POLICY REPORT 2025-2026

THE ECONOMICS SOCIETY, SRCC

THE TRADE MANDATE

UNRAVELLING INDIA'S AGRICULTURAL TRADE POLICY

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Executive Summary

The Indian Agricultural trade sector has witnessed multiple changes in the recent past, shaped by climate shocks, volatile policies, both domestic and global market disruptions, and a need for sustainable, technology-driven growth. Although post the Green Revolution, India has established itself as a leading exporter of rice, spices, dairy products, and horticultural goods, the sector is still facing a lower level of growth due to structural bottlenecks.

Historical events like the establishment of APMCs, the abolition of the zamindari system, the Green Revolution, and the L.P.G. policy in 1991 have all left a significant mark on the industry, altering cropping patterns, market incentives, trade balances, and farmers' choices. Currently, the government seek to manage domestic and international problems by employing measures such as the imposition of MSP, import duties, MEP, subsidies, and the SPS measures. These measures do help stabilise farmer incomes and food prices, but also result in a disturbed market environment, reduced competitiveness(both on a domestic and a global scale), lesser integration into the global value chains and heavily increased fiscal burdens on the government. Domestic trade policies, as exemplified by the 2019 Onion export ban, are often inconsistent with India's global trading agreements.

Indian agriculture suffers from growing levels of risk due to climate change, including soil degradation, flash floods in the Northeast, production fluctuations, and increased insecurity for farmers. In addition to these long-term risks, farmers are also dealing with short-term challenges like export bans/limitations that can assist in stabilising the domestic economy but ultimately erode long-term reliability between domestic and global economies.

Although new initiatives, including the Pradhan Mantri Fasal Bima Yojana and the National Mission of Sustainable Agriculture, have been created to help farmers increase their resiliency, many obstacles remain, including a lack of funding, geographic coverage and issues with implementation.

While some technology-based solutions, such as climate-resilient seed (DRR Dhan 66, MACS 647), drip irrigation, artificial intelligence-based grading systems, IoT cold storage and predictive weather systems may provide farmers with more resilient supply chains, there are several barriers to adoption, which include inadequate logistics capacity, poor market price discovery mechanisms and lack of adequate working capital.

India's trade governing mechanism, under three primary laws: The Foreign Trade Development Regulation (FTDR) Act, The Essential Commodities Act, and The Agricultural Export Policy, must strike a balance between domestic food security requirements and international obligations as evidenced by WTO trade disputes to date, current discussions about subsidies, and new international obligation issues such as Carbon Border Adjustment Mechanisms (CBAM) and increasingly stringent Sanitary and Phytosanitary Standards (SPS). As trade disputes create pressure on India to align with all International Trading Standards, to facilitate this transition would require significant reforms, which include:

- Rationalising export tax and control systems
- improving SPS certification processes
- increasing the number of Farmer-Producer Organisations (FPOs)
- Creating initiatives that promote Climate Smart Agricultural Technologies
- increasing private sector investment.

For India to remain competitive into the future, providing food availability for its citizens and improving the well-being of farmers will require an internationally consistent policy framework that is organised around stability.

Introduction

Agriculture has traditionally been the mainstay of India's economy, culture, society, and politics. While it is still an essential provider of livelihoods to a large segment of the population and a major source of food security and rural support, the sector is also culturally significant to the country. The role of agriculture in the Gross Value Added (GVA) has been decreasing gradually due to structural changes; however, its significance is much higher than what the numbers indicate at the national level. The sector still maintains a lot of political influence and, at the same time, is very much related to welfare, price stability, and social equity. India is indeed a major player in global agricultural markets. Historically, it has been a major player in the world markets and over time, it is increasingly contributing to the world production and exports of staple commodities such as rice, wheat, sugar, cotton, and various types of horticultural products, and the demand is continuously increasing. However, as it becomes increasingly integrated with global markets, it is also becoming vulnerable to world price fluctuations, trade negotiations, and supply chain problems. So, agricultural trade policy has become a very important instrument of the government to keep the domestic and foreign sectors in harmony.

Basically, on the one hand, India's agricultural policy framework has always been dominated by the focus on food shortages and farmers' incomes, as well as price volatility. During the first two to three decades after independence, state intervention through various acts such as land reforms, the Green Revolution, regulated markets under the Agricultural Produce Market Committee (APMC) system, and extensive price support mechanisms was a major factor.

These measures helped India in becoming self-sufficient in food and hence less vulnerable to external shocks. On the other hand, these interventions led to the creation of a policy environment that was heavily regulated, had limited integration with the markets, and was characterised by persistent inefficiencies that have ultimately resulted in low productivity growth and a lack of international competitiveness. Though the government tries to structurally balance these, there is always a trade-off between domestic

stability and international reputation. Trade strategy in agriculture mainly mirrors the domestic priorities mentioned above. Tools like export bans, quantitative restrictions, minimum export prices, and price controls have been regularly used to tackle inflation and protect domestic availability, especially when there are poor harvests or the world prices are going up. Although these kinds of actions have provided immediate relief, at the same time, they have tainted the predictability of India's trade system and made its cooperation with the international markets more difficult.

Climate change and rising volatility of international food markets have worsened these problems during the last few years. Changes in precipitation patterns, natural disasters, depletion of groundwater, and rising production costs have increased production risk and raised the level of policy intervention. Against this background, agricultural trade policy has increasingly been turned into a domestic demand management instrument, while India's participation in global food supply chains is on the rise, raising concerns about India's reliable position in the international market.

The Indian agriculture sector is facing a complex situation where it has to balance domestic welfare goals, market efficiencies, and align with global trade. How agricultural trade policy is formulated in response to these factors will carry a lot of weight for food security, farmers' incomes, public finances, and India's image as a player in the international agricultural market.

Overview

The policy report examines India's agricultural trade policy within the context of export potential, achieving objectives related to domestic food security, and farmer welfare considerations. Agriculture has always been considered the very backbone of the Indian economy and the source of livelihood for millions of people in India. The report initially delves into the structural changes that this sector has witnessed over the years, post-independence, as it provides a comprehensive overview to further understand the policy changes and their impact on the Indian economy, both at a micro and macro level. India currently stands at a pivotal stage wherein it is becoming an increasingly influential actor in the global agricultural markets, with its domestic policy decisions having implications that transcend state boundaries and affect the global agriculture supply chain.

The research provides an overview of the major government policies, involving the abolition of the zamindari system, transition to an ambitious, yet challenging system of APMCs, and the role of the Green Revolution in transforming the landscape of Indian agriculture. Additionally, it also provides us with insights into the evolution of India's agricultural trade framework, highly influenced by the transition in export controls, minimum support prices, and trade controls related to the sector. The report has emphasised the impact of Climate Change on Indian Agriculture and how it has played an integral role in defining India's agricultural trade policy, which has been illustrated through various case studies, involving export bans in recent years to ensure domestic food security. Additionally, emphasis has been laid on the challenges faced by the sector and the implications of the political economy in determining the development of the sector, while also examining how short-term political incentives have led to long-term substantial losses, affecting the functioning of the entire macro structure.

The study details India's protectionist approach towards the agriculture sector to protect the domestic farmers from foreign competition, and understanding how this approach has been influenced by various climatic factors to delve deeper into the intersection of climate change and trade policy. The research focuses on the economic implications of various protectionist measures taken by the government, including multiple subsidies, import controls, and rising fiscal pressures. It further situates these instruments within global trade rules and highlights the growing tensions between prioritising domestic policies and abiding by international trade obligations, especially

those of the World Trade Organisation. It further analyses the opportunity cost and long-term impact of each policy and lays down recommendations based on the feasibility of each solution.

The report further examines the success of certain domestic policies, such as the Bhavantar Scheme, implemented in Madhya Pradesh and explores how a similar policy can be implemented at the national level, while considering its existing loopholes. It also seeks inspiration from policies executed in foreign countries, such as the US Farm Bill, Indonesia's restriction on palm oil imports, etc. While the study lays down the needs of protectionist policies, it also emphasises the need to reform policies related to the channelise funds in key result areas, instead of those subsidies, which are resulting in negative consequences, both domestically and internationally.

Hence, the research illustrates the key structural and institutional challenges to identify the relevant policy gaps, as they have severe implications: price distortions, excess surplus in the domestic markets, huge losses due to lack of cold-storage and infrastructural facilities, etc., among several others.

The report also details certain arguments in favour of liberalising the agriculture sector to increase global competitiveness and strengthen India's export sector. There are certain caveats related to this policy that the research entirely acknowledges; however, it also recommends formulating policies that induce private investment in the sector, since traditional channels of development are gradually becoming exhausted, leading to stagnant growth of the sector, and hence, it is important for the Indian agriculture sector to extensively focus on research, development and effective execution.

Lastly, the report details certain recommendations, focused on four key areas integral to India's agricultural trade policy, which include the Trade Policy Design, the Climate-Resilient Policies, Technology & Logistics and Political & Institutional Recommendations. In an evolving world, it is crucial to leverage modern tools such as Artificial Intelligence to solve structural issues of the traditional sectors and additionally, focus on formulating trade policies that not only solve domestic challenges in the short run but also ensure India's integration and progress in the Global Value Chains (GVCs) from a long-term perspective.

Purpose of Writing

Agriculture in India stands at a decisive crossroads. The sector that provides for millions and forms the basis of national food security is gradually being jeopardised by the escalating climate shocks and a quickly changing, protectionist global trade environment. Being an economy that depends mainly on agriculture for employment, rural stability, and export revenue, India is not in a position to regard these forces as mere local weather events. On the contrary, they change the very factors of the game, hazards, and governmental choices that decide the outcome of the agricultural system.

This report is an in-depth analysis of a very complex system, climate-induced disruptions from the globe, and how these interact with agricultural trade policy and protectionist measures. Climate-induced disruptions are one of such scenes that overwhelm the others. The study employs an interacting system approach to study the effects and responses of climate-induced disruptions, agricultural trade policy and protectionist measures, and the economic, institutional, and social nodes.

This report deep dives into how abrupt climactic changes cause a ripple effect that starts from the agricultural production, goes along the supply chains, shocks price volatility and gradually appears in export performance. Disruptions have been forcing policymakers to make reactive trade choices, including export bans, changes in tariff rates, and procurement interventions.

A main goal of this report is to unravel the reasons behind protectionist interventions and find out the consequences they produce. The research looks into various measures such as minimum support prices, import controls, export restrictions, subsidies, and certification rules, to understand their impact on domestic food security, price stability, market competitiveness, and farmer livelihoods. These interventions are considered as part of a broader issue of rising climate uncertainty, which is increasingly leading governments to opt for short-term stabilisation measures.

Equally important is to focus on the systemic vulnerabilities that weaken the agricultural ecosystem in India. Problems like insufficient storage, cold chain networks with gaps, fragmented market linkages, and uneven institutional coordination frequently limit India's capacity to absorb shocks. Highlighting these constraints, the report intends to reveal how the structural limitations not only increase the pressure on policymakers but also lead to sudden, unpredictable policy decisions.

The report uses foreign examples to get familiar with the different methods other countries use in dealing with climate unpredictability and agricultural trade. By benchmarking India's policy reactions against those implemented in climate-vulnerable countries, the report spots worldwide strategies that foster resilience, enhance trade predictability, and ensure farmer protection. These global outlooks assist in situating India in a worldwide discussion where climate change is becoming a major factor in foreign policy, as depicted in the new strategic analyses.

One of the major objectives is to delineate the institutional and governance issues that affect agricultural policymaking. Included in this is the examination of the effects of political cycles, administrative capacity, coordination gaps, and the immediate need for stability on the direction of agricultural trade decisions. The report, by delving into these limitations, intends to demonstrate that the institutional choices often made by the authorities result in sacrificing long-term resilience for short-term convenience.

Moreover, the report tries to combine the economic, political and social inputs to demonstrate the interconnected nature of climate risks and trade policy decisions. It explains how a production shock very quickly turns into a supply chain shock, then into a price shock, and finally into trade interventions. This layered understanding provides a more holistic view of the policy environment in which decisions are made.

After all, this report intends to elaborate in a clear, evidence-based, and future-oriented manner the reality of the agricultural trade in India amid climate volatility. The report aims to find contradictions in the present policies, look at the pressures which influence the decision-making process and come up with actionable recommendations that not only can increase resilience but also secure farmers' welfare and raise global competitiveness. By laying out these insights in an organised way, the report is intended to help implement better policies and be a step towards an agricultural future for India which is more stable.

Methodology

Initially, we delve into the overview of the agricultural trade policy to get a basic understanding of how a country's trade functions and its relevance to the stability of a country's economic structure. It provides insights into the importance of the agricultural sector to India's economy and major existing policies that have a profound impact on this sector. To gauge a better understanding of the background of India's current agriculture trade policy, the report focuses on various historical aspects and provides a detailed analysis of the chain of events that are responsible for the formulation of the existing policy.

The historical context examines the evolving nature of India's agriculture and the major structural changes that were responsible for the functioning of this sector, and changing the pace of development. It delves further into the abolition of the zamindari system, the impact of the Green Revolution and its social implications.

To understand various existing policies, the report analyses the situation which paved the way for these policies to be implemented and their effect on different stakeholders. From analysing the establishment of APMCs to controversies around their abolition, the diverse perspectives related to MSP and the impact of Minimum Export Price (MEP) on international agricultural prices, this report dissects into various implications. These implications have been based on secondary data, collected from government surveys and research institutional reports, among other sources.

The report analyses the impact of climate change on Indian agriculture and the crucial intersection between climate change and policy formulation. A comprehensive understanding of climate change and its implications for the agricultural sector is crucial to understanding the sector's functioning as a whole and how its impact necessitates policy implementation.

To comprehend the entire situation at the root level, various case studies from the recent past have been included, such as the Onion Export ban in 2019, to launching initiatives such as the National Mission on Sustainable Agriculture (NMSA) and the Pradhan Mantri Fasal Bima Yojana (PMFBY), to protect the farmers and put an end to the worsening socio-economic divide in the country. Additionally, it provides insights into the key reasons behind India's approach to adopting a protectionist stance to ensure the social welfare of farmers, while highlighting the greater need for increased investment in agricultural infrastructure and research and development.

This report is not just restricted to agriculture and its economic implications, but it delves deeper into political, economic, social, and technological aspects, from analysing the political landscape in the country to shifting focus towards climate-smart innovations in trade & agriculture. Considering the volatility of the agricultural sector and its high dependence on climate conditions, this report examines the circumstances of various stakeholders and analyses the institutional shortcomings, including major policy constraints. It aims to provide feasible recommendations that promote sustainable development while adopting a long-term, collective approach that serves the diverse interests of all groups, rather than being driven by short-term political incentives.

INDIA'S AGRICULTURAL TRADE POLICY

1

India's Agricultural Trade Policy

Agricultural trade policy, primarily referred to as the agri-export policy, is a set of government regulations, measures and incentives designed to govern and promote the export of agricultural products from a particular country. It also includes how the state plans to import certain products from other countries, which are not likely to be produced within its own territory due to various constraints such as unfavourable climatic conditions or lack of economic feasibility, etc. This trade policy is vital to any nation since it has a profound influence on several factors, including food security, income of farmers, food inflation, foreign exchange earnings and economic growth by managing agricultural exports and imports.

From a historical perspective, agriculture has been closely related to the economic conditions of the people, and a common dilemma that often arises is how to ensure a balance between promoting agricultural exports and ensuring domestic food security. Furthermore, these trade policies also require consideration of trade impacts on the supply and prices of staple foods for domestic consumers.

These trade policies include various measures such as export subsidies, tariff reductions, import restrictions, ensuring quality standards, financial incentives and trade promotion macro initiatives to provide a platform to producers and exporters for access to international markets, increase their competitiveness, look for better prices while expanding their export ventures to ascertain control across different markets.

India's agriculture trade policy is a complex framework which incorporates various measures designed to achieve multiple objectives, which are often competitive in nature. It is implemented by the Government of India, primarily through the Ministries of Commerce & Industry, and Agriculture & Farmers' Welfare. Historically, agriculture has acted as the backbone of India's economy, not in terms of its contribution to the GDP but primarily because of its high surplus labour factor.

India's agricultural trade policy has a dualistic nature: defensively protectionist for its staple food sectors and ambitiously export-oriented for its competitive segments (India's Agricultural Trade: Policies and Prospects - Takshashila Institution). The future direction will hinge on several key factors: successfully diversifying the export basket into processed foods and horticulture; investing in supply chain infrastructure to reduce waste and meet global standards; and strategically navigating new Free Trade Agreements (FTAs) to secure meaningful market access.

It employs about 45% of the entire population and thus acts as a source of livelihood for the majority of the population. Comprehensive analysis of India's agriculture trade policy reveals that it is centred around four major pillars:

- **Food Security and Price Stability:** The paramount objective is to ensure the adequate availability of essential commodities such as rice, wheat, pulses, etc, within the country. Thus, self-sufficiency has been at the core of India's trade policy since independence to protect the domestic market from international volatility, which ensures price stability.

- **Stable financial condition of farmers:** As agriculture constitutes the majority of the population, and in order to ensure that farmers are able to pursue a decent standard of living, protecting the economic interests of the vast agricultural community becomes the utmost priority. The policy seeks to adopt a protectionist approach to prevent a possible collapse in domestic farm gate prices due to various factors, such as a surge of cheap imports and to enhance their profitability.

- **Strategic surplus management:** In areas where the sector can produce surplus, such as non-Basmati rice, sugar, dairy products and bovine meat, the policy focuses on securing and expanding export markets to absorb excess production and prevent domestic price depression.

- **Diplomatic Engagement:** Market access to other countries and opening the Indian markets to imports of competitive agricultural-related products acts as a tool of diplomacy and allows strengthening of bilateral ties with trading partners.

India has followed a dual-objective policy approach where it is defensively protectionist for its staple food sectors and ambitiously export-oriented for its competitive segments.

Current Government Policies in Action

Minimum Support Price (MSP):
The Minimum Support Price (MSP) is a promise from the Indian government to help farmers when market prices go down. Every year, before the sowing season starts, the government announces the MSP for certain crops so farmers know the least amount they will get when they sell. Even if the market price is less, farmers get this minimum rate.

For 2025-26, MSP for big crops like wheat and rice is increased. For example, the wheat MSP is ₹2,585 per quintal, encouraging farmers to grow more and earn better. (Hike in MSP - Lokmat Times)

MSP helps farmers feel safe about their income, so they don't have to sell in distress. It also makes sure our country has enough grain for the Public Distribution System. It even helps farmers grow more pulses and oilseeds, which is good for nutrition. But this support works mostly in states where the government buys lots of crops. Many farmers in other places don't get to sell at MSP. Sometimes MSP also makes Indian prices high, so it's harder to sell abroad.

Advantages of MSP:

- Gives a steady income to many farmers.
- Keeps the national food stock safe.
- Pushes more farming of pulses and oilseeds.

Minimum Export Price (MEP)

The Minimum Export Price (MEP) is used by the government to make sure some food items are not sold too cheaply abroad. Crops like onions, wheat, and rice have a minimum export price. Exporters cannot sell lower than this. This is to stop the shortage in India and keep prices in control. If supplies in India are low, the government can raise the MEP or stop exports for some time. MEP helps keep enough food in the country and stops prices from running high. But, frequent changes in MEP or bans on exports can confuse exporters and scare buyers in other countries. This can reduce the amount India sells overseas.

Advantages of MEP:

- Makes sure food stays available in India.
- Helps control food price inflation.
- Let's have the government manage exports when things get unstable.

The Export-Import (EXIM) Policy

The Export-Import Policy is India's plan for how to trade with other countries. It covers things like taxes, incentives, rules, and ways to make trade easier. The 2023-28 policy is focusing on online systems, making business smoother, and building infrastructure, such as zones for promoting farm products for export. This policy makes the export process faster and less trouble for exporters. Trade deals with other countries open more markets. There is a focus on making processed farm products and building special clusters so Indian farm goods earn more and sell to more places.

Advantages of EXIM Policy:

- Makes exporting faster and easier.
- Connects Indian farming with global markets.
- Supports food processing and related facilities.

