

Balancing Plates and Planet: The Sustainability-Nutrition Nexus

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Abstract

This paper explores the vital relationship between sustainable agriculture and nutrition security amid global hunger, malnutrition, and environmental degradation. As billions face the spectre of food insecurity and hidden hunger, the paper emphasises the need for comprehensive policies and programs at global and national levels. These initiatives should promote sustainable agricultural practices that ensure food availability and prioritise nutrition security by providing access to a balanced diet rich in essential nutrients. The paper emphasises the pressing issue of poverty, particularly in rural areas, and fosters social equity while promoting local food systems that reduce reliance on global supply chains. The paper explores the shift in societal perceptions of sustainable agriculture and nutrition, which has led to behavioural changes among consumers and producers. The paper also focuses on the global population increase and the urgency to achieve sustainable development goals; policymakers must prioritise sustainable agriculture to simultaneously address food and nutrition security, environmental sustainability, and social equity.

Introduction

In an era marked by unprecedented challenges in environmental sustainability and global food security, the interplay between what we put on our plates and the health of our planet has become a focal point of concern and discourse. Good health is directly associated with a healthy diet. For the physical growth and cognitive development of the

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human being, it is the most imperative question at present whether the food consumed by the man is nutritious. Billions of people across the globe face the persistent spectre of hunger, malnutrition, and food insecurity, even as ample food resources are produced. Simultaneously, we confront the ecological consequences of unsustainable agricultural practices that strain our planet's resources, threatening the very foundation of our food systems. In this delicate equilibrium, a crucial paradigm emerges: sustainable agriculture and its pivotal role in addressing nutrition security with food security and environmental sustainability is also inextricably linked to reducing hunger and poverty as a social problem.

Over 2 billion individuals globally experience hidden hunger, surpassing the 805 million who lack access to sufficient calories. Countries such as Sub-Saharan Africa and South Asia are particularly affected, with high prevalence rates (FAO, IFAD, and WFP, 2014). While hidden hunger is prevalent in developing nations like India, micronutrient deficiencies, notably iron and iodine, are widespread in developed regions. To alleviate this problem, in India, the Government has started the distribution of fortified rice (rich in iron, zinc, folic acid, and Vitamin B12) through the Public Distribution System. It means that nutrition security is a much broader concept than food security in recent times; it not only ensures access to sufficient calories but also emphasises the importance of a balanced diet rich in essential nutrients for physical and cognitive well-being.

The paper underscores the critical requirement for global and national level adoption of policies and programs to meet global nutrition targets. This involves advocating for sustainable agricultural practices aimed at addressing all aspects of malnutrition in humans while also safeguarding the environment through conscientious food production and food systems.

Principles and Basis of Sustainable Agriculture

The term began gaining traction in the United States during the 1980s, receiving formal recognition in US legislation for the first time in 1985. This paved the way for establishing the Low Input Sustainable Agriculture (LISA) program. By 1990, the US Congress officially addressed and defined 'sustainable agriculture' within the legal framework. Since then, various stakeholders, including civil society, the private sector, multilateral institutions, and different levels of government, have embraced the concept of sustainable agriculture. In India, the national government launched the National Mission for Sustainable Agriculture in 2014-15, providing a formal definition of sustainable agriculture within the Indian context and identifying its ten key dimensions (NMSA, 2014). The Food and Agriculture Organization defines sustainable agriculture as the strategic management and preservation of resources, coupled with the direction of technological and institutional advancements, to guarantee the fulfilment of current and future human needs. Consequently, sustainable agriculture constitutes the segment of agricultural progress that is environmentally sustainable, utilises appropriate technology, remains economically feasible, and is socially embraced (FAO, 1991).

