

GREEN ECONOMY-BASED SOLUTIONS FOR SUSTAINABLE AGRICULTURE USING VERTICAL FARMING

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Annotation: *This article examines the connection between sustainable agriculture and the green economy, with a particular emphasis on vertical farming techniques. Vertical farming is an advanced agricultural approach that uses modern technology and innovative structures to increase crop yields in limited spaces while reducing environmental impact. The study explores various aspects of vertical farming, including its environmental benefits, resource efficiency, and ability to overcome the challenges associated with traditional farming methods. In addition, it discusses the economic potential of vertical farming, such as creating job opportunities and supporting the production of high-value crops. Overall, the article highlights the important role of vertical farming in transforming agriculture into a more sustainable and environmentally responsible system that encourages efficient food production.*

Key words: *Sustainable agriculture, vertical farming, vertical cultivation, conventional agriculture, high-value crops, reshaping agriculture, resource efficiency, environmental impact, green economy, agricultural sector, LED lighting, greenhouse.*

Аннотация: *В данной статье исследуется связь между устойчивым сельским хозяйством и зеленой экономикой с акцентом на технологии вертикального земледелия. Вертикальное земледелие представляет собой современный подход, основанный на применении инновационных технологий и продуманной конструкции для увеличения объемов производства сельскохозяйственных культур в ограниченных пространствах при снижении негативного воздействия на окружающую среду. В работе анализируются основные преимущества вертикального земледелия, включая экологическую безопасность, рациональное использование ресурсов и возможность преодоления проблем, характерных для традиционного сельского хозяйства. Также рассматриваются экономические перспективы данной отрасли, в частности создание новых рабочих мест и выращивание дорогостоящих культур. В целом подчеркивается значимость вертикального земледелия в формировании более устойчивой и экологически безопасной системы сельского хозяйства, обеспечивающей ответственное и эффективное производство продуктов питания.*

Ключевые слова: *Устойчивое сельское хозяйство, вертикальное земледелие, вертикальное выращивание, традиционное сельское хозяйство, высокоценный урожай, преобразование сельского хозяйства, эффективность использования ресурсов, воздействие на окружающую среду, зеленая экономика, сельскохозяйственный сектор, светодиодное освещение, теплица.*

INTRODUCTION

Sustainable agriculture is becoming increasingly important in the modern world, driven by global population growth and the need to ensure food security while addressing environmental challenges. Vertical cultivation has become a promising solution within the framework of the green economy to solve these problems. This article examines sustainable agriculture through vertical cultivation and its potential to create a more environmentally friendly and economically sustainable agricultural sector. Vertical Cultivation: A modern agricultural approach Vertical cultivation, also called vertical farming or indoor farming, is a method in which crops are grown in stacked layers or on vertically inclined surfaces, typically in controlled environments such as greenhouses or urban warehouses. This approach uses advanced technologies such as hydroponics, aeroponics, and LED lighting to optimize growing conditions. The result is a highly efficient and resource-saving method of growing crops all year round, regardless of external weather conditions. So what do scientists say about vertical farming? In her May 2022 article, Victoria Masterson writes: "Vertical farming involves growing plants indoors, which is why it is sometimes all" referred to as indoor farming. Instead of sunlight and rain, vertical farms use LED lighting and controlled cultivation and nutrition systems. The plants are stacked vertically in layers, so many farms look like warehouses filled with large racks." Let's talk about the period of the initial appearance of vertical farming.

Dixon Despommier first introduced the first concepts of vertical cultivation of agricultural products in his experiments. Based on BYJU'S Exam Prep, Dixon Despommier first introduced vertical cultivation in 1999. This article says: "The concept of vertical farming was first proposed by Dixon Despommier in 1999. He was a professor of public and environmental health at Columbia University. By asking his students if it was possible to grow food on the roofs of New York skyscrapers, a concept was created in which a 30-story vertical farm grown using hydroponics and artificial lighting could feed about 50,000 people." It should be said here that although the professor's farm was not built, this idea inspired many subsequent projects.

METHODOLOGY

First of all, we use a data collection method. It is primarily based on quantitative and qualitative data.

