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## **Interrogating the Idea of ‘Sustainable Agriculture’ and its Impact in India**

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### **ABSTRACT**

This research paper aims to explore the paradigms responsible for using the term sustainability in agriculture, trace the trajectory of the concept of “sustainable agriculture” used in contemporary times and assess its social impact in the Indian context. The study was conducted using primary documents like reports of international organizations and those published by the Indian government and secondary literature i.e. popular articles, academic writings, journalistic pieces, online articles and blogs, to trace the usage of the concept “sustainable agriculture” and understand the social impact of using the sustainable agriculture approach. The study began by tracing the emergence and need for sustainability as a concept in agriculture on a global platform and its introduction in India. The paper ends with an outline of some of the policies and schemes formulated by the Government of India. It focuses on its impacts in due course of time to understand the current situation regarding the implementation of sustainability.

**Keywords:** Sustainability, sustainable agriculture, environment, development, science, technology

## 1. INTRODUCTION

The world has been rapidly transforming for decades now, witnessing the rise of disadvantageous effects on our natural resources. Various developmental projects have taken over the world, and advances in technologies have influenced every sphere. Our agro-based industries have also borne the fruits of economic and technological developmental projects in the past. They are currently benefiting from the variety of options available to obtain higher yields and make more significant surplus than usual. The transformation of agriculture from ‘farming for subsistence’ to ‘farming for profits’ encouraged science to develop new methods often referred to as ‘modern methods’ of farming. This includes excessive use of fertilizers, pesticides, water leading to its severe shortage, and the introduction of genetically modified crops. But lately, the effects of these on the environment have been noticed, raising concerns globally. For instance, around 40% of cropland across the world has deteriorated since the 1960s. Excess use of chemicals in the cultivation of crops has destroyed soil fertility and depleted other natural resources, especially water. Environmental degradation once again revealed the socio-economic stress arising from inequalities in standards of living, health, livelihood opportunities, and food security, etc. Due to the continued negative impacts of the existing strategies, alternative ideas like sustainability in agriculture were introduced specially to ensure ecological safety, economic viability, social responsibility and equity, and higher productivity. It eventually led to the usage of sustainable methods that can enhance the quality and quantity of produce without harming any natural resources and create better living conditions for communities worldwide.

The environment-development debate majorly contributed to the realization that in addition to these ecological conditions, there are social conditions that influence the ecological sustainability or unsustainability of the people–nature interaction (Lele 1991, pp. 611). Sometimes, sustainability is used fundamentally with social connotations. For instance, Barbier defines social sustainability as “the ability to maintain desired social values, traditions, institutions, cultures, or other social characteristics” (Barbier, 1987, pp. 107). This usage is not very common. It needs to be carefully distinguished from the more familiar context in which social scientists talk about sustainability, *viz.*, the social aspects of ecological sustainability. Sustainability as a social vision is not only

potentially acceptable, but it also meets with correspondingly broad approval across all social groups and political positions, nationally and internationally.

One cannot, however, overlook sustainability's conflict potential. As soon as relatively concrete goals or even strategies of societal action for attaining sustainability are put on the agenda – at the least– it becomes obvious that existing antagonistic societal values and interests are lurking behind the programmatic consensus (Grunwald, 2004). Despite the diversity in how sustainable agriculture is conceptualized, there is a consensus on three basic features: (i) maintenance of environmental quality, (ii) stable plant and animal productivity, and (iii) social acceptability. Yunlong and Smith (1994) too have suggested that agricultural sustainability should be assessed from the vantage point of ecological soundness, social acceptability, and economic viability perspectives. “Ecological soundness” refers to the preservation and improvement of the natural environment, “economic viability” to the maintenance of yields and productivity of crops and livestock, and “social acceptability” to self-reliance, equality, and improved quality of life (Rasul & Thapa, 2003).

