Sattva Knowledge Institute SKI primer

UNDERSTANDING SUSTAINABILITY IN AGRICULTURE

May 2022

Acknowledgements

About the Authors

This primer has been written by **Ayushi Baloni** and **Ashutosh Choudhary**. The technical review was done by **Debaranjan Pujahari**.

Disclaimer

This report has been produced by a team from Sattva Consulting as a product for the Sattva Knowledge Institute (SKI). The authors take full responsibility for the contents and conclusions. Any participation of industry experts and affiliates who were consulted and acknowledged here, does not necessarily imply endorsement of the report's contents or conclusions. To quote this primer, please mention: Sattva Knowledge Institute, *Understanding Sustainability in Agriculture,* May 2022. Use of the report's figures, tables or diagrams, must fully credit the respective copyright owner where indicated. Reproduction must be in original form with no adaptations or derivatives. For use of any images in the report please contact the respective copyright holders directly for permission.

About Sattva Knowledge Institute

Sattva Knowledge Institute (SKI), established in 2022, is our official knowledge platform at Sattva. The SKI platform aims to guide investment decisions for impact, shedding light on urgent problems and high potential solutions, so that stakeholders can build greater awareness and a bias towards concerted action. Our focus is on offering solutions over symptoms, carefully curating strong evidence-based research, and engaging decision-makers actively with our insights. Overall, **SKI aims to shift intent and action toward greater impact by influencing leaders with knowledge**. All of our content proactively leverages the capabilities, experience and proprietary data from across Sattva.

Design: Cognitive Designs; cognitive.designs@gmail.com

CONTENTS

EXECUTIVE SUMMARY

Introduction to Sustainability in Agriculture

'Sustainability' as a concept has been around for more than two decades. The UN has defined goals around sustainability aimed at the sustenance of both current and future generations. Agriculture is a very important sector requiring transformation towards sustainability, as currently, it is a sector that will undoubtedly impact the looming food and climate crises. Sustainability in agriculture is not just limited to the farm, but can have an impact at a systems level where all value chain processes aim towards becoming more sustainable.

Sustainable Practices in Indian Agriculture

India is also witnessing the emergence of many eco-friendly practices on and beyond farms. Many traditional practices like organic and natural farming are being adopted increasingly among small and marginal farmers, who make up most of the Indian farmer profile. The use of innovative and modern solutions, like precision farming through remote sensing technologies like GPS, is also on the rise. In the last four to five years there has been rapid adoption of practices like integrated pest management, rice intensification systems, hydroponics and aquaponics.

Challenges in Scaling up Sustainable Practices in Indian Agriculture

However, there are still lots of challenges to driving sustainable practices on Indian farms at scale. Unfortunately, most farmers are poor and lack the relevant knowledge, capacity, financial resources and incentives, hindering progress towards sustainability. Apart from that, there is low R&D spending on sustainable activities and a lack of harmonised green finance taxonomy to enable feasible adoption.

Solutions to Scale up Sustainable Agriculture in India

Four solutions to address existing challenges, and enable entire value chains to make agriculture more sustainable are:

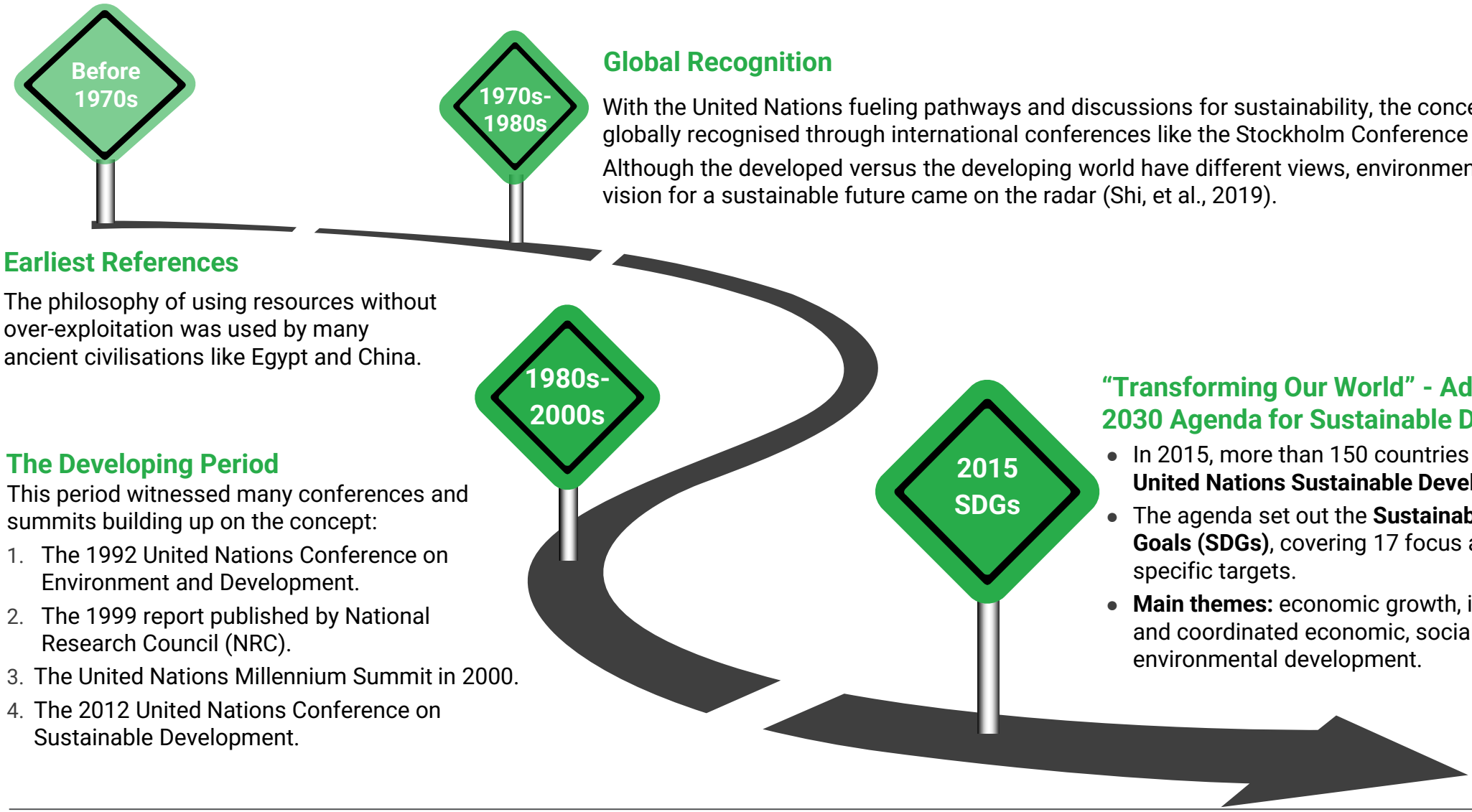
1. Strengthening capacity building and knowledge
2. Boosting financial incentives
3. Developing a climate imperative
4. Increasing the role of technology

Driving Agricultural Sustainability at Scale through Effective Collaborations

Governments, businesses, corporates and global philanthropy, along with non-profits and other development organisations at both a global as well as local levels, need to collaborate and combine their priority areas for interventions that lead to holistic impact within agricultural systems. Progress towards achieving sustainability is only possible when synergies are identified and utilised effectively.

INTRODUCTION TO SUSTAINABILITY IN AGRICULTURE

The United Nations first defined sustainability as meeting the needs of the present without compromising the ability of future generations to meet their own needs.



Earliest References

The philosophy of using resources without over-exploitation was used by many ancient civilisations like Egypt and China.

Global Recognition

With the United Nations fueling pathways and discussions for sustainability, the concept came to be globally recognised through international conferences like the Stockholm Conference in 1972.

Although the developed versus the developing world have different views, environmental issues and a vision for a sustainable future came on the radar (Shi, et al., 2019).

The Developing Period

This period witnessed many conferences and summits building up on the concept:

1. The 1992 United Nations Conference on Environment and Development.
2. The 1999 report published by National Research Council (NRC).
3. The United Nations Millennium Summit in 2000.
4. The 2012 United Nations Conference on Sustainable Development.

"Transforming Our World" - Adoption of the 2030 Agenda for Sustainable Development

- In 2015, more than 150 countries participated in **United Nations Sustainable Development Summit**.
- The agenda set out the **Sustainable Development Goals (SDGs)**, covering 17 focus areas and 169 specific targets.
- **Main themes:** economic growth, inclusive growth and coordinated economic, social, and environmental development.

Many of the UN Sustainable Development Goals also have direct and indirect relevance to agriculture.

Goals directly related to agriculture

End hunger, achieve food security and improved nutrition and promote sustainable agriculture

UNITED NATIONS

UN SDGs, created in 2015, form the base for 'Sustainability' goals throughout the world

Food and Agriculture Organization of the United Nations

FAO is the 'custodian' UN agency for 21 indicators, across SDGs relevant to Food and Agriculture

Goals indirectly related to agriculture

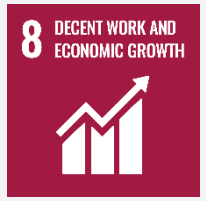
End poverty in all its forms everywhere.

Ensure healthy lives and promote well-being for all at all ages.

Achieve gender equality and empower all women and girls.

Ensure availability and sustainable management of water and sanitation for all.

Ensure access to affordable, reliable, sustainable and modern energy for all.



Promote sustained, inclusive and sustainable economic growth.

Reduce inequality within and among countries.

Ensure sustainable consumption and production patterns.