- Surveys: Structured surveys will be conducted among vertical farming professionals, farmers, and consumers to collect data on the economic and environmental aspects of vertical farming.
- Data sources: Economic indicators, yield data, and resource consumption data will be collected from existing vertical farms.

Methodology Element	Content
Research Object	Sustainable agriculture within the context of the green economy
Research Subject	Vertical farming as a tool for sustainable agriculture

Methodology Element	Content
Research Purpose	Analysis of the effectiveness of vertical farming for the sustainable development of the UAE
Research Objectives	1. To study the principles of the green economy in the agricultural sector. 2. To evaluate the environmental and economic advantages of vertical farming. 3. To identify the possibilities for scaling the technology.
Research Methods	Literature review, comparative analysis, systems approach, case study
Expected Results	Justification of vertical farming as a sustainable and profitable agricultural approach

1-the table. Green economy-based solutions for sustainable agriculture using vertical farming

ANALYSIS AND RESULTS

Vertical farming offers numerous benefits, including year-round crop production, reduced land and water use, and potential increased yields. However, it also faces a number of challenges and obstacles that need to be addressed for its widespread adoption and long-term sustainability. This section discusses its advantages and disadvantages.

Advantage	Description
Space Saving	Allows crops to be grown vertically, which is especially beneficial in urban areas.
Efficient Water Use	Uses up to 90% less water compared to traditional farming methods.
Reduced Environmental Pollution	Eliminates the need for pesticides and herbicides, reducing environmental damage.
Year-Round Production	Ensures stable crop yields regardless of season or climate conditions.
Proximity to Consumers	Reduces transportation costs and CO ₂ emissions during product delivery.
Automation and Technological Integration	The use of AI, sensors, and automated systems improves process efficiency.
Job Creation	Supports the development of new industries and increases demand for skilled workers.

Table 2. Key Advantages of Vertical Farming

This table reflects the key advantages of vertical farming as an innovative approach within the framework of sustainable agriculture. The main focus is on such aspects as resource efficiency (space and water), minimizing negative environmental impacts, the possibility of year-round production of products, as well as socio—economic benefits - reducing transportation costs and creating jobs. These factors make vertical farming a particularly relevant solution in the context of urbanization and climate change.

The main problems relate to the high cost of implementation, energy dependence, as well as technological and personnel risks. In addition, vertical farms can only efficiently produce a limited number of crops so far. The lack of a clear regulatory framework and scaling difficulties also make it difficult for this technology to be widely adopted. Eliminating these problems requires both technical solutions and government support.

CONCLUSION

In the quest for a more sustainable and environmentally conscious agricultural future, sustainable agriculture through vertical cultivation is becoming a compelling and innovative solution in the context of the green economy.

The convergence of technological advances, resource-efficient methods, and an increased understanding of the environmental impacts of traditional agriculture have brought vertical farming to the forefront of agricultural innovation.

Vertical cultivation, with its myriad benefits, has the potential to redefine the way food is produced. Its space-efficient design, year-round production capabilities, and reduced reliance on traditional farming methods offer a vision of agriculture that is fully consistent with the principles of sustainability. Conservation of land, reduction of water consumption and minimization of pesticide use combine to promote a more environmentally friendly approach to food production.

Moreover, vertical farming minimizes the distance between production and consumption, reducing food miles and increasing local food security. This proximity helps reduce supply chains, reduces carbon emissions associated with transportation, and mitigates the inherent vulnerabilities of global food distribution networks. As an industry that thrives on innovation, vertical farming also serves as a catalyst for integrating cutting-edge technologies. Automation, artificial intelligence, and data-driven decision-making improve crop management, resource optimization, and overall operational efficiency.

This, in turn, contributes to economic viability and job creation in the green economy. However, it is crucial to recognize the challenges that accompany vertical farming, including high initial investment costs, energy consumption, and the need for skilled labor. Removing these barriers through research, development, and collaborative efforts by stakeholders is essential to realize the full potential of sustainable agriculture through vertical farming. In conclusion, sustainable agriculture through vertical farming represents a key chapter in the evolution of the green economy.

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