Sustainable agriculture is a vital remedy for addressing the ongoing challenges within our food systems. It covers various agricultural approaches crafted to meet present requirements while ensuring the capacity of future generations to fulfil their necessities. It emphasises the enduring well-being of the environment. Their objective is to mitigate the adverse effects of agriculture on ecosystems, including but not limited to soil erosion, water pollution, and habitat destruction. During the 1960s, Rachel Carson's book, "Silent Spring" (1962) presented the initial conclusive proof of ecological harm caused by the overuse of chemicals and pesticides in agriculture. Carson demonstrated the correlation between the decline of raptor birds and the thinning of eggshells, directly attributed to the growing dependence on synthetic pesticides (Madden, 1998a). Hence, various techniques like crop rotation, organic farming, natural farming, agroforestry, etc., enhance soil fertility and reduce the need for harmful chemical inputs. Sustainable farming methods encourage biodiversity by preserving natural habitats, using cover crops, and avoiding monoculture farming. This method not only benefits local wildlife but also makes the agricultural system more resilient to pests and disease.

Sustainability involves meeting our present needs while ensuring that future generations can meet their own, considering both natural resources and social and economic factors. Recognising sustainability as a concept shaped by society (Webster, 1999) and still in the process of full realisation (Webster, 1997; Rasul and Thapa, 2003) highlights the role of sociology in substantially advancing agricultural sustainability. Essential to grasping the sociology of sustainable agriculture is a clear comprehension of agriculture and its sustainable counterpart. India is primarily an agricultural country and plays a crucial role in increasing food availability by supporting livelihoods and contributing to India's economic growth. Livelihood refers to the sufficient provision of food and financial resources for an individual or family to fulfil basic requirements. Security in this context implies stable ownership or access to resources and income-generating endeavours, encompassing reserves and assets to mitigate risks, manage unexpected challenges, and address contingencies (Acharya, 2006). It means that it is not only a primary source of food production but also a foundation for rural economies. Beyond nourishing communities, agriculture generates income by selling crops and livestock, fostering economic stability and reducing poverty. Moreover, it sustains rural communities by offering employment opportunities, preserving cultural traditions, and supporting social cohesion. Agriculture's multifaceted role extends food security, economic growth, and promoting environmental sustainability, making it an indispensable component of livelihood systems worldwide.

Socio-Economic and Environmental Elements of Sustainable Agriculture

An intricate interaction of socioeconomic and environmental factors significantly shapes the sustainability of Agriculture. Socio-economic factors include access to resources, education, and market opportunities. In developing nations where agriculture is a significant contributor to livelihoods, access to land and credit are crucial. For instance, approximately 1.5 billion people worldwide depend on smallholder farming, but often, they lack access to adequate resources, limiting their capacity to adopt sustainable

practices. In parallel, education and training programs are pivotal in disseminating knowledge about sustainable farming techniques, like organic farming or crop rotation. By reducing production costs and enhancing yields through sustainable practices, it can increase income and job opportunities. This, in turn, helps alleviate poverty and fosters social equity in rural areas. Rural areas experience a heightened prevalence of poverty, with 75 per cent of the global impoverished population residing and labouring in these regions. The vast majority, nearly 90 per cent, of impoverished individuals are concentrated in Asia and Sub-Saharan countries. Specifically, Asia hosts around two-thirds of the world's impoverished population, with South Asia alone representing 43 per cent of this demographic (IFPRI, 2001). Sustainable agriculture also promotes local food systems, reducing the reliance on the global supply chain and bolstering regional economies.

Environmental determinants are equally vital. Climate change, land degradation, and water scarcity are significant challenges to sustainable agriculture. The impact of climate change is evident with changing rainfall patterns and increased extreme weather events. According to the World Bank, by 2015, it was projected that as many as 86 million individuals in Sub-Saharan Africa might be compelled to relocate due to climate-induced alterations in agricultural practices. Sustainable agricultural practices, such as no-tilling farming and agroforestry, can mitigate climate change effects, improve soil quality, and enhance resilience. Government policies and international initiatives are also crucial. According to a report by the United Nations Environment Programme, providing financial assistance and implementing policies that support sustainable agriculture can effectively diminish poverty, improve food security, and safeguard the environment. Consequently, the various factors influencing sustainable agriculture are interconnected and should be addressed collectively to ensure the welfare of current and future generations.