Take urgent action to combat climate change and its impacts.

Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Protect, restore and promote sustainable use of terrestrial ecosystems.

Incorporating key principles across components to help define measurable indicators which can assess progress and gaps towards sustainability goals.

With the emergence of so many evolving definitions and frameworks for sustainability, it becomes necessary to present a singular representation of the concept. The following representation, derived from analysis by Sattva, captures the commonalities among various definitions and attempts to describe 'Sustainability' in a comprehensive manner and give it a defined scope.

Major components	Sub-components	Broad expected objectives or outcomes
1 Environmental	• Natural resources • Biodiversity • Climate and environment	• Conservation and protection of natural resources and biodiversity • Sustainable management of ecosystems • Climate change mitigation and adaptation
2 Social	• Food Security and nutrition • Employment • Livelihoods and living standards • Social awareness	• Safe and healthy food systems • Ensured dignity of work and labour rights • Social upliftment of communities • Well-informed decision making by stakeholders
3 Economical	• Productivity • Prices and incomes • Supply and demand	• High yields and diversification • Remunerative incomes • Robust market linkages

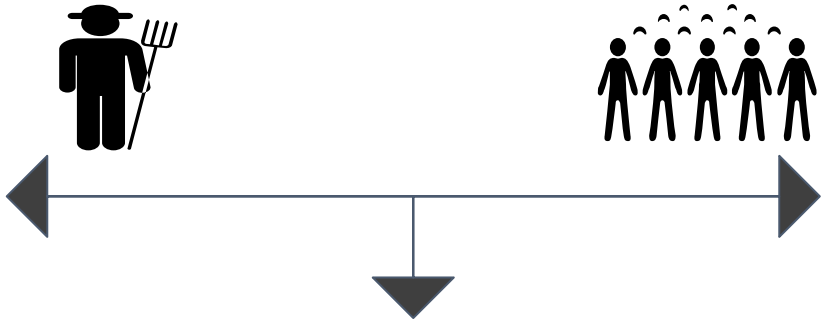
Note: Details added in Annexure

Integrating Sustainability within Agriculture requires following a holistic systems approach.

Integration of sustainable practices in agriculture is not only limited to practices at the **farm level**, but also the **complete supply chain life cycle** including raw material procurement, manufacturing, packaging, transportation, warehousing, distribution, consumption, return, and disposal.

Sustainable Farming Modes

- Farming practices form the core of agriculture and include various farming practices that can be categorised as sustainable.
- Examples include organic farming, regenerative farming, permaculture, and agricultural diversification.



Sustainable Value Chain Processes

- Agriculture is a multi-functional domain, not only limited to farming as an activity.
- E.g. Sustainable food systems, market linkages, and capacity-building models.

Sustainability in Agriculture

Sustainability in pre-production processes	Sustainability in production processes	Sustainability in supply chain processes	Sustainability in consumption
• High-quality, resilient agricultural inputs like quality seeds, biofertilisers and pesticides. • Sustainable agricultural farm practices.	• Sustainable, long-term growth and output. • Efficient harvesting. • Sustainable post-harvest and residue waste management.	• Robust storage and warehousing • Efficient transport and logistics • Efficient wholesale and retailing • Robust market access and linkages	• Eating sufficient and right quality, nutritious food • Sufficient distribution and consistent demand and supply of food • Sustainable food waste management

Leads to overall sustainable agriculture systems

Identifying actionable farm, food and agricultural solutions could enable India to reach its sustainability goals at a faster rate (1/2)

CATEGORY	ECOSYSTEM ISSUES AT GLOBAL LEVEL	POTENTIAL SOLUTIONS
 **Land and Soil**	• There is an estimated **111% increase in global managed land area** from 1900 to 2000 (Cranfield Environment and Agrifood: School of Water, Energy & Environment, 2019). • **Trebling of mean crop and crop residue yield** from 1900 to 2000. • Global population is predicted to grow to around **10 billion by 2050**, increasingly straining the carrying capacity of resources. • Estimates indicate that around **24% of Green House Gas (GHG) emissions** pertain to agriculture, forestry and existing land use patterns (United Nations Environment Protection Agency, 2022). • BY 2030, over **70% of agricultural land** is expected to suffer from soil-related constraints (Dixon et al., 2001).	• On-farm soil carbon sequestration can potentially sequester all of our current annual carbon dioxide emissions measuring roughly 52 gigatonnes (Rodale Institute). • Improved management of agricultural land with known, low-cost practices has the potential to both reduce net greenhouse gas emissions and to act as a direct carbon dioxide sink. • Reduction or elimination of tillage, using cover crops and enhancing crop rotations, ensure that land will not be left bare and that soil carbon will be fixed, rather than lost.
 **Water**	• Increase in irrigated land is three times the increase in farmland globally since 1961 (Dixon et al., 2001). • About 70% of freshwater is used for farming (Dixon et al., 2001).	• Cover crops increase soil carbon, reduce nitrogen leaching and discourage wind and water erosion. • Soil benefits translate into greater soil health and productivity, while reducing water or fertiliser needs.

