



Approaches to Sustainable Financial Mechanisms in Agriculture: International and Azerbaijani Experience

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Abstract. Agriculture is a strategic sector of the economy, playing a crucial role in food security, employment, regional development, and social welfare. However, its financing is constrained by seasonality, high risks, low profitability, and limited access to credit, which undermines long-term sustainability. The aim of this study is to identify the main characteristics of financial mechanisms in agriculture, analyse existing and potential sources of financing, and assess their applicability to ensure sustainable agricultural development. The research is based on a systematic literature review of 41 scientific sources published between 2003 and 2024. The analysis shows that while state support programs provide subsidies and soft loans, major barriers persist, including high interest rates, weak cooperatives, underdeveloped market infrastructure, and low financial literacy among farmers. International practice highlights the potential of complementing traditional sources with innovative instruments such as green bonds, venture capital, Islamic finance, and project-based financing. The study suggests that sustainable agricultural finance requires integrative mechanisms that diversify funding sources, strengthen cooperative structures, and improve financial literacy. Applying these strategies in Azerbaijan, alongside international experience, can reduce risks, increase resilience, and ensure long-term sectorial growth.

Keywords: Sustainable Agriculture; Agricultural Finance; Self-Financing; State Support; Financial Constraints.

1 Introduction

Agriculture, as one of the strategic sectors of economy, is of great functional importance in ensuring food security, protecting employment, promoting regional development and strengthening social welfare. The long-term sustainability of this sector is possible not only through the efficient use of production resources, but also through the formation of sustainable financial mechanisms that take into account economic, environmental and social factors. The specific characteristics of the agricultural sector cause its financing model to differ significantly from other types of economic activity.

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International experience shows that the sources of financing in agriculture are diverse. However, since most of the existing mechanisms do not fully take into account the structural characteristics and risk environment of the sector, financial sustainability is not ensured at any level. In this regard, the development of optimal financial mechanisms for agriculture, minimizing risks, taking into account environmental and social aspects, based on a comparative analysis of both international and Azerbaijani experience, is an urgent scientific and practical necessity. The main purpose of this study is to identify the characteristic features of financial mechanisms for sustainable agriculture, existing and potential sources and assess their application possibilities.

2 Material and Methods

The study is based on a systematic literature review aimed at identifying the main characteristics and financing sources of sustainable agriculture. The research design followed several stages.

Publications were collected from international and regional databases, including Scopus, Web of Science, the National Library of Azerbaijan, ULAKBİM Journal Park (Turkey), and the Russian National Science Network.

The time frame covered the period from 2003 to 2024. The search used predefined keywords and Boolean operators, such as “sustainable agriculture,” “agricultural finance,” and “financial mechanisms.” The inclusion criteria were:

empirical or theoretical studies focusing on agricultural finance;

analysis of existing or potential financial sources for sustainable agriculture;

availability in English, Azerbaijani, Russian, or Turkish.

Studies published before 2003, lacking methodological details, or not peer-reviewed were excluded. The initial search yielded 192 documents. After screening titles and abstracts, and applying methodological filters, 41 sources were selected for in-depth analysis. To ensure reliability, the screening process was conducted independently by two researchers, and discrepancies were resolved through discussion.

Comparative and content analysis were applied to identify common patterns, sector-specific constraints, and innovative financing approaches in both international and Azerbaijani contexts. This methodology ensured transparency, replicability, and comprehensive coverage of relevant studies.

3 Results and Discussion

Today, the economic sustainability of agriculture depends on the financial capabilities and sustainable operations of enterprises. Producers maintain food security, employment and economic stability by using resources such as seeds, fertilizers, irrigation, machinery and equipment. At the same time, it is important for the development of rural areas, the resilience of farmers to natural disasters and climate change, attracting investment in agribusiness and innovation, global competitiveness and food security.

Therefore, the creation of a financial mechanism that takes into account the economic, environmental and social dynamics of the agricultural sector, reduces risks and modernizes production can contribute to long-term efficiency and sustainable development of the country's economy.