Need for Sustainability in Agriculture

The Green Revolution initiated in 1960 aimed at enhancing crop production through increased fertiliser and pesticide use, introduction of high-yielding crop varieties, mechanisation, and improved irrigation. While it successfully bolstered food security, it fell short in addressing nutritional deficiencies, evident from India's Global Hunger Index (GHI) ranking of 107 out of 121 countries in 2022, indicating a severe hunger level. Recent data highlights India's highest child wasting rate among GHI-covered nations, although there have been improvements in child stunting and mortality rates from 2014 to 2022. Despite progress, the prevalence of undernourishment in India rose from 14.6% (2018-2022) to 16.3% (2011-2021), impacting approximately 224.3 million individuals, contributing to a global total of 828 million undernourished people (GHI, 2022).

In Rural regions, the presence of food largely hinges on crop yields and the financial situation of the inhabitants. Micro-nutrients are particularly crucial for the well-being of women and children. The nutritional condition of women during conception and

throughout pregnancy profoundly influences the growth and development of the fetus over the long term. Approximately 18 million infants suffer from neurological impairments annually as a result of insufficient iodine intake. Severe anaemia is a contributing factor to the mortality of 50,000 women and children annually (UNSCN, 2005; Micronutrient Initiative, 2014).

The significance of sustainable agriculture is on the rise globally. Sustainable agriculture transcends the conventional confines of crop cultivation and livestock management. It compasses a complex interplay of ecological, economic, and sociological factors, demonstrating its centrality in the global quest for nutrition security. Sustainable Agriculture entails farming practices that continuously meet increasing demand without imposing excessive economic, environmental, or social costs in line with rising incomes. It emphasises the need for agricultural systems to yield sufficient high-quality food while ensuring ecological safety (Donald, L.P and Donald, L.W: 1995). The various data shows that using different kinds of sustainable agricultural practices like organic farming, natural farming, rice- intensification system, crop rotation and intercropping, etc., improves the nutritional status of crops and ensures food security without damaging the environment. In the study, it is found that the use of Azolla (as green manure) bio fertiliser instead of chemical fertiliser enhances the yield and proper growth of crops. This means that the use of Azolla as a biofertiliser provided higher production along with higher nutritional value than the chemical fertiliser (Mishra and Dash, 2014). The use of nano fertiliser (NFS) can enhance crop production with reduced nutritional losses with significant advantages for the physiological fitness and performance of crops as well. Biofortification emerges as a promising, cost-effective, and sustainable approach to providing micronutrients to populations with restricted access to varied diets and other micronutrient interventions. Hence, they may prove a milestone in achieving SDG goals as we are handling the problem of nutrition security.

Sustainable Agriculture as a Way of Reducing Food Deserts and Enhancing Food Justice

Sustainable agriculture is a powerful tool in the fight against food deserts and a catalyst for enhancing food justice. Food deserts refer to regions where inhabitants face challenges in accessing fresh, nutritious and reasonably priced food, with marginalised communities bearing a disproportionate impact. Encouraging local food cultivation and distribution can facilitate enhanced access to fresh produce, enhancing food quality and public health on a broader scale. It also addresses food justice issues by focusing on equitable distribution and access to nutritious food. Local, community-based farming can empower marginalised communities, provide economic opportunities, and ensure their wages for farmworkers. A report by the U.S. National Research Council found that community-supported agriculture (CSA) initiatives and urban farming can improve access to fresh, healthy produce, particularly in underserved urban areas.

Moreover, sustainable farming practices prioritise environmental and social responsibility, ensuring that agricultural activities are conducted ethically and without

harm to surrounding ecosystems or marginalised communities. By promoting equitable access to healthy food, reducing the environmental impact of agriculture, and supporting fair wages for farmers, sustainable agriculture directly contributes to the broader goal of food justice, making it a key strategy to address the inequalities that perpetuate food deserts and improve access to healthy, affordable food for all.