The RoDTEP Scheme

The RoDTEP Scheme is meant to return the small taxes and duties which exporters pay but cannot get back in other ways. It includes things like mandi charges, electricity tax, and transport duties.

Advantages of RoDTEP:

- Cuts export costs so they can compete globally and helps small exporters get money on time.
- Encourages more variety in farm exports.

HISTORICAL CONTEXT

Historical Context

Formation of APMCs, APMR Acts, and Abolition of the Zamindari System

Agricultural Produce Market Committees (APMCs) are marketing bodies empowered by state legislation to operate under the guidelines of the Agricultural Produce Market Regulation (APMR) or the Agricultural Produce and Livestock Marketing (APLM) Acts. Their major objectives are to establish the marketing of agricultural produce which is fair and transparent, protect the farmers from being taken advantage of by intermediaries and promote the growth of market infrastructure.

The concept of APMCs was to bring market failures to light in the Indian agricultural market, where these problems were very severe. Before their setting up, private moneylenders and unregulated market traders controlled, priced at will, and even paid only when it suited them. As a result, there was a prevalence of exploitation and manipulation of prices. Besides this, farmers were suffering from a lack of information and infrastructure because the absence of organised grading, weighing, and storing weakened their negotiating strength. Therefore, there was an urgent need for regulated markets to ensure transparency and give fair access to buyers and sellers within the designated market areas.

One reason for the formation of the APMCs lies in the period between the 1940s and 1960s, when the majority of Indian states passed the APMR Acts and set up regulated market yards or mandis. These committees were assigned the tasks of controlling agricultural trade and securing the interests of farmers. The 2003 Model APMC Act led to the reforms that mainly focused on private markets, direct purchases, and contract farming, though the degree of their implementation varied considerably among the states. The coming of e-NAM in 2016 was a further step in the modernisation of the system, highly significant for the computerisation of several APMCs to facilitate inter-state trade and ensure transparency.

The APMC were, at first, crucial in the process of institutionalising price discovery, reducing the rate of exploitation, and providing a reliable platform for public procurement under the MSP regime, but several shortcomings have been present for a long period. The existing regulatory structure constructed protectionist barriers through mandatory mandi sales and limited licensing, which nurtured the monopolistic behaviour and hampered the free movement of the inter-state trade. The auctions are taken over by the trader cartels and commission agents

who have the maximum power, leading to what is called regulatory capture. The system's fragmentation with its varying market charges and multiple state laws has had a great effect on its efficiency and scale. Besides this, the overdependence on physical mandis has resulted in the system being exposed to climate risks and post-harvest losses.

During the initial years, the APMC Acts faced the challenge of eliminating unfair market mechanisms and gave farmers a fight against middlemen. Nevertheless, the infrastructure development stage in the market slowed down dramatically and, as a result, the progress of crop production has since outgrown it by more than four times according to a 2006 report and the subsequent years, where the trend has not changed. APMC markets, as originally envisioned as service-oriented institutions, are turning into money-making ones. The mandi charges and rural development fees on wheat and non-basmati rice purchased by the Food Corporation of India (FCI) in Haryana and Punjab are between 4-6 times the charges on basmati rice purchased by private traders, which is an indication of the structural distortions in the system that have become more and more evident (NITI Aayog, 2020, p. 9).

The Permanent Settlement Act of 1793 was responsible for instituting a system of landlords who lent money to farmers but still retained the majority of the profits for themselves. Farmers were made tenants who lost their property rights and worked under the conditions of limited ownership, indebtedness, and insecurity. As a result, the system exacerbated rural inequality and provided no incentive for farmers to invest in or improve the productivity of their land.

After independence, the government of India regarded the system as a hindrance to economic justice and land reforms. The Zamindari system's elimination between 1948 and 1956 aimed at regaining the ownership rights from the hands of actual cultivators, breaking down the intermediaries' power and handing over the long-lost liberty to farmers. Although the method differed from state to state, it had a profound effect on the rural economy.

The landless tenants were transformed into smallholders with the sale of their produce in the market directly as their right. But without an organised agricultural marketing system, farmers were confronted with the double-edged sword of price volatility, weak bargaining power, and traders taking advantage of them. To deal with the problem, the government resorted to setting up institutions like the APMC to guarantee fair deals and price stability. The abolition of Zamindari was a marking the transition from feudal control to protectionist policies designed to

safeguard farmers' interests.

The state took on a regulatory role by enacting the policies that would provide the farmer with a fair income and easy access to the market. This transformation was the start of the Indian protectionist agricultural policies that would later become the basis of the country's shield against global market shocks. However, the dividing up of the land into small pieces, the landholders' fragmented attitudes, and their high dependence on government-supported markets continue to be a drag on the growth of agriculture. In the context of climate change and global liberalisation, there is a pressing need for systems that are more resilient and market-responsive.

Effect of the Green Revolution on Agriculture

The Green Revolution, beginning in the 1960s, played a major role in transforming India from a country regularly facing famines, mass malnutrition, and an agricultural foreign trade deficit to a country with the second largest agricultural produce in the world, and ensured better availability of food grains. The Revolution introduced in India High-Yielding Variety seeds(more yield in lesser cropping time), stressed upon the importance of a proper irrigation system, advocated the use of chemical fertilisers & pesticides, and sought a better structured institutional support.

All these efforts lead to a great increase in the production of foodgrains: The total agricultural produce has grown approximately 300 per cent in the past 50 years, outgrowing the population by approximately 60 per cent in the same period, and thus, transforming India from a country with a food deficit to a country with the 8th largest agricultural export surplus in the world. The net food availability has increased, so has the market for the fertilisers, but there's a dark side to this revolution, too.

The gains from the Green Revolution were not uniform among the crops: Rice and Wheat production grew at a rapid pace, but at the same time, due to this Wheat-Rice hyperfocus, the traditional indigenous crops, such as millets, pulses, cereals, etc., saw a sharp decrease in their production. Even in the case of rice, the farmers focused so much on the high-yielding variety that we lost about one lakh varieties of rice in the past 60 years, many of which had taken centuries to evolve. Traditional varieties of rice have become almost non-existent, as only 7000 varieties remain now.

Shifting focus to the fertiliser part now, the market for fertilisers in India has grown substantially since the Green Revolution, but the effect of high usage of fertilisers on the soil is extremely concerning. Diving deeper into the scientific part, the soil becomes concentrated with excessive use of fertilisers, drawing the moisture from the plant and thereby resulting in crop failure. The soil has degraded in quality, it has become much more loose in nature, and has depleted vital nutrients and soil microbes.

The excessive focus on rice in the post-Green Revolution period, especially in Punjab and Haryana, has led to groundwater depletion in these states, thereby causing problems for farmers and impacting long-term yield capacity. Smallholder, marginal farmers have faced challenges with the capital-intensive requirements: they could not always afford irrigation, fertiliser, or HYV seeds, which is a grave issue of inequality in rural areas. The issue of inequality matters to trade policy: we want to ensure that an export-oriented agricultural system or production for international markets does not simply marginalise small producers, and that the policy "instruments" (subsidies, infrastructure, extension, etc.) do not abandon the point of inclusion from their overview.

To sum it up, India has achieved great feats in the field of Agriculture, thanks to the Green Revolution. The journey from a nation constantly facing the threat of famines to one that has the 2nd highest agricultural produce in the world, India has come a long way. But this growth has also had a heavy toll on structural and environmental fronts- the dominance of water-intensive crops in the total produce, reduced crop-diversification, excessive dependence on fertilisers, degrading soil quality, and depleting groundwater levels. The Agricultural policy requires strict reforms, focusing on sustainable farming practices, widening the range of crops grown, shifting from chemical fertilisers to organic manures and ensuring equitable access to all resources. These reforms would help India solve its current defects in the Agricultural system and maximise its production potential.

Impact of Liberalisation, Privatisation and Globalisation

India had a protectionist trade policy up until 1991, which included high tariffs, extensive import licensing, and quantitative limits aimed at achieving self-sufficiency. To guarantee food availability, agricultural trade was subject to stringent regulations, including buffer stock programs and public procurement. Such controls limited the involvement of private enterprises while hindering the integration of Indian agriculture with the global value chains.

The historical Liberalisation, Privatisation, and Globalisation (LPG) of 1991 were the consequence of a macroeconomic crisis of immense intensity that brought about a swift reorientation of the Indian economy away from the Licence Raj.
The liberalisation part of the 1991 reforms ended India's import-substitution approach by removing licensing, import limits, and high tariffs that had protected local markets from global competition. It redefined the very architecture of India's agricultural trade policy by shifting it from

a regime of quantitative controls to one governed by tariffs, price signals, and market access norms.

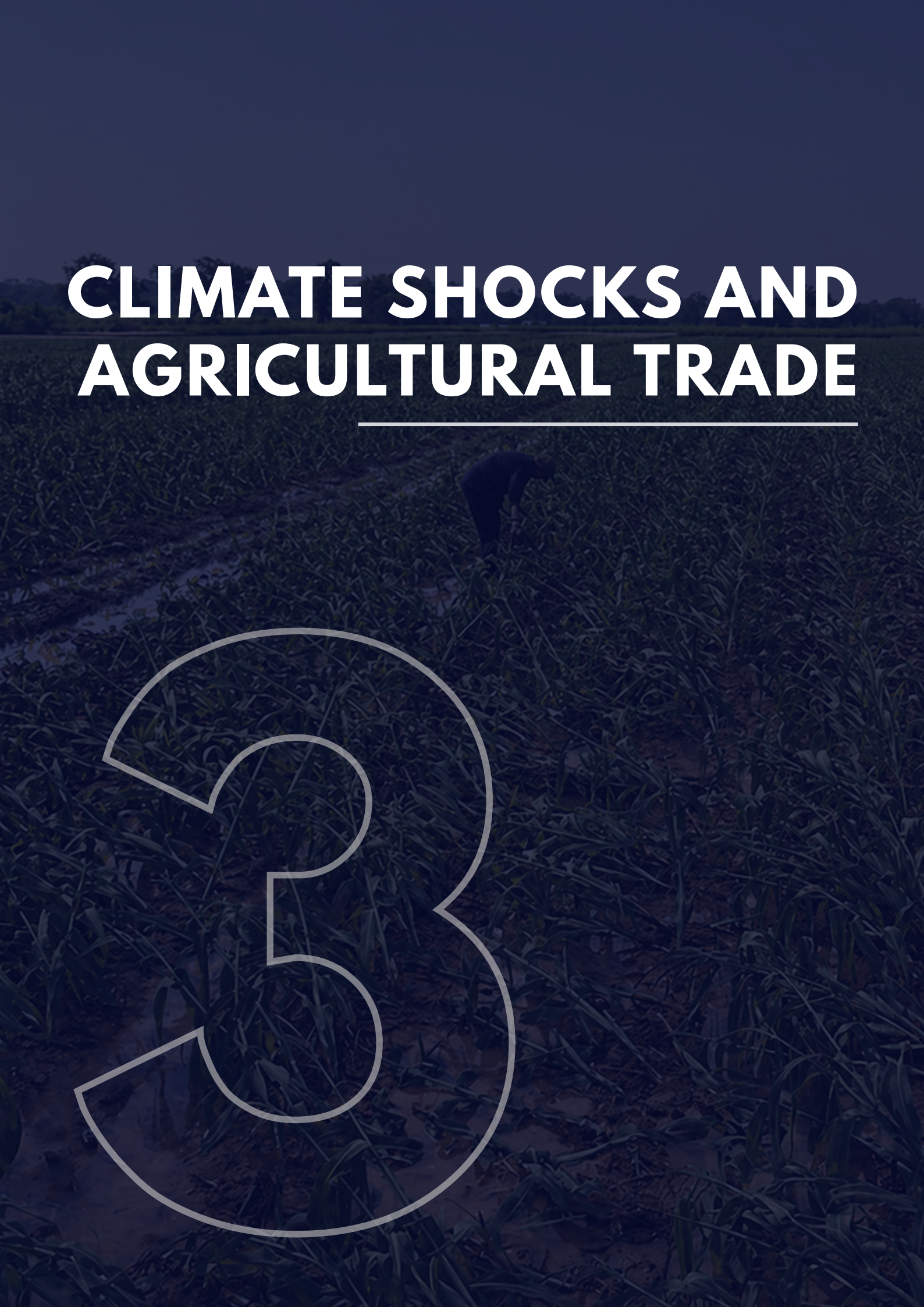
Agriculture had never operated under a formal licence system for production. Consequently, while industrial policy was revolutionised, agricultural production remained dominated by smallholder farmers operating in a fragmented and traditional market structure. The state's role did not diminish; it was redirected. Rather than freeing agricultural markets, the government increased its intervention through a system of subsidies.

India's agricultural trade policy was drastically altered by privatisation in the years following 1991, which altered the institutional framework and the power dynamics that controlled trade flow. Before 1991, both imports and exports of agriculture were closely managed through state trading entities like the National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED), State Trading Corporation of India Ltd. (STC), and the Food Corporation of India (FCI).

The 1991 liberalisation gradually undermined these monopolies to permit the involvement of private traders, processor-cooperators, as well as multinational corporations, in uneven export/import activities. The transformation, however, also brought unevenness with it: bigger companies and corporates gained larger export entitlements as well as easier compliance with international specifications, but the small producers were excluded. Privatisation, therefore, made India's agriculture trade policy market-aligned as well as globally connected, but also uneven in the distributional effects, mirroring the dilemma between efficiency and inclusivity that pervades current policy discourses.

The Globalisation pillar manifested most unevenly in agriculture. Though industrial tariffs declined from above 150% to around 35% in the course of a decade, agricultural trade protection continued to be much higher. Quantitative restrictions on Indian agricultural imports existed until 2000-01, with WTO disputes compelling the change to tariff-based protection. This mutually asymmetric integration imposed a persistent dichotomy on India's trade policy framework, an outwardly growing industrial side with the rest of the economy as managed by what had essentially become a default insulationist agriculture side, employing the use of trade policy towards the objective of domestic price stabilisation over export promotion.

CLIMATE SHOCKS AND AGRICULTURAL TRADE



Impact of Climate Change on Indian Agriculture

The agricultural sector is predominantly dependent on the climate factor, as unpredictable climate changes pose significant threats to this sector. In India, this problem gets worse as it is identified as one of the most vulnerable countries to these frequent changes. India's climatic conditions can be characterised by frequent changes in rainfall patterns, heat waves and unpredictable cyclonic activities that can possibly disrupt the entire crop cycle.

While analysing the implications of climate change on Indian agriculture, the scope of understanding often gets restricted to the problem of food security only; however, it is crucial to get a comprehensive understanding of its impact on various stakeholders, which primarily involve farmers, the state and the citizens. The situation also varies with diverse responses of these stakeholders, and it is pivotal to bear in mind that even the impact on these stakeholders is inequitable because the impact on small and marginal farmers is different from the impact of climate change on well-off farmers. Impact of climate change on Indian agriculture acts as a crucial economic factor which can alter the roots of the entire economic structure. The rise in concentration of greenhouse gases, especially CO2, accompanied by a rise in Earth's surface temperatures and constant changes in the the precipitation patterns are the three major reasons for unpredictable climate changes, which severely affect the food production in the country.

Before analysing the impact that different climate changes have on the agriculture sector, it is crucial to understand the scientific processes involved in the growth of crops due to these climatic factors, as it is due to these changes in the factors responsible for crop growth directly impact the crop yield.

Impact on water availability

Monsoon showers and the Himalayan rivers are the two crucial sources for water resource development in India. Due to India's high reliance on the monsoon season, the expansion of irrigation potential plays a critical role in agricultural development and ensuring food security in the country.

However, a rise in temperatures over the last few decades as a result of global warming has led to an increased rate of melting of snow, resulting in a decline in snow cover and has varied impacts as per different time frames. In the short run, this leads to a rapid rise in the flow of rivers, which may lead to floods in those areas where the water-carrying capacity is low due to increased sedimentation, whereas

in the long run, it reduces the flow of rivers and impacts the groundwater table as well. Under climate change, Indian monsoons are often projected to be uncertain, thus affecting the water storage capacity and decreasing the irrigation potential. As a result of this, agriculture could be under strain in the future as a decline in water storage leads to competition between water availability for agriculture and other uses of water.

Rising temperatures

The growth of crops is directly related to the temperature at which it is grown. It is the climatic temperature and monsoon conditions which affect the type of crop to be grown in a particular region during a season. However, due to frequent and unpredictable changes in temperature and constant heat stress, as a result of global warming, the supply chain of agricultural output is constantly disrupted. Increased temperatures affect the crop yields, especially of wheat, rice and maize, which are the staple diets for the majority of the population in the country. Additionally, it's not only the quantity of output which decreases, but there is also a major impact on the quality of these crops since exposure to higher temperatures may lead to loss of valuable nutrients.

In the long term, this can possibly reduce the demand for these crops among the health-conscious groups, which may form a significant portion of the population in the future and may shift to other alternatives. This could further deteriorate the financial conditions of the farmers while leaving them in a poverty-stricken bubble. As per the recent studies conducted by the Indian Council of Agricultural Research, a 1°C increase in mean temperature disrupts the growth of wheat on a large scale, by altering its yield by more than 4 tonnes annually.

Rising temperatures and heat stress not only deteriorate the status quo but may also lead to worse future contingencies as heat stress affects livestock productivity and increases the water demand for irrigation.

Soil Quality Degradation

Any change in climatic conditions has an impact on soil processes going forward. Irregular precipitation and rapid changes in temperature bring about fluctuations in soil moisture and nutrients such as nitrogen and carbon compounds, which are vital for plant growth. Besides these, the accelerated decomposition of organic matter also leads to a decline in soil fertility, pushing farmers to excessive use of fertilisers to make up for the drop in yield. This, along with over-irrigation, has caused salinisation and chemical degradation of agricultural soils mainly in the Indo-Gangetic Plains. For instance, although the Green Revolution was instrumental in increasing food production to a level where India was self-sufficient, it





also had an array of environmental consequences, such as waterlogging, surface water pollution, and a surge in pests and diseases. Moreover, it brought about different social and economic aspects, which I will discuss later in this paper.

The most severe level of soil erosion in India has been recorded in the semi-arid areas. Particularly, the Brahmaputra Valley in Assam has been hit hard by soil erosion due to various reasons such as deforestation, intensive agricultural operations, and frequent alterations in precipitation patterns. The Government has rolled out many policy measures to restrain deforestation. However, it is equally important to raise awareness about the future impacts of deforestation, which eventually affect the people themselves and their well-being to a great extent.

Pests and Disease outbreaks

Changes in climatic conditions make crops vulnerable to attack by pests and disease outbreaks. High humidity, followed by dry spells, leads to frequent pest infestations, which severely affect crop yields and act as one of the major threats to food security. The locust outbreak in 2020 led to huge agricultural losses as entire crop fields were destroyed, reducing the output on a huge scale, especially in the states of Punjab and Haryana. It was later revealed that the outbreak was partly caused by untimely rainfall and cyclic activity. These pest outbreaks compel farmers to buy higher-quality inputs to make the crop resistant to these attacks, thus increasing the costs incurred, which later leads to higher economic incidence on individuals buying fruits and vegetables for their domestic consumption. Lately, due to these changing conditions, even sugarcane and paddy have also become prone to being affected by bacteria and fungal diseases.

Salinisation and Alkalisation

In coastal regions like Gujarat and Tamil Nadu, saltwater intrusion from rising seas has made the soil too salty. Groundwater

pulled too fast in places like Punjab and Haryana worsens the problem. Crops fail when the soil is salty because roots can't absorb water properly. It seems hard to ignore how much farmland is now useless for common crops. About 30% of India's farmland gets irrigation; the rest depends on rain. Making it more vulnerable.

Soil microbes are disappearing due to warmer temperatures and wetter conditions. These tiny organisms help keep soil healthy and support strong plants. Arguably, without them, fields lose their natural ability to grow food. The loss of biodiversity is already affecting yields in many areas.

