

## CRITICAL REVIEW ON SUSTAINABLE AGRICULTURAL DEVELOPMENT

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### **ABSTRACT:**

Sustainable agriculture refers to farming practices that support and extend natural resource availability, preserve the environment, and maximize the use of nonrenewable resources. Sustainable agricultural development is when agriculture uses organic farming techniques to increase food quality while also implementing sustainable agricultural practices to protect the environment. The ecology, future availability of fresh water supplies, or arable land are not harmed by this type of agriculture. In this article, critical review on sustainable agricultural development has been discussed.

**Keywords:** Sustainable, Agricultural, Development

### **INTRODUCTION:**

The ability of a farm to produce food continuously without seriously impairing the health of the ecosystem is known as sustainable agriculture. The long-term consequences of different practices on soil characteristics and processes necessary for crop output are known as biophysical concerns, while the long-term socioeconomic issues are related to farmers' capacity to manage resources like labor and procure inputs. We know a little bit about sustainability's physical components. The practices can harm soil over time: too much tillage, which causes erosion, and irrigation without sufficient drainage, which causes salt to build up in the soil. Some of the finest information on how different methods alter soil qualities that are crucial to sustainability comes from long-term experiments. While air and sunlight are abundant in all places on Earth, soil nutrients and water availability are also critical factors for crop growth. Farmers remove some of these nutrients from the soil during the cultivation and harvesting of crops. In the absence of replenishment, the land would experience nutrient depletion and become unfit for additional cropping. Rebuilding the soil is essential to sustainable agriculture, as is utilizing as few non-renewable resources as possible, such as mineral ores (like phosphate) and natural gas, which is used to turn atmospheric nitrogen into synthetic fertilizer.

### **REVIEW OF LITERATURE:**

Rukhsana (2021) stated that the research, agricultural diversity may be defined as a shift from a single crop's regional dominance to a multitude of crops produced to fulfill the increasing demand for those products. This study looks at agricultural diversification in West Bengal, an eastern Indian state, at the district and sample block levels. The Herfindahl index has been designed to identify various agricultural impacts in West Bengal by analyzing the areas of crop diversification. Certain districts in West Bengal have been identified as having low levels of per capita income diversity, average holding sizes, effective traditional farming methods, and a lack of technology. Crop diversity can only increase if production risk is reduced through technical support, high-quality input supply, insurance coverage, and the presence of contemporary storage and processing facilities in the area. The study's findings indicate that West Bengal's agriculture industry is progressively shifting to produce higher-value goods.

Based on research by John Livsey (2021), there are growing pressures on the resources that the agriculture sector depends on, even though agriculture management strategies have been successful in improving the supply of food needed to fulfill the needs of the growing world population. Growing competition from other industries for shared resources limits opportunities for agriculture system development. Solutions for agricultural management, when attempting to address this limitation, frequently concentrate on issues pertaining to specific resources. However, this exclusive focus could result in inadvertent compromises. A deeper understanding of the trade-offs that could arise from resource-use efficiency measures applied in the agriculture sector is necessary to make wise management

