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Strengthening National Security through Sustainable Agriculture

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A B S T R A C T
This paper examines the role of sustainable agriculture within the expanded framework of national security, emphasizing its relevance to non-traditional security threats. It contributes to the literature by positioning sustainable agriculture as strategic infrastructure that supports food security, environmental resilience, and social stability. Employing a qualitative research design based on a review of peer-reviewed academic literature, policy documents, and institutional reports, the study analyzes key concepts linking food systems and national security. The findings indicate that sustainable agricultural practices strengthen national resilience by reducing dependence on food imports, mitigating environmental degradation, and lowering the risk of food-related social unrest. These results suggest that integrating sustainable agriculture into national security frameworks is essential for addressing contemporary and future security challenges.

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INTRODUCTION

National security, although commonly understood through the traditional military framework, encompasses a wide range of dimensions, including economic, public health, environmental, and societal. With the current expanded framework, food security stands as a pillar of national security as it has a direct impact on the population's well-being and state stability. A food-secure nation is determined by four interrelated factors, which are the ability to produce food, process food, ensure its availability, and maintain its affordability for the population.

Food security is widely recognized as important for national economic sustainability. As the agro-industrial complex is strengthened, resources are utilized more efficiently, and value-added production is increased, which therefore enhances foreign economic activities. Food security, through stable food systems, strengthens social comfort through assortment and price stability. This element also results in improved public health, which furthermore affects productivity and reduces pressure on the healthcare systems(Loginov, 2024).

Despite its importance, ensuring food security has been challenging worldwide, as numerous disruptions affect the food system. One factor disrupting this is the poor quality of food. This is especially evident in third-world nations, where availability is lacking, and their dependence on imported goods serves as a driver to use agro-chemicals. The use of these chemicals, however, leads to several consequences, from decreasing the quality of the product to jeopardizing the environment. This triggered the scientific community to find alternative systems that cause less damage to the environment and create safer food for human. The use of chemicals was initially done to push farm production to meet the needs of the growing population. This, however, not only puts human health at risk as they leave residual pesticides contaminating our foods, but also causes environmental damage, such as soil and water pollution (Sinha et al., 2009).

The challenges posed by the current common agricultural system have prompted the scientific community to develop solutions that minimize the harm resulting from it. The term sustainable agriculture was introduced as an alternative to conventional chemical-based agriculture. Not only does this push back the consequences to humans, but also to the environment. This concept of agriculture relies on the use of biological-based inputs and avoids the use of chemical-based fertilizers. By doing so, it aims not only to increase agricultural production but also to maintain farmland (Sinha et al., 2009).

Several countries, such as South Korea, have shown strong performance in sustainable agriculture, as reported by the Economist Impact's Food Sustainability Index 2021. This report ranks its Food Sustainability Index (FSI) based on three pillars: food loss and waste, sustainable agriculture, and nutritional challenges. The report also shows a strong correlation between FSI scores and the Human Development Index (HDI). This correlation suggests that countries with more sustainable food systems tend to achieve higher levels of human development. The report also highlights links among food sustainability,

health expenditure, and GDP per capita, thereby reinforcing the broader socioeconomic implications of sustainable agriculture.

Although there is a growing literature on sustainable agriculture regarding environmental protection, public health, and rural development, its implications for national security have remained largely unexplored. Existing studies on sustainable agriculture have been positioned within discourses of development, environment, or food policy; meanwhile, security studies often view food insecurity as an outcome of instability rather than as an active strategic variable subject to deliberate management. As a result, the role of sustainable agriculture within national security infrastructure has not been adequately theorized or empirically integrated into security research, a gap the paper addresses.

This paper makes a theoretical contribution to national security studies by integrating sustainable agriculture into the concept of non-traditional security. Unlike most other research that has tended to address agriculture, sustainability, and national security in a more or less segmented manner, this paper seeks to conceptualize sustainable agriculture practices as being a type of strategic infrastructure that facilitates food, social, and environmental sustainability.

From a policy perspective, the significance of the current study lies in its emphasis on integrating sustainable agriculture into national security. Its findings on the concept are significant for policymakers concerned with food security, agricultural issues, and national security, as a tool for addressing evolving threats such as climate change and dependence on food imports, which may stem from international disruptions to food supply chains.

LITERATURE REVIEW

National Security

National security is commonly defined as the system of protecting the nation from various threats. The concept was initially rooted in the realist theory, mainly viewing security through military perspectives. Lippmann (1943) defined security as a condition where a nation does not have to sacrifice its legitimate interests to avoid war and is able, if challenged, to maintain them by war. Another definition was brought up by Harold Lasswell as 'freedom from foreign dictation'. Wolfer Arnolds later built on to this definition by adding elements such as the lack of fear, saying that security in an objective sense measures the absence of threats to acquired values, and in a subjective sense, the absence of fear that such values will be attacked' (Lucinescu, 2021).