Nutrition Security and its Sociological Implications

As per IFPRI, nutrition security ensures sufficient protein, vitamins, energy, and minerals for all household members (IFPRI, 2012). It extends beyond mere food availability to encompass access to safe, plentiful and nutritious food, vital for maintaining a healthy and active lifestyle. Nutrition security encompasses not only the quantity of food but also its quality, safety, and cultural relevance. Within sociology, examining nutrition marks the inaugural inclusion of a socio-cultural viewpoint. George Simmel interprets nutrition as a cultural element and a socially regulated behaviour that dictates what, how often, and what social context individuals should consume. According to Simmel, meal etiquette and aesthetics carry significant importance. Food culture thus serves as a means of socialisation and a marker of one's social standing (Simmel, 4,187-192,2010). An integral aspect of ensuring nutritional security involves the concept of food security, which pertains to the availability and accessibility of food. Nutritional deficiencies can result in malnutrition, undernutrition, and deficiencies in micronutrients, often termed as 'hidden hunger'. Hidden hunger arises when there is inadequate intake and absorption of crucial vitamins and minerals, hindering optimal health and development. In countries like India, there is a shift from traditional diets, which are primarily based on minimally processed foods, to diets consisting of highly processed, energy-dense, and nutrient-poor foods and beverages, contributing to the rise of obesity and diet-related chronic diseases. This transition in nutrition patterns has led many developing nations to now experience the triple burden of malnutrition, which includes undernourishment, micronutrient deficiencies, and obesity (Pinstrup-Andersen, 2007). Each year, approximately 1.1 million child deaths are attributed to undernutrition resulting from micronutrient deficiencies (Black et al., 2013; Black et al., 2008).

According to FAO's observation in 2022, the global progress towards ending hunger, food insecurity, and malnutrition is regressing, with the gap to achieve SDG2 targets widening each year and only eight years remaining until 2030 (FAO, 2022). In his publication "Hunger as a Factor: The Influence of Hunger on Human Behavior, Social Organization, and Social Life" (1922), Sorokin delved into the societal ramifications of nutrition and the effects of widespread hunger on social stability. He highlighted the primary social function of nutrition as contributing to social reproduction and order while also linking food shortages to the emergence of deviant behaviour and social unrest, particularly in the form of crime and protests (Sorokin, 1992).

Nutrition is pivotal in realising the objectives of SDG2, which aims to eliminate hunger, guarantee food security, and advance sustainable agriculture. Additionally, it is

fundamental in achieving numerous other SDG targets, which concentrate on promoting nutritious and sustainable diets and securing food access for everyone (Giuseppe Grosso et al., 2020). Nutritional inadequacy is impacted by various socio-economic elements, encompassing food insecurity stemming from micronutrient deficits, illnesses, economic hardships, and hunger. Education, job prospects, and economic advancement (aligned with SDGs 4 and 8) have been associated with improved dietary standards. However, individuals from lower socio-educational backgrounds may consume lower-quality, energy-dense, and nutrient-poor foods due to limited accessibility or affordability of higher-quality alternatives, among other considerations (Giuseppe Grosso et al., 2020).

Swaminathan describes nutrition security as the provision of physical, economic and social access to a balanced diet, environmental hygiene, primary health care and primary education (Swaminathan, 2008). Socio-economic factors strongly influence nutrition security. Socio-economic determination plays a crucial role in shaping the ability of individuals and communities to exist and consume nutritious food. Income and economic status are significant determinants, as they impact the purchasing power of individuals. Lower-income households often struggle to afford nutritious food, leading to dietary deficiencies and poor health outcomes. Researchers assert that the issue of food insecurity is not primarily linked to the increased output and efficiency of farmers but rather to poverty. Amartya Sen, an Indian Nobel laureate in economics in 1998, argued that food insecurity stems from problems in food distribution (Gonzalez, 2014). Approximately 80% of individuals experiencing food insecurity worldwide reside in rural areas. These individuals often cultivate small plots of land, rely on essential irrigation, or farm in dry regions with limited productivity. According to Godfray and Garnett (2014), one potential indicator that contributes to poverty reduction is the ability of small-scale farmers to enhance productivity sustainably, thereby fostering food security (Godfray et al., 2014). Education is another vital determinant. It affects individuals' knowledge about nutrition, food preparation, and dietary choices. Elevated levels of education frequently correlate with improved nutritional choices and a deeper appreciation of the significance of a well-rounded diet. Routine medical examinations and the availability of healthcare experts play a crucial role in detecting and managing nutritional deficiencies and health issues linked to dietary patterns.