decisions. The purpose of this thesis was to examine the trade-offs that arise when addressing demands imposed on agricultural systems if management solutions are narrowly targeted, with an emphasis on soil and water resources in particular. In general, we propose that, in order to assure sustainability, land management strategies that embrace a more holistic perspective—viewing agricultural systems as pieces of an ecosystem mosaic—should be implemented. According to a global assessment of possible land requirements, the availability of land may limit the amount of food produced at the national level. As a result, allocating space for the development of nutritious crops may result in the loss of land for other crops or uses. States in Africa will experience this limitation the most. In subsequent research, we concentrated on the management of water resources, which are increasingly becoming a constraint for crops with high water requirements, like rice. We investigated the impact of water management strategies on soil attributes by conducting soil sampling in An Giang, a significant rice-producing province in Vietnam, and conducting a meta-analysis of paired plot experiments, which evaluated the impact of water-saving irrigation on rice production. According to the meta-analysis, the replacement of continuous flood irrigation with water-efficient practices has been shown to result in notable decreases in soil organic carbon and possibly organic matter-bound nutrients. This implies that water-saving irrigation may eventually result in lower soil fertility and yields, even if yield losses might not be seen right away. Concerns have been raised about the loss of nutrient-rich, flood-borne sediments in fields in An Giang province, where the yearly floodwaters have been fully controlled. Comparing these fully regulated locations to those with just partially regulated floods, however, we find no evidence of decreased soil nutritional characteristics. More research was done in Tanzania's Kilombero Valley to determine how various land management techniques affected the characteristics of the soil. We observed that irrigation and fertilization had different effects on soil organic carbon, with irrigation boosting soil organic carbon and fertilization decreasing it, when we compared farming practices over a gradient of intensity. Overall, this thesis' findings emphasize the significance of considering options other than satisfying immediate wants, which may have unfavorable long-term effects. The effectiveness of land management strategies used now does not guarantee that they will remain effective later on. The long-term trade-offs that may result from current practices need to be at the forefront of agricultural management, as the pressures placed on agriculture will only rise.

Gopal Bhattacharya (2021) stated that social scientists, especially geographers, have long been concerned with population studies. In geography, classic human geographers have long focused on the study of population expansion. When Uttar Dinajpur was last counted in 1951, there were 528607 people living there; in 2011, that number had dropped to 3007134. Thus, during the course of 60 years, the population increased by roughly 2478527. This was a very significant population rise for such a small district. The district has a total area of 3142 square feet. There are a multitude of socioeconomic issues in the district. Even though Uttar Dinajpur population growth rate has slowed over the past few decades, numerous steps must still be implemented to manage the district's enormous population growth. Uttar Dinajpur is a synthesis of castes, cultures, and religions. Every religious community has unique conceptions of fecundity. There is no set formula for how many children to take. Naturally, the growth rate skyrocketed following independence. Following the realization in the 1990s that there was an overpopulation problem, the district's residents took action along with many governments to stem the population growth. We still have a long way to go before the district reaches its ideal population.

According to Pagliarion E. et al. (2020), the Green Revolution was characterized by a typical top-down approach in global agriculture. The constant external input of chemicals, equipment, guidance, subsidies, and expertise has constrained the level of autonomy, innovation, and accountability of farmers. Agriculture is moving toward alternative models as a result of the complexity and uncertainty that the sustainability issue has added to this primarily linear process of innovation. Agroecology is a cutting-edge agricultural paradigm that places a high emphasis on farm assets while minimizing the use of outside inputs. Agro ecological production depends on farmers managing resources directly and participating

actively in the system of agricultural knowledge and innovation. In one of Italy's most extensively cultivated, lucrative, and environmentally sensitive study areas, a group of farmers, scientists, government officials, and managers of private businesses are testing agroecology in the cultivation of rice. This study focuses on their experiences. The partnership meets frequently to talk about agricultural methods and outcomes, needs, and future directions. It also encourages and participates in research initiatives using a participatory approach based on co-learning and shared accountability. Our work may help to clarify the function of participatory research in sustainable agriculture and the characteristics of effective involvement by utilizing ethnographic techniques like in-depth interviews and direct observation.

According to Ndor E et al. (2020), the agricultural sector in Nigeria used to be one of the main drivers of the nation's economic development. Although various strategies and programmes put in place by various governments to encourage investment and diversification in the agricultural sector have not been able to deliver good or expected outcomes up to the present, the sector started to decline following the oil boom in the 1970s. The development of agriculture in Nigeria is hampered by a wide range of issues, some of which include the impact of climate change combined with the harmful conventional farming practices. These issues have the potential to have an impact on the nation's food security and economic prosperity. Sustainable agriculture is one tactic that has been created as a solution to all of these issues. In order to highlight their implications for the health care system as it affects community and social life in Nigeria, this study will aim to explain the ideas of sustainable agriculture, economic growth, and the role of sustainable agricultural development on economic growth.