The formation of a financial mechanism in agriculture should be carried out taking into account the following characteristics of this sector (Abbasov, 2017; İbrahimov, 2016; Mustafayeva, Hətəmov, Həsənova, & Süleymanov, 2022; Özçelik, Fidan, Albayrak, Güneş, & GülçubukBUK, 2013; Quliyev, 2015; Sadıqov, Hüseynov, & Həsənov, 2012):

- agriculture has multifunctional (ecological, economic, social, cultural, etc.) characteristics;
- it provides other sectors of the national economy with raw materials and plays a strategic role in the country's economic security;
- the presence of land, animals and plants as the means of production;
- it affects the lifestyle, employment, economic and cultural level of society;
- it is one of the types of economic activity that is easily affected by natural conditions;
- the level of risk is uncertain due to its dependence on natural conditions;
- the lack of overlap between production and collection processes, the requirement of a certain period for the completion of production, and therefore the determination of profit at the end of the year and the weak elasticity of demand and supply of agricultural products;
- the ability of agriculture to renew itself and the possibility of its involvement in repeated production;
- agriculture is a seasonal type of activity depending on the type of products grown;
- the adaptation of the production process to the characteristics of the use of labor resources and equipment due to seasonality;
- market dominance of small-scale peasant farms and lack of widespread use of their innovation potential;
- high capital intensity, low capital turnover, and diversion of special funds from circulation;
- very little technical knowledge about agriculture among farmers engaged in the production of agricultural products, and the process is carried out with informal knowledge.

The formation of financial relations and the development of relevant mechanisms in the agricultural sector have slightly different characteristics from other areas as a result of the influence of a number of factors listed above, which we can systematize as follows:

- Characteristics arising from production - the agricultural production process is generally long-term and the financial need is formed accordingly (Hoxha et al., 2023). Characteristics arising from production - the agricultural production process is generally long-term and the financial need is formed accordingly;
- Characteristics arising from organizational structure - most agricultural enterprises are family farms, and since they are small-scale and production-oriented, their financial potential is limited (Kumari & Garg, 2023; Soria, Hernandez, & Ciacci, 2019). This makes access to credit difficult due to natural conditions risks and increases the costs

of controlling geographical distribution. As a result, the agricultural sector requires longer-term and lower-interest loans.

- Personal characteristics of the producer - agricultural producers do not have sufficient knowledge of financial markets and financial management (Bülbül, 2006, p. 56; Oleynikova, Chernova, Reshetilo, & Yankina, 2020). Limited awareness of financing and alternative options makes it difficult to objectively determine credit terms. Farmers' age and education level indicate the degree of risk aversion. US research shows that less educated, older farmers are more risk averse and have difficulty assessing investment risk than their younger, more educated counterparts (Rosen, Tsai, & Downs, 2003)
- Features arising from the structure of capital - since the seasonal and long-term production process causes money circulation to occur only after harvest, capital circulation is completed once a year, sometimes the return on investments takes 5–20 years (Кибиров, 2021). Such a low turnover rate limits access to external sources and forces businesses to rely on short-term financing to ensure uninterrupted production.
- Risk characteristics arising from natural conditions - agriculture has higher uncertainty than other sectors because it is directly dependent on climate (Çetin, 2022). Meteorological disasters such as drought, frost, and floods cause crop losses and quality degradation, which poses serious challenges to producers in terms of liquidity, capital turnover, and losses, threatening the long-term sustainability of the sector. The characteristics resulting from the size of fixed assets - land, machinery and equipment, and buildings having a high share in assets - increase the need for liquid funds of enterprises and limit their financial flexibility. (Sadıqov et al., 2012; Tiryaki & Kandil Göker, 2021).
- Characteristics resulting from poor access to finance – although industrial enterprises try to meet their financial needs through public and private institutions, as well as international organizations, the high level of risk and low profit margin cause private institutions to approach this sector cautiously, resulting in increased financing costs and tighter credit conditions. In such a situation, state support plays the role of the main source of finance (Sadıqov et al., 2012). At the same time, the poor treatment of agricultural loans, leasing, insurance and other financial instruments, due to the wide geographical spread of agricultural producers and the high dependence of the sector on natural factors, further limits their access to financial services (Khan et al., 2024). However, research shows that access to financial resources from various sources is vital for businesses to invest in sustainable technologies and practices. (Кибиров, 2021)

A successful agricultural finance mechanism should be based on sector-specific principles - sustainability, accessibility, flexibility, relevance, efficient management of resources, transparency, accountability, participation and risk minimization. These principles should ensure farmers' resilience to climate, economic and market fluctuations, access to financial resources for enterprises of all sizes and long-term environmental, economic and social sustainability, and should be implemented through harmonious cooperation between the public, private sector and international organizations (Zeynalli, 2023).