Identifying actionable farm, food and agricultural solutions could enable India to reach its sustainability goals at a faster rate (1/2)

CATEGORY	ECOSYSTEM ISSUES AT GLOBAL LEVEL	POTENTIAL SOLUTIONS
 **Biodiversity**	• **Significant decrease in biodiversity** with loss of several indigenous flora and fauna worldwide (Dixon et al., 2001). • The decline has been driven by **unsustainable land use practices**. • **15% of all land** is currently **protected** due to special biodiversity and ecosystems around it.	• Sparing land is a technique which is claimed to de-stress resources and enhance the conservation of biodiversity associated with the same land (Cranfield Environment and Agrifood: School of Water, Energy & Environment, 2019). • Well-established sources indicate that the numbers of pollinators, birds, and invertebrates are enhanced due to conservation agriculture.
 **Food Systems and Supply Chains**	• The estimate for the number of people suffering from severe food insecurity in 2019 was 135 million and post-pandemic this number **more than doubled** to 276 million by 2021 (United Nations). • More than **30% of the world population** faced food availability issues currently. • **Africa, Asia, Latin America and the Caribbean** have been the highest affected states by hunger (Food and Agriculture Organisation). • **One-third** of the global population did not have access to adequate food in 2020 (Food and Agriculture Organisation).	• Incorporating sustainable activities in agriculture may provide a higher premium in some cases, and lead to long-term economic benefits for farmers, and increased revenue for the supply chain. • Sustainable processes within the value chain ensure that incentives help to drive sustainability to the end-level producers and make systems resilient. • Agri-based food industries and companies to focus more on sustainable sourcing and circular economy models to impact brand perception and contribute solutions to climate change issues.

SUSTAINABLE PRACTICES IN INDIAN AGRICULTURE

With the highest proportion of global cultivatable land, India is now increasingly adopting nature-friendly agricultural practices which can drive progress towards sustainability. (1/3)

Agricultural Practice	Adoption Scale in India	Evidence-based measurable impacts		
		Environmental	Social	Economical
AGRICULTURAL DIVERSIFICATION* (I. Crop based such as cover crops, intercropping, multicropping. II. Activity-based, non-farm allied activities.)	**30 million hectares of India's cultivable land**	1. Soil becomes healthier due to elimination of monocropping. 2. Crops become more resistant to diseases and need less chemical inputs.	1. Positive effects on food security and nutrition due to more variety of crops and allied activities.	1. Economic uncertainty can be reduced if farmers engage in diversified agricultural activities.
AGROFORESTRY (Practices involving cultivation of trees and shrubs among crops and farmland to increase biodiversity.)	**13.5 million hectares of India's cultivable land**	1. Reduction of pressure on forests and protection of forest ecology. 2. Positive impacts on soil health by increasing soil nutrients and minimising leaching.	1. Improvement in rural living standards and quality of food and nutrition. 2. Ease for upland or hill communities for relocation to farm.	1. Additional remuneration from forest-related activities and outputs like fuel, wood, timber. 2. Reducing risks by eliminating monocropping patterns.
PRECISION FARMING (Practice improving crop yields and assisting management decisions using high technology sensors and analysis tools)	**Nearly 9 million hectares of India's cultivable land**	1. Optimal use of inputs such as water and fertilisers. 2. Practices based on suitability of land.	1. Fewer risks for livelihoods in terms of shifting impacts of conventional practices. 2. Effective waste and residue management.	1. Elimination of financial volatility and risks based on uncertainty of agricultural outcomes.

With the highest proportion of global cultivatable land, India is now increasingly adopting nature-friendly agricultural practices which can drive progress towards sustainability. (2/3)

Agricultural Practice	Adoption Scale in India	Evidence-based measurable impacts		
		Environmental	Social	Economical
INTEGRATED PEST MANAGEMENT (Practices that integrate methods for economic control of pests.)	**Nearly 5 million hectares**	1. Lessen the negative impact of chemicals on soil economy.	1. Food quality increases with fewer negative impacts on human health and food systems.	1. Potential to increase quality and quantity of yields. 2. Save future costs of pesticide usage on crops.
VERMICOMPOSTING (Practice whereby earthworms convert waste material with rigid structures into compost.)	**Nearly 4 million hectares**	1. Diverts wastes from ending up in landfills and also reduces the emission of GHG due to the very small amount of energy used in the process. 2. Increase soil moisture and nutrients.	1. Vermicomposting leads to positive social effects due to proper waste management.	1. It is profitable in a circular economy model.
ORGANIC AND NATURAL FARMING (Practices which avoid the use of synthetic fertilisers, pesticides, growth regulators, genetically modified organisms and food additives)	**2.78 million hectare of India's cultivable land**	1. Positive impact on soil health due to no usage of chemical or synthetic inputs. 2. Input requirements such as water and labour are minimised.	1. Combines traditional modes of farming and local livelihoods. 2. Positive effect on food output quality due to non-GMO and synthetic inputs. 3. Climate change adaptation and mitigation due to carbon sequestering effects.	1. Alternative modes of farming can create new value for consumers. 2. Less cost on expensive, synthetic inputs.