Impact of climate change on farmers' livelihood

As illustrated above, small farmers suffer the most from the economic impacts of climate change on agriculture. In fact, for these farmers, farming isn't a job, but their very source of life and any little change in their climate can disrupt their entire family's lifestyle. Climatic changes have even made farmers' incomes more unstable. Especially for small farmers, who are relatively vulnerable, the situation only gets worse as they are scarcely able to produce larger harvests and are less likely to have access to better-quality inputs due to their financial limitations. Crop failures resulting from droughts in numerous regions of the country plunge farmers into a debt trap, which in turn adversely affects their mental health. Accordingly, several farmers have taken their own lives in recent years.

Not having any formally organised feedback mechanisms like safety nets, institutional credit, or procurement guarantees amplifies their desperation. Besides, people have left their farming work and migrated searching for other work opportunities, which has led to the agriculture sector being deserted, traditional knowledge lost and underemployment occurring, according to various reports.

These instances project the increasing human cost of climate change and increase the urgency of effective adaptations that can help build a sustainable future.

Case Studies

2023 Rice Export Ban

The international rice market suffered serious disruptions in 2023 as there was a series of export controls mainly implemented by India, the largest rice-exporting nation. It created dislocation in global trade, highlighting the weakness of the world food system because of climate shocks and reactive protectionist policy measures. This case study examines the 2023 rice export ban, which was due to climatic reasons.

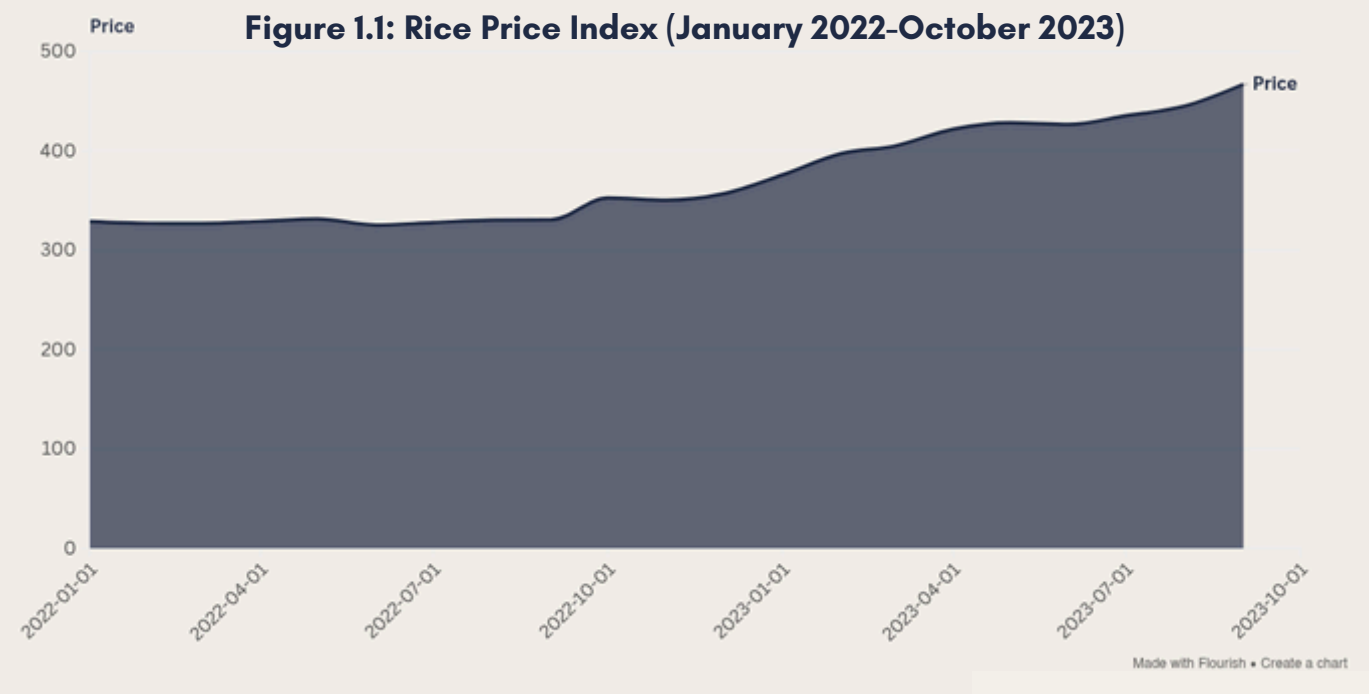
To start with, India contributes 25% of global rice production and 40% of global rice export, exporting 16% of its domestic rice production (FAO 2022). This means that any policy shift in India would have immediate global repercussions.
Because of India's prominence in the world rice market, even a small change to its export policy can have repercussions throughout global trade. The 2023 restrictions were not just an economic decision, but a defensive act to maintain domestic food security in the face of inflation and erratic weather. Immediately, global importers, especially in Asia and Africa, felt the tremors of what is an indication of how dependent the rest of the world has become on Indian rice supplies.

The key cause of the 2023 crisis had been an extreme disturbance of the South Asian monsoon system, precipitated by a strong variant of the El Niño climate pattern. The El Niño event in mid-2023 resulted in highly unusual weather conditions across South Asia and Southeast Asia. El Niño usually brings a lower and deficient monsoon to India by triggering sea surface temperature (SST) and atmospheric circulation alterations in the Pacific Ocean. The southwest 2023 monsoon was 5% deficient, but with regional variations: Bihar and, to a certain extent, Uttar Pradesh had massive floods, West Bengal and Odisha received less than normal rains in the critical sowing season.

During this uneven monsoon, the cultivation of Kharif crops, especially rice, raised concerns about domestic production and India's ability to maintain its extensive export commitments, which were to be done while safeguarding its own food security.

Thus, the government of India resorted to several restraints on trade. In July, India declared a halt to its export of non-basmati white rice. This category constitutes a major portion of its export, which is crucial for markets in sub-Saharan Africa and Southeast Asia. The ban also included a plethora of other varieties of rice, such as broken brown and parboiled rice.

Figure 1.1: Rice Price Index (January 2022-October 2023)



Total rice exports from India declined from 16.55 lakh metric tons to 7.58 metric tons between July 2023 and November 2023. In August 2023, exports of non-Basmati white rice declined sharply from 3.81 metric tons to 0.41 lakh metric tons. In August 2023, the policy was tightened with the 20% export duty on Parboiled rice, which further constricts global supply (European Commission, 2023).

This all led to an increase in the global price of rice, which was not a result of global crop failure but was primarily a result of the trade policy response to a regional climate event. These responses did provide short-term domestic relief in the form of preserving buffer stocks and protecting the domestic supply chain, but in the long run, they damaged the country's long-term reputation and also led to a potential loss of market share as importers sought more stable alternatives and other countries with potential export capacity entered the market.

The implications of India's decision were felt almost instantly across the global food system. Countries that were reliant on importing rice from India most heavily, such as those in West Africa, experienced a dramatic increase in food inflation. The World Food Programme (WFP) and Food and Agriculture Organisation (FAO) both cautioned that the manoeuvre could exacerbate food shortages in developing countries where rice is a key part of many people's diets.

Moreover, this happened when wheat and maize supplies were already volatile due to other global shocks. Thus, India's rice export ban worsened the already fragile food market, highlighting how local climate events can impact global food prices in this interconnected economy.

It had a dual domestic impact, economically speaking. On the one hand, it managed to cool domestic prices of rice and maintain adequate buffer stocks in

India's public distribution system (PDS). On the other hand, it punished farmers and exporters who rely on foreign markets for stability in income.

An interesting effect was also the market diversification of importing countries. After India had left its seat vacant, countries like Vietnam, Thailand, and Myanmar swiftly seized the opportunity to grow their own exports. This move suggests that India's decades-old stranglehold on the market could be challenged over time if importers view Indian policy as unpredictable. And even after any bans were lifted, trust failures in trade relationships can take longer to heal than supply chains themselves.

At a macro level, the episode served as an alarming reminder of a broader trend that can be observed across global food markets: the weaponisation of agricultural trade policy in response to climatic risks. It also underscored the failure of multilateral food-governance systems to adapt to the new era of climate volatility.
This case study proves that in the 21st century, climate change is not just a distant factor that contributes towards a country's trade policy, but is now a major one. The agricultural trade policies, which were once shaped by market logic, are now being reshaped by the intensity and frequency of climate-induced disruptions.

Lifting of ban- On 28 September 2024, more than a year after restricting it, the Indian government lifted the ban. officially removed the ban on exports of non-basmati white rice by imposing a minimum

basmati white rice by imposing a minimum export price (MEP) of US$490 per metric tonne.

Further, in October 2024, there was the elimination of minimum export price, and suspension of export duties for all types of rice (par-boiled, husked brown, and paddy) altogether to effect a complete comeback of India's rice exporting sector to the world market.

The reasons for the reversal were as follows. Firstly, unexpectedly strong harvests and rising inventories relieved pressure on domestic supply, international pressure, and market influence, growing concern about India's absence, which had already caused significant disruptions in the global rice market. The ban was short-lived, but the damage to trust and trade was done, and recovery would not happen overnight.

TIMELINE

2018
Oct-Dec

KHARIF BOOM
Ideal rains yielded record harvests, flooding markets and crashing onion prices below Rs. 4/kg production costs.

SUPPLY CRISIS
Delayed monsoons, farmer caution, and heavy rains slashed output, spiking prices from Rs. 20 to 80/kg (250% rise).

2019
Jul-Dec

2019
Sept

GOVERNMENT INTERVENTION
Sep 2019-Mar 2020: Banned exports on Sep 29, set stock limits, released NCCF/NAFED buffers, imported from Egypt/Turkey.

MARKET RECOVERY
Mar 15, 2020: Rabi harvest boosted local supply alongside imports, stabilizing markets and prompting export ban lift.

2020
March

2019 Onion Export Ban:

India's Government, on 29th September 2019, banned the export of onions after prices saw a rise of approximately 250%. The government imposed this ban to help curb inflation and stabilise the supply of onions in local markets, which would lead to lower prices and less price volatility. This is a precise example of how climatic conditions can either make or break a market for an agricultural product. Let's examine the causes for the same and explore how it happened.

In the 2018 Kharif season, it rained as needed, the weather was great, and as a result, the harvest was the best we had seen in a few years, breaking records. Higher yield led to higher supply by the farmers, and due to the fact that the demand for Agricultural goods is relatively inelastic, an increase in supply of onions led to a very sharp fall in its prices towards the end of 2018. In certain wholesale markets in Maharashtra, the price fell below the cost of production, going down to Rs. 300-400 per quintal (Rs. 3-4 per kg).

Different sources state different data regarding the cost of production in the said period, but the cost of production lay between Rs. 6-8 per kg, thereby showing the losses that the farmers were incurring. Being unable to recover even their cost of production, farmers started protesting on a large scale, hoarding supplies, and even dumping their produce on highways. All this eventually led to a decrease in supply, a recovery in the price level, and thus, the

next year, i.e., in 2019, a decreasing trend was seen in the production of onions, partly due to delayed monsoons, and partly due to the shock that farmers had to bear just 6 months back, rendering them cautious of a repetition of the previous year's market scenario. To add to this, a heavy seasonal rainfall was witnessed, harming the stock of onions stored by farmers, thereby leading to a substantial decrease in the supply of onions. This led to a huge spurt in onion prices, rising from 20 Rs. per kg to approximately 80 Rs. per kg.

The government had initially fixed an MEP for onions to tackle this problem, fixing the export price at $850 per tonne, keeping in view the local supply-demand mismatch. When the prices continued to rise despite the MEP, a ban on exports was imposed by the government. As domestic supply plummeted, there wasn't enough supply to meet local demand, and thus, the government wanted the leakage of produced goods to foreign countries to stop for a while. Also, in a bid to increase domestic supply and reduce possible hoarding attempts to raise prices, the government imposed stock limits on wholesalers and retailers. As per the new orders, retail traders across the country were now allowed to keep a stock of only 100 quintals of onions, whereas wholesalers would not be allowed to stock more than 500 quintals of Onions.

Protests were witnessed as the already aggrieved farmers(due to heavy rains reducing their stock of harvest) saw a further decrease in their margins following the export bans. The farmers missed out on opportunities to earn higher profit margins by exporting their produce. Initially, the government maintained the ban on exports despite the pressure from farmers and political leaders such as Mr Sharad Pawar. The government did not reverse the ban in the short run, but employed measures to boost supply in order to stabilise the prices.

The government released its buffer stock of onions for sale in the market, flagging off mobile vans of National Cooperative Consumer's Federation of India Ltd. (NCCF) and National Agricultural Cooperative Marketing Federation of India Ltd. (NAFED). State-run trading firm MMTC had also floated tenders for importing huge quantities of onions from other countries, such as Egypt (6,090 metric tonnes), Turkey (15,000 metric tonnes), etc. Also, the local supply saw a sharp rise as the crop harvest from the 2019 Rabi season, wherein January and February saw a great addition to the market arrival of onion stock. All these measures contributed to an increase in supply, and thereby, led to a reduction of prices, following which the ban was lifted on 15th March, 2020, when it was evident that there was no major discrepancy in the supply and demand of onions. Heavy rainfall disrupted India's onion market and affected neighbouring countries. Prices rose sharply in Bangladesh, while Bhutan and Sri Lanka saw nearly 50% increases. Nepal and the Maldives experienced almost 100% hikes, showing climatic shocks influence regional markets and economies.

Policy And Institutional Changes

As demonstrated through the case studies above, India's farming system is largely affected due to weather, prices, and soil problems. To help farmers with many new problems, the government has started some big programs. The main ones are the National Mission on Sustainable Agriculture (NMSA) and the Pradhan Mantri Fasal Bima Yojana (PMFBY). These programs try to make farming safer, more resilient, more sustainable, and fairer for all farmers.

National Mission on Sustainable Agriculture (NMSA)

NMSA was established in 2010 as part of India's initiative to combat climate change. It aims at making the Indian agricultural system resilient enough to handle tough weather like drought or floods. It teaches farmers to save water using different techniques like drip or sprinkler irrigation, take care of soil health, etc, and not depend only on one crop but to grow diverse crops and livestock. It also emphasises research to find climate-smart seeds and tools. The NMSA focuses on 4 key areas related to farming:

Rainfed Area Development (RAD)- The main focus of RAD is to help farmers develop an Integrated Farming System (IFS), with major emphasis on promotion of diverse cropping practices (such as mixed cropping, rotational cropping, etc.). It also stresses the importance of integrating farming with allied activities such as horticulture, livestock, fishery, apiculture, etc., to help develop a more climate-resilient and sustainable source of revenue. Financial support is provided to those willing to diversify their cropping pattern or add an allied activity.

On-Farm Water Management (OFWM)- OFWM would focus on developing a system which involves efficient utilisation of water for farming. Usage of efficient technologies like efficient water application and distribution systems, drip and sprinkler irrigation systems, and proper water storage and drainage facilities would be promoted by the government. To add to this, in conjunction with RAD, OFWM would also focus on efficient harvesting, storage, and usage of rainwater.

Soil Health Management (SHM)- The focal point of this component is the maintenance and improvement of crop-specific as well as location-specific soil health. Under this initiative, State Agencies and scientific bodies conduct surveys and research, and analyse their findings to create Soil Fertility Maps. Using these maps, farmers are enabled to understand deficiencies with the macro and micro nutrient content of the soil, thereby helping them to adopt suitable

strategies to fix the same. SHM also aims at reducing soil degradation and erosion risks, as it encourages conservation agriculture, contour farming, and proper usage of fertilisers based on Soil Fertility Maps.

Climate Change and Sustainable Agriculture: Monitoring, Modelling and Networking (CCSAMMN)- The main focus of this component is to integrate the current Indian Agricultural System with the tech-based climate adaptation, including climate-related research and monitoring, and communication of these results to the stakeholders, i.e, the farmers. CCSAMMN collaborates with State Agricultural Universities (SAUs), Krishi Vigyan Kendras (KVKs), ICAR institutions, public and private R&D organisations, and international partners to create a single window system where farmers can access knowledge, innovations, and advisory services for climate resilience.

In some states like Maharashtra and Andhra Pradesh, farmers using techniques like drip irrigation have started contributing towards water conservation. Some areas witnessed better soil health and higher yield because they used organic manure and mixed farming, which was a result of NMSA. But not everything works perfectly. A lot of small farmers don't know about this program. In some states, government money comes late, and not every farmer gets help. Experts say that funds are still too small for such a big farming system. Still, NMSA helped farmers understand sustainable farming and made them start thinking about long-term weather changes.

So while the plan has problems, it gave many farmers hope. It made climate talks reach the ground level, where farmers really face problems. After some time, NMSA will help India's agriculture to get stronger and greener.

Pradhan Mantri Fasal Bima Yojana (PMFBY)

Pradhan Mantri Fasal Bima Yojana, known as PMFBY, is a program started by the Government of India in 2016 to help farmers. It gives insurance for crops. Farmers face many problems like floods, drought, pest attacks, and diseases.

When these problems destroy crops, PMFBY gives money to farmers so they can continue their farming and not fall into big money trouble. This program is run by the Ministry of Agriculture and many insurance companies together.

The main aim of the scheme is to protect farmers' income, give them confidence to work, and make farming safe and stable. Farmers pay only a small part of the insurance cost. For example, they pay 1.5–2 per cent for food crops like rice or wheat and 5 per cent for cash crops like cotton or sugarcane. The rest of the cost is paid by the government (PMFBY, GOI). This makes it easy for small and poor farmers to join. When crops get damaged because of bad weather (rain) or a natural disaster, the scheme pays money directly into the farmer's bank account. That helps them to buy new seeds or fix their field quickly.

PMFBY covers almost all crops- food crops, pulses, oilseeds, fruits, and even commercial crops. It is one of the biggest crop insurance schemes in the world. New technology, like satellite pictures and mobile apps, is also used to check how much crop damage has occurred. This helps to make payment fast and fair.
Advantages-
This program gives many benefits to farmers. First, it protects them from losing income when crops fail. Secondly, it reduces the number of farmers who borrow from moneylenders at high interest, and it helps them stay free from debt. Thirdly, because of this safety net, many Uarmers now try modern tools, better seeds, and irrigation methods. It also makes it easier for farmers to get loans from banks because the risk is less now. Many poor farming families can also buy food and education for their children even if a bad season comes, because they get compensation money.

Disadvantages-
Even though the scheme helps a lot, it still has some issues. In some places, farmers get their money very late, and sometimes crop loss is not properly assessed. Some farmers, especially in small villages, don't know how to fill out the forms or join the scheme. There are also times when government money for the scheme arrives late. But the government is trying to fix this by using better technology and running awareness drives to encourage more farmers to join.

Importance-
In India, farming is risky because the weather changes fast. One bad season can push a farmer into debt. PMFBY gives farmers hope and courage to continue farming. It reduces fear and gives financial security in the form of insurance to millions of farmers. Due to this scheme, the lives of farmers have become better, and they can take care of their families.

Climate Smart Innovations In Trade And Agriculture

Climate-Resilient Seeds

Climate-resilient crops are one of the main ways in which India is tackling the global climate change challenge. These seeds are developed in such a way that they are made tolerant of drought, deficient soils and heat stress, which contributes not only to lower productivity but also to destabilising trade.

For instance, the Indian Institute of Rice Research (ICAR-IIRR) has developed the DRR Dhan 66. The rice variety DRR Dhan 66 comes with the Pup1 QTL gene for rice plants to thrive in low-phosphorus soils, a condition that is common in the areas of eastern and central India. DRR Dhan 66 has a short growth period of 120 to 125 days, and the yield it delivers is substantially higher than the one obtained by its parent, MTU 1010, by 24.4 per cent, 24.1 per cent, and 36.3 per cent at phosphorus levels of 60, 40, and 20 kg per hectare, respectively (ICAR-IIRR, 2023).