According to Sadıqov, Huseynov and Hasanov, agrarian finance aims at the distribution and redistribution of GDP and national income, the creation and use of centralized and

decentralized monetary funds for profit (Sadıqov vd., 2012). Ellis sees financing as a guarantee of investments, liquidity needs of small businesses, access to new technologies, and mitigation of the negative effects of economic fluctuations (Bayner, 2012). Omobitan & Khanal note that agricultural finance should support both long-term needs and high-yield seeds, labor, innovative technology, efficiency, marketing, and short-term risk management (Omobitan & Khanal, 2022). In general, agricultural financing is a process that meets production, investment and working capital needs, diversifies risks and regulates financial flows. The main problems are lack of finance and ineffective allocation of resources; therefore, financing should be directed towards expanding production, protecting it and diversifying risks.

In international practice, agricultural financing is carried out by integrating various sources, and researchers classify these sources in different ways. M. Huseynov emphasizes personal funds, credit and budget funds, investment and international allocations, and funds from national park projects (Hüseynov, 2006). Turkish researchers Oğuz & Bayramoğlu divide sources into internal and external sources (Oğuz & Bayramoğlu, 2015), Taşkıran and Özüdoğru into organized (bank, cooperative, association) and unorganized sources (Taşkıran & Özüdoğru, 2010), and Omobitan and Khanal divide into official (bank, credit unions, state control) and unofficial (family, friends and relatives, cash and barter debts) resources (Omobitan & Khanal, 2022). Intriago Zambrano et al. distinguish between family, official and unofficial sources, while Tchewafei et al. distinguish between personal, state, private and international sources (Intriago Zambrano, Diehl, & Ertsen, 2023; Tchewafei, Yang, Wendkuuni Kaghembege, & Sambiani, 2020). Russian scholars Eskiyevev highlights loans, state support and investment funds (Эскиев, 2020), while Boldyreva highlights specific leasing investments (Болдырева, Андрющенко (Семенютина), & Рябова (Митрофанова), 2017). Bodiroya et al. consider personal funds, state, international organizations and commercial bank loans as the main sources (Bodiroya, Vico, Perkovic, Yushkov, & Tomic, 2017), while Bugaeva separately emphasizes state support among external resources (Бураева, 2018).

We believe that sources should be divided into three groups based on duration: short-term (to meet working capital needs up to 1 year), medium-term (for equipment investments between 1–5 years), and long-term (for land acquisition, large investments, and infrastructure projects over 5 years) (Zeynalli, 2023). Financial sources should be categorized as traditional operating income, depreciation and reserve funds, short-term operating and long-term investment loans from banks and financial institutions, government subsidies and direct support, and non-traditional long-term leasing, venture capital, project-based financing, factoring, forfeiting, smart contracts, green shares, and Islamic finance instruments.

Self-financing, which is widely used in international practice in agricultural financing, is the financing of the activity of the entity with internal resources - operating profit, depreciation fund, proceeds from asset sales, shareholder fees and securities issues - without resorting to external sources. Atashov, Novruzov and Ibrahimov evaluate this as one of the main principles of corporate finance, payment of expenses with personal funds (Ataşov, Novruzov, & İbrahimov, 2014). Bagirov, Hasanli and Mammadova, on the other hand, include the use of bank and commercial loans, when necessary (for investment purposes), in self-financing, considering it a condition for competitiveness

(Bađirov & Həsənli, 2011; Məmmədova, 2018). While self-financing is essential for the sustainability and independence of enterprises, the sector's high risks, long-term investments, and limited profitability hinder its full realization. Research in Bosnia shows that agricultural enterprises are mainly financed by private funds, which is associated with low levels of state support (Vaško & Ožegović, 2018).