The meaning of ‘sustainable agriculture’ in the Indian context may seem to carry a broader meaning from the global context. In the global context, sustainability in agriculture is mainly focused upon ecological crisis, whereas the engagement with sustainability in the Indian context has been further extended. Thus, in addition to the impending ecological crisis, it has come to include issues like the welfare of farmers, ensuring their minimum support price, implementation of sustainable methods, boycotting the use of chemical fertilizers and the utilization of technology in the process of cultivation to the storage of the produce to ensure sustainability.

## **2. METHODOLOGY**

In view of the above discussion, the prime focus of this study was to investigate the history of sustainability in agriculture in India, focusing on the failure and replacement of modern methods that were introduced in the year 1968, with the commencement of the Green Revolution. The study explored the shift from traditional to modern and then to sustainable methods, eventually focusing on the trajectory of sustainable agriculture and its implementation in different regions of India. The role of sociology is highlighted

with reasonable arguments supporting the above-mentioned things. Sociology and other social sciences have given us an understanding of sustainability and offer a great deal of interest in achieving agricultural sustainability. According to Fredrick H. Buttel (1993, pp.180), sociologists did significant research related to the adoption of resource-conserving practices for staff sociologists and other social scientists who have contributed to identifying and implementing strategies for sustainable agricultural technology. Agriculture involves economics, technology, politics, international relations and trade, environmental problems, and sociological problems, thereby arguing that agriculture is as much social as it is agronomic and ecological.

The grave concerns regarding the degradation of the environment have led to several research activities to find a stable solution to this problem. We intended to locate the history of sustainability in agriculture, how it has been implemented in the Indian context and what are its impacts. Following this, the research project aimed to:

1. Explain the trajectory of the term ‘sustainability’ in agriculture
2. Explore the impact of sustainable agriculture in the Indian context

For the objectives mentioned above, we used the websites of organizations related to agriculture or sustainability, including the Department of Agriculture and Cooperation, Ministry of Agriculture, New Delhi; Indian Council of Agricultural Research (ICAR); International Panel on Climate Change (IPCC); United Nations Environment Programme (UNEP); Unilever; U.S. Department of Agriculture; World Health Organisation (WHO), and World Wide Fund (WWF). Additionally, we used statistical data, graphs and reports published by several organisations and the Government of India to show the worsening conditions of crops grown using modern methods. We also referred to news articles published over the years to learn about the state of agriculture in the past and current times and various research papers published across the world.

### **3. DATA AND FINDINGS**

#### **3.1. A Call for Sustainability in a Global Context**

One of the first mentions of the word ‘sustainability’ was found in a *Handbook of Forestry*, published in 1713 in German. The word sustainability during the 18th century

essentially meant never harvesting more than the forest can regenerate. By the 19<sup>th</sup> century, the majority of the people had moved out of the forests and started to live on farms leading to noticeable and unquestionable growth in agriculture. This era was characterized by an increase in agricultural production-with 78% through technical progress, the decrease of fallow land and the rise of capital provided by the developing industries.

The latter half of the 20th century was the beginning of modern agriculture. It was remarkably successful in meeting the increased food demands for the growing world's population. During this time, the world witnessed a dramatic increase in the yields of primary crops such as rice and wheat and the decline in food and crop prices. Due to famine caused by natural disasters as well as crop destruction due to warfare, the modern agricultural methods were used to meet the increasing demands. The introduction of high yielding varieties of crops, multiple cropping, better irrigation and sufficient supply of fertilizers and use of crop protection measures against disease and pests have contributed to bringing the green revolution in modern methods of agricultural practices.

However, as modern methods were established, negative environmental impacts became noticeable. The high input-high output technology using hybrid seeds of higher-yielding variety and abundant use of water for irrigation, fertilisers and pesticides resulted in the compaction of soil leading to its degradation. The lack of aerial facilities results in the decaying of crops and leads to low crop yield and low mechanical strength, the accumulation of water causing salinity in the soil. Modern agriculture uses High Yielding Varieties (HYV) of crops to increase yield, which requires a large amount of water and fertilizers. The excessive use of water supply leads to accumulation of water in farms due to which improper drainage, low productivity and waterlogging are caused. The excessive use of chemical fertilizers and pesticides kills beneficial bacteria. Despite these concerns, the middle-class farmers were, and are still compelled to buy expensive high yielding varieties to maximize their annual produce and profits.

