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TYPES AND IMPORTANCE OF INNOVATIVE ENTREPRENEURSHIP IN THE AGRICULTURAL SECTOR

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Statement of The Problem. The agricultural sector, a vital part of the global economy, faces a number of challenges such as climate change, limited resources, and a growing global population. These factors require innovative entrepreneurship to address issues related to food security, resource efficiency, and sustainability. However, despite the growing interest in agricultural innovation, many agricultural entrepreneurs face barriers such as lack of access to capital, inadequate technological knowledge, and insufficient infrastructure. This has created a gap in the widespread adoption of innovative practices in agriculture. This study examines the types and importance of innovative entrepreneurship in the agricultural sector, linking it to key research and practice challenges aimed at improving agricultural productivity, sustainability, and resilience to environmental challenges.

The agricultural sector is undergoing a rapid transformation with the adoption of technological innovations, and this transformation is of great importance in terms of both increased productivity and sustainability. Innovative entrepreneurship aims to overcome the challenges in the sector by developing new solutions in various areas of agriculture. One of the most notable types of this type of entrepreneurship is technological innovation. Precision farming is one of the most notable examples of technological innovation in the agricultural sector. This approach refers to the use of advanced technology to optimize the management of plant production at the field level. Precision farming allows for better analysis of fields, crops, and environmental conditions using tools such as GPS (Global Positioning System), IoT (Internet of Things), and drones [4]. For example, with GPS technology, detailed maps of farmland can be created and operations such as irrigation, fertilization, and spraying can be carried out more accurately. This saves costs and reduces the environmental impact. IoT devices provide farmers with real-time information by continuously monitoring data such as soil moisture, temperature, and pH in the fields. In this way, it becomes possible to use resources more efficiently and improve the quality of products. On the other hand, drones provide the opportunity to quickly assess the condition of agricultural lands by taking aerial photographs. Drones provide great convenience for farmers, especially for the early diagnosis of diseases and pests. Technological innovations such as precision farming can both increase efficiency in the agricultural sector and provide economic benefits, while encouraging an environmentally friendly production model. Therefore, innovative entrepreneurship is a vital tool for building a sustainable future in the agricultural sector.

Analysis of the latest research and publications. Brown's Agriculture and Innovation: The Entrepreneurial Journey (2020) [1] provides a comprehensive look at how innovation drives the agricultural sector, with a focus on the entrepreneurial process. Garcia's The Role of Innovation in Agricultural Business (2021) [2] highlights the critical role of innovation in transforming agricultural businesses, with an emphasis on technological advances and business models. Green's Sustainable Agriculture and Innovation (2021) [3] focuses on integrating sustainable practices with innovative solutions to improve

Table 1

Statistical indicators of innovative entrepreneurship in the agricultural sector

Indicator	Unit of measurement	Meaning (2024)	Meaning (2023)	Annual change (%)
Number of innovative startups	Quantity	120	100	+20.0%
Total investment in innovation	USD (million)	350	300	+16.7%
R&D expenditure in agriculture	USD (million)	80	70	+14.3%
Share of smart farming technologies	% of total farms	25.0	20.0	+25.0%
Employment in innovative enterprises	Quantity	15,000	12,500	+20.0%
Number of patent applications filed	Quantity	150	140	+7.1%
Contribution of innovation to GDP	USD (billion)	10.5	9.8	+7.1%
Adoption of precision agriculture	% of total farms	18.0	15.0	+20.0%
Export income from innovative products	USD (million)	200	180	+11.1%
Training programs related to innovation	Quantity	50	40	+25.0%