This rice product technology also entails a saving of about 25 percentage points of phosphorus fertiliser, thereby lessening the production costs and the carbon emissions associated with the fertiliser-making process. These improvements also position India's rice production as more dependable and eco-friendly, and thus, it can supply domestic and foreign markets

There is also a very good example, which is of MACS 6478. The wheat accession, MACS 6478, was developed at Agharkar Research Institute (ARI), Pune, under the Department of Science and Technology. By sowing these varieties, the farmers had achieved an average yield of 45 to 60 quintals per hectare over earlier average yields of 25 to 30 quintals per hectare in Satara district, State: Maharashtra (Department of Science and Technology, 2022).

Apart from this, MACS 6478 is a highly short-lived variety with a life cycle of around 110 days and is immune to most leaf and stem rust disease-causing pathogens and also nutritious in nature with 14 per cent protein, 44.1 ppm zinc, and 42.8 ppm iron. All these varieties depict the Indian model of bio-innovations as the nation is moving towards climate-resilient and nutritionally secure solutions. Thus, they allow India not only to maintain its international agricultural market share but also to become even more competitive through yield stabilising and quality improving.

Irrigation Technology: Drip versus Flood and PMKSY Innovations

Agriculture in India cannot be done without water. Making good use of it remains at the core of climate-smart agriculture. A traditional flood irrigation technique, still used commonly in the nation, typically results in the utilisation of water in a wasteful manner and soil degradation. (Food and Agriculture Organisation [FAO], 2021). Research has shown that water-use efficiency for flood irrigation is between 35 and 40 per cent, while modern drip is between 80 to 90 per cent and can increase yields by 30 to 40 per cent.

One of the biggest factors for these technologies to emerge has been the Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). The scheme initiated in 2015 is mainly about providing irrigation facilities to all the farms with the help of its "Per Drop More Crop" component that promotes water-use efficiency. Micro-irrigation had reached over 83.06 lakh hectares with central funding of ₹18,714 crore by 2023 (India Brand Equity Foundation [IBEF], 2024). These irrigation systems, such as drip, sprinkler, pivot, and rain-gun systems provide an accurate water supply with reduced losses. In addition to internal productivity, effective irrigation has international trade considerations. Rice growing in India, for instance, uses an estimated 7,848 cubic metres of water per ton of produce, with 60 per cent from rain (green water) and 40 per cent from irrigation (blue water) (Nature, 2021). Implementing drip systems, India can minimise the embedded "virtual water" in exported crops, keeping up with global sustainability standards and making its agri-exports more efficient.

Certification Systems: Carbon and Water Footprints

Sustainability certifications are turning into necessary instruments for Indian agriculture to be linked with worldwide markets. Such certification mechanisms that evaluate carbon and water footprints offer transparency regarding the environmental impact of production and thus allow exporters to avail of premium markets.

ISO 14046 standard for water footprint, along with the Product Carbon Footprint (PCF) method, is being localised in India for agriculture. The study indicates that the emissions related to irrigation practices are 8-11% of the total Greenhouse gas emissions in India, corresponding to likely 45-62 million metric tons of CO2 per year (Science Direct, 2020). Similarly, the water footprint of Indian rice is one of the largest in the world, indicating the need for proper water management and the use of good,

certified, sustainable practices. (Nature, 2021).

Regions like Telangana and Haryana are adopting measures for carbon-neutral rice and water-saving basmati programmes that enable the certification of crops for global buyers. These certification activities position India as a source of sustainable products, thus fulfilling the environmental regulations of the importing countries. As a result of trade relying more on sustainability verification, such certification systems are a means for ecological responsibility to coexist with export competitiveness.

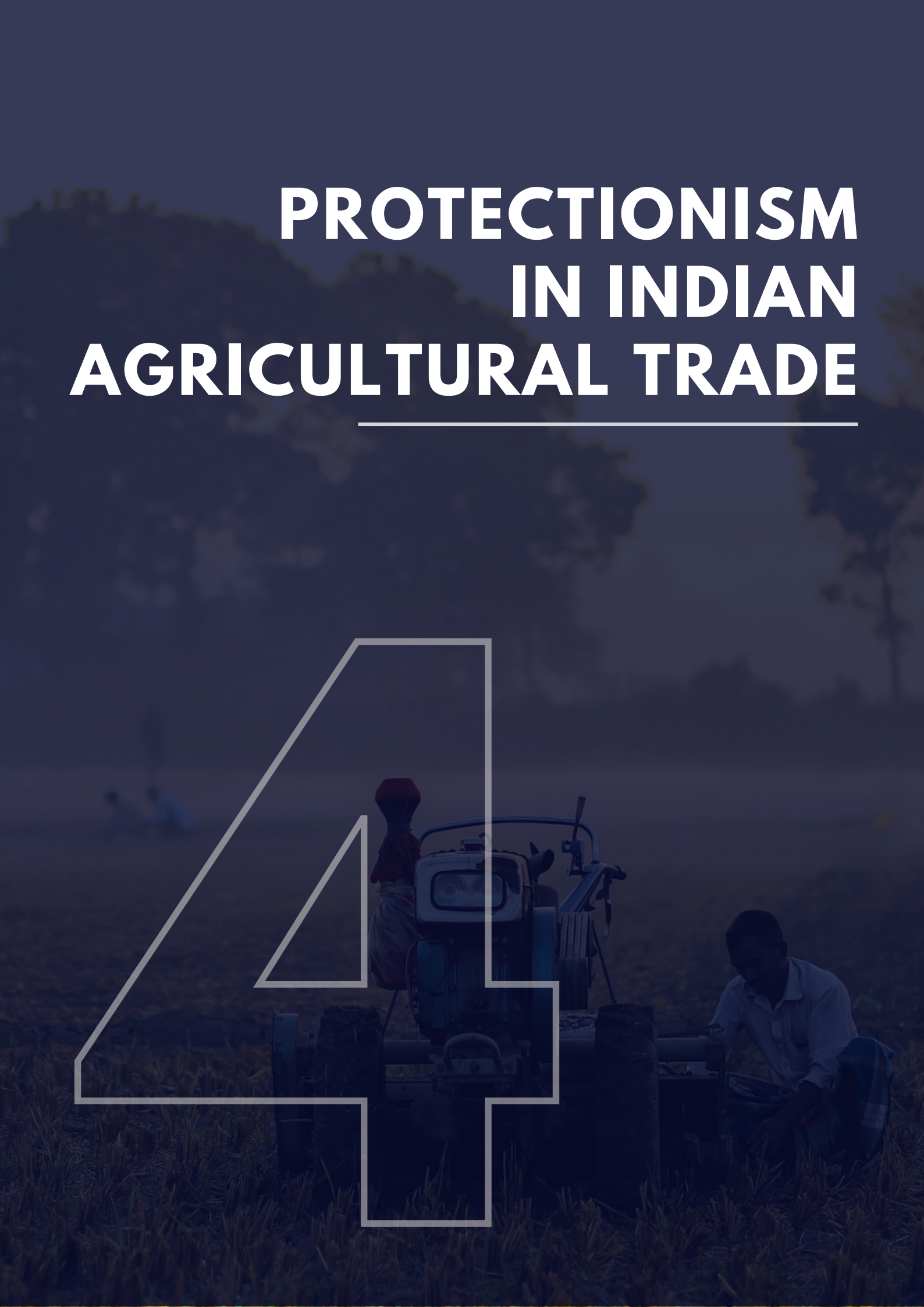
Commodity Futures and Hedging Tools

With climate variability, Indian agriculture is exposed to newer types of economic risks. Various tools are provided by commodity futures markets to farmers, cooperatives, and exporters to protect themselves from price and weather-related changes, thus helping them to stabilise not only their income but also their trade flows.

Agricultural futures contracts, which are available on exchanges like NCDEX and MCX, are some instruments through which the stakeholders can control and minimise the risk that arises from the price fluctuations of certain commodities like wheat, rice, soybean, and cotton. The studies show that the effective hedge ratios for Indian agricultural futures are between 56 and 99 per cent, thus implying that these futures are very helpful in reducing price volatility (National Bank for Agriculture and Rural Development [NABARD], 2022).

Moreover, various kinds of new financial instruments, such as weather-indexed derivatives and parametric insurance, serve as risk management tools better than others. They link the payment to changes in rainfall or temperature instead of loss in yield, thus making it possible to compensate the farmers faster who are affected by the climate. On the other hand, financial hedging instruments, when combined with such innovations as the use of resilient seeds and the efficient irrigation system, become a complete method of handling both production and market risks in the agricultural trade ecosystem.

PROTECTIONISM IN INDIAN AGRICULTURAL TRADE



Protectionism in Indian Agriculture

Since independence, India has predominantly followed a defensive protectionist approach for its agricultural trade policy, especially in the case of staple food sectors. Before delving deeper into the policy, it is imperative to understand all actions involved in implementing its policy and India's primary objective in pursuing this approach. Protectionist agriculture refers to a state's policy to support the domestic income of farmers and protect rural livelihoods, while maintaining food security.

This policy structure is channelised through various government measures, such as tariffs, subsidies to domestic farmers to protect them from foreign competition, quotas, direct payments to affected stakeholders and various regulatory non-tariff barriers, which will be illustrated in the latter part of this section.

After independence, the Indian economy was in a dilapidated condition with the majority of the population employed in the agriculture sector and farming being the major occupation. The country had already gone through several famines, with food insecurity being one of the biggest challenges lying ahead for independent India. At this time, it was observed by the government to accelerate the development of the agriculture sector and support the local farmers, since the entire rural India was dependent on agriculture for its livelihood and allowing free trade in the sector would further leave the farmers and the rural economy in despair. Hence, by understanding the significance of this sector, the government adopted a protectionist approach to protect the farmers from foreign countries and to ensure food security, both at the household level and the national level. As a result of this, even the initial first five-year plans, which focused upon stabilising the economic structure of the country, essentially included agricultural growth as one of the primary objectives.

In the status quo, the objective of these policies is not just restricted to protecting the farmer or local dairy producers, but it is also to mitigate short-term fluctuations in the economy. India's protective stance

has come under scrutiny multiple times at various international forums; thus, it follows a cautious approach while engaging in international agreements at the World Trade Organisation.

In 1991, due to high fiscal pressure and cash crunch, India was compelled to liberalise its economy, wherein several sectors witnessed expansion; however, development in the agriculture sector was limited due to a lack of investment, which is still a major factor for the protectionist approach adopted by the Indian government even in the status quo. The liberalisation in agriculture gained momentum in 1994, post the implementation of the 1994 WTO Uruguay Round Agreement on Agriculture (*India's Agricultural Trade: Policies and Prospects - Takshashila Institution*, n.d.).

The key reason for low development in the agriculture sector is due to a lack of investment, as the sector has relatively low incentives for big private players to enter the field due to long gestation periods and high uncertainty. Thus, despite the liberalisation efforts, India continues to employ a mix of domestic protectionist measures, export controls and higher import tariffs. To further understand how the government carries out this protective approach, let's delve into some of the measures undertaken to implement this policy:

Export bans

Export bans are one of the critical instruments aimed at maintaining food security and ensuring price stability. The government frequently take measures to restrict or ban exports of essential food commodities such as wheat, rice, onions and pulses during years of low yields or rising food inflation, etc. For example, frequent export bans on onions can be referred to as one of the measures taken by the government due to fluctuating prices as a result of unpredictable changes in domestic demand. Minimum Export Price is one of the most important measures that comes under export bans and plays a major role in determining various future contingencies.

Minimum Export Price

Minimum Export Price is a regulatory mechanism implemented by the Government of India to regulate the lowest price at which goods can be exported. It is one of the major export control policy tools that the government has employed to protect consumers from inflationary pressures, ensuring food security through orderly supply by discouraging the export of agricultural products.

By fixing the minimum price at which goods can be exported, these agricultural products become unattractive in foreign markets and facRe high competition, thus reducing their demand, whereas in the domestic markets, where the demand is high, consistent supply is ensured.

The MEP caps are always kept at a higher rate compared to the prevailing prices globally, thus reducing the viability of exporting certain products. It is crucial to understand that MEPs are not just

restricted to solving the food security problem, but also holds immense political-economic significance. Products including rice, wheat, onions and potatoes are not merely the staple diets of the nation's population because fluctuation in their prices and inflation directly impacts the political climate of India. Some recent instances include imposing an export ban on basmati rice to curb domestic inflation by increasing the supply domestically.

However, this policy has also been criticised by several economists for creating market distortions by disrupting the forces of demand and supply operating in the market. Additionally, it is claimed to have led to higher consumer prices and various inefficiencies in the market, thus rendering the policy ineffective for the very objective it was implemented for.

Import Tariffs

Import tariffs refer to the taxes that are levied on imported agricultural products to protect the domestic farmers, dairy and boost local competitiveness. Though its primary objective is to shield the agricultural economy, it also has certain constraints, such as leading to higher consumer prices, a negative impact on international relations, as it can reduce global trust as a supplier and could result in retaliatory measures from other nations, which may impact the indigenous farmers who are dependent on their exports to foreign markets.

Before delving further into the caveats, it is also important to understand the positive Implications of these tariffs on the agricultural economy. These tariffs allow local producers to remain competitive in the domestic markets when there are declines in the world prices. They protect the farmers from external shocks and act as a major source of revenue for the government, wherein these funds can be utilised to roll out multiple productive schemes to further help the agricultural sector. Additionally, they also help in ensuring food security domestically, thus acting as a pivotal policy in ensuring the stability factor.

India's protectionist approach and strong inclination towards tariffs have also witnessed widespread criticism from various economists and other global member states, as it disrupts prices in the global markets, considering that India is one of the leading producers of agricultural and dairy products in the world, thus playing a key role in determining the functioning of the economic ecosystem. Though we have observed the importance of adopting these protectionist measures to protect the rural livelihood and ensure food surplus within the country, it is crucial to analyse the opportunity cost that comes along with these measures, to gain a comprehensive understanding of whether the implications are still pragmatic or not. Tariff protections, though initially played a

critical role in shielding farmers from foreign-based competitive exploitation has been observed to be counterproductive. Tariffs have been criticised for creating an uncompetitive agriculture, thus leading to inefficient food systems. They may be useful for the local farmers in the short run; however, they may discourage efficiency, reduce competitiveness, and make downstream industries reliant on high-cost inputs in the long run.

Additionally, policies like the Minimum Support Price have created a major disruption in the agricultural sector. The farmers have restricted themselves to growing certain crops in order to derive the benefits of the scheme. As a result, there is a lack of variety of crops produced in the nation, thus compelling the state to import those items in which India has a deficit production. This has led to a distorted cropping pattern and is often referred to as the food security paradox, wherein India has become a simultaneous importer and exporter of agricultural products, which often indicates the current security model to be flawed.

It has also been claimed that the minimum support price further creates inflationary pressure and also acts as a major constraint in the free market mechanism. However, this shall be discussed in the latter sections of this report.

Considering that agriculture is the largest employment sector in the country with a high proportion of state intervention, there are several speculations about a long-term economic failure because of increasing reliance of rural farmers on the government, thus reducing the possibility of an independent, sustainable livelihood for millions. However, despite several criticisms, India has continued to adopt a dual policy approach because of the high diversity that exists within the agriculture sector, where the poor farmers constitute the major portion. If a free trade mechanism is implemented, these small farmers will not merely be vulnerable because of internal factors, but mainly because of external factors.

A significant challenge that comes across is the heavy subsidies provided to its farmers by countries like the United States. For eg, the U.S. Farm Act (2018) allocated $428 billion in subsidies for domestic agriculture, shielding farmers from price shocks. As a result, the cost of production incurred by these farmers is less, and they can sell their produce in international markets at low rates, where the Indian local farmers will be unable to compete with these prices. Additionally, the vast disparity in the scale of farming makes it difficult for Indian farmers to compete with their U.S. counterparts.

The average Indian farm is 1.08 hectares (2.67 acres), compared to 187 hectares in the U.S. For dairy farmers, the difference is even more dramatic - a small herd of two or three animals versus hundreds or more in the U.S. Many Indian farmers also rely on traditional, unmechanised techniques, while American agriculture has developed into a highly efficient, tech-driven industry. (Rauscompass, 2025). Thus, reducing

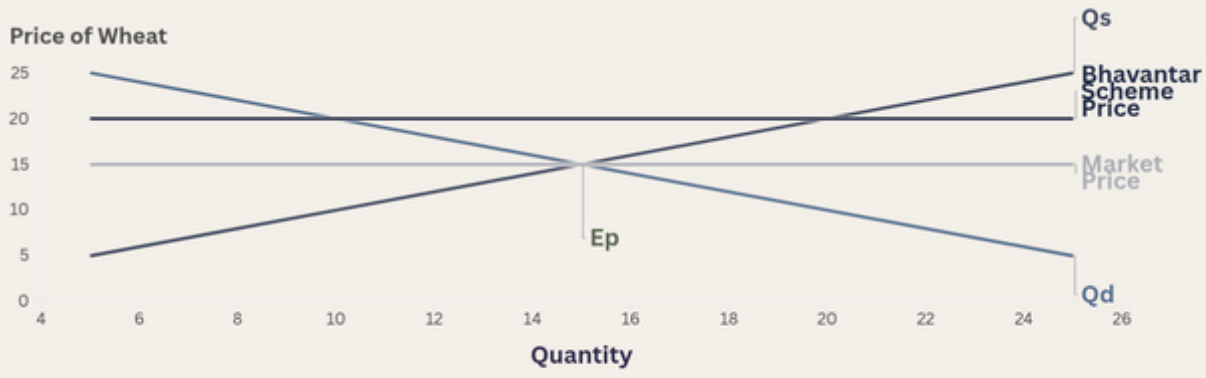
is a major barrier to ensuring their welfare. High agricultural tariffs are to protect India's domestic agricultural sector, which faces inefficiencies due to low investment (6% of total national investment). Hence, to accelerate the development, planned and strategic investment is the most optimal way to increase the independence of the Indian agricultural sector.

Bhavantar Scheme

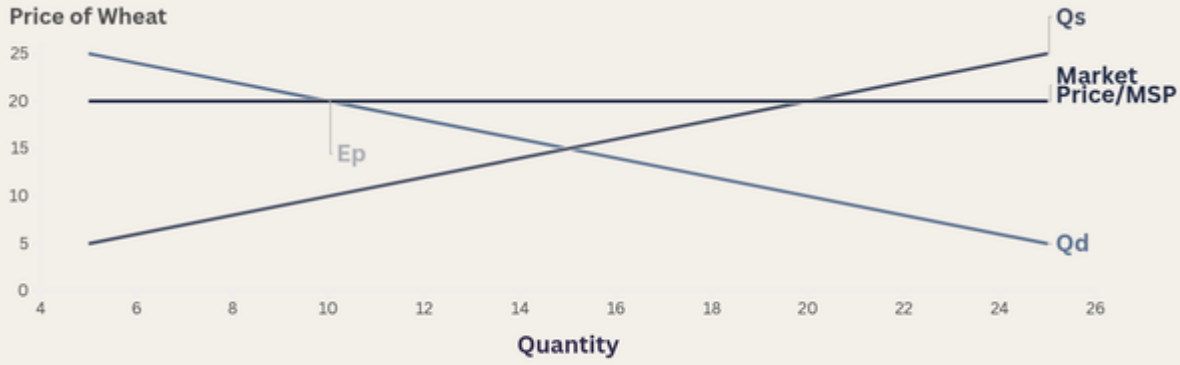
Moving forward with the protectionist measures in the Indian Agricultural System, let us take a look at the Bhavantar Scheme implemented in Madhya Pradesh in 2017. In order to help the farmers get appropriate prices for their product without creating a distortion in the market, the Government of Madhya Pradesh launched the Mukhya Mantri Bhavantar Bhugtan Yojana. This scheme works as a Price Deficit Payment (PDP) system, under which the difference between the MSP imposed by the government and the actual prices in the market is paid to the farmers, and in turn, the farmers are required to supply the goods at market price. Let's examine this purely from an economic point of view with the help of an example.

