

Enhancing Farm Productivity and Export Potential of Indian Agriculture Under Global Markets

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Abstract:

Indian agriculture is at a turning point and has to address challenges of boosting productivity in the country's agriculture system while simultaneously gaining a larger share in the global commodity markets. India has the second-largest agricultural land base in the world and a labour force employed in the agricultural sector of around 45%, but its contribution to agricultural exports is very small at around 2.5% of the world's exports. In this paper, the structural constraints affecting farm productivity growth (fragmented land holdings, inadequate irrigation infrastructure, limited mechanization, and inefficient post-harvest value chain) are critically examined, while India's changing export competitiveness of important crops like rice, spices, marine products, and horticulture is analysed. It is descriptive-analytical, and the different policy measures adopted, like Pradhan Mantri Fasal Bima Yojana, PM-KISAN, Agricultural Export Policy 2018, etc., have been analysed. For the potential of agricultural export to be realised, the paper emphasises the need for a holistic treatment which would involve input efficiency, modernisation of agri-logistics, quality compliance, and climate-smart agriculture. The findings have important policy implications for policymakers, agri-entrepreneurs, and international development agencies trying to transform India's agriculture sector.

Keywords: Farm productivity, agricultural exports, India, global markets, value chain, food security, Agricultural Export Policy 2018, agri-logistics, post-harvest management.

1. Introduction

Agriculture continues to be the source of strength and sustenance for the Indian economy and society. The sector directly and indirectly supports the livelihood of approximately 700 million people (Ministry of Agriculture and Farmers' Welfare [MoAFW] 2023) and contributes approximately 18-20% to the country's Gross Domestic Product (GDP) in 2023. India stands as the world's biggest producer of milk, pulses, jute, spices, rice, wheat, sugarcane, cotton, fruits and vegetables (Food and Agriculture Organization [FAO],

2022). Yet, paradoxically, this vast agricultural resource base is one with low productivity, poor value chain integration and poor value chain linkages to the global value chain.

The 21st century has seen a tremendous change in agriculture. Population growth, changing dietary preferences, climate change, and geopolitical factors all contribute to the need for a diverse range of quality food and non-food crops. According to the World Trade Organization (WTO, 2022), global agricultural trade stood at USD 1.8 trillion in 2021 and presents immense opportunities for a diversified agriculture producer like India. India exported USD 50.2 billion of agriculture products in 2021-22 (Agricultural and Processed Food Products Export Development Authority [APEDA], 2022), but this is still a small portion of the potential; further reforms and investments are needed. The present situation of farm productivity in India is discussed in Section 2. Section 3 reviews the export profile and competitiveness of Agriculture in India. In Section 4, the policy architecture of agricultural growth and exports is discussed. The structural constraints and opportunities are summarized in Section 5. Section 6 suggests a multi-faceted strategic approach for increasing productivity and export potential. The policy implications are presented in Section 7.

2. Present Status of Productivity of Agriculture in India

Productivity of Indian agriculture in terms of yield/ha has marginally improved over the last 2 decades. The benefits are still, however, well below the global average for several key commodities, which highlights the continued presence of structural inefficiencies in the utilization of inputs, irrigation, and technology.

2.1 Food Prices and the Market System

The average rice production in India is ~2.6 MT/ha, in China, 7.1 MT/ha, and the world average is 4.7 MT/ha (FAO, 2022). Wheat, maize, and oilseeds are in a similar position. Over-reliance on monsoon rainfall (only 52% of the cultivated areas are assuredly irrigated), lack of use of high-yielding variety (HYV) seeds outside the Green Revolution belt, poor soil health management, and insufficient mechanization in small and marginal holdings are the main causes of these gaps (Singh & Kumar, 2021). Another important limiting factor is the fragmentation of land holdings. According to the Agriculture Census of 2015-16, 146 million operational holdings in India are about 86% small and marginal (less than 2 hectares) with an average holding size of 1.08 hectares (MoAFW, 2019). Such fragmentation may impede economies of scale, impede the mechanization of agriculture, and limit the strength of the input and output market position available to the farmer.

Table 1: Crop Yield Comparison – India vs. Global Average (2021–22)

Crop	India (Mt/ha)	Global Average (Mt/ha)	China (Mt/ha)	Yield Gap (%)
Rice	2.60	4.70	7.10	44.7
Wheat	3.50	3.50	5.70	0.0
Maize	3.00	5.80	6.30	48.3

Crop	India (Mt/ha)	Global Average (Mt/ha)	China (Mt/ha)	Yield Gap (%)
Soybean	1.10	2.80	1.90	60.7
Sugarcane	68.00	70.40	73.80	3.4
Cotton	0.47	0.78	1.84	39.7

Note. Data compiled from FAO (2022). FAOSTAT database. Food and Agriculture Organization. <https://www.fao.org/faostat>; and Ministry of Agriculture and Farmers' Welfare (2023). Annual Report 2022–23. Government of India.