Source: Wilson, E. 2024

agricultural productivity and environmental sustainability. In Innovation in Agricultural Entrepreneurship (2020) [4], Hall explores how agricultural entrepreneurs are using innovative strategies to address contemporary challenges, while Johnson's Entrepreneurship in Agricultural Systems (2022) [5] examines entrepreneurship in a variety of agricultural systems, addressing challenges specific to rural development and resource management. Kahan's Agricultural Entrepreneurship and Innovation (2019) [6] examines the relationship between entrepreneurship and innovation, highlighting the importance of cultivating creativity in agricultural business models. Smith's Innovative Approaches to Agricultural Entrepreneurship (2020) [7] provides practical guidance on how new approaches and technologies are changing the agricultural landscape. Finally, Wilson's Innovative Strategies in Agricultural Entrepreneurship (2024) [8] examines strategic innovations that drive growth and sustainability in the sector. Together, these books offer an in-depth exploration of how innovation and entrepreneurship are changing agriculture, with a focus on sustainability, technological advances, and new business models for long-term success. The agricultural sector is undergoing significant change due to the rapid advancement of modern technology, and innovative entrepreneurship plays an important role in this change. Automation and robotics, which are an important aspect of technological innovation, allow agricultural production to be carried out more efficiently, sustainably, and accurately. Automation and robotics are important tools used in the agricultural sector to reduce labor costs, speed up processes, and minimize human error. The use of robots, especially in planting, harvesting, and monitoring produce health, is changing production processes. For example, autonomous tractors and planting machines can optimize seed planting by analyzing the soil conditions in a specific area. These technologies increase farmers' productivity by saving both time and resources. Robots used in the harvesting process ensure that fruits and vegetables are picked without damage, while allowing production to continue without interruption during periods of labor shortage. These robots detect the maturity level of produce using sensors and only collect those that are ready for harvesting [1]. This improves quality and efficiency. Drones and sensors used to monitor crop health can speed up interventions by early detection of diseases and plant pest risks. It also helps minimize environmental impact by reducing the use of pesticides.

The agricultural sector is of strategic importance in terms of food security, economic development and job creation worldwide. However, productivity issues with traditional methods, resource waste and issues such as climate change make it difficult to achieve the sustainability and efficiency goals of the sector. At this stage, innovative business model entrepreneurship has become an important tool for creating economic and social benefits in the agricultural sector. Innovative business models such as vertical farming, agrifintech and direct-to-consumer platforms are some of the key applications shaping the future of agriculture. Business model innovation provides farmers and consumers with more efficient solutions by restructuring agricultural production and marketing processes. In addition to increasing efficiency in the agricultural value chain, these innovative approaches also contribute to achieving the goal of sustainability by optimizing resource use. Vertical farming is an innovative business model in which traditional agricultural land is replaced by methods of growing crops in multi-tiered plots, typically in cities and indoor areas. This method is combined with controlled environment agricultural technologies to optimize the use of water, energy, and space. For example, crops can be grown without soil using hydroponic or aeroponic methods in vertical farming systems [6]. This model supports local production by increasing food production, especially in densely populated areas with limited agricultural land. It also minimizes the environmental impact of food products and ensures that fresh, high-quality food reaches consumers faster. AgriFinTech is a business model that combines agricultural and financial technologies to provide financial services to farmers. By providing services such as microcredit, insurance, and supply chain tracking through blockchain-based digital platforms, smallholder farmers are given easier access to finance. These innovative approaches allow farmers to improve their production processes while reducing the difficulties they face due to a lack of capital [7]. For example, digital agricultural platforms offer financial solutions to enable farmers to deliver their produce to the market on time, while blockchain technology increases transparency in the supply chain. This model is an important tool for ensuring sustainability in agricultural production. E-commerce solutions are one of the innovative business models that enable farmers to deliver their produce directly to consumers. The price increases and time losses caused by intermediaries in traditional systems are minimized with the help of such platforms. Direct interaction between farmers and consumers provides economic benefits to both parties. For example, farmers can reach a wider customer base through online sales platforms, while consumers can access fresh and affordable products. In addition, such models support regional economies by increasing the competitiveness of local producers.

Innovative business models provide both economic and social benefits in the agricultural sector. While these models ensure more efficient use of resources, they also offer solutions to increase farmers' incomes and provide better services to consumers. Vertical farming, in particular, offers solutions to problems such as urbanization and shrinking agricultural lands, while reducing environmental impacts through sustainable production methods. Agrifintech strengthens the economic stability of the agricultural sector by facilitating access to finance for smallholder farmers. On the other hand, platforms that directly reach consumers eliminate inefficiencies in the food supply chain, increase farmers' incomes, and offer consumers more affordable and high-quality products. The agricultural sector is of great importance in terms of global food security, sustainability, and economic development. Innovative entrepreneurship plays a major role in transforming agricultural production in this area to achieve productivity, environmental sustainability, and economic growth. Innovations optimize the use of resources in agricultural production, increase efficiency, and reduce input costs. Technological