Family financing means that farmers receive financing, sometimes interest-free, from family members, friends and relatives. It is considered a flexible option for small and medium-sized farms, especially in developing countries, due to low financial inclusion (Klerx, 2015). The biggest advantages are low costs, flexible payment terms, trust-based relationships, and lower, sometimes zero, interest rates than bank loans, which reduces financing costs and mitigates liquidity risk. The lack of strict procedures makes the farmer more resilient to economic shocks. However, the limited amount of funds, disputes arising from trust and lack of legal protection, early repayment or uncoordinated interest requirements, etc. State funding is one of the main sources of finance for agriculture and aims to redistribute resources to ensure economic security, thereby reducing production losses and supporting the sustainable operation of the sector. Trusova points to state aid, subsidies, tax regimes and price regulation as the main instruments of influence (Трусова, 2015)). Basalayeva considers direct subsidies, grants, interest rate subsidies, assistance in repaying the principal debt, budget loans, debt guarantees, buyer guarantees, tax breaks, and investment loans to be the most important forms in this direction (Басалаева, 2007). Especially in developing countries, public funding is the most widespread and diverse form of support in the agricultural sector due to the limited availability of other sources.

In the agricultural sector, loans from banks and credit institutions finance both short-term working capital and long-term investments in logistics, innovative technologies, and product quality improvement, but the small volume of loans provided does not create a sustainable financial mechanism. Radović, Pejanović, and Njegovan consider the lack of inclusiveness of banking services to be a result of risk factors, limited insurance, lack of expertise, unrecognized product collateral, and infrastructure problems (Radović, Pejanović, & Njegovan, 2013). Gamidov emphasizes that high risks, financial instability of enterprises, seasonality of production, and difficulties in sales and collection limit lending (Гамидов, 2020). Even though farmers receive loans, high interest rates and seasonal cash flow uncertainty make debt repayment difficult and increase financial risks.

Cooperatives and unions in the agricultural sector provide their members with financing, support in reducing production costs, and assistance in marketing products. (Zhu, Wachenheim, Ma, & Zhu, 2018). They not only provide credit, but also increase efficiency through technical and training assistance, bulk purchasing, shared use of equipment, and direct delivery to the market. However, since cooperative models are not fully implemented in developing countries, this mechanism does not provide the expected benefits. Çetin explains this by management and organizational shortcomings (Çetin, 2022).

International organizations and institutions provide funding in the agricultural sector in the form of grants and assistance to support food security, sustainable practices, climate risk reduction, and socio-economic development in developing countries. FAO, UNDP,

IFAD, World Bank (IDA and IFC), EBRD, and ADB are the main sources of funding in this area (Lele, Baldwin, & Goswami, 2021; Pandey, 2014), and the European Union's IPARD program provides grants to ensure CAP compliance. NGOs such as Oxfam, Heifer International, and CARE International, as well as some transnational corporations, allocate additional financial assistance to agricultural projects as part of their social responsibility policies.

4 Conclusions

The study confirmed that the sustainability of the agricultural sector in Azerbaijan is strongly influenced by sector-specific risks such as seasonality, climate dependency, limited profitability, and insufficient access to credit. Current state support programs, although important, remain fragmented and do not fully address the long-term financing needs of farmers and agribusinesses.

A comparative analysis of international experience demonstrates that relying exclusively on subsidies and traditional bank loans is insufficient. More diversified financial mechanisms are required, including Islamic finance, project-based financing, venture capital, and green bonds. These instruments can complement traditional tools and provide long-term stability for the sector.

The findings also reveal institutional weaknesses, such as the underdevelopment of cooperatives, inadequate rural infrastructure, and low financial literacy, which significantly limit access to financial resources. Addressing these gaps requires coordinated policy reforms and targeted training programs.

Future research should focus on designing financial products tailored to small and medium-sized farms, developing risk-sharing models for climate adaptation, and assessing the effectiveness of innovative financial instruments in local conditions. This will contribute not only to strengthening resilience in Azerbaijan's agricultural sector but also to its integration into global sustainable finance practices.

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