Social inequalities, encompassing factors such as race, ethnicity, gender, and geographic location, can significantly impact food access and, by extension, nutrition security. These inequalities often manifest as food deserts—areas lacking affordable and nutritious food options. In many cases, marginalised communities, particularly those with lower incomes, may live in these food deserts, making it challenging to obtain fresh produce and other healthy foods. Gender inequalities further exacerbate the issue of nutrition security in many societies. Women typically hold pivotal roles in food preparation and distribution within households. Yet, gender discrimination and disparities can lead to unequal access to food and nutrition for women, impacting their families' well-being. Addressing social inequalities and improving food access is crucial for achieving nutrition security. Policies and interventions aimed at diminishing disparities, bolstering access to fresh and nutritious food in underserved communities

and promoting education on healthy eating can help narrow the gap, ensuring that everyone has the opportunity for nourishing healthy life, as highlighted by the FAO in 2011, providing women farmers with equal access to agricultural resources, education, and market could potentially reduce the number of hungry individuals by 100-150 million across 34 countries examined (FAO, 2011).

Societal Perceptions and Behavioral Change

The societal perspectives on sustainable agriculture and nutrition have undergone significant transformations, reflecting a heightened awareness of environmental issues and health considerations. This evolution in mindset has spurred behavioural changes among consumers and producers. There is a growing acknowledgement of the environmental consequences associated with conventional agricultural practices, which heavily rely on chemical inputs like fertilisers and pesticides. Concerns about food quality and its impact on human health have become more pronounced, with a widespread acceptance of the notion “you are what you eat”, leading to a great emphasis on nutrient-dense foods. George Homans, an American sociologist, introduced the exchange paradigm, which interprets food practices through the lens of social relations at the micro level. Utilising the detective-nomological model, Homans outlined six fundamental patterns of human behaviour based on the concepts of “rewards” and “punishments” (Homans, 1984). Within this framework, food is viewed as a social exchange characterised by rewards and benefits, shaping gastronomic preferences, trends, and rituals. Consequently, sustainable agricultural methods are now considered more responsible and environmentally friendly alternatives. This shift has prompted increased support for farming practices aimed at preserving soil health, minimising water consumption, reducing carbon emissions, and ultimately producing healthier and more nutritious food options.

Pierre Bourdieu’s concept of habitus underscores the structured attitudes and collective and individual behaviours that define the perceptions, thoughts, and actions of individuals within social groups occupying similar societal positions. He views habitus as the generative force behind objectively categorised practices and the system through which these practices are classified, thereby shaping the space of lifestyles (Bourdieu, 1984, p.537). The change in societal perspective has resulted in numerous shifts in behaviour. Farmers and producers increasingly embrace sustainable practices to fulfil this demand and minimise their ecological impact. Consumers are willing to invest more in sustainably sourced food, driving the expansion of organic and local food markets. Furthermore, educational programmes and initiatives aimed at raising awareness are being launched, encouraging more significant participation in local and sustainable food production endeavours. These changing perceptions lead to behavioural changes at both the consumer and producer levels, focusing on more sustainable and responsible practices in the food industry.