In retrospect, the time of the 1960s denoted a defining moment in our agricultural history. During the late 1960s and early 1970s, ideas about progress, sustainability,

growth and development that had developed over many years started pointing in a new direction, that of sustainable development. In 1972, in the British book *Blueprint for Survival*, sustainability was used for the first time in the context of humankind's future. In 1974, the United States used the term to justify a no-growth economy. After many years, in 1978, the United Nations documents used the term sustainability with a normative context called eco-development.

Once ecology became a concern among different disciplines, the concept of sustainability became more pronounced, and referred to forests and biological systems. The roots of sustainability can be traced back to ancient times. The fear of depleting natural resources for our future generations made us rethink our decisions and motivated us to move towards a sustainable approach.

According to Rolf Jucker (2003, pp.7), "sustainability is achieved when all people on earth can live without compromising the quality of life for future generations". Sustainability is intended to organise human activity, so the society with its members can meet their needs in the present while preserving biodiversity and natural ecosystems for the future. The focal point of sustainability broadly aims at having a delicate balance between meeting our needs without destroying the environment and moving ahead technologically and economically.

Over the last 50 years, several research studies have been associated with sustainability, its definition, and its various aspects. Some of them had limited viewpoints of what the term sustainability means, while others viewed it as a term that can only be explained while looking at interconnected aspects, which together will define sustainability comprehensively. In the study of Erol et al (2009; quoted in Karami, E., & Keshavarz, M., 2010), the authors defined sustainability by evaluating sustainability's economic and social aspects. Their research resulted in developing a tool for measuring sustainability performance. Another research by Harrison White (2009) was focused on the environmental, social and economic aspects of sustainability. The study by Porter and Kramer (2006) talked about "organization sustainability". It showed that organization sustainability lies in the social, commercial, economic, and environmental

aspects of sustainability which will give long-lasting competitive advantages. Shukla, Deshmukh and Kanda's (2010) study focused on the environmental and social aspects but not on the economic ones. The study of Carter and Rogers (2008) focused on organization of sustainability from the three components- of the natural environment, society and economic performances. Overall, sustainability as a term was interconnected with the environment. Over time, the meaning of the term has evolved with extensive research. Nowadays, sustainability is not just about environmentalism. Embedded in most definitions of sustainability, we also find concerns for social equity and economic development. Due to the growing awareness of imminent ecological crisis threats and disasters, sustainable development was formulated as a new morally defensible paradigm. It was seen as a driving force in world history around the end of the 20th century. When modern high technology agriculture was being exported during the green revolution around the globe, there was a beginning of the counter movement – the sustainable agriculture movement. The movement grew during the second half of the 20th century. It can be said to have intensified in the aftermath of the crisis of the 1980s when low crop incomes caused by the low crop prices eventually brought down the farmland value to drop to 60% in some parts of the Midwest, notably from 1981-to 1985. The sustainable agriculture movement has its roots in organic farming and hence can be seen as an attempt to move away from industrial agriculture. Organic farming is an integrated farming system that strives for sustainability. Some have argued that organic farming and sustainable agriculture are synonymous. There are several concerns and factors that are advocated within the movement and are centred around non-renewable resources, water resources, environmental concerns like conservation of soil and economic and societal effects.

It is argued that a model of sustainable agriculture must be ecologically sound and socially responsible for both current and future generations. Sustainability in agriculture is derived from the relationship between social and economic life. Sustainable agriculture was not just seen as an option but as an absolute necessity. The reason behind this is our current industrial agriculture which is neither ecologically sound nor socially and economically viable. Even today, our economic and political culture is not

sustainable and needs fundamental changes in farm policies. Implementing the sustainable agriculture movement will not be easy; it will undoubtedly require some fundamental changes, especially a concern for shared ethics of sustainability that transcends the local economy and society.