According to Arus P (2020), the primary problem for 21st-century agriculture is ensuring access to food for a growing human population, based on sustainability standards and in light of the threat posed by climate change. The issues are inherently complicated, call for a number of coordinated actions, and ultimately depend on the advancement of science and technology in order to make better use of the resources at hand and raise crop yields and food quality to feed the globe. To achieve these goals, it will be essential to employ technologies like genomics, computing, robotics, and nanotechnology correctly. This will require highly qualified users.

Siebrecht, Norman (2020), there are a lot of research studies and publications on sustainable agriculture. Numerous articles examine the need for sustainable agriculture and offer strategies for achieving it. Studies are also casting doubt on agriculture's sustainability at the same time. The so-called implementation gap is the result of a number of barriers that impede or slow down implementation, including theoretical, methodological, personal, and practical concerns. Potential roadblocks to the practical adoption of sustainable agriculture are discussed in this paper. Several approaches and measures are needed to go beyond the challenges and enhance execution. The purpose of this study is to provide examples of how to minimize or eliminate barriers and close the implementation gap. Regretfully, there are no simple fixes due to the variety and complexity of the problems. A more comprehensive strategy that takes into account various factors and stakeholders is needed. Institutionalization, evaluation and system development, education and capacity building, and social and political support are areas of action. Collaboration amongst numerous actors and transdisciplinary work are necessary to better execute the recommendations and suggestions and make them a reality.

Irrigation is used in locations where rainfall is seasonal and insufficient for crop production, based on Suchandra Neogi (2020). Monsoonal land, which receives seasonal rainfall, needs to be irrigated using a well, tank, or canal to maintain agricultural output. Rainfall occurs in India in different seasons and with unequal distribution. The largest area of land under irrigation is in India. The cropping intensity is found to be high in the high-irrigated area and low in the low-irrigated area. The current state of block-by-block farming and irrigation in West Bengal, India's Uttar Dinajpur district, was the main topic of this article. Following the application of various techniques and procedures (such as regression lines, Pearson's product moment correlation coefficient, etc.). The districts have a favorable relationship between the two variables, as has been determined. While using groundwater is the primary method of irrigation, other

methods are also employed in the area to intensify agriculture. While certain blocks have high irrigation capacity, the capacity is insufficient.

Kapoor O. Virat et al. (2019) investigated that the goal of the current study was to evaluate social and economic sustainability as well as how they affected rural livelihoods in north-east India. The entire input self-sufficiency ratio increased from 0.29 to 0.53, an almost two-fold increase, according to the results. Cropping diversification will be higher, and the farming system will be more relatively sustainable, the lower the index score.

Goutam Sarkar (2019) explored that "globalization" really refers to international integration (II). By enabling agriculture to develop significantly faster than domestic consumption, globalization can significantly enhance the role of agriculture as an engine of growth for low-income people. Approximately 67% of the district's population still makes their living from agriculture, and of the district's 312,470 hectares of land, 272,564 hectares, or 87.23%, are under cultivation (Census of India, 2011). Through its mandated activities on the training of practicing farmers, rural youth, and extension functionaries, front-line demonstrations, and on-farm adaptive trials to enhance the district's overall production as well as the generation of self-employment, Uttar Dinajpur Krishi Vigyan Kendra (UBKVK) is committed to bringing forth agricultural development in the rural blocks. Thus, the current study examines how globalization has dominated agriculture in the district of Uttar Dinajpur. An MS Excel sheet was used for the statistical analysis of the data, and ArcGIS software (version 10.3.1) was used to create the maps. This paper's primary focus is on the effects of globalization on agriculture and the growth rates of production, improved cropped area, and enhanced irrigated area from 1981 to 2016 using secondary data.