With the highest proportion of global cultivatable land, India is now increasingly adopting nature-friendly agricultural practices which can drive progress towards sustainability. (3/3)

Agricultural Practice	Adoption Scale in India	Evidence-based measurable impacts		
		Environmental	Social	Economical
CONSERVATION AGRICULTURE (Promotes minimum soil disturbance, maintenance of a permanent soil cover, and diversification of plant species.)	**1.5 million hectares of India's cultivable land**	1. Healthier soil due to minimum disturbance and water retention. 2. Permanent organic soil cover. 3. Diversification of soil and crop species.	1. Climate change adaptation and mitigation due to carbon sequestering effects from agricultural conservation can also positively impact livelihoods.	1. Reduction in inputs like labour and time would reduce costs. 2. Higher efficiency for limited output.
REGENERATIVE FARMING (Reverses climate change by rebuilding soil organic matter and regenerates degraded soil biodiversity.)	**Less than 0.1 million hectares**	1. Improved biodiversity in soil, and increased soil health. 2. Less chemical pesticides and inputs.	1. Community-oriented efforts can strengthen farmer livelihoods. 2. Local communities and practices can be invigorated.	1. Positive impact on farm and ranch profitability. 2. Reduced costs of inputs.
PERMACULTURE (Developing self sustaining, efficient and productive natural systems that can be used by anyone, anywhere.)	**Less than 0.05 million hectares**	1. No-till practices which aim to conserve soil fertility and land use. 2. A minimum ecological footprint from active usage of biodegradable materials for farm and non-farm allied purposes.	1. Not limited to just rural communities, but across various areas. 2. Works on the principle of equitable distribution of resources within the community.	1. Enhancement of business by developing community organisations and social links.

CHALLENGES IN SCALING UP SUSTAINABLE PRACTICES

Despite there being a consensus regarding the viability of alternative and sustainable modes of farming, scaling the adoption of them in India will face challenges.

Most sustainable agricultural practices in India cover a very small proportion of the land with only approximately five million or fewer farmers, out of India's 150 million farmers, practising them (NABARD).

Farmer Constraints

1 Limited awareness

- Lack of **awareness and knowledge dissipation** from promoting organisations to end-level producers (Baliwada et. al., 2017).
- No standardisation of knowledge related to technical usage, market standards, or incentive-generating financial products.

2 Lack of financial incentives

- Lack of **market-based incentives** for farmers, incentives like subsidies are criticised due to their short-term benefits and long-term adverse effects.
- Unavailability of **sufficient credit** options, market **subsidies and risk mitigation** tools like insurance discourage adoption.

3 Skilling gaps and capacity constraints

- **Complexities in the adoption of new tools, skills and techniques** on farms make it difficult for producers to innovate.
- Limited **capacity building and awareness** activities executed by Civil Society Organisations (CSOs) present further challenges (Gupta, et al., 2021).

Enabling Ecosystem Constraints

1 Limited literature and evidence-building

- Lack of **long-term assessments of sustainable practices** based on comprehensive evaluation around relevant social, environmental and economical indicators.
- Gaps in **availability of data and research insights** due to limited documentation across geographies (Gupta et.al., 2021).

2 Lack of harmonised green finance taxonomy

- Poor coordination among stakeholders because of the complexity and constant evolution of the climate financing system.
- Poor regulation, coordination and lack of robust framework is creating a constraint on financial institutions.

3 Low R&D spending

- Spending on agricultural R&D stands at Rs. 8,513 crores in the budget 2022-23 compared to the subsidies of Rs. 1,45,339 crores and Rs. 1,04,222 crores on food and fertiliser respectively.
- Difficulty in the **availability of organic inputs** like quality seeds, and irrigation constraints to producers (Muthuprakash et. al., 2020)

SOLUTIONS TO SCALE UP SUSTAINABILITY IN INDIAN AGRICULTURE

Major themes for a sustainable future of Indian agriculture.

Going forward, a focus on the following major themes emerging in Indian agriculture may enhance sustainable progress towards bridging existing gaps.

Solution 1	Solution 2	Solution 3	Solution 4

Strengthening capacity-building and knowledge

01

Boosting financial incentives

02

Developing a climate imperative

03

Increasing the role of technology

04

Solution 1: Strengthening capacity-building and knowledge.