With a primary goal to protect the people, economy, and institutions, development has expanded the domains of national security to encompass non-military elements such as food and environmental security (Basset, 2024). As the development of technology arises, the security environment becomes more complex. A recent study by Putri et al. (2024) shows that globalization has profoundly affected security by accelerating cross-border mobility, expanding access for extremist groups, and exacerbating environmental damage. Emerging security threats are evidence of the growing urgency for nations to develop security paradigms that also include complex, multidimensional, non-traditional threats.

Sustainable Agriculture

Sustainable agriculture is a system of food production serving as an alternative to the present chemical- based agriculture system. The development of this system is intended to be a system free of chemicals that could protect the environment, conserve natural resources, and further push financial independence (Singh & Mondal, 2017). The 1990 "Farm Bill" mentioned sustainable agriculture as food production practices, both plant and animal, with five main long term purpose, namely: (1) satisfy human nutrition needs, (2) enhance environmental quality and national resources, (3) optimize the use of natural resources and naturally occurring processes, (4) sustain the economic viability of farm operations, and (5) enhance the quality of life for the society, especially farmers (Cohen et al., 1991).

The concept of sustainable agriculture ensures that practices are done with little to no harm to the environment, society, and economy. The application of this is site-specific and involves techniques such as rotating crops, cover cropping, agroforestry, conservation tillage, and integrated veterinary practices (Sheeba et al., 2023). The development and implementation of sustainable agriculture require continuous assessment by farmers and scientists, based on their impacts on social, environmental, and health aspects (Singh & Mondal, 2017; Sinha et al., 2009).

The importance of sustainable agriculture lies in its capacity to balance productivity with long-term ecological and economic sustainability. The methods of this system are intended to protect the environment, conserve natural resources, diminish the use of natural resources, and push for financial independence (Sheeba et al., 2023). It is required that the system ensures maintenance of soil microbiology and fertility, long-term productivity and stability, minimum to no use of tillage and agro-chemicals, efficient water management techniques resilience to extreme climates, preservation of crop diversity, preservation of natural resources, preservation of benevolent organisms, flora, and fauna, preservation of groundwater table, preservation of good health, and resource efficiency (Sinha et al., 2009)

METHODOLOGY

The study employs a qualitative approach based on a review of the literature. Data used in this study were collected from peer-reviewed academic articles, policy reports, and other institutional publications. The sources were chosen to provide a comprehensive understanding of the impacts of sustainable agriculture on national security (Arlene, 2019; Booth et al., 2016).

RESEARCH RESULT AND DISCUSSIONS

The growing need for nations to address food and environmental security underscores the need to consider sustainable agriculture. While agriculture has historically served as the foundation of food provision, the intensification of farming practices following the Green Revolution has introduced new vulnerabilities, particularly environmental degradation and resource depletion.

Summary of Literature Review Findings

Before advancing the discussion, Table 1 summarizes key strands of the literature reviewed and clarifies how existing studies inform the present analysis.

Table 1. Summary of Literature Review Findings

No.	Author(s) / Year	Journal / Source	Main Focus	Key Findings Relevant to This Study
1	Sinha et al. (2009)	*Environmental Science & Pollution Research*	Chemical vs. sustainable agriculture	Chemical-intensive farming degrades environment and health; sustainable practices reduce long-term risks
2	Pretty (2008)	*International Journal of Agricultural Sustainability*	Sustainable agriculture & productivity	Sustainable practices enhance resilience and long-term yields
3	Tendall et al. (2015)	*Global Food Security*	Food system resilience	Resilience depends on environmental, economic, and social dimensions
4	Hendrix & Brinkman (2013)	*Journal of Peace Research*	Food insecurity & conflict	Food insecurity acts as a threat multiplier for social unrest
5	Basset (2024)	Policy analysis	Environmental security	Soil and environmental degradation undermine national stability
6	Abbott (2012); Clapp (2017)	Political economy studies	Food trade & dependency	Import dependence increases vulnerability to market shocks
7	Economist Impact (2022)	*Food Sustainability Index*	Comparative food systems	High sustainability performance correlates with stronger national outcomes

This literature review emphasizes that while the concerns of food security, sustainability, and conflict have been widely studied, the further concern within the framework of national security remains limited, which is the focus of this paper.

Enhancing Food Security and Reducing Dependency on Imports

The current global food system is characterized by uncertainty in global food supply chains and vulnerability to external shocks. It is therefore important for nations to achieve food self-sufficiency. The FAO (1999) defines food self-sufficiency as "the extent to which a country can satisfy its food needs from its own domestic production." The concept of food self-sufficiency refers to the condition in which a nation produces food in an amount equal to or greater than its domestic consumption.