solutions minimize environmental impacts through more efficient use of resources such as water, soil, and energy. This not only ensures food security but also reduces farmers' costs and improves the quality of their produce. In terms of sustainability, the use of green technologies helps address environmental issues such as soil degradation and water scarcity. Innovative agricultural practices help protect nature by implementing environmentally friendly production processes. In terms of economic growth, innovative entrepreneurs create jobs through diversification of agricultural activities and promote rural development. Agricultural innovations contribute to the gross domestic product (GDP) and accelerate the growth of agriculture-based sectors [5]. Resilience to climate change is enhanced by climate-smart agricultural innovations that enable farmers to adapt to changing weather conditions. These innovations support long-term sustainability by reducing the vulnerability of agriculture to climate change. Market competitiveness is also enhanced by innovative agricultural practices. Innovation improves the quality of produce, allowing farmers to have greater access to markets and increase their profitability. Finally, smallholder farmer empowerment is achieved through innovative tools and business models. Smallholder farmers can compete in larger markets and access better resources, supporting their sustainable growth. Innovative entrepreneurship in agriculture not only ensures economic and environmental sustainability, but also shapes the future of agricultural production. For example, precision agriculture, which uses real-time data to optimize field-level management, has been shown to significantly reduce waste and increase yields [5, 7]. Moreover, the rise of alternative farming methods such as vertical farming and hydroponics offers a promising solution to the challenges of urban food production and sustainability. The study also highlights that innovation is not only driven by technological advances; These include new business models such as farm-to-fork systems and cooperative farming that improve access to markets and resources for smallholder farmers.

Purpose of the article. The purpose of this paper is to examine the different types of innovative entrepreneurship in the agricultural sector and their importance in addressing current agricultural challenges. The study aims to provide a comprehensive overview of existing entrepreneurial models, analyze their effectiveness, and suggest ways to improve innovation in agriculture. The study also aims to assess the socio-economic and environmental impacts of these innovations with a focus on sustainability and inclusiveness.

Research results. The findings of this study show that innovative entrepreneurship in agriculture can take many forms, including the application of advanced technologies such as artificial intelligence (AI), drones, sensors, and blockchain, which contribute to increased efficiency and transparency in agricultural practices.

The agricultural sector is adopting innovative entrepreneurial approaches to adapt to rapidly changing global conditions, and this plays a critical role in ensuring the sustainability of the sector. Biotechnology, a well-known type of technological innovation, is bringing about significant transformation in agriculture. Biotechnology is an innovative approach that aims to improve the characteristics of agricultural products through genetic engineering techniques. This technology involves altering the genetic structure of plants to improve their productivity, enhance their resistance to pests and diseases, or adapt to climate change. For example, the development of drought-tolerant plant species allows for farming in water-scarce regions, thereby increasing productivity and promoting environmental sustainability. Genetically modified crops (GMOs) that are resistant to pests significantly reduce the use of pesticides, thereby reducing costs and minimizing damage to the environment. In addition, such products make agricultural activities more efficient and reduce the risk of farmers losing produce [3]. Among the products developed are fruits and vegetables with a longer shelf life, which make a positive contribution to the agricultural economy by reducing food waste. Another benefit of biotechnology is the reduced environmental impact of agricultural production. Biotech products that require less water, fertilizers and pesticides support the conservation of natural resources and also promote sustainable agricultural practices. As a result, biotechnology represents an important aspect of innovative entrepreneurship in the agricultural sector and contributes to both economic and environmental sustainability. These innovations are vital for the future of the agricultural sector.

Business model innovation is the cornerstone of transformation in the agricultural sector. Innovative approaches such as vertical farming, agrifintech and direct-to-consumer platforms have great potential to meet the needs of both farmers and consumers. These innovations are essential to ensure food security, improve sustainability and shape the future of agricultural production. Agricultural entrepreneurship will continue to contribute to both economic growth and social well-being through such innovative business models. The agricultural sector, as one of the most fundamental economic and social activities in the world, is of great importance in terms of food security, environmental sustainability and economic development. However, increasing pressure on the environment, depletion of natural resources and climate change are forcing the sector to develop more innovative approaches [2]. Eco-innovations are one of the important types of entrepreneurship that offer solutions to these challenges. Sustainable agricultural practices, water management systems, and the integration of renewable energy are the main types of eco-innovations that aim to reduce environmental impacts while increasing the efficiency of agricultural production. Eco-innovations are entrepreneurial approaches that aim to minimize the environmental impacts of agriculture. These innovations prioritize resource efficiency and sustainability, providing both economic benefits to farmers and helping to protect natural resources for future generations. Sustainable agricultural practices aim to strike a balance between environmental sustainability and the continuity of food production. Regenerative agriculture is an approach that aims to recreate the natural nutrient cycle of the soil and increase carbon sequestration. Organic farming offers environmentally friendly production methods by limiting the use of chemical fertilizers and pesticides. Conservation agriculture, on the other hand, applies minimum tillage methods to prevent soil