Although the movement has not yet successfully transformed industrial farming into sustainable farming, neither has it gone away. The movement must be sustained regardless of how it may evolve, as it continues to add to public awareness that our current food system isn't meeting the needs of many today.

### **3.2. Sustainable Agriculture in India: History, Impact and Future Plans**

The years immediately after India gained its independence were not the golden years for its agriculture's history; the 1950s is regarded as the critical period that witnessed the commencement of the agricultural revolution as envisioned by Nehru, who stated, "Everything else can wait but not agriculture" (quoted in Prof. M.S. Swaminathan, Financial Express, 2009). This was because our freedom was brought into the world in the aftermath of the incomparable Bengal Famine, when more than two million people died due to starvation. Nehru focused his attention on building the nation through infrastructural development. The water system, manure and pesticide industry, and exploration and training got impressive consideration. On account of advances in preventive and healing medication, average life expectancy increased just as the population growth rate went up. Thus, food imports developed tremendously under the PL-480 program in the US.

The agricultural history of India can be divided into four phases: the first phase started from 1947-to 1964; the first phase of post-independence land reforms in the 1950s and 1960s yielded a mixed result. It could be termed successful in the sense that all intermediaries were abolished, which provided the basis for improvement in agricultural productivity. Nevertheless, the unequal agrarian structure remained in place. This phase is also known as the "Lal Bahadur Shastri-Indira Gandhi era", when the focus was laid on fulfilling two objectives: food security and agricultural production. Lal Bahadur Shastri coined the famous slogan "Jai Kisan, Jai Jawan" during



this era of transformations. The second era started from 1965-to 1984 that saw the launch of the Green Revolution. In 1968, Indira Gandhi announced the birth of the Green Revolution, where the prime focus was laid upon the production of rice and wheat. During this phase household-level variance in income from cultivation was primarily dependent on variance in land ownership. The outcomes favoured the farmers in the upper Northern Plain, including Punjab, Haryana, Uttar Pradesh and Bihar. However, the methods of the Green Revolution were not beneficial to everyone since many states faced huge losses resulting in greater income inequality among the farmers in different as well as within the same region.