The condition of food self-sufficiency is incredibly beneficial as it not only supports food security, but also enhances national resilience. This condition enables a country not to depend on food imports, as this carries significant risks. Dependency on imported food exposes countries to the volatility of global markets, where price instability and export restrictions can undermine domestic stability (Abbott, 2012). Moreover, practices of sustainable agriculture, from crop diversification, soil regeneration, precision farming, and reduced reliance on the use of chemicals, are implemented to enhance domestic production capacity, leaving minimum harm to the environment, so the benefits are sustainable and long-term. By integrating environmental, social, and economic considerations, sustainable agriculture strengthens national resilience and supports long-term food security (AlFadhly et al., 2024).

Sustainable agriculture contributes to national stability by strengthening food system resilience. This is supported by Tendall et al. (2015), which defines food system resilience as the capacity of food systems to absorb disturbances, adapt to change, and continue to ensure food security over time. Food system resilience, as this article states, does not only rely on the amount produced, which is a major shortcoming, because it overlooks many aspects, including environmental sustainability, economic viability, and social stability. Sustainability in agriculture, therefore, enhances a nation's capacity to withstand shocks such as global warming by increasing soil productivity, conserving water resources, and reducing dependence on external inputs. Sustainability in this context acts as a strategic asset for increased food system resilience, which in turn supports long-term national security.

Role in Preventing Social Unrest and Conflict

It's been evident that conflict and violence are driven by a wide range of factors, including economic, social, and environmental issues. Hendrix and Brinkman (2013) studied the causal relationship between food insecurity and various forms of violence, including civil and communal conflict. The lack of food supply could result in social unrest, possibly leading to conflict. Furthermore, during conflict, food insecurity can serve as a multiplier.

It's well known that food is closely linked to a nation's agricultural system. However, a poorly managed agricultural system could also have countervailing effects on conflict. Environmental damage and crop failures, resulting in acute food insecurity, might motivate people to pursue war aims by increasing social grievances, a form of motive for acts of rebellion. This contrasts with the aim of sustainable agriculture, which, like conventional agriculture, seeks to provide adequate food while minimizing environmental damage. By reducing chemical contamination and improving food quality, sustainable agriculture contributes to public health, further reinforcing social stability (Hendrix & Brinkman, 2013).

Environmental Resilience as a Foundation for National Stability

Environmental security is an important aspect of national security. Threats from this sector, such as soil erosion, water scarcity, and biodiversity loss, undermine long-term national stability, one of which affects the supply chain. The disruptions would also lead to shortages in resources, food production, and

distribution, which would increase societal vulnerability and may escalate into broader economic and security challenges. Such threats are greatly impacted by human activities that prioritize short-term benefits, which disrupt ecological integrity (Basset, 2024).

As conventional agricultural practices prioritize quantity over quality and integrity, the environment is taking the consequences. The current agricultural practices have led to environmental degradation due to the use of chemicals and poor management. Basset (2024) emphasizes the importance of secure and sustainable soil management as it is the foundation for not only food security but also national security, given its central role in sustaining agricultural productivity and economic stability.

Sustainable agriculture is key to strengthening environmental resilience. Through practices such as agroforestry, integrated pest management, conservation tillage, and climate-resilient crop varieties, sustainable agricultural systems help preserve ecological balance while reducing vulnerability to climate chocks. These approaches enhance the adaptive capacity of agricultural systems by maintaining soil health, conserving water resources, and stabilizing yields under changing climatic conditions (Pretty, 2008).

These practices enhance adaptive capacity to climate change, reducing the likelihood of climate-induced crises such as food shortages, displacement, and resource-based conflicts. As climate change increasingly intersects with security concerns, agricultural sustainability emerges as a critical element of climate security policy. States that invest in resilient agricultural systems are better positioned to withstand environmental shocks and avoid cascading security risks associated with ecological decline (Altieri et al., 2018).

Agriculture as Strategic Security Infrastructure

The growing knowledge of the food system being an essential foundation for nations has led to increasing considerations for governments to integrate sustainable agriculture into national security frameworks. Evidences have shown that disruptions in the food system have impacts on state stability and societal functioning (National Research Council, 2010). Strategic policies such as food reserve management, technological innovation programs, and institutional support for sustainable farming are vital in enhancing national preparedness against geopolitical, environmental, and economic crises (FAO et al., 2021).

Integrating sustainable agriculture into national security enhances resilience as it reduces dependence on global market and other external actors, therefore reduces exposure to its volatility due to price instability and export restrictions (Abbott, 2012; Clapp, 2017). This integration also aligns with the current shift in security studies, moving from conventional military perspectives to include environmental, economic, and societal dimensions of security. With the expanded understanding, sustainable agriculture functions both as a foundation for national resilience and a safeguard for long-term national stability (Buzan et al., 1998; Martin & Anderson, 2012).