Let us suppose that the prevailing market price of wheat is Rs. 15 per kg, which causes farmers to earn lower profit margins. Keeping this in mind, the government fixes the price of wheat to be Rs. 20 per kg, the farmers are required to sell their produce at the market price in the notified APMC mandi and the shortfall of Rs. 5 per kg would be reimbursed by the government directly to the farmers. This scheme helps its stakeholders in multiple ways:

- Farmers: It helps them get proper prices for their produce.
- Consumers: It helps them avail the goods at the market price only, and not at an increased price, as would be the case if an MSP of Rs. 20 were imposed. This ensures that the aggregate demand by consumers is maintained, thereby wiping out excess supply.
- Government: It saves the government from huge costs that it would have incurred if an MSP had been implemented instead of this scheme. Under an MSP, a part of the excess supply is bought by the government from the farmers. This purchased stock of goods has to be stored in warehouses and has to be transported to and from warehouses. All these costs are saved by the government, as in the current scenario, they don't need to buy and store the excess supply, as it's wiped out due to the goods being supplied at the market price, and not the MSP.



Bhavantar Scheme



MSP

The Bhavantar Bhugtan Yojana appears beneficial in theory, but creates unintended economic distortions. By guaranteeing farmers a price (e.g., ₹20/kg), it encourages overproduction and full market supply, leading to excess output in regions like Madhya Pradesh. This oversupply drives prices down, attracting buyers from other regions and disrupting broader market equilibrium.

While the scheme supports local farmers and reduces direct government procurement costs, it depresses prices nationally, harming farmers in regions not covered by the policy. Thus, a region-specific benefit ultimately creates wider market inefficiencies and inequality.

Sanitary and Phytosanitary Measures

As the name suggests, Sanitary and Phytosanitary measures are steps taken by the Government to ensure the safety of the agricultural system, making efforts towards reducing exposure to pests/ diseases that could enter the country through imported agricultural commodities. These steps mainly include:

- Restriction on imports of high-risk commodities(that have a higher chance of bringing in pests/diseases)
- Mandating treatment/inspection/ fumigation of goods imported from other countries

- Mandating the acquisition of import permits and phytosanitary certificates.
- By controlling animal/livestock-based product imports via sanitary permits.

The major motive of these measures is to reduce the risk of crop disease/pests spreading in the country, but they also serve the protectionist motives of the government side-by-side. With respect to this, let us now examine the Plant Quarantine Order, 2003.

The SPS measures in India are carried out under the purview of the Destructive Insects and Pests Act 1914, which was basically an act to empower the government to take actions regarding the import of plants and plant material.

The SPS measures in India are carried out under the purview of the Destructive Insects and Pests Act 1914, an act to empower the government to take actions regarding the import of plants and plant material. The Plant Quarantine Order, 2003, lays down regulations to be imposed on the import of plants/agricultural products in India to safeguard the country's animals and plants from harmful insects. For this purpose, a Pest Risk Analysis is conducted on the agricultural commodities imported, and based on the level of threat they pose to a disease/weed contamination, the regulations are placed on the quantum of imports, the level of licensing required, and the rigour of inspection that takes place on these products after importing them.

The measures implemented under the PQO, 2023, also serve as a protective sheath for the farmers of the country.

- Barriers to Entry: The PQO empowers the government to limit or even ban imports of certain commodities, thereby creating a barrier for foreign exporters to enter the Indian Markets.
- Discouragement to Traders: By mandating inspection and phytosanitary certification of every imported lot of goods, these measures add to the cost incurred by the exporter.
- Lack of Convenience: The importers have to wait for quite a long period before they can avail themselves of the goods imported, as they undergo inspection/treatment in the manner prescribed by the PQO 2023. Thereby, sellers get a delayed delivery of goods, reducing the relative convenience of imports.

All these measures under the PQO,2003, though enacted as an attempt to improve crop safety and prevent plant-based disease outbreaks, eventually help the local farmers sell a larger quantity of their produce. The quantity restrictions, the stringent and costly inspection practices, and the extended time period between order and delivery, all contribute to making consumption of local goods relatively cheaper and much more convenient as compared to importing the same commodities.

Economic Implications

Price Stabilisation and Domestic Agricultural Protection

The agricultural trade policy of India is mainly directed at the stabilisation of prices and protection of its domestic producers from market fluctuations. To that end, the government resorts to a range of instruments such as MSPs, input subsidies, tariffs, and export controls with a view to assuring a good and stable income for farmers and, simultaneously, keeping price increases within manageable limits for consumers. Consequently, India has emerged as one of the most protected agricultural economies in the world.

The Minimum Support Price, or MSP, is the main instrument with which the government ensures price stability in the agricultural market and provides farmers with a safety net when market rates decline. Under this scheme, the government declares a fixed price for 23 agricultural products, including staples such as rice, wheat, and pulses, and procures them directly from farmers if the market prices are lower than that. It is thus guaranteed that farmers get at least a minimum living income even in years of low demand or a surplus of production. The cereals bought at MSP are thus warehoused and used for public distribution, which also facilitates food security (Commission for Agricultural Costs and Prices [CACP], 2024).

Buffer stock system is a stabiliser tool that functions with the MSP framework, not only to keep the prices stable but also to ensure the availability of food. The Food Corporation of India (FCI) is buying and storing large quantities of grains like wheat and rice through MSP operations. These stocks are made available to the market whenever prices go up drastically or if there is a shortage of products. This is done to control inflation and keep food affordable for consumers. An analysis of the situation states that Indian food grain stockpiles are frequently higher than buffer norms, with the stocks reaching close to 65 million tonnes in some years, which is more than twice the prescribed requirement of roughly 31.9 million tonnes (Evolution and Critique of Buffer Stocking system in India, 2014).

Apart from price support schemes, the government of India offers a variety of subsidies to lower the production costs and maintain steady productivity in the agricultural sector of agriculture. The farmers are aided with lower-cost fertilisers, electricity, and irrigation facilities, which are their means of managing the increased input costs. Just to give an example, the fertiliser subsidies account for almost 8 to 10 per cent of India's agricultural GDP, which clearly indicates how vital these measures are not only for the farmers but also for the whole rural economy (Sengupta, 2024).

India additionally makes use of tariffs and export controls for the protection of domestic producers as well as to have control over food supplies. Import duties are usually imposed on products like wheat, pulses, and sugar when global prices fall, thus stopping cheap imports from flooding the Indian market. On the other hand, export restrictions or bans may be imposed on first necessities such as rice and onions to limit the rise of prices in the domestic market and ensure availability to the local people. An important instance was the non-basmati rice export ban in 2023 that was instrumental in price stabilisation when there was a lack of rainfall in the district.

India's average applied tariff rate on agricultural products was approximately 39 per cent in 2023, which is among the highest in the world, indicating that the country is still heavily reliant on domestic protection (Moneycontrol, 2024). Even though these trade policy measures are beneficial to farmers and provide protection to consumers, the frequent changes may result in the trading partners being uncertain and India's status as a reliable exporter being affected.

Reduction In Global Competitiveness and Higher Cost to Consumers

The protectionist measures in India's agricultural trade, such as export duty, export ban, import restrictions, and subsidy-heavy domestic policies, have generated significant implications for both India's global competitiveness and consumer welfare. While these measures are often looked at as short-term stabilisation tools, their cumulative effects have led to the weakening of India's export credibility and increased costs for domestic as well as global consumers.

Reduction In Global Competitiveness-

Global competitiveness in agriculture mainly refers to a sector's ability to produce and export goods at a price, quality, and reliability that is prevalent and attractive in the international market, but protectionist trade policies undermine global competitiveness.

Export bans and restrictions: When the government frequently imposes export bans, for example, on non-Basmati rice sweets and onions, to control domestic inflation, it signals unreliability to international buyers. Foreign importers cannot depend on India as a stable supplier, leading them to contract with

more predictable competitors. This leads to the destruction of long-term export relations and market share.

One of the examples of this is the 2023 non-Basmati rice export ban and 20% export duty on Parboiled rice. During this, global buyers in Africa and the Middle East began sourcing from Thailand and Pakistan, as reports by IFPRI (2023) and the World Bank (2024) indicate India's rice exports share declined notably in these markets in a span of a few months, which highlighted a structural competitiveness loss. This highlights a major drawback of export bans, including a long-term structural loss of market dominance.

Import Protection: High tariffs and restricted imports shield domestic producers from international competition. But this poses a major problem: without the pressure of competing with more efficient international players, there is little incentive for Indian farmers to actually adopt cost-reducing technology, improve quality, or even align with global quality standards (like SPS measures).
The long-term impact of this is a reduction in technological upgradation, yield efficiency, and competitiveness of Indian agricultural exports.

Empirical evidence suggests that sectors shielded from competition display slower adoption of precision agriculture and digital farming tools. Between 2018 and 2023, productivity in crops like pulses and oilseeds, which were protected by high tariffs, grew at under 1.2% annually, while globally traded horticulture and spice sectors, facing global competition, grew above 3.5% (NITI Aayog, 2024).

Furthermore, while many agroclimatic zones in India naturally enjoy a comparative advantage over producing crops such as cotton, rice, and spices, protectionism often results in resource allocation driven by political and security processes; for instance, heavily water-dependent rice and wheat in Punjab. This leads to India underachieving in its most productive sectors and overproducing in its less productive ones.

In trade theory language, such action drags India's RCA (revealed comparative advantage) down over time, causing existing and potential exports to be compressed and shackled by long-term shielding.

Higher Cost to Consumers:

The protectionist policies, which are designed to protect producers, often lead to the perverse effect of increasing the cost of food for consumers, thereby reducing their real income and purchasing power.

The price inflation effect of export restriction: The usual motive behind an export ban is to increase domestic supply and lower prices. Still, sometimes the long-term impact can be the opposite.
A farmer who has been artificially deprived of the high international prices that he could have received in the current season gets a distorted signal that the high costs of investing in additional output to be ready for the following season do not pay off. Therefore, he reduces what he spends on the quality-enhancing inputs. This reduces production, alongside growing domestic demand, creates a tight market, ultimately triggering a new round of price inflation, which is often worse than the initial problem the ban was meant to solve. One example of this is when India's restriction on rice tightened international supply, driving global rice prices to a 15-year high (FAO food price index, 2023).

The cost inflation effect of the import tariff: High import duties on products like edible oils, pulses, and fruits make these essential commodities more expensive for the domestic consumer. Moreover, the domestic industry, shielded from competition, faces less pressure to keep prices low; for instance, a 50 to 60% tariff on Palm oil directly results in much higher retail prices for cooking oil. For instance, India's applied tariff on crude palm oil averaged 35-50% during 2022-24, compared to 5-10% in most ASEAN economies. As a result, India's retail edible oil prices remained 25-30% higher than the global average despite falling world prices (Economic Survey, 2024).

The higher consumer cost is therefore two-fold:

- Directly, when consumers pay more for food domestically due to supply distortions or inefficiency in government procurement and distribution systems
- Indirectly, when higher global prices rebound into the domestic market in the form of imported commodities, the fertiliser-linked cost chain aggravates food inflation.

In short, protectionism makes the domestic market inefficient. The lack of competition reduces the willingness for investment in modern, cost-effective supply chains, cold storage, and logistics as a whole. This inefficiency directly leads to the addition of high cost, which is ultimately borne by the consumer.

Although the issues are the consequences of the same policy, they have adversarial direct targets and operate through dissimilar, yet interlinked, channels.

The critical link: The policies that reduce competitiveness (e.g., export bans) are often the same ones enacted to prevent a rise in consumer prices in the short term.

FEATURE	REDUCTION OF GLOBAL COMPETITIVENESS	HIGHER COST TO CONSUMER
PRIMARY STAKEHOLDER	The Nation and its Agricultural Exporters, like Farmers, Agri-businesses, etc.	Domestic Households, especially the poor, spend a larger share of their income on food.
CORE PROBLEM	Inability to compete and earn a higher international price in global markets.	Reduction in purchasing power and increased cost of living in the domestic market.
MAIN CAUSAL POLICY	Export restrictions, SPS Barriers, and Subsidies leading to inefficiency.	Import Tariffs, Domestic Supply Chain Inefficiencies, and Fiscal Burden of Subsidies.
NATURE OF IMPACT	It leads to long-term structural impact, which weakens the foundation of the agricultural economy.	It leads to immediate and recurring impact. It directly impacts household budgets and inflation indices.

In the end, while protectionism may seem to provide short-term political or food security relief. Its overall effect is the loss of the export coalition and persistent price pressure on consumers.

Lesser Aggregate Demand:

When a country wants to protect agriculture, it protects its farmers by stopping or reducing food imports from other countries. To do this, the government uses high taxes, which can be qualitative and quantitative on foreign food items. Because of such taxes, imported food becomes a lot more expensive. When prices go up due to this, people buy less of those goods. This leads to a reduction in the total demand for goods and services in the country, and this is called lower aggregate demand. Because protectionism makes food more costly, normal people have to spend more money on things like rice, wheat, vegetables and fruits. When they spend more on food, they don't have much money left for other stuff like clothes, phones, or going out. As a result, the people buy fewer things overall, and the whole economy slows down.

A fall in consumer expenditure means businesses sell fewer products. When sales fall, companies lose profit, and in some cases, they are compelled to incur huge losses. As a result, they cut down on production or delay expansion. This indicates that fewer jobs are created and workers are laid off. This leads to a fall in aggregate demand in the economy. Though farmers may be protected by

various government schemes in these uncertain times, overall, there is a fall in consumer demand and thus, the growth falls.

It is also important to note that when tariffs are imposed to protect local farmers, they benefit due to a lack of competition, but this also induces the local industries not to make better products or lower their prices. This indicates that in the case of less competition, prices remain high, and people actually don't get many choices. Hence, higher import costs and reduced competition lead to higher prices and fewer choices, thus leading to a fall in consumer expenditure. This drop in demand causes unemployment, severely impacts business growth and weakens the overall economy.

Rise in fiscal deficit

When the government expenditure exceeds its earnings, the difference is known as a fiscal deficit. It reflects the net borrowing of the government, and when it announces subsidies or launches schemes to protect the farmers' interests, this further increases the deficit as the rise in government expenditure is not balanced by a rise in alternative sources of income. When the protectionist policies force the government to further support the farmers by announcing subsidies on various agricultural inputs and crops, the gap between spending and income widens.

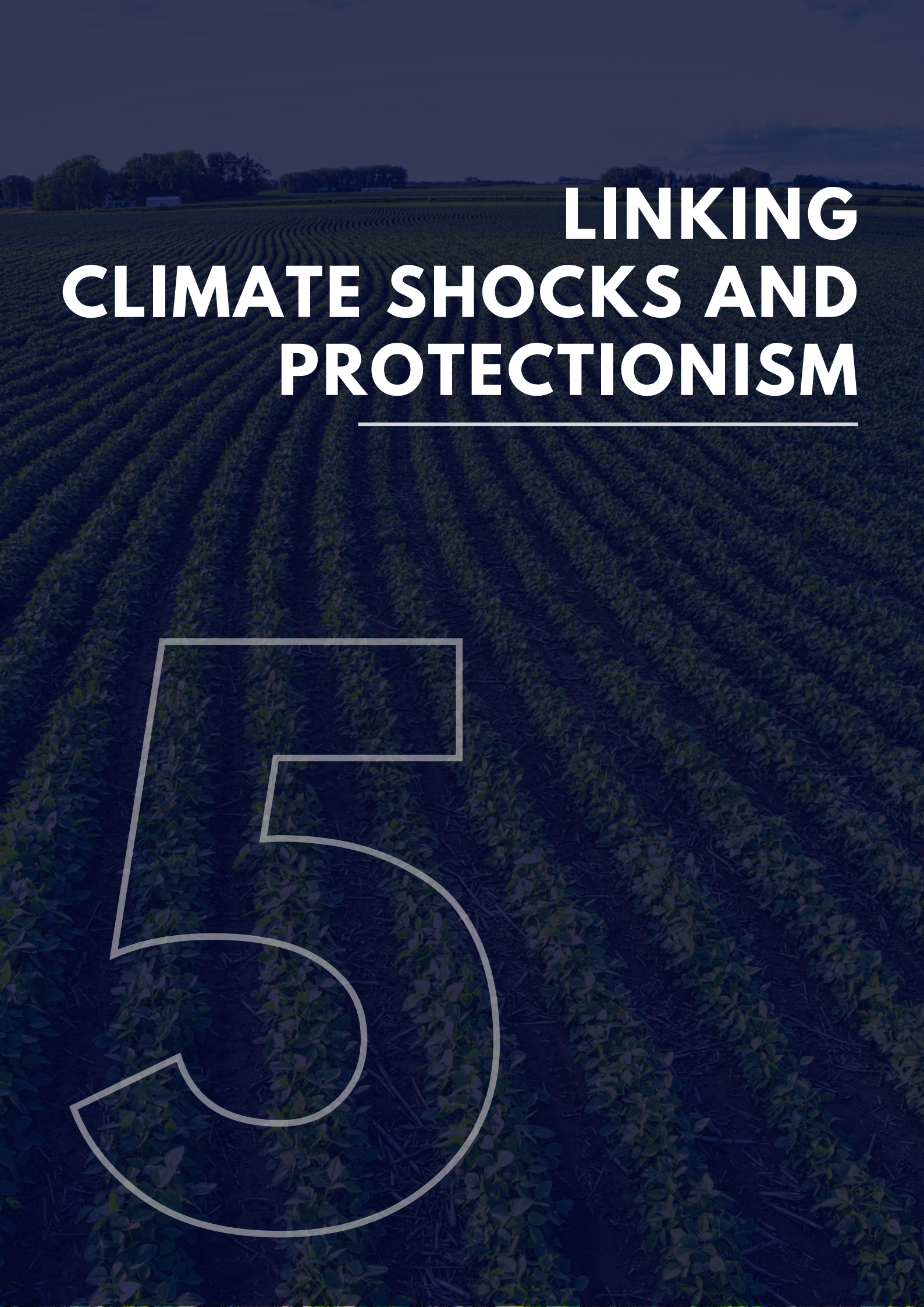
A higher fiscal deficit poses a problem as the government has to borrow money to cover the extra expenses. Borrowing in

excess increases the country's debt and interest payments. Governments' ability to spend on areas like education, healthcare, and infrastructure is reduced due to a high level of debt.

Apart from that, when the government borrows more money, it can lead to higher interest rates. Higher interest rates make loans expensive for businesses and consumers. As a result, investment and spending slow down in the economy.

If protectionism leads to a continuous rise in fiscal deficit, it may cause inflation, which means prices of goods and services rise quickly. Inflation reduces people's purchasing power. Many people, especially poor households, suffer because their income does not increase as fast as prices.

Overall, the rise in fiscal deficit caused by protectionism creates a financial burden on the country. It limits the government's options to invest in growth and development. It can also shake the confidence of investors and international partners who watch economic health closely.



LINKING CLIMATE SHOCKS AND PROTECTIONISM

5

Interactions between Climate and Trade Policy

How do climate shocks influence the adoption of protectionist measures?

We have understood the severe impact of climate change on agricultural productivity in the previous sections of this report and how micro changes can alter the entire landscape of this sector in the long term, for example, even a 1-degree rise in temperature acts as a major obstacle in the growth of a crop. The implications of climate change, as discussed earlier, are not only restricted to the farmers but also affect multiple stakeholders. In order to understand this impact further and how it influences government policies, it is essential to understand the flow of events that led to the formulation of these policies.

When rapid climate changes take place, it becomes difficult to lay out the plans since the conditions are often unpredictable. High temperatures and rainfall severely impact crop yields, degrade soil quality, and thus reduce agricultural productivity. As a result, farmers are unable to earn enough to ensure a sustainable livelihood. Additionally, this makes it difficult to maintain the export levels and increase the reliance on imports. India, being one of the largest exporters of staple crops like rice, wheat, and pulses, is particularly vulnerable to these changes.

As a result, reduced agricultural output affects not only local consumption but also India's ability to meet international demand. To boost the yields, farmers end up incurring higher expenses for irrigation and fertilisers, thus decreasing their competitiveness in the global markets. This leaves the small and marginal farmers vulnerable because of the entry of foreign market players who could displace them from the agricultural market in the long run. It may be argued that international trade helps in stabilising the international markets and managing imbalances while ensuring food security in the country. It may appear to be a rational perspective from an economic outlook, but its implications are not always definite. In the case of India, where most of the farmers belong to the low-income groups, it may further lead to negative externalities. In this section, we will gauge an understanding of the relationship between climate variability and how it impacts trade policy.