Policy Formulation for a Balanced Future

Over 40 years, the global population has doubled, surging from 3 billion in 1959 to 6 billion in 1999. Projections indicate a further 50% increase over the subsequent four decades, with estimates reaching 9 billion by 2037, 10 billion by 2057, and 10.4 billion by 2100 (UN, 2023). This population surge poses significant environmental concerns globally, intensifying the challenge of maintaining sustainable development to safeguard the needs of future generations. Hence, there is a pressing need to implement preventive measures to mitigate the uncontrolled environmental impact that poses serious threats, alongside formulating policies to foster healthy ageing and sustainable development. In response to these challenges, countries worldwide have embraced the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals. This global policy framework acts as a navigational guide toward eliminating poverty, the assurance of universal health and prosperity, and the preservation of the Earth's ecosystems. In light of these findings, policy formulation for a balanced future is imperative. Agricultural developments are undeniably linked to both food and nutrition security. Policymakers must prioritise sustainable farming practices that not only ensure food availability but also promote nutrition security, environmental sustainability, and social equity. SDG 2, aiming for Zero Hunger by 2030, strives to establish a world without hunger. Yet, the worldwide challenge of hunger and food insecurity has witnessed a concerning rise since 2015, intensified by a blend of factors, including the pandemic, conflicts, climate change, and widening disparities. Projections indicate that over 600 million individuals worldwide will grapple with hunger by 2030, underscoring the daunting task of reaching the Zero Hunger target (SDGs Report, 2023). Furthermore, nutrition is a vital element in achieving other SDG goals; improved diet quality has been linked to advancements in education, economic growth, and the promotion of decent work.

In rural areas, food availability hinges mainly on crop production and the population's economic status. Consequently, there is a pressing need to revamp agricultural practices to enhance food security and address nutritional deficiencies. Embracing sustainable agriculture presents a viable solution for boosting crop production and nutritional value, thereby addressing these challenges while simultaneously improving the socio-economic well-being of farmers and environmental conditions. In India, the government has implemented various measures, including initiatives like Poshan Abhiyan, Pradhan Mantri Matru Vandana Yojana, NFSA, and the Mid-Day Meal Scheme, to ensure access to nutritious food for all and mitigate hunger. Whereas solutions to hidden hunger such as diversifying diets, fortifying commercial foods, biofortification, and supplementation may effectively tackle the menace of hidden hunger and its socio-economic consequences but still becomes a matter of grave concern to study various other social issues such as public health problems like, severe visual impairment, weakened immune system, anaemia, impaired motor and cognitive development, blindness, etc. which not only affects the individual but has severe repercussions to the society as well. Hence, National and Global actions should promote sustainable agricultural practices to provide nutritional status to all individuals for better livelihoods and will try to achieve the target of various socio-economic problems.

Conclusion

In the face of global challenges such as hunger, malnutrition, and environmental degradation, the nexus between sustainable agriculture and nutrition security emerges as a critical paradigm. This paper has explored the multifaceted dimensions of sustainable agriculture and its socio-economic and environmental significance. Sustainable agriculture not only addresses the pressing issue of food security but also emphasises the importance of nutrition security, ensuring access to balanced diets rich in essential nutrients for physical and cognitive well-being.

The paper highlights the need for comprehensive policies and programmes at both the global and national levels to achieve global nutrition targets. These policies should advocate for sustainable agricultural practices, driving progress in addressing various forms of malnutrition and promoting environmental sustainability. Furthermore, sustainable agriculture can catalyse reducing social disparities, promoting food justice, and empowering marginalised communities by encouraging local food production and equitable distribution. Moreover, it aligns with the Sustainable Development Goals and broader global agenda to foster a fairer and more sustainable future. The SDGs offer a holistic framework to steer these endeavours, emphasising the importance of eradicating hunger, advancing sustainable agriculture, and ensuring universal access to nutritious food.

The societal perspective on sustainable agriculture and nutrition has evolved over the years, leading to behavioural changes in producers and consumers. Farmers are increasingly adopting sustainable practices, consumers are willing to support sustainable food production, and educational initiatives are raising awareness and encouraging participation in sustainable food systems. These changing perceptions and behaviours underscore the importance of sustainable agriculture in addressing the world's pressing challenges.

By examining the intricate web of sustainability and nutrition, we aim to shed light on how our dietary decisions impact not only our well-being but also the sustainability of the planet. This study seeks to deepen comprehension of the obstacles and prospects found at the convergence of nutrition and sustainability, providing a groundwork for well-informed choices and policies that can lead toward a healthier and more sustainable future.

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