Human development, according to Prosenjit Kayal and Indrajit Roy Chowdhury (2018), is the process of increasing people's freedom and opportunity while also enhancing their well-being. The term "human development" can be defined very simply as the biological and psychological growth of an individual over the course of his life. These two ideas make it abundantly evident that the most important factor in a region's overall development is its human population. This study computes a composite index to assess the variation in the district of Uttar Dinajpur's Raiganj Community Development Block's degree of human development. The study has taken into account a number of criteria, such as the adult literacy rate, enrollment ratio, delivery safety, safe drinking water, immunization rate, and work participation rate. These factors have been used to generate three indices that are distinctive to the Human Development Index: the Economic Livelihood Index, the Health Index, and the Education Index. Primary and secondary data from a variety of government and non-government sources served as the foundation for the current investigation. As can be observed from the results, the majority of the villages located in the Raiganj block's periphery do not receive proper services and continue to live in poverty. Therefore, an attempt has been made to highlight the Raiganj C.D. Block's level of human development in this study work, followed by some post-deterministic measures that should help the periphery region's backwardness issues be resolved soon.

Barbara Kielbasa et al. (2018) stated that the study reports the findings of a research project that aimed to reduce nutrient losses from farms by using strategies for more sustainably applying fertilizers. This case study examines a few different facets of farm management, with an emphasis on sustainable agriculture and its instruments. The primary objective of the research was to examine and assess farmers' understanding of the fertilization process and its components, as well as the implementation of sustainable farming practices on farms. The study emphasized how crucial nutrient management is to farming that is sustainable. An analysis was also done on the connections between the opinions and actions of farmers. The key concern was the introduction of sustainable farm management practices on the farms, along with groundwater nutrient leaching control methods. For the case study, interviews with 28 farmers from two

regions of Poland were conducted to learn about their perspectives. Farmers thought that their farming operations were more sustainable than they had been in the past, on the whole. They showed that they understood the concept of sustainable agriculture in general. Nonetheless, a lot of farmers continued to show a weak understanding of farm-level nutrient balances and flows. Rather than specialized knowledge acquired from an academic or professional course, their knowledge and perception were based on general knowledge. The farmers showed an awareness that, while some novel or inexpensive ways to improve management in a sustainable and environmentally friendly manner may be implemented, a broader acceptance of sustainable agriculture practices is still required.

According to Hans VB (2018), the new agenda for Indian agriculture should have a purpose that specifically focuses on enhancing agricultural systems and integrates rural development. The goal of guaranteeing justice and sustainability becomes even more crucial now that Indian agriculture has passed the threshold from traditional farming to modern agribusiness. To fulfil the growing demand, more effectively combat poverty and malnutrition, and improve ecological sustainability, agriculture must evolve. The task is difficult yet doable. This essay examines the problems in developing sustainable agriculture. With more farmers adopting an open mindset and the government launching fresh initiatives, there is hope for positive developments. According to the study, issues that are primarily institutional, structural, and administrative must be resolved in order to advance development generally and sustainable agricultural development specifically.

Chopra is a community development block that operates as an administrative entity under the Islampur subdivision of West Bengal's Uttar Dinajpur district, according to DHDR (2018). It has been Bengal's breadbasket for many centuries thanks to its distinctive physiographic and agroclimatic features, producing huge amounts of numerous varieties of fine and coarse rice as well as important economic crops like jute. More than two-thirds of the active workforce continue to draw their livelihoods directly from agriculture and allied occupations, and the livelihood profile has changed in parallel with these traditional agricultural patterns.

Agriculture has been the foundation of the Indian people's occupation since ancient times, according to research by Satyen Sarkar and Tapan Kumar Ghosh (2017). Approximately 70% of India's population depends on agriculture for their livelihood, and even with deliberate modernization over the past 60 years, the sector is still highly regarded. It makes a significant contribution to both exports and the gross domestic product. A considerable portion of the workforce—more than two-thirds—is employed in agriculture, and they rely on it for trade in agricultural products, agro-based enterprises, etc. About 60% of all workers in the nation are employed in agriculture, which is the major industry in the nation. This paper examines the differences across districts in West Bengal's rural agricultural sector and how these differences affect agricultural growth by conducting an inter-temporal analysis of 18 districts using a cross-sectional study design. A cluster of rural economic districts has been constructed for ten selected indicators for the years 1990–1991; 2000–01; and 2010–2011. According to the investigation, there are still significant differences in the district-level availability of economic statistics in rural areas. Regarding the growth of rural infrastructure, district patterns have likewise largely stayed the same. Agriculture in West Bengal ought to encourage diversification and an emphasis on exports. For more balanced regional development, the underprivileged districts require special attention. This means both the public and private sectors need to invest more in rural infrastructure.