Building evidence, generating research-based support to sustainable activities on and off farms, educating and supporting farmers to make better decisions and understanding their needs and challenges would enable the process of transforming Indian agriculture towards a future-oriented, sustainable system.

Major Drivers

- **Evidence-based studies of farming systems.**
- **Research and perception studies on the ground.**
- **Focus on skilling labour as per their role.**
- **Training and knowledge of stakeholders as per requirements.**

Areas to increase potential

- Need to skill the population to suit the needs of **globalisation** and increase the economy's size. Evident skilling gaps exist and there is a disproportionate usage of skills on and beyond farms (Mehrotra, et al., 2013).
- A large proportion of India's workforce is informal, with disguised and seasonal employment issues.
- Rural to urban migration has led to the feminisation of agriculture which would require more **inclusive training models** for skilling (Das, et al., 2021).

Possible solutions

- Conducting **evidence-based needs and gap assessments** on the ground to understand specific areas which require training and knowledge dissemination.
- Building **training tools and mechanisms** that help build the capacity and knowledge of farmers and other stakeholders.
- Providing **necessary technical assistance** to build the capacities of other stakeholders like the financial ecosystem, including both lenders and borrowers.

Solution 1	Solution 2	Solution 3	Solution 4

Strengthening capacity-building and knowledge

01

Boosting financial incentives

02

Developing a climate Imperative

03

Increasing the role of technology

04

Solution 2: Boosting financial incentives.

The agriculture sector can generate investment into climate-smart and green technologies through combined investments, using blended financing and market mechanisms, like carbon credits, to drive sustainability at a faster rate.

Major Drivers

- **Diversification of investments.**
- **Developing momentum towards green financing.**
- **Using market-based mechanisms.**
- **Availability of timely credit to beneficiaries.**
- **Efficient systems for entry and exit into farming.**

Areas to increase potential

- Evident **funding gaps** and **boosting R&D** towards reaching sustainable development goals.
- **Emerging need to provide incentives** for farmers to change up their options in allied agriculture activities to boost income and stay competitive.
- Agricultural investments in India currently show an **inclination towards traditional, resource-draining activities** as these primarily focus on food and fertiliser subsidies, grants, and crops like rice and wheat.

Possible Solutions

- Building a **dedicated taxonomy** for sustainable agriculture.
- Introduction of **financial and risk mitigation products** for climate-resilient activities.
- Adopting **innovative mechanisms** to leverage additional sources of both public and private capital e.g. Carbon Markets.
- Using **blended financing** instruments, where development-oriented funding is used to mobilise additional private capital.

Solution 1	Solution 2	Solution 3	Solution 4

Strengthening capacity-building and knowledge

01

Boosting financial incentives

02

Developing a climate imperative

03

Increasing the role of technology

04

Solution 3: Developing a climate imperative.

Building a sustainable infrastructure, activities and processes by integrating climate-conscious goals effectively into them would drive the transformation towards an increasingly climate-resilient, green and decarbonised economy, significantly fueled by best practices and solutions within agriculture.

Major Drivers

- **Setting goals towards decarbonisation of the economy.**
- **Adoption of climate-resilient agriculture.**
- **Sustainable food and waste management processes.**
- **Production-linked incentives.**

Areas to increase potential

- Customers are becoming increasingly aware and becoming loyal to brands which are more **sustainable and eco-friendly.**
- **The policy push towards green bonds** can mobilise resources for green infrastructure and elicits investments for public sector projects, which help to reduce carbon intensity in the economy.
- **Promoting chemical-free farming**, such as Zero Budget Natural Farming (ZBNF) and organic farming, practised in states like Andhra Pradesh and Sikkim, are serving as models for other states.
- Increasing **incentives for businesses** to become environmentally active.

Possible solutions

- **Transitioning to a circular economy** by eliminating waste, upcycling resources, and building an emphasis on taking a comprehensive view of products and processes.
- Adopting more effective **climate mitigation and adaptation strategies,** like sustainable sourcing and traceability across supply chains.
- Enabling **high premiums and remuneration** by making the adoption of climate-resilient activities cost-effective.

Solution 1	Solution 2	Solution 3	Solution 4
			
Strengthening capacity-building and knowledge	Boosting financial incentives	Developing a climate imperative	Increasing the role of technology
01	02	03	04

Solution 4: Increasing the role of technology.

A huge opportunity exists for private and foreign entities to expand their footprint in India by providing usable digital solutions to approximately 267 million farmers and optimising costs for rural farm households.

Major Drivers

- **Monitoring crops through smart systems like GPS.**
- **Using drones in farming.**
- **Automated farming machinery.**
- **Smart-building and equipment machinery.**
- **Collaborative agribusiness digital platforms.**

Areas to increase potential

- Addressing **market linkage** issues for sustainable practices, especially post-COVID, by avoiding costs for transportation and distance.
- **Shifting narratives towards agritech** and technology-led innovations to push sustainable solutions which require proper technical skills.
- **Pushing policy towards technology adoption** such as the National Agricultural Market (e-NAM) in 2016 and applications like Jio Agri (JioKrishi) platform launched in February 2020.