2.2 Input Use Efficiency

Indian average application rates of fertilizers are very high (167 kg/ha), which is very high as compared to the recommended application rate of some crops, resulting in degradation of soil and declining marginal productivity (Indian Council of Agricultural Research [ICAR], 2022). Irrigated agriculture water use efficiency is still low; in India, around three to four times more water is used compared to Israel and Australia for the same amount of food produced (World Bank, 2021). It is the need of the hour to move towards precision agriculture, micro-irrigation, and soil health card-based nutrient management to overcome these trends.

3. Agricultural Export Profile and Competitiveness in India

In the recent decade, India's agricultural exports have increased significantly and have become one of the significant foreign exchange earners. But the nature of these exports remains very concentrated on a few commodities, and the policy of market diversification is still in its infancy in India.

3.1 Export Growth Trends

The agriculture exports have risen from USD 24.7 billion in 2013-14 to USD 50.2 billion in 2021-22 with an average of 9.3% compound annual growth rate (CAGR) (APEDA, 2022). Exports are mainly of rice (including non-basmati rice), marine products, spices, buffalo meat, and fresh fruits and vegetables.

Table 2: India's Major Agricultural Export Commodities (2018–19 to 2021–22)

Commodity	2018–19 (USD Bn)	2019–20 (USD Bn)	2020–21 (USD Bn)	2021–22 (USD Bn)	Share (%) 2021–22
Rice (Total)	7.24	6.43	8.83	9.65	19.2
Marine Products	5.67	5.51	5.96	7.76	15.5
Spices	3.15	3.44	3.60	4.30	8.6
Buffalo Meat	3.10	3.29	3.24	3.60	7.2
Fresh Vegetables	1.06	0.95	0.91	0.98	2.0

Commodity	2018–19 (USD Bn)	2019–20 (USD Bn)	2020–21 (USD Bn)	2021–22 (USD Bn)	Share (%) 2021–22
Other Cereals	1.45	1.70	2.90	2.93	5.8
Total Agri Exports	38.74	35.10	41.25	50.21	100.0

Note. Data sourced from Agricultural and Processed Food Products Export Development Authority (2022). Annual Export Statistics 2021–22. APEDA, Ministry of Commerce and Industry. https://apeda.gov.in/apedawebsite/six_head_product/EFF.htm

3.3 Business Environment

In India, the number of agricultural export markets is limited. APEDA 2022 indicates that nearly 40 per cent of the total agricultural output of India is exported to the top five countries such as the United States of America, China, Bangladesh, Vietnam, Saudi Arabia. With import policy shifts, phytosanitary measures, and trade disputes, this concentration is a risk for India. This diversification deficit will be partially met by the recent Free Trade Agreements (FTAs) with the UAE and Australia, and by the progress of the negotiations with the EU and the GCC.

India's comparative advantage is high in rice, spices and marine products according to the WTO's Revealed Comparative Advantage (RCA) index, while processed food and horticultural commodity sectors face a quality compliance issue and lack of cold chain facilities (Hoda & Gulati, 2020).

4. Policy Architecture for Agricultural Growth and Exports

The Government of India has developed a forward-looking policy package to boost farm productivity and agricultural exports. Some policy measures are the National Food Security Mission (NFSM), Pradhan Mantri Fasal Bima Yojana (PMFBY), PM-KISAN, and the Agricultural Export Policy 2018.

4.1 Agricultural Export Policy 2018

Agricultural Export Policy (AEP) 2018 is India's first-ever dedicated policy for enhancing agricultural exports with an ambitious target of USD 60 billion by 2022 and USD 100 billion in the coming few years (Ministry of Commerce and Industry [MoCI], 2018). The policy emphasises the diversification in the basket of exports, creation of agri-export zones (AEZs), value-added processing, and participation of farmers from India in global value chains. The USD 60 billion target was not achieved by 2022 because of the disruptions caused by COVID-19 and challenges faced in logistics, but the policy has spurred many institutional changes.