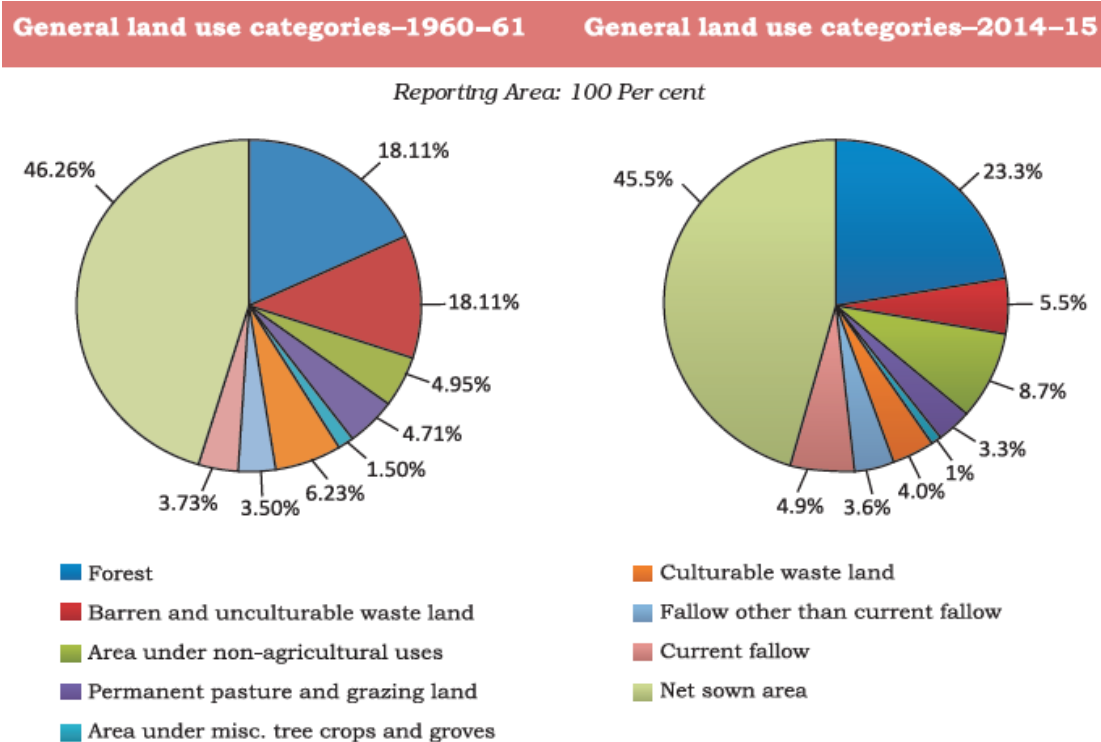
Over the years, there have also been significant spatial and temporal transformations in the patterns of land use in India. The radical changes in land use have occurred across the country, but the changes in agricultural land use are substantial in the regions of the Green Revolution. Under the 1949 plan, states were granted the powers to enact (and implement) land reforms. Existing assessments of the effectiveness of these different reforms are highly mixed. Though promoted by the centre in various Five-Year Plans, the fact that land reforms were a state subject under the 1949 Constitution meant that enactment and implementation were dependent on the political will of state governments. Broad political support for the abolition of intermediaries had led to widespread implementation of these reforms, most of which were complete by the early 1960s. With many state legislatures controlled by the landlord class, the hierarchical values and unequal social structures reinforce each other, making the change of status quo very difficult.

The third phase, covering 1984 to 2004, was stroked by both joy and distress. This phase focused on improving and modifying pulses and oilseeds with the assistance of technology. The negative impacts of the Green Revolution were observed in this phase, i.e., due to the excessive usage of water in irrigation techniques, water levels went drastically down, the use of various chemical products affected the fertility of the soil, etc.; significantly affecting our economy as well as our ecology. Furthermore, it has been critiqued severely because it led to an increase in unemployment, benefitted few crops, created a chemically dependent environment, caused regional and economic

inequalities, and created difficulties for farmers in the usage of modern technologies. According to the data produced by NSSO (NSSO, 2011, quoted in Department of Agriculture, Cooperation and Farmers' Welfare Annual Report 2020-21), around 40% of farmers wanted to quit farming and opt for other sources to earn their livelihood; the recurrent losses decreased the interest of the youth in rural areas, constituting 70% of the total population.

According to the Department of Agriculture, Cooperation and Farmers' Welfare. (2010), the land ownership patterns differ on certain levels, in five states viz. Andhra Pradesh, Arunachal Pradesh, Madhya Pradesh, Nagaland and Tripura, agriculture and allied activities contribute more than 30% of State Gross Value estimated for 2016-17 (at current prices). The number of operational holdings in the country is estimated at 14.64 Crore. OBCs (other backward classes) are becoming the most significant stakeholders in agricultural activities. They have close to 47% share in population and land ownership—the highest in both categories—in rural areas, and the “The Others” own 28.5% of the land, whereas the SCs (scheduled castes) own 10.2% of rural land while the scheduled tribes own 14.1% of total land. The social group-wise landholding in rural areas makes an important finding since it gives us an insight into the role of social determinants in the sphere of agriculture. Currently, land in India has been used for diverse purposes to satisfy the needs according to suitable conditions. The distribution of land use has been projected as shown in Figure 1.