Climate change plays a huge role in determining the trade policy, especially in the agriculture sector, as it is a sector which is highly dependent on climatic factors. As a result, these changes also shift the comparative advantage and affect the competition in the global markets. Due to changes in temperature and monsoon conditions, countries may

witness declining productivity, and this may provide alternate opportunities to other global players to penetrate the market and consolidate their positioning.

These constant changes in trade patterns lead to further attempts by major exporting countries to ensure their presence in the global markets. They try to preserve their dominance by adopting various measures through schemes, policies, such as subsidies or trade agreements, etc. Moreover, countries start adopting various non-tariff barriers in the form of supply chain restrictions, carbon footprint certifications and sustainability standards, etc. However, usually these measures are meant to ensure environmental sustainability, but are rather used as a means to ensure a protectionist approach to influence the market conditions.

With the increasing expansion of Global Value Chains (GVCs) that lead to integrated supply chains, they also become vulnerable to climatic factors. Since these changes can distort the entire supply chain network, they can further disrupt the entire functioning of these value chains. Hence, to reduce dependence on these factors and protect in India, this situation is worse since it is a land of diverse geographical features with high climate variability. Thus, to protect the farmers and the country from these vulnerable situations, the government adopts several protectionist measures, focusing on mitigating various short-term and long-term risks. This involves restricting exports, rolling out various government schemes, and making use of the buffer stock in order to control food inflation in the country, etc. These measures are crucial to ensure stability and food security in the country; some of them include:

In order to mitigate the risks faced by climate change, it is essential to develop climate-resistant crops and further induce investment in the agricultural sector to ensure innovation. In the status quo, it is vital to understand that providing monetary incentives to farmers is not the mere solution to overcome these uncertainties; rather, emphasis needs to be laid on research and development.

Climate shocks usually lead to a reduction in local produce/supply, thereby leading to an upward surge in prices. Protectionist measures employed in response to such problems are usually targeted at stabilising supply in the local market, and thereby stabilising the prices as well. Thereby, to ensure that in such perilous times the supply of the country doesn't drain away to other economies in the form of exports, the government imposed export bans.

Short-term impact:

Domestic price moderation for local consumers: The major impact of protectionist measures employed in response to climate shocks is on the prices in the domestic market. The export bans placed on the affected commodities tend to maximise local supply, which thereby helps to curb the rising prices to some extent, and eventually helps in stabilising them. This also eventually provides political relief to the government, as the sky-high prices lead to great political pressure on the government from the opposition. The stabilisation of prices leads to a brief period of gain, whereas the already affected farmers lose out on higher revenue due to reduced export opportunities.

Global Price Volatility: As understood above, a ban/ restriction on imports increases domestic supply and lowers prices; but if the country imposing the ban is a major exporter, then this ban can turn into a grave problem for the global market. When a large contributor to the global supply withdraws its exports, the global supply shrinks, leading to a sudden spike in the prices for the product. Even after the Russia-Ukraine war, 96 trade restrictions were placed on exports, of which 88 applied to food and feed and 8 specifically targeted fertiliser exports. This led to a surge in global prices in 2022, after which the prices fell for 10 months straight. This not only leads to price volatility but also leads to a lack of trader confidence in the market. Traders tend to rely less on the stability of prices, and thus they try to indulge in speculation and hoarding of goods, eventually leading to a higher degree of price volatility. The underdeveloped countries are the ones which face the most severe hits from these protectionist measures, as they have limited foreign exchange reserves.

Distortion of Incentives for Traders & Producers: Due to the prevalence of such protectionist policies in the market, traders tend to refrain from signing forward contracts, as they fear sudden policy changes. Even farmers fear production of goods, as they frequently miss out on high-earning opportunities through exports. This tends to cause more problems in the market, as the already depleted supply now faces the risk of a further decrease in the future, as the farmers are discouraged from producing. It also increases the risk associated with the logistics related to the goods, as they tend to leave goods in ports or in the exporter's godowns. The insurance premiums rise due to volatile markets, and thus, overall trade costs rise.

Long-Term Impact

Reduced Global Trade Resilience: A regular implementation of such protectionist barriers and sudden policy reversals leads to lower importer confidence as well, thus leading to a lower chance of the importers signing multi-year deals with countries. When protectionist measures become common in occurrence, the firms importing from various places tend to decrease the diversification of their suppliers, which again leads to higher risks.

Another major impact is faced by the countries specialising in the production of certain commodities. Reduced reliance on the global markets leads to a lower incentive for countries to specialise in the production of certain commodities. Reduced reliance on the global markets leads to a lower incentive for countries to specialise in the production of certain products where they possess a competitive advantage. These countries then shift from specialisation to trying to produce everything locally, which eventually leads to lower economic efficiency and, eventually, to the contraction of the global value chains.

Harm to the Import-Dependent Countries: This takes place as a result of the compounding effect of the short-term impacts. Import-dependent countries face a continued period of high prices in the market due to unstipulated hoardings, thereby leading to a great problem for countries which depend on imports for their consumption.

They also face procurement problems as the market supply is uncertain due to the importers frequently using export restrictions/bans. Also, a lack of exporters leads to an increase in the number of low-quality imports by these countries, eventually leading to an adverse impact on their health. As the import-dependent countries suffer financially and physically due to the aforementioned reasons, the disparities among the economies tend to grow larger, as in a market with a constrained supply, wealthier nations can outbid poorer and import-dependent ones.

Self-enforcing Protectionist Cycles: Protectionism, once employed, tends to be a large contributor to the global supply withdrawal of its exports, the global supply shrinks, leading to a sudden spike in the prices for the product. Even after the Russia-Ukraine war, 96 trade restrictions were placed on exports, of which 88 applied to food and feed and 8 specifically targeted fertiliser exports. This led to a surge in global prices in 2022, after which the prices fell for 10 months straight. This not only leads to price volatility but also leads to a lack of trader confidence in the market.

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Impact on GVCs

Disruptions in Input-Output Linkages In Global Agri-Food Value Chains

Global agri-food value chains (GVCs) are the interconnected systems of production, processing, distribution, trade, and consumption of agricultural and food products that generally cross borders.
Such systems include the entire cycle, beginning with inputs (seeds, fertilisers, pesticides, machinery), primary production (farmers), processing (mills, factories), distribution/logistics, trade, retail and consumption.

Input-output linkages in these chains indicate the points at which the output of one stage is the input of the other. Accordingly, seeds and fertilisers are transformed into agricultural products; crops are turned into raw materials for processors; processed food is made into export products; and these products travel via logistics systems until they get to retailers.The disruption of any stage, therefore, causes its effects to spread to the next stages. Economists refer to these linkages as the "flow of goods and services between interconnected sectors," a notion that was first formalised by Leontief (1936). Linkages in the agri-food sector are highly sensitive due to the fact that food is perishable, seasonal, and dependent on natural conditions.

According to the studies, climate change and related climate shocks (for example, extreme weather -floods, droughts, heat waves, changing rainfall patterns) are the main causes that are gradually being recognised as major disrupters of the food system. Food availability, access, utilisation, and stability are all impacted by climate change, which causes production, market/transport infrastructure, and supply chain dependability disturbances.

As a result, the core issue remains that climate shocks cause disruptions in input-output linkages within agri-food value chains, which eventually lead to changes in global trade, food security, GVC participation, and value distribution.

How Climate Shocks Disrupt Input-Output Linkages in Agri-Food Global Value Chains

Climate shocks are events like droughts, floods, cyclones, and heatwaves that change the agri-food value chains negatively by making the availability of the inputs and outputs at each stage of the system less. When severe weather conditions lead to lower yields of crops, farmers will naturally produce less crop production; consequently, processors will have less raw material, and exporters will face the problem of a shortage of the commodities. Thus, the flow of goods from

one stage to another is affected. Taking the example of drought that causes a shortage of grains in a region where grains are produced heavily, this situation results in less wheat being available for mills, which in turn, flour production decreases, and food prices increase even in countries that are far away from the region where the drought happened.

As agri-food value chains are interconnected on a global scale, any change in a single country leads to effects on others. Export restrictions, supply shortages, and shipping delays caused by climate extremes in one region can raise food prices, reduce availability, and increase uncertainty for importing countries (WTO, 2020). Thus, climate shocks ripple through local farmers' communities and dismantle the network of input-output linkages that flow through global markets, hence affecting the producers, traders, and consumers of the whole world.

The following are some of the mechanisms that lead to these disruptions:

Upstream Production Disruptions (Inputs - Outputs): Climate shocks have a devastating effect on the most basic stage of the chain- agricultural production. Initially, very hot or very cold temperatures hinder seed germination and may even kill plant growth, while in the case of drought, the soil loses moisture, and that is why the crops die. However, too much rain and floods also cause fertilisers to be washed off, irrigation systems to be damaged, and it becomes very difficult for farmers to obtain good-quality seeds. Consequently, the output of primary agricultural products is lowered, and there may be an irregular supply. Moreover, burning heat is also responsible for attracting a lot of pests and diseases, thereby exposing production to further risks.

Heat stress has been considered the main factor that leads to yield losses in crops such as wheat, maize, and rice. In the same manner, food supply becomes unstable in the long run due to climate shocks since the losses in the production stage make it very difficult to meet the supply of both local and global markets. The agricultural value chain studies are also pointing to the fact that extreme weather events cause farmers to lose access to necessary inputs, thereby decreasing farms' productivity and weakening supply stability.

Mid-Chain Disruptions (Processing, Logistics, Storage): After the harvest, the crops go through the processes of processing, storage, and transportation. These nodes of the mid-chain, which are frequently targeted by climate-related shocks, thus cause bottlenecks. Such

Extreme weather events as floods and cyclones may cause a series of events, like the demolition of a factory for food processing, the pollution of a storage unit, and the breaking of a cold-chain system that is necessary for perishable products like milk, fish, and fruits. Moreover, transport infrastructures such as roads, ports, and railways may be blocked or damaged, and thus the delivery of products to consumers becomes restricted. These disruptions in the intermediate goods' movement slow down or temporarily halt the process, which in turn leads to a decrease in the amount of food available for trade and an increase in costs.

Extreme weather events significantly affect logistics systems, which become more susceptible, resulting in widespread delays and higher spoilage. Studies based on network theory also suggest that climate risks may result in the closure of the most influential nodes of global economic systems, which decreases the supply chain connectivity and creates shortages.

Downstream Trade & Export-Import Disruptions: The climate-shock events also have a very serious impact on the entire trade chain. After the interruption of the production or logistics process in the domestic market, it is a common measure for local governments to implement export restrictions or ban exports to ensure the local demand of the population, thus preventing a shortage of the supply chain at home (the most common products affected by this type of restriction are wheat, rice, and vegetables). Such actions reduce the amount of goods available for trading in international markets, which causes an increase in price volatility. Import commissioning countries get suppliers changed immediately, which may result in higher transportation costs or delays in shipments. These trade shocks are slowing down global value chain activities, and international food flows are less predictable.

Global Ripple Effects (Network Propagation)

The dependence of global value chains on each other has made them very sensitive to climate shocks. A climate shock in one region can cause its effects to spread to other regions as well, and in this way, the repercussions will be felt globally. When a country's production decreases, its partners become short of goods, processors cannot get the necessary raw materials, and retailers have to increase prices. These consequences run through input-output relationships, so a tiny shock can cause very large disruptions in several countries. This becomes stronger due to the multi-regional supply chains. Before the present day, several studies analysed with global input-output models have led to the conclusion that climate shocks have effects on different sectors and they move across borders, resulting in economic losses in the countries that are not even directly affected by the event. Network studies also reveal that disruption in a major supplier can cause a drop in global connectivity in agri-food GVCs.

The given examples show evidence of these disruptions :

The 2010-11 Heatwave in Russia that Led to a Collapse of Wheat Export

The heatwave in Russia in 2010-11 was extremely harsh and led to huge crop failures in areas that majorly produced wheat. Adding to this, there was negligible rainfall for a long period of time, which led to the soil becoming dry. This led to a 30% drop in the wheat harvest of Russia as the drought and the high temperatures also lowered the germination rates (Wegren, 2011). As wheat is one of the main commodities required for the milling and processed food industries, these losses in production immediately caused disruptions in the upstream segment of the value chain.

Due to the shortage of wheat, the Russian government decided to impose a ban on wheat exports, thus withdrawing a major supplier from the global market. The decision made by the Russian Government led to a dramatic increase in the price of wheat on the world market, by almost 60% within a few months, as countries that import wheat were in a hurry to find other suppliers. The disturbance flowed downstream through the trade networks, thus affecting not only the price stability, food insecurity, and input costs for the bakery, livestock feed, and processing industries but also the industries that depend on these sectors, located all over the world. The event demonstrated that local climatic problems could have a worldwide impact on food value chains.

The 2022 Pakistan Floods (Agriculture & Textile Chain Breakdown)

The 2022 floods in Pakistan, one of the most severe climate disasters in the country's history, destroyed nearly half of the country's agricultural land. The extreme weather events killed the crop in the flood-soaked areas of cotton, rice, sugarcane, and vegetables. Since Pakistan is among the top cotton producers globally, the disaster has led to the most substantial damage to the first stage of the cotton value chain (World Bank, 2023).

The harm that was done to farms was only a part of the story of how the floods affected the economy. The floodwaters wiped out the infrastructure of ginning units, warehouses, rural roads, and power lines.

Thus, processing was slowed down, and the movement of raw cotton to textile factories was stopped. Consequently, Pakistan's textile GVC, which is the major source of the country's exports, suffered from a shortage of inputs, productivity decline, and increased production costs. Several global apparel brands which sourced yarn and fabric from Pakistan

have reported delays and supply bottlenecks. This incident demonstrates how a climatic shock in the agricultural sector can lead to a spill-over of non-food value chains via shared input-output linkages.

One main point that the evidence puts forward is that climate shocks are not only isolated production problems. They are, indeed, systemic risks that affect the architecture of global agri-food value chains. The disruptions, actually, start from the upstream production level but move to the mid-chain logistics and finally reach the downstream trade turbulence. The case of Russia and Pakistan demonstrates how extreme weather events in a particular area can lead to economic consequences, such as losses at the farm level, followed by global price spikes.

Moreover, it is very important to understand that this cascade most of the time results in a policy reaction which, although aimed at domestic stability, actually intensifies global instability: protectionism. The export ban is the perfect example of that. A climate-induced supply shock causes domestic political pressure to secure food supplies, resulting in export restrictions. This protectionist step, thus, disconnects a very important link in the global value chain, making the disruption more severe and bringing volatility to the rest of the world.

The Path Ahead: Solutions

India's food production is highly affected by climate shocks, which result in sudden and unpredictable changes in yields, availability of inputs, and price signals. However, we observe that governments often resort to protectionist trade measures, such as export bans, import restrictions, and sudden tariff adjustments, in response to these disturbances. Although in the short run, such actions may bring domestic markets back to equilibrium, they usually lead to the disintegration of global value chains (GVCs), the creation of uncertainty for producers and exporters, and the reduction of India's trading reliability over time. Therefore, it is necessary to implement corrective measures that foster the resilience of the domestic agricultural sector, ensure the stability of market systems, and allow India to deal with climate-related disruptions without engaging in sudden trade interventions.

One of the main strategies is to work on the agricultural systems that are climate-resilient and thus less sensitive to extreme weather phenomena. For instance, this would entail the use of climate-resilient seed varieties like drought-tolerant or flood-resistant crops; moreover, the change of cropping patterns to spread the climate risk to farmers. Besides these, the government can support initiatives like micro-irrigation, soil fertility management, and conservation of land, which will make yields more stable even under an unpredictable monsoon. The rationale behind this is that farmers who have less volatile production will be less likely to resort to aggressive lobbying for protectionist measures.

Besides that, it is also very important for India to strengthen its risk management framework. One of the ways could be by broadening the area and the efficiency of the crop insurance programs through which farmers could be able to get compensation for their losses quickly. This would lead to a decrease in pressure from the political side for the distortions of trade. Local grain and seed reserves, especially in regions frequently hit by natural disasters, can be at the service of the community as stabilisers in case of short-term supply interruptions. At the same time, producers and exporters should be encouraged to use more market-based tools for price risk management, such as commodity futures and options, to be able to handle the volatility themselves instead of waiting for government decisions, which are usually taken in an ad-hoc manner.

It is really important to have predictable and transparent trade governance from the policy side if we want to avoid climate shocks escalating to trade shocks. Open export management systems, where it is

clearly stated the causes and the limits for export restrictions, can lessen the unnecessary market uncertainty a lot. Fixed bilateral contracts for basic agricultural products can also help to keep trade flowing even when there are shocks in the domestic market. The regional cooperation systems like BIMSTEC and SAARC, on the other hand, can be the "safety nets" which, through coordinated responses and commodity-sharing arrangements, help to overcome the climate-related disruptions.

India's GVC participation should not only be durable but it also needs to be made safe through diversification and proper coordination. Diversifying sourcing regions and logistical routes will lessen the risk of supply chain bottlenecks caused by climate change. Developing local capacity for vital agricultural inputs, such as fertilisers and good seed varieties, will help to reduce dependence on import restrictions or global shortages. Better digital traceability, which uses a simple blockchain or an integrated digital registry, can make supply chains more transparent; thus, the response to climate shocks can be quicker.

Infrastructural changes are just as significant as other factors in lessening people's exposure to danger. Spending on decentralised cold storage, state-of-the-art warehousing systems, and the creation of an effective rural transportation network will help in lessening the quantity of food lost after the harvest in the case of an extreme weather event. Furthermore, computerising APMC operations and enhancing market information flows can help in lessening the postponements and stabilising the prices during periods of climatic stress. These facilities guarantee that the perishable goods will be able to be transported, stored, and sold with minimum interruption, even when there are climate anomalies.

The implementation of technology is one more layer that can help. Farmers can be supported in changing their sowing, irrigation, and harvesting operations through the expansion of real-time weather advisory platforms during climate volatility. The use of AI in crop monitoring, sorting, and grading can be a great help to keep the standards of export-quality in production years that are unpredictable. The adoption of climate-smart storage and processing tech can be a way to lessen the agricultural supply chain's exposure to heatwaves and unseasonal rains.

When considered together, these routes covering agricultural resilience, market stability, infrastructural development, technological integration, and coordinated governance constitute a layered framework that lessens the combined effect of climate shocks and protectionist reactions. India can use them to construct a less volatile, more foreseeable, and climate-resilient agricultural trade ecosystem of domestic and international markets, while still being able to compete in the long term and without resorting too much to measures that break up markets or weaken their sustainability.

INFRASTRUCTURE, TECHNOLOGY, & MARKET DYNAMICS

Infrastructure, Technology And Market Dynamics

Logistics and Storage Challenges

After a detailed examination of the effect of climate shocks and protectionist measures on the agricultural industry, let us now take a look at some of the major challenges that this industry faces. We'll be focusing on the challenges with respect to the logistics in the upcoming section, also taking a look at how these challenges are being amplified by these challenges.

Warehousing and transportation are the vital pillars which help the agricultural industry thrive. Creating place and time utilities, warehousing, and transportation ensures a proper, evenly spaced supply of agricultural products during the year. It helps overcome the geographical discrepancies in production, provides goods produced around the year during their peak seasons, and eventually helps in matching the demand and supply of agricultural goods. As climate shocks and protectionist measures threaten the stability of demand and supply, the importance of a strongly built transportation and warehousing network has greatly increased.

Erratic monsoons, long dry spells, floods, etc., all contribute to the destruction of crops. Thus, warehousing helps farmers to hold a stock of their goods during unfavourable conditions, to help them earn better and live better. It also gives them the option to store goods for future seasons, helping farmers get a chance at securing a better price in the future than selling them at a distressed price in the current times. The protectionist measures implemented, especially related to export control, result in a higher domestic supply of goods, which in turn has to be stored in the warehouses.