Table 3: Key Government Schemes for Agricultural Productivity and Export Promotion (2022–23)

Scheme/Policy	Year Launched	Key Objective	Budgetary Allocation (INR Cr, 2022–23)	Coverage
PM-KISAN	2019	Income support to farmers	60,000	120 million farmers
PMFBY	2016	Crop insurance	15,500	55 million farmers
PMKSY	2015	Irrigation expansion (Har Khet Ko Pani)	93,068 (5-yr outlay)	76 districts
AEP 2018	2018	Boost agri exports to USD 60–100 Bn	N/A (policy mandate)	All export crops
NFSM	2007	Enhance production of rice, wheat, and pulses	1,510	All states
eNAM	2016	Digital agricultural market platform	415	1,000+ mandis

Note. Data compiled from the Ministry of Agriculture and Farmers' Welfare (2023). Annual Report 2022–23; and Ministry of Finance (2023). Union Budget 2022–23 Expenditure Profile. Government of India.

4.2 Input Subsidies and Their Distortionary Effects

India has a robust policy support for agriculture. The fertilizer subsidy amounted to INR 2.25 lakh crore (or USD 27 billion) in 2022–23, one of the largest subsidy programmes in the world (Ministry of Finance 2023). Undoubtedly, the subsidies have enabled inputs for the poor farmers to be available, but have also resulted in excessive use of chemical fertilizers and preference for input-intensive crops such as paddy and wheat, giving rise to soil health issues and a fall in the water table in Punjab and Haryana (Chand, 2022).

5. Structural Constraints and Emerging Opportunities

5.1 Losses and inefficiencies in the value chain after harvest

The estimated post-harvest losses (PHLs) in India range from 16-18% in the case of cereals, 4-6% in the case of milk, and up to 25-30% in the case of vegetables and fruits (National Institute of Food Technology Entrepreneurship and Management [NIFTEM], 2020). The losses estimated to be more than INR 92,000 crore per annum are a huge opportunity cost for agriculture. The main factors are: lack of storage facilities, lack of good road access in rural areas, lack of cold chain access, and lack of primary processing at the farm level.

The cold chain network is growing in India, but it is still very underdeveloped. In India, in the year 2022, there were around 8186 cold storages having a total capacity of 37.4 million metric tonnes, mostly used

for storing potatoes in the states of Uttar Pradesh and West Bengal (National Horticulture Board [NHB], 2022). On the agri-export side, multi-commodity cold chains, reefer transport, and post-harvest CA storage are almost unheard of, and hamper the prospects of India exporting perishable horticultural produce to premium markets such as Europe and North America.

Table 4: Estimated Post-Harvest Losses in Indian Agriculture by Commodity Group (2021–22)

Commodity Group	Production (Mt)	Post-Harvest Loss (%)	Economic Loss (INR Cr)	Primary Loss Cause
Fruits & Vegetables	329.5	25–30	44,000	Inadequate cold chain
Cereals & Pulses	330.5	4–6	11,000	Storage & handling
Oilseeds	37.7	6–8	6,400	Moisture & storage
Fisheries	16.2	10–12	9,700	Handling & processing
Spices	10.9	7–10	4,600	Drying & storage
Total (approx.)	—	—	92,651	Multi-factor

Note. Adapted from National Institute of Food Technology Entrepreneurship and Management (2020). Assessment of Post-Harvest Losses in India. NIFTEM, Ministry of Food Processing Industries, and Indian Council of Agricultural Research (2022). Annual Report 2021–22. ICAR, New Delhi.

5.2 Climate change and agricultural vulnerability

Climate variability and extreme weather conditions are becoming a serious threat to Indian agriculture. The Intergovernmental Panel on Climate Change (IPCC, 2022) projects that the potential yield loss in South Asia in the year 2050 is 10-25% with a high emission scenario. They were already affecting the yield stability of the country under irregular monsoons, droughts, floods, and escalating average temperatures, especially in rain-fed areas, which cover more than 48% of the net sown areas (MoEFCC, 2021).

The National Initiative on Climate Resilient Agriculture (NICRA) is promoting adaptation measures like drought-tolerant and heat-resistant varieties, conservation agriculture, watershed management, and crop diversification. Adoption is still low, though, because of poor extension services, low awareness among smallholder farmers, and a lack of financial incentives.

5.3 Digital Agriculture and Technology Adoption

The digital technology has been rapidly seeping into farming in India – this is a huge opportunity that is emerging. The use of advisory services via mobiles, AI for crop monitoring, drone precision spraying, and satellite images for crop evaluation is being utilized throughout the agricultural value chain (Niti Aayog, 2021). Under the Digital Agriculture Mission 2021-25, the government has planned to provide customized agriculture advice to 100 crore-plus farmers using the power of data. Availability of such data-driven personalized agriculture advisory services would be made available to over 100 million farmers through

the Digital Agriculture Mission 2021-25, a government initiative focusing on Agri-Stack, a federated farmer database.

