



Agriculture Innovation in Sustainable Development: Concept, Benefits and Future Prospects

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Present expansion on a sustainable basis meets the needs of the current generation without jeopardizing the next generation's ability to meet their requests for higher-quality products. In agriculture, sustainability means that the land and resources used for agriculture should be passed down to future generations in a sustainable state, allowing them to continue farming while ensuring food security. Lands, water, and other resources must be managed in such a way that future generations can also benefit from sustainable development. Three important aims are interwoven into sustainable agriculture development: environmental health, economic success, and the ability to earn a living (Dutt, 2019). Agricultural innovation drives rural development by increasing production, providing food security, and promoting sustainable practices. Agricultural innovation focuses on implementing new ideas, technology, and practices to enhance production and sustainability. Advancements in agriculture include high-yield crop types, precision farming, biotechnology, ICT, enhanced irrigation, and sustainable practices. Adopting these innovations can improve crop yields, minimize environmental impact, and raise resistance to climate change, ensuring sustainable development in rural areas. To prevent migration from rural to urban regions, agriculture innovation should prioritize upgrading rural infrastructure, promoting agribusiness and subsidiary farm firms, and creating additional employment opportunities. Climate change and rising temperatures are unavoidable in India. We need to produce drought-resistant, water-efficient, and short-duration crops in drought-prone areas of the country.

Agriculture Innovation

Adopting a novel agricultural concept might be quite tough. It is especially difficult when the proponents of a new idea appear to have clear advantages. It can be difficult to implement new ideas in rural areas, particularly in less developed countries where people are fixed in their ways that have evolved over time via trial and error. Historically, rural sociologists and extension service specialists studying the spread of agricultural technologies have focused on speeding up the process. The agricultural innovation system (AIS) idea emphasizes the outcomes of knowledge development and adoption by focusing on the entire set of players required to promote innovation and growth. The paradigm takes into account economic dynamics, the effects of organizational learning and behavioural change, non-market organizations, and public policy processes (Anandajayasekeram, 2011).

Importance of innovation in the agriculture sector

There is widespread consensus that innovation is vital for meeting the human race's needs, which include increased competitive agricultural strength, sustainable development, and equality. The agricultural system has changed considerably over the course of history as a result of technological advancements and new discoveries. These changes have inspired the development of new goods and manufacturing techniques, leading to the evolution of the

industry itself. When this occurs, we are discussing agricultural innovation. The innovation in the agricultural sector is summarised in three categories:

1. **Agro-chemical innovations:** The progress of technology in the agrochemical industry has resulted in the development of a diverse range of field products, all aimed at increasing production levels. Today, it is widely recognized that there are two distinct agricultural trends: conventional and biogenic crops, which employ both non-chemical fertilizers and natural, biological, and ecological pest management approaches. Today, there is a considerable trend toward organic agriculture, as well as a reduction in the use of chemical pesticides, which has helped to the development of new agricultural products meeting these standards.
2. **Mechanical innovations in agriculture:** It focuses on technical procedures of agricultural mechanization using machines to improve production methods in all phases, from land preparation and seed sowing to harvest. The employment of mechanical aids (farm mechanization, such as tractors, tractor-mounted harvesters, sprayers, bed-making machines, threshing machines, and so on) saves time that would otherwise take much longer in manual activities.
3. **Biotechnological innovations in agriculture:** New biophysics inventions apply physical laws and principles to biological activities. Biophysics has been employed in a variety of ways to stimulate biological mechanisms or evaluate the consequences of other innovations, including the aforementioned chemical developments.

Benefits of innovation in agriculture

According to government figures, India's economy is predominantly agrarian, with 58% of the population employed in 2019 (IBEF, 2022). The agriculture sector in India is expected to grow as a result of steady demand, the culture's preference for living in rural areas and embracing farming practices, and policy-backed chances to boost commercial crops through agribusiness. Tissue culture, hydroponics, aeroponics, and other innovations in agriculture provide significant benefits.

1. **The major source of livelihood:** Agriculture is a significant source of income. Agriculture provides a living for more than 58% of the Indian people. Agriculture, forestry, and fisheries are expected to earn Rs 19.48 lakh crore (US\$ 276.37 billion) in FY20 (IBEF, 2022). Agriculture and allied sectors accounted for 17.8% of India's gross value added (GVA) at current prices in FY20. People who make their living through agricultural pursuits. People in prosperous countries like the United States, Japan, and Germany rely less on agriculture than in India.
2. **Improves productivity:** When new technology is applied, output increases compared to when primitive methods are used. The application of cutting-edge technology boosts land and labor productivity. Innovation will help to increase efficiency and productivity in proportion to labour time. Total food grain production in the country hit a record 310.74 million tonnes in fiscal year 2020-21, up 13.24 million tonnes from 297.50 million tonnes in the previous calendar year (Directorate of Economics and Statistics, Department of Agriculture and Farmers Welfare, 2021-22).
3. **Creates employment opportunity:** Indian agriculture employs and provides work for the vast number of the rural Indians. Agriculture and allied agro-industries provide a living for over 70% of the inhabitants in rural and backward areas. When a country's policy supports innovation, multiple jobs are created in research and development and agriculture.
4. **Source of industrial growth:** Agriculture greatly helps to industrial development by providing industrial raw materials. Sustainable agriculture is critical for the farming industry's transition to more energy- and resource-efficient infrastructure. Sustainable

agricultural specialists can advance by focusing on systems that have a low environmental impact.

5. **Optimal utilisation of produced output:** With developments in warehousing and storage facilities, manufactured output will not go to waste and will reach the people who need it.

Future prospects and solution for India

The right use of soil, water, livestock, plant genetics, forest, environment, rainfall, and topography are critical for long-term agricultural output. Resource constraints, infrastructure limitations, institutional impediments, technological limitations, and policy-induced limitations all have an impact on Indian agriculture. Crop yields in India are heavily reliant on rain, which is one of the primary reasons for the agriculture sector's poor growth rate. Poor farmers and labourers living on a shoestring budget are the most severely impacted by these issues. As a result, something must be done to empower farmers, as well as provide them with adequate water and energy, as they continue to suffer from drought, floods, and fires. India is the world's second most populous country, and it should realize that its people are a valuable asset to the country. There are plenty of idle folks in India. As a result, there is a need to find ways to capitalize on their expertise and use the results to drive growth. Farmers are committing suicide because of the country's financial traps. People are relocating to cities in quest of a better life, yet the urban poor population is also increasing. As a result, rural residents should be offered opportunity to work and prosper within their communities. For a long time, India has been classified as a "developing" country; in order to become "developed," we must minimize our dependency on agriculture (Chahal, 2015).

Conclusion

Agriculture development is critical to a country's economic success. Even rich nations prioritise agricultural growth. There is enormous potential for agricultural development through agricultural innovation and the development of farmer entrepreneurship. Educating farmers through agri-extension services, print and digital media, workshops, and so on, while also promoting commercial crops such as medicinal crops, floriculture crops, and other plantation crops under various agricultural methods. The current article also addressed agricultural innovations for sustainable development, with the goal of improving livelihoods, increasing productivity, creating job opportunities, industrial expansion, food supply, and growing foreign trade. Sustainable farming techniques promote environmental health, while technological advancements can increase agricultural output. Addressing these difficulties and promoting agricultural development can create a successful and sustainable future for rural areas. Rural development is critical to attaining sustainable and inclusive economic growth.

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