Based on B.J. Shirazy et al. (2017), the creation of agricultural planning is heavily reliant on accurate and thorough statistics about the current cropping patterns, cropping intensity, and crop diversity of a given area. These statistics serve as a guide for decision-makers in the fields of policymaking, research, extension, and development. In order to record the current cropping patterns, intensity, and diversity for the Dinajpur region, a pre-tested semi-structured questionnaire was used to conduct a survey across all of the upazilas in the region in 2016. Boro-Fallow-T is the most significant cropping pattern. Aman was distributed throughout all of the upazilas and made up around 41% of the region's net cropped area

(NCA). Wheat-Fallow-T comprised 9% of NCA, the second-largest area. Aman, dispersed among eighteen upazilas. Over 112 distinct cropping patterns were found throughout the entire area. Thirty cropping patterns were found in the Panchagarh district's Boda upazila, while the Dinajpur district's Kaharolupazila had the fewest—eleven. Birampur has the lowest reported crop diversity index (CDI), at 0.708, followed by Ghoraghat, Dinajpur, at 0.753. The highest reported CDI was 0.955 in Ranisonkail, and the next highest was 0.952 in Thakurgaon's Baliadangi. Cropping intensity was found to range from 206 to 249%, with Khansama in Dinajpur having the highest value and Boda in Panchagarh district having the lowest. Overall, the Dinajpur region's CDI and cropping intensity were calculated to be 0.924 and 229%, respectively, indicating that land usage and crop diversification are insufficient to meet the needs of the country.

D.K. Behera (2015) explored that the inclusive growth approach has been in place since the start of the 11th five-year plan and will continue to be a significant factor in deciding the long-term viability of India's agricultural growth. A key element of the inclusive growth strategy is agricultural development. The overall goal of this article is to connect agriculture development with inclusive growth through rural transformation led by farm sector expansion. According to the study, Gujarat's agricultural industry grew faster than India's from 2001–2002 to 2010–11. Higher production of wheat and cotton has been sown in response to the growth. It has also influenced some external elements, such as increasing net and gross irrigated area, increased fertilizer use, and increased use of contemporary agricultural tools, among others. According to an overall review of Gujarat's and India's performance in terms of agricultural and related growth, Gujarat appears to have facilitated inclusive agricultural development by focusing on the livestock and horticulture industries with the goal of boosting farm income and sector growth.

Velten S et al. (2015) stated that the concept of sustainable agriculture has gained popularity since the Brundtland Report's 1987 release. However, the definition of sustainable agriculture is quite nebulous and unclear, making its use and application very challenging. By highlighting areas of complementarity and concern between newly developing definitions of sustainable agriculture, we hope to expand understandings of sustainable agriculture from a social science and governance perspective in this systematic review paper. In order to achieve this, we performed a structured literature review along with a cluster analysis to: (1) identify the general ideas and aspects associated with sustainable agriculture; (2) identify patterns and differences in how these ideas and aspects are adopted or applied; (3) assess how the various ideas and aspects of sustainable agriculture are combined in the scientific debate, and determine whether these various conceptions correspond with those that have been previously established. This study has produced two worthwhile results. The first is a framework for comprehending sustainable agriculture's elements. The second result is in emphasizing approaches for those working in sustainable agriculture to constructively address the complexity and diversity of this idea.