Transportation facilities also play a major role in curbing the disruptions caused by climate shocks. An efficient, well-connected transportation system throughout the country helps control the price disruptions caused by climate shocks (such as heavy, erratic rainfall, etc.) by quickly supplying the required goods to the respective places, thereby preventing lany shortages in supply. The vitality of a diverse transportation system increases with the imposition of protectionist measures such as import restrictions, as import-dependent areas now need to be supplied with a timely stock of food grains.

Challenges and Gaps in the presently available infrastructure:

- **Warehousing Sector Deficiencies**: The Warehousing Sector faces several problems, including the heavy concentration in certain states, a lack of proper storage capacity, and poor quality. About 60% of the total warehouses are concentrated in 4 states(Business Standard,2014). The lack of manpower and inadequate standardisation of equipment and processes impacts crop safety and leads to post-harvest loss(3.89-5.92% for cereals, 5.65-6.74% for pulses, 2.87-7.51% for oil seeds, 6.02-15.05% for fruits, and 4.87-11.61% for vegetables)(Down to Earth,2024). India suffers a significant blow to its overall agricultural produce every year due to poor quality, losing almost 22% of its total agricultural produce yearly (PMF IAS,2024).

- **Transportation Infrastructure**: A lot of rural areas lack proper transportation connectivity. Despite Government efforts, a significant proportion of the total population remains unconnected by all-weather roads. Even in connected areas, the road quality remains a major concern. Additionally, according to the NABCONS report, India falls significantly short of the total refrigerated truck capacity it requires to prevent its produce from perishing.

- **Institutional and Financial Gaps:** Farmers lack access to formal credit, thereby leaving them helpless and without access to proper warehousing and safe transportation services. This forces them to sell their produce at the prevailing market price (with no way to store the goods), eventually leading to low profits, a higher overall market supply, and, ultimately, the destabilisation of prices throughout the year. Low awareness related to various schemes by the government also contributes to the same.

Thus, the warehousing and transportation system plays a vital role, especially in an economy affected by protectionist measures and climate shocks. Improving infrastructure and quality standards, expanding connectivity, and improving financial inclusion are essential to bolster India's agricultural supply chain and reduce wastage. These problems related to warehousing and transportation have led to the fragmentation of the supply chain of agricultural products.

A fragmented supply chain refers to a system where different parts of the supply chain, such as producers, transporters, warehousers, retailers, etc, operate in isolation as per their own will without proper coordination. The severity of fragmentation of the supply chain in the case of agricultural products is extremely grave. Farmers, not having access to proper funds to use direct transfer services to markets, are forced to sell their produce to middlemen. This increases the time between harvest and sale, thereby increasing the risk of the produce getting spoiled.

Climate shocks further worsen this fragmentation by creating unpredictable disruptions in the supply chain. Erratic monsoons, droughts, floods, and severe weather conditions can cause grave supply shocks, creating a ripple effect and making it difficult for different parts of the chain to integrate, adapt, and redistribute resources quickly. The lack of proper transportation facilities also contributes to these distortions.

Protectionist measures also play a role in increasing domestic supply in certain regions, creating storage and distribution burdens, with no corrections being offered by the market forces. Such fragmentations include delays in supply cycles, thereby leading to a massive loss of crop post-harvest. The prices too rise sharply in this case, as the supply goes down. Such a situation, in which the price remains highlyvolatile, is extremely harmful for the farmers, limiting their market access and earnings. All these factors together hinder the growth and resilience of the sector. To mitigate fragmentation, an integrated system of supply chains should be adopted. Institution-driven aggregations such as FPOs (farmer producer organisations) and government-led infrastructure development can help enjoy economies of scale, boost efficiency, and reduce overall cost, leading to a smooth supply channel. Efficient inventory and transport management is vital to achieve these goals. Through these measures, we can ensure a better and smoother flow of goods, leading to lower spoilage, higher revenues to farmers, and an overall growth of the agricultural industry, as it grows larger and more resilient.

Working Capital Crunch

Working capital crunch refers to a situation in which an individual/organisation's working capital falls short of its working capital requirements. In the agricultural sector, working capital is mainly used to purchase inputs such as seeds and fertilisers, paying operational expenses, and managing cash flow fluctuations between the harvesting period and the time of sales. A major proportion of the smallholder farmers suffer from this working capital crunch, as they lack access to formal credit due to limited securities, cumbersome processes, and low-amount requirements, which might not be granted by many banks. This leads to a higher supply of goods by farmers right after the harvesting season, thereby leading to a situation of excess supply in the market. This leads to cyclical fluctuations in pricing during the year, with higher prices during the off-season and lower prices prevailing near the harvest season.

Climate shocks and protectionist measures make the farmers more prone to the

working capital crunch. Climate shocks, including erratic monsoons, increase the working capital requirements of the farmers, thereby exacerbating the situation, as climate variability intensifies the need for proper storage facilities and leads them to opt for refrigerated trucks. As these trucks are way less in number to fulfil the required capacity, the prices for their services rise, thereby again leading to higher working capital requirements on the part of the farmers.

Protectionist measures also lead to a similar problem, as export restrictions increase the domestic supply of goods, and lead to a higher demand for warehousing and cold storage facilities, though the condition of the farmers doesn't improve, as the financial services still remain equally inaccessible as before. The inability of the farmers to invest in such facilities again forces them to sell goods right after harvesting them. An agriculture working capital crisis is critical to address, as it enables resilient supply chains, which can withstand climatic shocks as well as changes related to trade policy. Increased credit access will provide resources to these farmers, allowing them to invest in storage and transportation, which will provide a better logistics effort towards improved inventory management and better market timing. This will help mitigate the price crashes that frequently happen during the harvest seasons and stabilise revenues that fuel economic growth in rural communities, as well as food security.

Through a robust policy response and improved financial inclusion, we can support the agri-food sector to develop resilience to climatic uncertainty and market factors, all while improving agricultural productivity and sustainability across India.

APMCs

Before delving deeper into the infrastructure and logistical issues existing in the agriculture sector, it is important to understand the functioning of the agricultural market and how it is structured. History has played an integral role in the framing of the current existing systems, and similarly, it is the case with agricultural policies as well. Before independence, the working of the Indian agricultural system was highly unfavourable to the local farmers and was mainly characterised according to the needs of the colonial powers. Farmers were exploited and forced to undertake actions as directed by the British government. They lacked any say on the crops to be grown, had to face high taxes being levied by the local administrative bodies and were compelled to accept low prices for their produce. Even after independence, the situation didn't improve instantly, and despite the entire economy being dependent on the agriculture

sector, there were major obstacles lying ahead. The government recognised major defects in the sector, including losses to farmers due to unfair prices, high marketing costs and considerable physical losses of the produce due to a lack of storage facilities. Thus, the need for a regulated system was recognised with a view to establishing a mechanism to monitor market conduct while ensuring smooth transitions in the system. Regulation and development of primary agricultural produce markets was taken up as an institutional innovation, and the construction of well-laid-out market yards was considered crucial to regulate the practices in primary wholesale markets. This led to the formation of the Agriculture Produce Market Committee, often abbreviated as APMC.

These APMCs are the regulators of the agricultural commodity markets and operate under the State governments in India. The key idea behind these APMCs was to ensure transparency and prevent exploitation of farmers by intermediaries, hence ensuring free trade. These APMCs are constituted under the APMC Acts for managing the agricultural markets. Under this Act, farmers will be able to sell their produce in designated markets, known as mandis, which came under the direct purview of the APMCs. These mandis offered multiple benefits to farmers, such as offering a transparent auctioning platform, price discovery and ensuring trade regulation for the efficient working of the agriculture sector. They were formed to fulfil various objectives related to the agriculture sector. Though we have already listed some of them above, we must try to gauge an understanding of how they brought structural changes, as it will help us in understanding the inefficiencies as well.

- **Price Discovery:** Farmers were usually unaware of the market conditions and were frequently misled by middlemen to end up selling their produce at lower prices. This resulted in huge losses for farmers, and due to the absence of any alternate mechanism to allocate prices, they were left vulnerable to exploitation by middlemen. To solve this issue, one of the primary objectives of APMCs is to safeguard farmers' interests and ensure fair prices at adequate levels.

- **Timely payments to farmers:** The agricultural sector was earlier characterised by multiple defaults, where farmers usually sold their produce on credit; however, this led to higher defaults due to a lack of supervision. Thus, APMCs focused on ensuring transparency, which further ensured timely payments to farmers.

- **Limit the Distress Sale by the farmers:** Due to the absence of a platform, farmers were unable to negotiate prices and unable to understand the market situations. These situations led to distress sales by the farmers, which severely impacted their livelihoods. These APMCs connected multiple buyers and sellers in the market to help farmers sell their produce at market prices. It further

helps in the direct procurement of farm produce by contract farming companies with a predetermined agreed price.

Although these APMCs were established to serve these objectives and protect the farmers, they have been seen as a major cause of market inefficiencies in the status quo. These mandis have been held responsible multiple times for forming market monopolies and creating market barriers between farmers and consumers in the long run, thus causing pressure to reform them and further liberalise the market.

AI Based Sorting and Grading

AI-based sorting and grading are very helpful for farmers as they make the process of quality checking of the products very simple. At a very basic level, such systems employ cameras and sensors to inspect the size, colour, and texture of fruits and vegetables, thus freeing farmers from the monotonous task of manual checking. It shortens the time used in separating good produce from the defective ones. Since these systems get their learning from thousands of images, they become more precise than human graders, which is a win for farmers

because they will be able to get a better price for their produce due to consistent sorting. Research has indicated that AI grading has the potential to lower post-harvest losses to about 20-25% for perishable products like tomatoes and apples through the identification of the poor quality items at the early stages (Appl. Sci, 2022). Besides this, the technology gives farmers quicker access to premium markets as standardised grading helps in building trust with buyers. In the long run, AI-enabled sorting helps in making value chains more organised as traders become confident that they are getting produce of consistent quality.

Weather Based Advisory Apps

One of the primary reasons such a large number of farmer-communities have taken to weather advisory applications is that these are really simple information-providers telling them the time of rain and its impact on the crops. They deliver both daily and weekly navigations in quite concise language to enable farmers to carry out basic decision-making, like whether to go on the seed sowing or irrigation. These apps are more than just temperature and rainfall providers; in fact, it is their true value. Many of them, for example, directly recommend the best time to fertilise or when to protect from pests after unexpected showers. According to research, farmers who follow such advisories are less likely to face a loss as they are in a position to take preventive measures beforehand. In such weather conditions as hurricanes or heatwaves, notifications assist farmers in safeguarding

equipment and lessening damage in the fields. The said applications are also great community-level resilience enhancers because when a large number of farmers decide to change their farm routine based on one and the same trustworthy forecast, then the whole local market gets more stable and predictable. This, in turn, lowers the probabilities of sudden shortages or excessive production, which is responsible for the frequent price fluctuations. Ultimately, weather applications turn into the main decision-making tools in rural areas that help them deal with the rising problem of climate uncertainty.

IoT-enabled cold storage facility

An IoT-enabled cold storage facility ensures freshness of the farm produce for a long time, which is a simple technology. In detail, it is the sensors that control temperature and humidity inside the unit and offer any variation in real time to those who keep them. The farmers are thus relieved from the physical presence where they should check the safety of the product. By effectively sending cooling levels, the incidence of food spoilage will be decreased as well.

Cold chain research in India reveals that because of bad temperature control, about 15 to 20 per cent of fruits and vegetables are lost during storage and transport (NCCD, 2021). Technology-enabled systems are a very good way of cutting these losses by giving a more precise and trustworthy storage place. This equipment gives an option of sale at a time when a farmer needs to sell, instead of the immediate post-harvest sale. Such a position gives farmers greater negotiation power and a steady income. Exporters who use product-based cold storage with the help of IoT create a strong credibility because buyers receive produce which has been kept in stable conditions throughout. This technology especially benefits food processors and retailers, as safe storage helps in less contamination and maintaining quality. As

more farmers have access to affordable cold storage, it turns the complete supply chain into a more flow chain, which is less dependent on market behaviour that is not predictable.

Domestic Market Considerations

India's role in global agricultural trade is being redefined by climate-induced production shocks and escalating protectionist measures. However, the extent and the way these effects interact with the domestic agricultural market in India are the decisive factors. The regime of price supports, procurement policies, supply-chain infrastructure, and regulatory interventions together determine whether the environment and trade disruptions become a source of resilience or a crisis. Therefore, domestic market factors constitute the vital link between climate variability, protectionist policy actions, and the actual effects on producers and consumers. This part of the report delves into the institutional and political economy dynamics of the domestic market, concentrating on MSP-driven price support, the PDS interface, internal price stability issues, the role of the Essential Commodities Act (ECA), and the governance trade-offs that influence the agricultural policy direction.

Low Prices for Essential Goods and the Domestic Price Stability Imperative

Agriculture in India is influenced by a political environment in which food inflation is considered one of the most sensitive indicators. As more than 50% of the household expenditure for low-income families is on food, governments are under intense electoral pressure to keep the consumer prices in check. This situation leads to a structural prioritisation of low retail prices over high producer prices, thus resulting in a persistent trade-off between farmer income security and consumer affordability.

Food price shocks that are the result of crop failures, logistical bottlenecks, or global supply chain disruptions usually lead to the rapid intervention of domestic markets. Such interventions are export bans, stock releases, temporary import tariff reductions, or closer enforcement of storage limits. Although these measures stabilise short-term inflation and protect consumers, they usually keep farm-gate prices at a low level and decrease farmers' capacity to take advantage of the favourable international market conditions.

Therefore, the domestic imperative for price stability is not only of an economic nature but also a deeply political one. The changes in agricultural prices affect inflation expectations, fiscal projections, and electoral outcomes, thus putting governments under continuous pressure to intervene.

Political Influences and the Cropping Incentive Structure

Agricultural prices as well as procurement decisions are influenced by farmer market signals, but they are also significantly affected by the political economy of the

farmer constituencies and the regional interests. The focus of the crops that get the most support is mostly determined by lobbying at the state level and the historical patterns of procurement.

To give an example, Punjab and Haryana have benefited from a very high procurement support for rice and wheat as a result of the deeply-rooted procurement networks that were built during the Green Revolution. Regions without procurement infrastructure, including states with high levels of poverty and vulnerable to the climate, have been almost completely left out of effective MSP access. This structural imbalance has the effect of regional concentration of monocropping, which in turn causes groundwater depletion and soil degradation, and at the same time strengthens the re-entrenchment of political capture.

Therefore, policy signals are not just a means to rectify market failure; they are a way to recalibrate political power. Reform proposals encounter opposition not only from farmers as an economic group but also from state governments, who are the defenders of the entrenched resource channels.

The MSP-PDS Complex Issue

The MSP system is closely connected with the Public Distribution System (PDS) to form a system with double functions: income stabilisation for farmers and subsidised food security for consumers. Nevertheless, this combination leads to the emergence of the three most pressing internal issues:

1. **Unequal Access and Limited Coverage:** While MSP theoretically covers 23 crops, most of the procurement is actually done from rice and wheat. The majority of small and marginal farmers who are far from procurement centres and do not have access to information cannot procure and thus are compelled to sell their products at a low price due to a lack of options.

2. **Distortion of Crop Patterns:** Excess procurement of rice and wheat leads to the distortion of farmers' cropping choices and discourages them from switching to pulses, oilseeds, and horticulture, thus India continues to face a shortage and price volatility of these products.

Fiscal and Storage Burden: Large amounts of procurement cause the Indian Food Corporation (FCI) to have storage problems that are not easy to resolve, and also, to a great extent, contribute to the food subsidy bill, which in turn leads to less fiscal flexibility for investment in infrastructure and climate resilience. Therefore, MSP is vital for income

stabilisation; however, the existing setup leads to systemic distortions in the long run, which, in turn, call for gradual reforms instead of sudden withdrawal.

Essential Commodities Act (ECA) and Market Regulation

The Essential Commodities Act equips the state with the power to set stock ceilings, ban speculative hoarding, and, if necessary, step in to stabilise prices. The 2020 amendment aimed at lessening the regulatory intervention issued by the private investors by confining the government interventions to only very few cases, like war or a very fast price increase.

As the reform was meant to lure investment in warehousing, cold chains and processing, critics claimed that by loosening the regulatory control, the risk of oligopolistic concentration in storage and wholesale markets was increasing, in particular, due to the very disadvantaged bargaining position of small farmers.
The above tangle of issues marks the fundamental policy paradox:

If you remove regulation too early, there is a risk of corporate concentration and exploitation. If you keep heavy regulation, investors will be discouraged, and inefficiencies will remain. Therefore, the ECA reform is about the difficulty of balancing consumer protection, the development of a competitive market and political legitimacy.

(The reform had the specific goal of attracting private investment in warehousing, cold storage, and food processing facilities through a loosening of regulatory controls. Nevertheless, there was a concern that reduced supervision could lead to the concentration of storage and wholesale markets, which could then affect competition and the bargaining power of small and marginal farmers.

Such concerns highlight the policy trade-off behind the issue. On the one hand, easing regulations can enhance investment incentives and solve supply chain inefficiencies; on the other, regulation is still seen as a protective measure against market concentration and price volatility. In this situation, the Essential Commodities Act reform is a manifestation of the problem of reconciling efficiency with market competition, consumer interests, and political and institutional factors.)

Domestic Political Trade-offs and Reform Constraints

Just like the other policies, Indian agricultural policies are also influenced by the domestic political trade-offs and constraints. Any initiative to change MSP, PDS, mandi systems or stock regulations needs to consider facts like rural incomes are extremely vulnerable to shocks of any kind, Inflation is a source of political risk, farmer unions have a strong capacity to mobilize, there are Centre-State federal tensions and due to short-term political survival, governments are often encouraged to take reactive, short-horizon, decisions that abandon the problem of volatility unaddressed - thus, their survival is reinforced instead of resolved.

Climate Shocks as a Stress-Test of Domestic Market Weakness

Climate extremes induced by climate change, such as less predictable rainfall, floods, heat stress and cyclones, are magnifying market vulnerabilities. Sudden supply shortages lead to panic buying, speculative holding and retail price spikes. Governments react with urgent trade controls that restrain long-term policy consistency. Therefore, the domestic market resilience is equally important with climate adaptation and trade liberalisation. If there is no strong storage, decentralised procurement, diversified cropping and shock-responsive support, climate shocks will keep forcing India to take protectionist measures as a reaction, thus losing its competitiveness.

Agricultural results are first and foremost dependent on domestic market factors that serve as a kind of filter through which climate change and international trade have an impact on them.

REGULATORY AND INTERNATIONAL CONTEXT

7

Regulatory And International Context

Legal and Institutional Framework

The Foreign Trade Development and Regulation Act- 1992

The Foreign Trade Development and Regulation Act of 1992 is the legislation that the Indian government uses to organise the export and import activities of India. It is somewhat similar to a control switch. When there is a concern about the shortage of necessary commodities due to exports, the government is enabled by the Act to vary the regulations on the export of goods within a very short time. Thus, exports can be restricted, export duties can be increased, and export consignments can be stopped temporarily, among other things. Price stability through the regulation of supply and demand and keeping an adequate stock in India are the primary objectives of such interventions.

The Act resulted in the end of an old and tightly closed law and marked the beginning of the liberalisation of India's foreign trade policy, which was to be based on promotion and regulation rather than control. It empowers the government to issue regulations that result in export promotion, allow imports with fewer restrictions, and, at the same time, protect the domestic market. The government is permitted to publicise trade policies, determine the kinds of goods that may be traded, and take rapid steps if necessary, such as in the event of a weak monsoon or high inflation. This statute is instrumental in balancing India's internal needs against global market forces.

Some economists point out that the Act is primarily invoked for crops such as wheat, sugar, and non-basmati rice when there is a decline in production or an increase in global prices. By modifying export regulations, the Act enables India to adjust to local and global market conditions very quickly, and this is the central reason why there can be episodes of sudden and significant rises or drops in the level of agricultural exports from India. In a nutshell, it is a pivotal foreign trade law that is instrumental in the management of India's external trade while simultaneously ensuring the stability of the domestic markets and putting the economy on the path of growth.

