəmov, M. Həsənova and F. Süleymanov. 2022. Aqrar iqtisadiyyat. Mütrəcim.

Nesirov, E., Karimov, M., and Zeynalli, E. (2022). Does the Agricultural Ecosystem Cause Environmental Pollution in Azerbaijan? Economic and Environmental Geology, 55(6): 617-632. https://doi.org/10.9719/EEG.2022.55.6.617

Nuriyev, Əli. 2017. Davamlı və tarazlı regional inkişaf. "Avropa" nəşriyyatı.

Pakdemirli, B., N. Birişik, I. Aslan, B. Sönmez and M. Gezici. 2021. Türk Tarımında Dijital Teknolojilerin Kullanımı ve Tarım-Gıda Zincirinde Tarım 4.0. Toprak Su Dergisi, 10(1): 78-87. https://doi.org/10.21657/topraksu.898774

Schaller, N., 1993. The concept of agricultural sustainability. Agric. Ecosyst. Environ., 46(1): 89-97. https://doi.org/10.1016/0167-8809(93)90016-I

Tufan, Y., A.N. Kurt and M. Özkurt. 2023. Sürdürülebilir Tarım Açısından Yem Bitkilerinin Önemi. 325-330. https://www.researchgate.net/profile/Yasir-Tufan/publication/374950594_Surdurulebilir_Tarim_Acisindan_Yem_Bitkilerinin_Onemi/links

Turhan, Ş., 2005. Tarimda sürdürülebilirlik ve organik tarim. Tarım Ekonomisi Dergisi, 11(1, 2), Article 1 ve 2.

Weiss, E., W. Wetterstrom, D. Nadel and O. Bar-Yosef. 2004. The broad spectrum revisited: Evidence from plant remains. Proc. Natl. Acad. Sci., 101(26): 9551-9555. https://doi.org/10.1073/pnas.0402362101

Wu, P., Y. Wang, J. Shao, H. Yu, Z. Zhao, L. Li, P. Gao, Y. Li, S. Liu, C. Gao, X. Guan, P. Wen and T. Wang. 2024. Enhancing productivity while reducing water footprint and groundwater depletion: Optimizing irrigation strategies in a wheat-soybean planting system. Field Crops Res., 309: 109331. https://doi.org/10.1016/j.fcr.2024.109331

Zambon, I., M. Cecchini, G. Egidi, M.G. Saporito

and A. Colantoni. 2019. Revolution 4.0: Industry vs. agriculture in a future development for SMEs. Processes, 7(1): 36. https://doi.org/10.3390/pr7010036

Гусейнов, М.Д. and Э.А. Салахов. 2016. Основные Проблемы Финансовой Обеспеченности Аграрной Сферы. Финансовый Вестник, 2(33): 52-58.