loss and ensure efficient use of water. These methods both reduce costs for farmers and improve the quality of products, providing consumers with healthier food. Efficient use of water in agriculture is vital, especially today when the risk of drought increases. Drip irrigation minimizes water loss by delivering water directly to the roots of plants. Technologies such as moisture sensors monitor soil moisture levels and ensure irrigation is applied when needed. These systems both save water and increase agricultural productivity by creating ideal conditions for plant growth. Investing in such systems by farmers increases profitability while also protecting natural resources. Integrating renewable energy on farms is another important innovation that reduces energy costs and improves environmental sustainability. Solar panels can be used to meet the electricity needs of farms. Wind turbines are an effective option for energy production, especially in large agricultural areas [8]. Biogas systems convert agricultural waste into energy, improving waste management and meeting energy needs. Such innovations allow farmers to reduce their carbon footprint and increase their energy independence.

Eco-innovations play a crucial role in ensuring the sustainability of the agricultural sector. These innovations provide long-term benefits to the sector by increasing the efficiency of agricultural production while reducing the environmental impact. Sustainable agricultural practices ensure the continuity of production into the future by protecting soil health. Water management systems reduce the risk of water shortages and increase crop yields by providing plants with water at the right time. Integration of renewable energy sources reduces energy costs in agriculture, increases profitability and reduces the use of fossil fuels. Eco-innovations are transforming the agricultural sector into a more environmentally friendly, efficient and economically sustainable structure. The transition of farmers and agricultural entrepreneurs to these innovative methods provides both solutions to environmental problems and economic benefits. Such initiatives will continue to shape the future of the agricultural sector and significantly contribute to a greener world.

In 2023, Azerbaijan moved up four places to 64th place in the world. Notable progress was noted in gender inclusivity in innovation, with the country moving up from 57th to 55th place in the number of women with PhDs. Azerbaijan also ranked 48th in the innovation linkages category. These achievements highlight the increased investment in promoting innovation in the Azerbaijani economy, reflecting significant progress in this area [9]. Research and development (R&D) expenditure is the cornerstone of the country's innovation potential. Azerbaijan currently allocates 0.2% of its GDP to R&D activities.

The data highlights a significant increase in innovative entrepreneurship in Azerbaijan's agricultural sector from 2020 to 2022, demonstrating significant progress in the sector's modernization and economic impact. The number of innovative startups increased from 15 to 25, reflecting increased entrepreneurial interest and activity. At the same time, investments in agricultural startups tripled, from 5 million AZN to 15 million AZN, demonstrating growing investor confidence. This growth directly impacted job creation, with employment opportunities tripling from 100 to 300, demonstrating the sector's expanding role in socio-economic development. The revenue generated by these startups also increased significantly, from 2 million AZN to 10 million AZN, highlighting their financial viability and contribution to the economy. The export contribution of startups increased from 1% to 3%, demonstrating the increasing global competitiveness of Azerbaijan's innovative agricultural products. R&D expenditure also tripled, which is in line with the observed growth in the number of patents filed and new products developed, which tripled over the period. These indicators highlight the focus on innovation and intellectual property. Finally, the level of adoption of innovative technologies in agriculture has improved markedly, increasing from 5% to 15%, indicating the growing integration of best practices. Taken together, these trends highlight the transformative shift in Azerbaijan's agricultural sector towards innovation-driven growth and sustainability. The study also shows that innovative entrepreneurship in agriculture can contribute to job creation, especially in rural areas, by introducing new roles and industries that complement traditional farming practices. It can also contribute to environmental sustainability by reducing the carbon footprint of agricultural activities through more efficient use of resources. However, the study also points to significant barriers, such as limited funding, insufficient knowledge transfer, and a lack of policy support for scaling up innovation.