According to Badavam (2005), in 1995, a non-government organisation (NGO) called Prakruti broke a long-standing fantasy that chemical pesticides and fertilizers are mandatory for abundant produce. For instance, Kisan Mehta of Prakruti initially proposed that cotton, the most significant consumer of substance pesticides, could be developed naturally. 130 farmers submitted 1,200 hectares of land to develop cotton naturally on the Global League of Natural Agriculture Developments guidelines. The produce was subsequently evaluated by the German Authorize Organization, AGRECO, and discovered to be of excellent quality. The achievements were noteworthy, thereby giving us some hope for the future.



Source: Changes in pattern of land use (2021). Lotus Rise. Retrieved from <https://lotusarise.com/changes-in-pattern-of-land-use-in-India> (January 26, 2021)

**Figure 1:** The change in land-use patterns between the years 1960 and 2015.

The fourth phase began in 2004 and continues till today. It marks the commencement of a paradigm transformation from measuring agricultural progress from merely growth rates in production to measuring the well-being of farmers in terms of actual improvement in their net income. In 2004, the Asian Tsunami destroyed the fertility of the soil for decades. According to the report given by the Inter Press Agency, “The Nagapatnam district recorded 6,065 deaths, more than 85 percent of the state’s death toll. Farmers bore the brunt, struggling to revive their fields, which were inundated for up to two miles in some locations. Nearly 24,000 acres of farmland was destroyed by the waves” (23 July 2021, p.2). The saline water left by the waves that hit the crops seeped through the soil, destroying the soil’s fertility and ending up killing the microorganisms present in the soil. This event was a tragedy that affected the farmers’ incomes where after the Tamil Nadu Organic Farmers’ Movement (ToFarM) stepped in and adopted a village named South Poigainallur. With the help of sustainable methods, they successfully revived the soil that, included the sowing of ‘soil doctor’ (Dhaincha) seeds into the soil.

The call and the efforts to eradicate ‘modern methods’ was a remarkable event for the upsurge of sustainability in Indian agriculture. One such movement was the Normal Cultivating Movement. India’s Normal Cultivating Movement began in the early 2000s and has played an enormous part in advancing maintainable cultivating land that further develops well-being, creates employment opportunities, cuts work costs, and improves people’s and groups’ general personal satisfaction. In 2000, villagers from the village of Pudukula, Andhra Pradesh, launched a grassroots movement against the use of pesticides, focusing on non-pesticide management techniques that employ natural alternatives like chilli pepper and planting trap crops like castor. Within a year of the start of the movement, farmers saw pesticide-related medical problems dissipate, costs drop, and maximization of profits. Additionally, new methods were designed to meet the requirements of the farmers with the assistance of regular products. Villagers stated that the development worked towards their personal satisfaction — advancing their monetary circumstances, their well-being and their general bliss. More villagers started to boycott the utilization of pesticides, and the town proclaimed itself as without pesticides in 2004. Manageable cultivating lands were utilized to work on horticultural yield and effectiveness, which implies that more food is delivered, fewer assets are being used, and more benefits are made by farmers. Instances of supportable cultivating techniques incorporate utilizing a biodegradable mulch film rather than one produced using Polyethylene. Furthermore, because farming depends so intensely on precipitation, viable economic water is pivotal for an adequate harvest.

To address the issues outlined above, the government of India announced the National Agriculture Policy in July 2000, which provided a framework for planning and program formulation in the agriculture sector according to the Hindi agriculture sector of the Indian Government. The policy sets out the following broad agenda (Hazra 2003, quoted in Department of Agriculture, Cooperation and Farmers’

Welfare Annual Report 2020-21):

- A growth rate over 4% per annum in the agriculture sector
- Growth based on efficient use of resources, such as soil, water and biodiversity.
- Growth with equity-focused on farmers and agricultural labourers.

- Growth that is demand-driven that also caters to domestic markets with maximization of profits through the export of agricultural goods.
- Growth that is sustainable technologically and ecologically.