Possible solutions

- **Adoption of low-cost technology to enable** tech at scale and to realise its long-term effects towards sustainability, the costs of technologies have to be driven down for smallholder and poor farmers.
- **Making digital and technological equipments more beneficial** to smallholder farmers with the help of private sector players like agritech startups.
- **Training farmers and beneficiaries** to build use cases towards new and advanced technologies at scale.

SCALING SUSTAINABILITY THROUGH EFFECTIVE COLLABORATIONS

UN Agencies and Global Philanthropy can strengthen the case for low-scale, sustainable solutions in agriculture by promoting and driving investments towards evidence-based assessments, of the needs and realities of the ecosystem.

Low Priority | Medium Priority | High Priority

Type of Organisation	Examples	Value generated towards enabling sustainability: Funding and Capital Investment	Implementation and Delivery	Research, Development and Innovation	Advocacy
Big Global Funders	Bill & Melinda Gates foundation; The Rockefeller Foundation; syngenta foundation for sustainable agriculture				
Global Non-profits	United Nations; Food and Agriculture Organization of the United Nations; World Health Organization				
Global Financial Institutions	ADB; IFAD International Fund for Agricultural Development; WWF				
Global Impact, Research and Development Organisations	World Economic Forum; giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH; CGIAR; World Resources Institute				

Businesses and corporate philanthropy can strengthen the case for low-scale, sustainable solutions in agriculture by driving responsible and transparent processes across the agricultural supply chain and investing in projects accordingly.

Low Priority | Medium Priority | High Priority

Type of Organisation	Examples	Value generated towards enabling Sustainability: Funding and Capital Investment	Implementation and Delivery	Research, Development and Innovation	Advocacy
Agribusiness Companies	PATANJALI, Godrej, MARS WRIGLEY, McCain, Amul The Taste of India, Unilever, Walmart Save money. Live better.				
Private Financial Institutions	State Bank of Ind, ICICI Bank, HDFC BANK, punjab national bank ...the name you can BANK upon!, AXIS BANK				
Agriculture Input Providers	Cargill, JOHN DEERE, syngenta, DUPONT, BAYER				
Corporate Funders	TATA, Mahindra, DCM SHRIRAM Growing with trust, CISCO				

The focus of the Government should be on appropriate and timely policy interventions and leveraging their influence across all stakeholder groups to enable sustainability at scale.

Type of Organisation	Examples
Central Governments	कृषि एवं किसान कल्याण मंत्रालय MINISTRY OF AGRICULTURE AND FARMERS WELFARE; सत्यमेव जयते; Dept. of Animal Husbandry, Dairying & Fisheries; MOFPI MINISTRY OF FOOD PROCESSING INDUSTRIES GOVERNMENT OF INDIA
State Governments (all states)	Agriculture Department Government of The Punjab; Directorate of Agriculture Agriculture, Farmers Welfare and Co-operation Department Government of Gujarat
Regulatory Authorities	fssai Food Safety and Standards Authority of India; International Organization for Standardization ISO
Autonomous Institutions	NITI Aayog; भारतीय कृषि अनुसंधान संस्थान IARI 1905; भारतीय कदन्न अनुसंधान संस्थान Indian Institute of Millets Research

Low Priority | Medium Priority | High Priority

Value generated towards enabling sustainability			
Funding and Capital Investment	Implementation and Delivery	Research, Development and Innovation	Advocacy

Nonprofits and community organisations need to leverage the value of cooperation and collaboration to implement sustainable agricultural activities at the ground level.

Low Priority | Medium Priority | High Priority

Type of Organisation	Examples	Value generated towards enabling Sustainability			
		Funding and Capital Investment	Implementation and Delivery	Research, Development and Innovation	Advocacy
FPOs and Cooperatives	CAPCL Chetna Organic Agricultural Producers Company Ltd., IOFPCL, APICOL, WOTR water gives life				
Local Non-profit Organisations	Pradan, Vrutti Livelihood Resource Center, swades FOUNDATION Rural Empowerment, ASHA Food . Farmers . Freedom				
Consumers and Households	NetSCoFAN Network for Scientific Co-operation for Food Safety & Applied Nutrition, Consumer Rights Organisation, CONSUMER VOICE, CONSUMER GUIDANCE SOCIETY OF INDIA CGSI				