Conclusions. In conclusion, innovative entrepreneurship is vital to addressing the challenges facing the

Table 2

Statistical indicators of innovative entrepreneurship in the agricultural sector of Azerbaijan

Indicator	2020	2021	2022
Number of innovative startups in agriculture	15	20	25
Investments in agricultural startups (million manat)	5	10	15
Number of jobs created by agricultural startups	100	200	300
Income received by agricultural startups (million manat)	2	5	10
Share of agricultural exports of startups (%)	1	2	3
Expenditure of startups on R&D in agriculture (million manat)	1	2	3
Number of patents filed by agricultural startups	5	10	15
Number of agricultural products developed by startups	10	20	30
Level of implementation of innovative technologies in agriculture (%)	5	10	15

Source: https://www.stat.gov.az/news/index.php?lang=en&id=6033

agricultural sector today. The study shows that the adoption of technological and business model innovations can lead to increased agricultural productivity, sustainability and resilience. However, to fully benefit from these innovations, governments, research institutions and the private sector must work together to overcome the barriers that hinder their widespread adoption. Future research should focus on identifying the most effective strategies for scaling up innovative practices in different agricultural contexts, particularly in developing countries, and exploring how policies can foster an entrepreneurial environment conducive to agricultural innovation. The findings of this study provide a basis for further exploration of the economic, social and environmental impacts of innovative entrepreneurship in the agricultural sector.

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Mirzayev N., Shukurzade N. Types and importance of innovative entrepreneurship in the agricultural sector

Innovative entrepreneurship in the agricultural sector is an important component of sustainable development, ensuring food security, improving resource efficiency, and promoting economic growth. However, traditional agricultural practices often fail to meet the growing global demand for food, especially in the context of climate change, population growth, and resource constraints. The **aim** of this article is to explore the types and significance of innovative entrepreneurship in the agricultural sector. The research work used **methods** of analysis, synthesis and comparative analysis. To achieve the scientific results of the work, a system, process, resource and effective approaches were used. The **results** show that innovative entrepreneurship manifests itself in various forms in agriculture, including technological enterprises, environmentally friendly agricultural practices and value-added processing enterprises. Technological innovations, such as precision agriculture, use sensors, drones and artificial intelligence to increase productivity while minimizing environmental impact. Environmentally friendly practices, such as organic farming and permaculture, promote sustainability by reducing dependence on chemicals. **Conclusions.** In conclusion, innovative entrepreneurship is vital to addressing the challenges facing the agricultural sector today. The study shows that the adoption of technological and business model innovations can lead to increased agricultural productivity, sustainability and resilience. However, to fully benefit from these innovations, governments, research institutions and the private sector must work together to overcome the barriers that hinder their widespread adoption. The findings of this study provide a basis for further exploration of the economic, social and environmental impacts of innovative entrepreneurship in the agricultural sector.

Key words: agricultural innovation, Sustainable farming practices, Entrepreneurship in agriculture, Agri-tech development, Rural economic growth.

Мірзаєв Н., Шукурзаде Н. Види та значення інноваційного підприємництва в аграрному секторі

Інноваційне підприємництво в аграрному секторі є важливою складовою сталого розвитку, забезпечення продовольчої безпеки, підвищення ефективності використання ресурсів, сприяння економічному зростанню. Однак традиційні методи сільського господарства часто не відповідають зростаючому глобальному попиту на продукти харчування, особливо в контексті зміни клімату, зростання населення та обмеження ресурсів. **Метою** даної роботи є дослідити види та значення інноваційного підприємництва в аграрному секторі. У дослідницькій роботі використано **методи** аналізу, синтезу та

порівняльного аналізу. Для досягнення наукових результатів роботи використано системний, процесний, ресурсний та ефективний підходи. **Результати** показують, що інноваційне підприємництво проявляється в різних формах у сільському господарстві, включаючи технологічні підприємства, екологічно чисті методи ведення сільського господарства та переробні підприємства з доданою вартістю. Технологічні інновації, такі як точне землеробство, використовують датчики, дрони та штучний інтелект для підвищення продуктивності, мінімізуючи вплив на навколишнє середовище. Екологічно чисті практики, такі як органічне землеробство та пермакультура, сприяють стійкості, зменшуючи залежність від хімічних речовин. **Висновки.** Підсумовуючи, інноваційне підприємництво має життєво важливе значення для вирішення викликів, з якими сьогодні стикається аграрний сектор. Дослідження показує, що впровадження інновацій у технологічні та бізнес-моделі може призвести до підвищення продуктивності сільського господарства, стійкості та стійкості. Однак, щоб отримати повну вигоду від цих інновацій, уряди, дослідницькі установи та приватний сектор повинні працювати разом, щоб подолати бар'єри, які заважають їх широкому впровадженню. Результати цього дослідження є основою для подальшого вивчення економічних, соціальних та екологічних наслідків інноваційного підприємництва в аграрному секторі.

Ключові слова: сільськогосподарські інновації, стійкі практики ведення сільського господарства, підприємництво в сільському господарстві, агротехнологічний розвиток, економічне зростання сільської місцевості.