This shift from ‘modern methods’ to ‘sustainable methods’ was also highlighted in the National Policy for Farmers placed in Parliament by the union minister for Agriculture and Food in November 2007. Whenever executed fully, this strategy is expected to assist in moving toward the decrease in agricultural development, as well as it will stop the desertion of youth from the farm sector. Additionally, the National Mission for Sustainable Agriculture (NMSA) is listed as one of the eight Missions under the National Action Plan Climate Change (NAPCC) to advance Reasonable Farming. The eight National Missions on Climate Change (NAPCC 2008, quoted in Department of Agriculture, Cooperation and Farmers’ Welfare, 2010):

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for Green India
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge on Climate Change

The Thrust Areas of NMSA include:

- Dryland Agriculture
- Access to Information
- Biotechnology
- Risk Management (NAPCC 2008, quoted in Department of Agriculture, Cooperation and Farmers’ Welfare, 2010)

The methodologies and programmers of actions (POA) laid out in the Mission Document, which was agreed upon ‘in principle’ by Prime Minister’s Council on Climate Change (PMCCC) on 23<sup>rd</sup> September, 2010, aim at advancing reasonable

horticulture through a progression of variation estimates zeroing in on ten key measurements including Indian agribusiness specifically; ‘Further developed yield seeds, domesticated animals and fish societies’, ‘Water Use Proficiency’, ‘Pest Management’, ‘Improved Farm Services’, ‘Nutrient Management’, ‘Agricultural insurance’, ‘Credit support’, ‘Markets’, ‘Access to Information’ and ‘Livelihood Diversification’. During the XII Five Year Plan, these actions are being installed and mainstreamed into ongoing/proposed Missions/Programmes/Schemes of Department of Agriculture Cooperation and Farmers Welfare (DAC & FW) through an interaction of rebuilding and combination. NMSA engineering has been planned by meeting, combining and subsuming all ongoing as well as recently proposed exercises/programs identified with feasible farming with an uncommon accentuation on soil and water preservation, water use productivity, soil wellbeing the board and downpour took care of region advancement.

NMSA will oblige vital elements of ‘Water use efficiency’, ‘Nutrient Management’ and ‘Livelihood diversification’ through the reception of maintainable improvement pathways by continuously moving to environment-friendly technologies, adoption of energy proficient hardware, conservation of natural resources, integrated farming, and so on. Additionally, NMSA targeted the advancement of agricultural practices through soil wellbeing the executives, upgraded water use productivity, careful utilization of synthetic substances, crop broadening, reformist reception of yield animals cultivating frameworks and coordinated methodologies like crop-sericulture agro-forestry, fish farming, etc.

In addition to the national mission, under Sustainable Development Goals 2030, the governments of the two most populous economies of the world, China and India, had stated their desire to double farmers’ income by 2020 and 2022, respectively. This will require efforts to address the challenges of doubling agricultural productivity and incomes of small-scale food producers.

#### **4. DISCUSSION**

“Sustainability as a goal seeks permanence for an activity or a system where the system is a conglomeration of different elements, components, subsystems, or constituents knit

together into an integrated whole that helps in the system's organization and maintenance of its integrity" (Von Bertalanffy, 1968, quoted in Hegde and Sudhakara Babu, 2016, pp.1). The problems related to sustainability are a perpetual issue in contemporary times, especially in agriculture, which is the lifeline for the sustenance of life. Every aspect of human survival is encompassed by agriculture. Thus, there was an awakening of agricultural sustainability in the 20th century. The transformation of agriculture from 'farming for subsistence' to 'farming for profit' may have resulted in meeting the expected demands for the resources. Still, its negative impacts on declining resource base both in quality and quantity led to major threats to the environment.

Crop yield is unlikely to happen if the soil enhancement is not done properly, affecting soil quality. For soil enhancement, certified Biodegradable mulch film is used. There are some emerging patterns for yields under a few Sustainable Agriculture Practices and Systems (SAPS). Crops, according to some studies, have equal and higher yields. The short duration studies indicate no statistically significant yield changes for more crops. For SRI (system of rice intensification), paddy varieties are statistically increasing as yields are well documented.