REFERENCES

1. Azim Premji University 2021, *State of Working India 2021: One year of Covid-19, Centre for Sustainable Employment*.
2. Bhavani, R & Rampal, P 2020, *Harnessing Agriculture for Achieving the SDGs on Poverty and Zero Hunger*, ORF Issue Brief.
3. Biodynamic Association, n.d. *Biodynamic Principles and Practices*.
4. Brown, KA, Srinivasapura VN, Law, C, Harris, F, Kadiyala, S, Shankar, B, Mohan, S, Prabhakaran, D, & Knai, C 2021, 'Moving towards sustainable food systems: A review of Indian food policy budgets.' *Global Food Security*, Volume 28.
5. Cranfield Environment and Agrifood: School of Water, Energy & Environment, 2019. *Regenerative Agriculture: Identifying the impact, enabling the potential*.
6. Das, A, Mohapatra, S & Patnaik, NM 2021, 'Feminization of Indian Agriculture: A Review', *Agricultural Reviews*.
7. Dixon, J, Gulliver, A & Gibbon, D 2001, *Farming Systems and Poverty: Improving Farmers' Livelihood in a Changing World,* FAO and World Bank, Rome.
8. Food and Agriculture Organization of the United Nations 2022, *Organic Agriculture*.
9. Food and Agriculture Organization of United Nations 2022, *Agroforestry*.
10. Food and Agriculture Organization of United Nations 2022, *Conservation Agriculture*.
11. Government of India 2020-21, *Economic Survey 2020-21*.
12. Gulati, A, Paroda, R, Puri, S, Narain, D, Ghanwat, A 2021, *Food System in India Challenges Performance and Promise*, The Scientific Group for the UN Food Systems Summit.
13. Gupta, N, Pradhan, S, Jain, A & Patel, N 2021, *Sustainable Agriculture in India: What we Know and How to Scale Up*, Council on Energy, Environment and Water.
14. Directorate of Plant Protection, Quarantine & Storage. IPM at a glance.
15. Kiani, AK, Sardar, A, Khan, WU, He, Y, Bilgic, A, Kuslu, Y & Raja, MAZ 2021, 'Role of Agricultural Diversification in Improving Resilience to Climate Change: An Empirical Analysis with Gaussian Paradigm'. *Sustainability*, vol. 13, no. 17, pp 9539.
16. Mehrotra, S, Gandhi, A & Sahoo, BK 2013, *Estimating the Skill Gap on a Realistic Basis for 2022*, Institute of Applied Manpower Research, Government of India.
17. NITI Aayog 2021, *Natural Farming*.
18. Permaculture Research Institute 2022, *What is Permaculture?*.
19. Petchey, OL & Gaston, KJ 2006, 'Functional diversity: back to basics and looking forward'. *Ecology Letters*, vol. 9, no. 6.
20. Rodale Institute n.d. *Regenerative Organic Agriculture and Climate Change: A Down-To-Earth Solution to Global Warming*.
21. Satapathy, BS, Raghu, S, Nayak AK, Kumar A, Swain PK, Mishra SK, Chakraborti M, Saha S, Lenka S, Mohanta RK, Mondal, B, Marandi, BC, 2021, *Vermicomposting for sustainable crop production in hill and tribal regions of Odisha,* NRRI Technology Bulletin - 143.
22. ScienceDirect 2022. *Precision Agriculture: An Overview*.
23. ScienceDirect 2022. *Vermicomposting: An Overview*.
24. Sharma, A, Byrant, L, Lee, E & O'Connor, C 2021, 'Regenerative Agriculture: Blog Series'. NRDC (National Resources Defense Council) Expert Blog.
25. Shi, L, Han, L, Yang, F & Lijie, G 2019, 'The Evolution of Sustainable Development Theory: Types, Goals, and Research Prospects'. Sustainability, vol. 11.
26. Sidharth, R 2022, 'Indian agri-supply chain: The flight and fight to make agriculture a powerhouse for the economy'. Logistics Insider magazine.
27. Singh NP, Kumar R, Singh RP 2006, 'Diversification of Indian Agriculture: Composition, Determinants and Trade Implications', Agricultural Economics Research Review, vol. 19.

28. Bhan, S & Behera, UK 2014, 'Conservation agriculture in India – Problems, prospects and policy issues', *International Soil and Water Conservation Research*, vol. 2, no. 4.
29. United Nations Environment Protection Agency 2022, *Global Greenhouse Gas Emissions Data, viewed on May 15 2022.*
30. United States Environmental Protection Agency 2021, *Integrated Pest Management (IPM) Principles.*
31. Muthuprakash, S, Pawar, V, Deora, S, Gupta, S, Kumar, G, Rabha, M, Serupally, R, Gevariya, R & Sridhar, S 2020, 'Sustainable Agriculture in India – Why Does It Not Scale Up?' *Studies in Development Process*, no. 10, VikasAnvesh Foundation, Pune.
32. Baliwada H., Sharma J.P., Burman R.R., Nain M.S., Kumar A., & Venkatesh P 2017, 'Constraints and Strategies in Scaling up of Farmer-led Innovations', *Journal of Community Mobilization and Sustainable Development,* Vol. 12(1), p.72-78