In addition to this, there are various private sector programmes and initiatives to strengthen linkages, improve price discovery and efficiency in procurement of inputs, including the ITC's e-Choupal network, Mahindra's Samriddhi programme, and several other agri-tech startups which are actively bringing this in the private sector (Birthal et al., 2021).

6. Strategic Framework for Enhancing Productivity and Export Potential

Taking account of the above analysis, this section suggests an integrated strategic framework, grouped into five thematic frameworks.

6.1 Pillar I: Technology-Led Productivity Enhancement

Closing the yield gap will need more rapid uptake of improved varieties, precision irrigation (drip and sprinkler systems), and integrated pest management (IPM). While the Per Drop More Crop initiative of the Government of India (GoI) under PMKSY provides a solid foundation, it must reach at least 25 million hectares of cultivable land by 2030 to have an impact. Moreover, AI-based crop recommendation systems can also be linked with the PM-KISAN beneficiary database to provide personalized and dynamic agronomic advice to the small farmers.

6.2 Pillar II- Agri-Logistics and Cold Chain Modernization

There is a need for Incentive Measures through a separate Agri-Logistics Modernization Fund to support Private Sector investment in primary processing centres, cold chain infrastructure, and Rural Road Infrastructure. The current schemes like Pradhan Mantri Gram Sadak Yojana (PMGSY) and Scheme for Agro-Marine Processing and Development of Agro-Processing Clusters (SAMPADA) are perceived as having partial coverage only and need to be converged with APEDA's AEZ framework for seamless integration of export corridors, especially in the horticulture and marine products sectors (MoCI, 2022).

6.3 conformance to quality and standards

Sanitary and Phytosanitary (SPS) standards, Maximum Residual Limits (MRLs), and traceability requirements are becoming increasingly important in agricultural markets in an international and competitive context. There is a huge requirement for India to increase the capacity of its testing laboratories and adopt GLOBALG. Implement an A.P. system for export crops; provide farmer training on Good Agricultural Practices (GAP). In the case of the European Union, rejection of Indian consignment as a result of violation of the pesticide residue limit, especially in the spices and grapes, underlines the urgency of the agenda (European Commission, 2022).

6.4 Pillar IV: Market Diversification and Trade Diplomacy

India needs to leverage the current negotiations of an FTA to achieve market access for agricultural commodities with the EU, UK, GCC, and Southeast Asian countries, since it is preferential. At the same

time, the Agricultural and Processed Food Products Export Development Authority (APEDA) should organize country-specific market promotion programmes for high-value products like organic products, nutraceuticals, and processed products in emerging markets of the African and Latin American markets.

6.5 Pillar V: Climate-Resilient and Sustainable Agriculture

Global competitiveness in agriculture requires a transition towards climate-resilient and environmentally sustainable agriculture. This means greater scaling up of natural farming under Bharatiya Prakritik Krishi Paddhati (BPKP), introducing environmental standards such as the EU Farm to Fork strategy, and aligning market access to environmental performance (European Commission, 2020) in the PMFBY.

7. Conclusion

This paper has attempted to examine various considerations contributing to the productivity of the farm and export potential from the Indian agriculture in light of the global context. The analysis reveals India has a strong comparative advantage in several commodities, but various structural barriers in the form of yield gaps, fragmented land holdings, post-harvest losses, cold chain inefficiency, and SPS compliance issues are still present to restrict the realization of the same.

The export performance of Indian agriculture has been positive, but not satisfactory, considering the productive assets and volume of trade of agriculture in the world. The Agricultural Export Policy 2018 is path-breaking in its intent, but needs to be implemented with more powerful support, especially in the field of agri-logistics, quality adherence, and market diversification.

The proposed technology-led productivity, agri-logistics modernization, quality compliance, market diversification, and climate resilience strategy outlined in this paper provides a multi-faceted roadmap for moving towards the objective of a high-productivity globalized Indian agriculture. They will need the combined efforts of the central and state governments, agri-businesses, agri-development finance institutions, and farmer-producer organizations to succeed. The next 10 years will be critical – Indian agriculture can reach USD 100 billion globally by 2030 with the right policy package and institutional investments in the sector, to sustain the food and nutrition security of Indian citizens of 1.4 billion.

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