South Korea has shown great progress in institutionalizing sustainable agriculture into its security planning. The Economist Impact (2022) marked South

Korea in its Food Sustainability Index 2021 as one of the countries with very high performance in sustainable agriculture. Given the risks the country faces, the government has taken issues in the food and agriculture sector and integrated sustainable agriculture into its strategic security. South Korea's strategy for enhancing agricultural productivity and sustainability is evident in its investment in research and development of smart agriculture technologies, such as AI-based monitoring systems and greenhouse automation. Through this approach, the government aims to stabilize domestic food production while minimizing land and water constraints, therefore addressing challenges such as climate change and resource limitation. As part of their national food security planning, the government emphasizes the importance of maintaining its strategic grain reserves, which also serve as a buffer against global supply disruptions (Lee et al., 2022; OECD, 2018).

Challenges

Despite its potential to enhance food security and national resilience, the widespread adoption of sustainable agriculture is constrained by several factors. Limited farmer engagement remains a key challenge, often driven by short-term economic pressures and concerns over income stability. Sustainable practices may require upfront investments, changes in traditional methods, or delayed returns, making them less attractive without adequate incentives or support. In addition, institutional weaknesses, such as fragmented policies, limited administrative capacity, and insufficient inter-agency coordination, undermine the effective implementation of sustainability-oriented agricultural programs (Sharma & K.C., 2024).

These challenges are further compounded by gaps in technical support and knowledge dissemination. Sustainable agriculture relies on context-specific expertise in soil management, climate-adaptive cropping, and integrated pest control, yet agricultural extension services in many regions remain under-resourced and inaccessible. From a national security perspective, these implementation barriers weaken food system resilience and sustain vulnerabilities to environmental degradation, climate shocks, and external supply disruptions. Addressing these constraints requires stronger state involvement through financial incentives, institutional strengthening, and the integration of sustainable agriculture into broader national security and resilience strategies (Sharma & K.C., 2024).

CONCLUSIONS

Sustainable agriculture constitutes a strategic pillar of national security rather than a purely environmental or developmental concern. As contemporary security threats increasingly emerge from food insecurity, environmental degradation, and socio-economic instability, resilient agricultural systems become essential to maintaining state stability. By strengthening domestic production capacity, reducing reliance on volatile global markets, and safeguarding the ecological foundations of long-term productivity, sustainable agriculture reinforces national food security and resilience.

Beyond food provision, sustainable agriculture contributes to national security by supporting social stability, public health resilience, and environmental sustainability. Stable food systems reduce the risk of social unrest, while environmentally sound farming practices mitigate climate-related vulnerabilities that can exacerbate conflict and crisis. To fully realize these security benefits, sustainable agriculture must be integrated into national security and resilience frameworks through coherent policies and institutional support. Recognizing agriculture as strategic security infrastructure is therefore critical in addressing contemporary and future non-traditional security challenges.

RECOMMENDATIONS

Sustainable agriculture should be incorporated into national security frameworks. Governments need to considering agriculture in the context of national infrastructure and not solely as an economic or development sector. Incorporating food system resilience and sustainable agricultural dimentions into national security strategies and long-term development plans would give states the ability to prepare for and manage non-traditional security threats arising from food security, climate change, and other disruptions within global supply chains.

There must also be improved policy consistency among the agricultural, environmental, and security departments. Issues in this can weaken the effectiveness of sustainable agriculture projects, particularly in nations that are largely dependent on food imports. There must be coordination among various departments, including the agricultural, environmental, security, and national planning departments, for a united response against food security challenges.

Greater investment is also needed for sustainable innovation and capacity building in agricultural innovation. Governments should promote environmentally sustainable farming practices and technologies, biological resources, and climate change-resistant crop systems, as well as offer incentives for farmers to embrace sustainable farming practices. Enhancing domestic production capacity reduces reliance on volatile international food markets and contributes to long-term economic and social stability.

Finally, the importance of food system resilience can also be integrated into national risk assessment and early warning systems. Through the monitoring of indicators such as the condition of the soils, the accessibility of water, the volatility of food prices, and the degree of import dependence, governments can identify potential security risks related to food systems at an easrly stage. Therefore, a security-oriented evaluation framework for sustainable agriculture policies should be adopted to support preventive, evidence-based decision-making and reinforce the strategic value of sustainable food systems

ADVANCED RESEARCH

The study has several limitations that point to important directions for further research. Its reliance on broad literature and the case of South Korea, a high-income country with strong technological capacity, limits its applicability to developing nations facing different economic and structural constraints.

Future studies can compare differences between developed and developing countries concerning the way in which sustainable agriculture can promote security in conditions with limited resources.

The study also does not fully address the transitional risks associated with shifting from conventional to sustainable agriculture. This involves the risks caused by a possible decrease in agricultural production during the transition. Therefore, further studies are still required on the issue of "transition security."

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