Sharma R et al. (2014) investigated that the setting for agricultural growth evolved, so did the approaches to innovation. To slow down the rate of change, various strategies, including the National Agricultural Research System (NARS), the Agriculture Knowledge and Information System (AKIS), the farmer first and last approach, Participatory Rural Appraisal (PRA), and Public Private Partnerships (PPP), have been developed over time. Due to a variety of factors, current agricultural research initiatives are failing to result in social and economic change. It becomes vital to create new strategies in order to deal with, compete against, and endure new problems. The concept of the Agriculture Innovation System (AIS) approach provides a fresh framework for examining how science, technology, and other actors interact to produce commodities and services in this situation. It acknowledges the significance of specific interactions and linkages for the flow of information in dynamic biophysical and social systems. The shrimp farming and small-scale food processing industries in Bangladesh, the medicinal plant and vanilla sectors in India, the pineapple and cassava processing industries in Ghana, and the production and marketing of agricultural commodities by U.K. cooperatives in the United Kingdom are some examples of successful applications of the Agriculture Innovation System in developing and developed nations. As a result, rather than being considered solely as a discovery or creation, innovation is seen in a social and

economic context. The idea of an innovation has influenced a more comprehensive method of organizing the creation and application of information.

According to Narayan BS (2012), the agricultural sector has grown extraordinarily since the middle of the 20th century. The Green Revolution's technology-driven expansion has significantly reduced the global supply of food grains, ensuring the food security of the world's expanding population. Despite the recent boom in manufacturing and services and the falling contribution of agriculture to the national economy, India may still be safely classified as an agricultural nation because the majority of its workers (65%) is still involved in agriculture and related industries. In India, policies for organic farming and sustainable agriculture are discussed, as well as potential course of action.

Since the middle of the 20th century, the agricultural sector has grown phenomenally globally, based on Babar Someshwar Narayan (2012). The increase, propelled by the technology of the Green Revolution, has significantly reduced the total amount of food grains available, guaranteeing food security for the expanding population. However, there is a significant sustainability challenge for the next stage of growth. Since the bulk of its workforce (65%) is still employed in agriculture and related industries, India can be securely classified as an agricultural nation despite the recent boom in manufacturing and services and the declining proportion of agriculture in the country's income. The necessity of sustainable agriculture has been underlined in this research. Possible initiatives in India, as well as policies for organic farming and sustainable agriculture, are explored.

Chandan Roy (2011) stated that a state's ability to grow economically is based on how many economic possibilities its citizens have access to. It depends, on the one hand, on the geographic advantages, which include both natural resources and conveniences unique to the area. However, to fully utilize such resources, both the public and private sectors must adopt an entrepreneurial mindset. Historical data has shown that North Bengali districts have long been denied access to sufficient security and assistance in subsequent planning and other thrust programs. Due to unfavorable geographic conditions and inadequate infrastructure in comparison to districts in the south, many areas remain perpetually underdeveloped. The districts of Uttar Dinajpur and others are experiencing similar economic hardships. 1992 saw the division of the former West Dinajpur District, giving rise to the new district. The district is among the most economically disadvantaged in the state, and even within the district, the level of poverty differs between blocks in terms of many economic metrics. The district's residents mostly rely on agriculture for both their economic and survival needs.

## **CONCLUSION:**

Three primary objectives are integrated into sustainable agriculture development: economic prosperity, environmental health, and sustainable livelihoods. To put it another way, the foundation of sustainability is the idea that we must satisfy our current demands without endangering the capacity of future generations to satisfy their own. The promotion of soil and water management, high-yielding cultivars, enhanced agronomical techniques, plant protection measures, enterprise diversification, and risk-aversion technologies are all included in the strategic action plans. Preservation and advancement of the environment, ecosystem, integrated agricultural system, traditional food crops, and indigenous culture Restructure water management organizations and create a water rights-based water pricing system to deal with the depletion of water supplies for diverse uses, including drinking, farming, fishing, and other uses. Encourage better agricultural practices such as grading and packaging, value-adding of conventional and non-traditional food grains through effective processing systems, drying and storing of farm output, etc. Investigating new local and international markets; streamlining and consolidating the marketing system; growing the marketing network; upholding differentiated pricing; facilitating easier access to financial institutions; and offering a productive means of transporting farm products.

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