India holds the position of the 3rd largest Greenhouse gas emitter in the world after China and the USA. While per capita emission on the Global average is only 1/3<sup>rd</sup> the Indian agriculture sector ranks 2<sup>nd</sup> in contributing to the country's total greenhouse gas (GHG) emission. According to 2018 reports by the International Energy Agency, India emitted 2,299 million tons of carbon dioxide. This accounts for 7% of the Global Greenhouse gas emission. SRI promotes aerobic soil conditions reducing Methane emission. However, intermittent irrigation, an intrinsic component of SRI, can increase nitrous oxide emissions.

Diet exposure to pesticides used in the agriculture sector has negatively impacted health. Pesticides are mainly found in the crop growing fields and on the farms where animals are raised. "Human exposure to pesticides can come through residues in food - either on or within fruits and vegetables, or in the tissues of fish and animals we eat" (Horrigan et al., 2002, pp. 451). The health effects linked to pesticides affect how the human body can develop and reproduce. Sustainable agriculture practices use low



impact practices and have fewer contaminating effects on the health of the living being. Manure and organic soil fertility have fewer adverse health effects. Crop rotation under sustainable agriculture controls pesticides and diseases. So far, the research has only found the health impacts of various SAPSs through dietary diversity and less exposure to harmful chemicals such as pesticides.

Moreover, there are curtailments faced by Indian agriculture, for instance, resource, infrastructure, institutional, technological and policy-induced limitations. Area Production and Statistics (APS) has impacted farmers' income: the agriculture share in GDP has increased to 19.9% in 2020-2021 from 17.8% in 2019-2020, and revising the last year's data of employment in the agriculture sector, India was reported at 41.49% according to the World Bank collection of development indicators. Over a hundred million people are employed in the agriculture sector, but it did not result in higher farm incomes. Due to the inadequate proportion of land and assets, payment, farmers' income remains insufficient till now. Recently due to corona virus disease-19 (COVID-19) induced lockdown, the income of farms has seen a significant fall due to the rise in input costs. The agriculture sector has witnessed significant upheavals in 2020 and 2021. In the recent farmers' movement, these three laws faced a considerable backlash: Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020; Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020 and Essential Commodities (Amendment) Act, 2020, where the farmers' main concerns were the loosened rules around the sale, pricing and storage of farm produce - rules which have protected them from the free market for decades. Farmers' unions said these laws would leave farmers vulnerable to big companies and destroy their livelihoods.

Although the current economics of developing or developed countries around the world prioritise agriculture sustainability over the modern methods used in agriculture, such protests draw our attention to existing socio-economic inequalities and a need for a more comprehensive action plan for achieving sustainability in agriculture.

## **5. CONCLUSION**

It becomes clear that the long-term use of modern methods in agriculture has adversely affected our environment, techniques creating an imbalance in the relationship between



humans, nature and society. Consequently, the concept of sustainability is seen as essential to address the current ecological crisis. Today, globally, the topic of sustainability of the agriculture system has become more critical to every country. Not only scientists but the general public have raised questions concerning the current scenario of desertification, accumulation of chemicals in soils, decreasing water level across the world, increasing socio-economic inequalities and are pushing for possible alternatives for the future. In the Indian context, sustainability is related to many issues, thereby needing a more holistic approach. The need for sustainable agricultural practices and sustainable resource management is increasing urgently. The profound connection of agriculture with the world economy, biodiversity and human societies makes sustainable agriculture one of the foremost frontiers for conservation around the globe. Therefore, irrespective of its vague conceptualisation, sustainability in agriculture is a valuable concept that might help us engage with our current crises related to food, economy, environment, and farmers' welfare.

#### **CONFLICT OF INTEREST**

The authors declare that there is no conflict of interest.

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