Essential Commodities Act, 1955

The Essential Commodities Act, 1955 (ECA) is a law that enables the Indian government to interfere with the supply and distribution of those essential goods without which people cannot live, especially food items and products from agriculture. The purpose of the Act is to avoid such situations where it is deployed, where there is a shortage of supply, or the

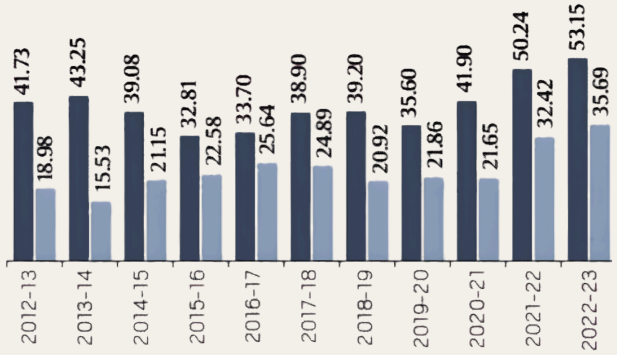
prices of important goods rise sharply. The government may impose stock-holding limits on traders through this Act so that there would not be anyone who would store goods and sell them at a very high or exorbitant price. Moreover, the Act empowers the government to control sales, movement, and distribution of goods to ensure the welfare of society, if necessary. The act is instrumental in controlling the exports as well, along with domestic market management. Whenever there is a shortage of goods inside India, or prices rise suddenly, the government is allowed to impose a ban on exports to safeguard the domestic consumers. The major amendment in 2020 made it more difficult for stock limits to be imposed in such an area, stating that controls on stocks may only be employed in situations such as war, famine, natural disaster of great magnitude, or an extreme rise in prices. This change protects food security at home while not completely denying free trade.

In a nutshell, the ECA is like a market safety valve. In a supply shortage situation, where demand is not met, and there is a risk of hoarding to drive prices up rapidly, the government may take measures through this law to stop hoarding and ensure access to essential goods for everyone at a fair price. It is this Act that stabilises the market and makes food affordable in tough times.

Agriculture Export Policy, 2018

The Agriculture Export Policy 2018 was an initiative by the Indian government to open up foreign markets to Indian farmers by increasing product exports. It was developed to first increase the exports of agricultural products from $30 billion to $60 billion by 2022 and subsequently go beyond that figure. Assisted by the state, the farmer was to be put at the forefront of a strategically improved infrastructural network, the product of his labour being processed, value-added, and globally qualifying for standard and safety norms. An additional aspect was the simplification of the export route through the formation of clusters for crops, the revitalisation of transport and processing spaces, as well as improving coordination between the central and state governments.

India's Agricultural Trade



Indian farm products such as tea, coffee, spices, fruits, vegetables, processed foods, and organic products were the focus of the policy to be made competitive in the world market. At the same time, the program acknowledged that staples might have to be safeguarded against shortages or price spikes; hence, the export of such commodities would be contingent upon the domestic supply and food security situation. Such a policy balances support for farmers in the international market and food availability and affordability within

the country. The program's dream reposed in the Indian agricultural export capacity as the means of elevating farmers' income and placing India among the global leaders of the agricultural market through the enhancement of trade infrastructure, market access, and export quality standards.

National Food Security Act, 2013

The National Food Security Act 2013 subsidises food grains through ration shops for nearly two-thirds of the Indian population. The Act provides for 75% of the rural population and 50% of the urban population with a monthly supply of 5 kg per person: rice at ₹3/kg, wheat at ₹2/kg, and millets at ₹1/kg. In addition, it offers free meals to children up to the age of 14, nutrition to pregnant mothers, and a cash benefit of at least ₹6,000. ((Parliament of India, 2013)

The law obliges the government to maintain sufficient stocks and distribute food all over the country, thus giving priority to domestic needs. In situations of low harvests due to bad rains or a sudden increase in demand, it results in export bans on rice and wheat as a measure to protect local supplies and maintain prices. The states select the families and issue ration cards to the women heads of the households, while the centre is responsible for the supply of grains.

By doing this, food is made a legal right, and welfare is cleverly linked to trade rules. The Act ensures that there is no hunger at home before food is sold abroad, which is the reason for India's brief export bans during difficult times. The point: it protects millions from price shocks while requiring higher farm output to be able to feed both the people and the global markets.

CFS Principles and How India's Policies Relate to Global Food Security Ethics

The Committee on World Food Security (CFS) is a UN forum that basically is a meeting place for different stakeholders, such as governments, farmers, businesses, and scientists, where they work together out the rules for just and environmentally friendly food systems all over the world. Their Voluntary Guidelines on Food Systems and Nutrition, which were adopted in 2021, include 105 recommendations spread over seven areas, such as transparent governance, sustainable supply chains, equitable access to healthy diets, food safety, nutrition education, gender equality, and resilient systems in crises. These, among other things, urge countries to make safe and nutritious food accessible to all, at the same time that they protect the most vulnerable, stop hoarding, and encourage sustainable agriculture while at the same time respecting human rights. (CFS: Voluntary Guidelines on Food Systems and Nutrition, n.d.)

During bad harvests or price inflation, India's export bans and stock limits go along well with CFS principles as they prioritise domestic food access. So, in 2023, India, for example, as mentioned before too, prohibited the export of non-

Basmati white rice and also imposed some additional charges on parboiled rice so that there would be enough local supplies amid global shortages, and this in turn would help keep buffer stocks of around 41 million tonnes for the Public Distribution System. Consequently, it not only keeps millions of people away from hunger and price hikes but also corresponds to the CFS calls for the promotion of affordability rather than that of unrestricted trade.

Moreover, the policies are interlinked as India's 2018 Agriculture Export Policy is consistent with this by aiming at the doubling of exports through improved infrastructure and standards for tea, spices, and fruits, thus becoming one of the top-10 global agricultural exporters in 2023 with $53 billion worth of shipments. Such a combination of welfare and trade is in line with the CFS advice for context-specific policies, which should be sensitive to national needs such as food security.

Sustainability & Green Trade Standards

Carbon Border Adjustment Mechanism (CBAM): In a step towards global decarbonisation, the European Union has implemented a mechanism known as CBAM, i.e., Carbon Border Adjustment Mechanism. Under this scheme, any product imported into the European Union from countries having more relaxed emission-related regulations is subject to fair prices on carbon emissions that take place as a part of the production process. Its goals are to prevent the promotion of carbon emissions, as this mechanism tends to equalise the carbon-emission burden on goods produced across the globe, and not just in the EU, preventing producers from non-EU members from gaining an advantage over the same.Though CBAM's scope doesn't cover the agricultural market just yet, it still impacts the fertiliser segment. Fertilisers produced in India have a large carbon intensity. Thus, importers from India would have to pay a higher price for these fertilisers, making them less competitive in the global market. To avert this problem, Indian exporters would have to invest in low-carbon production technology, which helps them gain competitiveness in markets and regain their share in the GVCs. Also, due to the increased restrictions and compliance to the increased restrictions and compliance

requirements on imports from non-EU member countries, the European countries would prefer to purchase these goods from the EU itself, escaping the legal hassles involved in these transactions.

If CBAM is extended to agricultural products in the future (as the world moves towards emission trading systems), Indian exporters might yet again face compliance issues, such as reporting embedded emissions and keeping a proper track of Scope 3 emissions, leading to the process of export becoming relatively much more tedious. Thus, even though CBAM doesn't have a direct impact on the Indian agricultural industry as such, it has a significant indirect impact, which poses challenges. India is still significantly behind in the level of preparation they have for the implementation of CBAM. CCTS (Carbon Credit Trading Systems) should be developed, and investment should be made in low-carbon production processes, to save the Indian exporters from the perils that CBAM puts forth.

Carbon Credit Training Systems are mechanisms developed by the relevant authorities and governments to ensure compliance with emission targets. These systems incentivise enterprises to comply with the emission targets and, on the whole, reduce their total emissions by providing them with a tradeable carbon credit certificate for the same. In India, necessary amendments were incorporated in the Energy Conservation (Amendment) Act, 2022, to ensure the development of a proper and efficient carbon credit trading system.

One of the provisions of this amendment includes empowering the Central Government to "Specify a Carbon Trading Scheme" under Clause (w) of Section 14.

The amendment to the Energy Conservation Act also facilitates the issuance of carbon credit certificates by any agency designated by the Central Government. Under the compliance mechanism, the Central Government shall specify the registered entities as obligated entities. For this purpose, the Bureau of Energy Efficiency will identify sectors and potential for reduction of greenhouse gas emissions and recommend including such sectors in the Indian carbon market.

Water Footprints:

Simply speaking, water footprint is a measure of the total volume of fresh water utilised in the production of a commodity. It accounts for the total usage of water at different stages in the production process. It consists of the following 3 components:

- Green Water Footprint: Water stored in the soil (through precipitation), helpful in growing crops/plants. Relevant for the agriculture and forest-based industries.
- Blue Water Footprint: Water available at the surface level(freshwater lakes, rivers, etc.), or groundwater accessed through wells or other sources.
- Grey Water Footprints: Water used to dilute the pollutants given out by the producers in the process of production, to meet certain water quality standards.

This measure was introduced with a view to understanding the impact of the production of various commodities on the freshwater supply of the country. With the help of this index, issues like water shortages and pollution can be better understood, and corrective measures can be implemented more efficiently.

India is home to about 18% of the world's population, but it has access to only 4% of the world's freshwater resources. With an increasing population, the requirement for freshwater resources has also risen. In order to solve this problem, several measures have been undertaken to assess water footprints and, eventually, avert water scarcity. The National Water Mission: Under this mission, the government has explicitly mentioned the need to reduce virtual water export by assessing water footprints in the agricultural sector. Even though these are only guidelines and not actual rules, these steps have paved the way for the government to enforce these measures.

Certain state governments have also imposed certain restrictions. The Punjab government, through the Punjab Water Regulation and Development Authority, has imposed strict restrictions on water usage. From now onwards, groundwater extraction by industries and other establishments will be metered and charged, and anyone with an existing borewell or anyone digging afresh will have to take permission from the Punjab Water Regulation and Development Authority (PWRDA). Using the water footprints, major problems like water shortages and pollution can be examined more effectively, and remedial actions can be taken more effectively.

India, despite hosting about 18% of the world's population, has access to only 4% of the world's freshwater resources. The freshwater demand is on the rise, owing to the ever-increasing population of the country. In order to tackle this, several measures have been undertaken to assess water footprints and, eventually, reduce the water scarcity prevailing in our country. The National Water Mission has been implemented, under which the government has explicitly mentioned the need to reduce virtual water export by assessing water footprints in the agricultural sector. Even though the Mission is only prescriptive in nature and doesn't bind the entities legally, these steps have paved the way for the government to enforce these measures.

Certain state governments have also imposed restrictions. The Punjab government has imposed restrictions on water usage(especially groundwater usage) through the Punjab Water Regulation and Development Authority. A strict monitoring system has been established for the extraction and usage of groundwater, requiring industries and individuals to install meters and pay a charge to the government to use groundwater, and anyone with an existing borewell or anyone digging afresh will have to take permission from the Punjab Water Regulation and Development Authority (PWRDA) for the usage of such wells.

Consumers using 300-1500 cubic metres of water would have to pay:

- Rs. 4 per cubic meter in the green zones
- Rs. 6 per cubic meter in the yellow zones
- Rs. 8 per cubic meter in the orange zones

The Haryana government has announced its Integrated Water Resources Action Plan, under which it aims to integrate the currently employed farming practices with rainwater harvesting, reuse of treated water, and demolition of illegally created wells throughout the entire state.

Thus, even though there are no strict regulations regarding the water footprints of various commodities, the Indian Government has started making conscious efforts towards the same, with its main focus on the agricultural sector. These measures aim to reduce virtual water exports and promote an efficient and sustainable utilisation of the scarce water resources we have left.

Carbon Intensity:

Similar to the water footprints, carbon intensity is a measure to assess the total volume of CO2 released in the production of a commodity. It is calculated using the following formula:

Carbon intensity = Total Carbon Emissions/Activity Level

The carbon intensity index is mainly used to understand how efficiently an organisation is using its resources in terms of the greenhouse gases they emit. It helps identify high-emission sectors, compare organisations with industry benchmarks, and impose restrictions/penalties on those organisations violating the given benchmarks. It is also helpful in tracking progress and efficiency of measures implemented by the government in such directions, and assists investors and banks in taking proper decisions, preventing them from falling into the greenwashing trap

The agricultural sector in India is still a major contributor to its GDP, but at the same time, it also contributes a lot to greenhouse emissions, as Agriculture still ranks 2nd on the list of industries with high carbon emissions, only behind the Energy sector. Thus, the government aims to reduce carbon emissions from the agricultural sector through various measures, such as the NMSA (promoting efficient utilisation of water and other resources), the carbon credit trading scheme for farmers(where they can earn carbon credits by adopting sustainable, low-carbon practices like efficient

fertiliser usage, better water management in rice-growing areas, etc., and reducing their GHG emissions, direct benefit transfer to farmers using organic inputs, and subsidies for using climate-smart and sustainability-promoting technologies.

Owing to such a move towards reducing carbon emissions, the farmers might also come across certain hurdles. Technological integration into the farming process might benefit the industry as a whole, but for the smallholder farmers, it still poses challenges as to adaptability(lack of technology-related upskilling), affordability (small-scale farmers don't have enough funds available) and uncertainty of outcome (doubtful whether low-carbon practices would be efficient, and a potential loss of income if the farmers can't comply with the standards for exporting their produce). Thus, the government needs to ensure that the carbon intensity is minimised without compromising on the farmers' welfare.

Certification Of Exports:

Indian Organic: National Programme for Organic Production(NPOP) carries out inspection and certification of organic agricultural produce. It ensures that agricultural products are grown without synthetic fertilisers, pesticides, or genetically modified organisms.

India Good Agricultural Practice: The IndGAP certification is designed to promote safe and sustainable agricultural practices in India and ensure that the produce grown in the country meets international food safety and quality standards. The certification is recognised by various international organisations, such as the GlobalGAP, and can help Indian farmers access new markets and increase their export potential.

Global G.A.P.: This certification mainly focuses on Traceability, Food Safety, and Worker Health, minimising environmental Impact and ensuring production Practices Meet International Food Safety and

Sustainability Standards. This certification is recognised globally and helps guarantee that food products are produced in ways that are safe, environmentally responsible, and socially equitable.

Fairtrade: This certificate is provided by the Fairtrade Labelling Organisations International (FLO). It is provided to those farmers who own plantations and usually grow tea/coffee as their primary agricultural product. Certified products normally receive higher and more stable

sales prices, and thus, help farmers increase their revenue and prevent them from being affected by climate shocks.

The Indian Government has enacted a National Programme for Organic Production (NPOP). NPOP inspects and provides certificates for organic agricultural produce. NPOP guarantees that organic agricultural products do not have any synthetic fertilisers, pesticides, or genetically modified organisms added to them during growth, thereby guaranteeing higher prices to the farmers engaged in organic farming, and ensuring that only actual organic agricultural produce is treated as organic produce.

IndGAP (India Good Agricultural Practices) certifies that the agricultural produce produced in India conforms to international food safety and quality standards as established by various national and global agencies (e.g., GlobalGAP). IndGAP certification enables Indian farmers to establish the legitimacy of their products, providing them with the ability to sell their products at higher prices and creating a larger market opportunity.

GlobalGAP (Good Agricultural Practices) establishes requirements for traceability, food safety, and worker health in the agricultural supply chain while mitigating the negative impacts of agricultural production on the environment and ensuring compliance with international food safety and sustainability standards. By establishing these requirements through its international certifications, GlobalGAP also increases the credibility of food products and adds value to them.

Fairtrade certification is issued to Farmers who own plantation businesses and produce either tea or coffee as their primary agricultural income. Compared to other types of products, Fairtrade certified products typically command higher and more predictable prices in the marketplace, improving the income of the farmer and protecting them from the impacts of climate.

COMPARATIVE ANALYSIS

Comparative Analysis

Lessons From Global Analysis

Unpredictable climate conditions and fluctuating food prices in the world markets have led the big powers to rethink the welfare programs of farmers that will keep the trade competitiveness intact. The analysis of how countries, notably China, Indonesia, the United States, and the European Union, deal with the issue gives out the main points of balancing internal safety and participation in the global value chains. These examples demonstrate the ways countries help their citizens in a targeted manner instead of buying up the whole production or issuing price guarantees that are not competitive.

China- Grain Policy

China's agricultural reaction to climate-induced changes in the environment is mostly dependent on its grain self-sufficiency policy, which is aimed at achieving 95% domestic security for the main staples such as wheat and rice. The government runs a Minimum Purchase Price (MPP) program, through which state-owned grain enterprises buy grains at floor prices that have been announced in advance to stabilise producer incomes and prevent market collapses during supply shocks. At the same time, China provides heavy input subsidies for seeds, fertiliser, machinery, and irrigation, which

lowers production costs and keeps the output at a consistent level despite climate variability. Besides that, huge buffer stock reserves enable large-scale releases to occur during shortages, thus the domestic market is shielded from the global price changes.

The enactment of the 2020 Grain Security Law has been an additional measure to tighten state control over grain circulation, hoarding, and export restrictions during crisis periods. China's model is a supply chain model that is agriculturally resilient and is dependent on institutional capacity and strategic stock management rather than market-determined signals alone, which is a significant contrast to India's fragmented procurement and storage structure.

Indonesia - Palm Oil Export Controls

Indonesia, the world's largest producer and exporter of palm oil, has limited its exports from time to time. Among these limitations was a complete export ban announced on 28 April 2022 to limit domestic shortages and lower rising cooking-oil prices. As part of this policy, the export of refined palm oil was halted, while the export of crude palm oil (CPO) was allowed to continue, essentially a move to reconcile global commitments with domestic supply needs. The intended result of this action by the government was that this selective restriction would allow the export of crude palm oil while suspending the export of refined palm oil, which was aimed at redirecting raw palm oil to domestic refineries and distributors. Thus, the availability of cooking oil would increase in the domestic market without the upstream export earnings being fully disrupted or the long-term international supply commitments being breached.

The primary effect was a drastic decrease in local cooking oil prices; it was reported that the prices dropped by more than 17% within a couple of weeks after the ban was imposed. Hence, consumer inflationary pressure was eased.

Nevertheless, these export restrictions have interrupted the supply chains of edible oils worldwide and resulted in the volatility of international markets, which, in turn, has caused the loss of trade credibility in the long run.

The lesson that Indonesia provides is that

temporary, demand-side trade controls can stabilise domestic prices during supply shocks; however, they still have serious costs in terms of export competitiveness and global market trust if they are used repeatedly or for a prolonged period of time.

Indonesia's experience highlights for India the potential use of targeted and temporary trade restrictions as a short-term stabilisation tool during severe supply or climate-related shocks. Without enforcing a complete export ban, a differentiated export policy that prioritises domestic availability of processed food products while maintaining limited engagement in upstream exports could help moderate consumer prices.

United States - Farm Bill

The U.S. Farm Bill is a periodic omnibus legislation that mainly aims at providing income security to farmers, but without the government intervening with procurement.

It does not provide a guarantee of purchase at fixed prices (like MSP), but rather, it aids farmers by giving them subsidised crop insurance, revenue-protection schemes, and providing them with relief in case of natural disasters. Through devices such as Price Loss Coverage (PLC) and Agriculture Risk Coverage (ARC), farmers are given compensation only when the market prices or revenues fall below the predetermined level. This helps to keep production decisions market-oriented, lowers the demand for keeping large stocks as a reserve, and also prevents the existence of long-term distortions in the competitiveness of trade.

Considering that losses caused by climate change are on the rise, the current system is a highly adaptable risk-management tool, or a safety net, which keeps farmer incomes stable while also making sure they receive global price signals. In fact, it serves as a comparison, pointing to a different government intervention model where the latter only ensures income rather than prices, thus being a major difference from India's procurement-centric approach.

European Union - Common Agricultural Policy (CAP)

IThe Common Agricultural Policy (CAP) of the European Union, which has been in place since 1962, has progressively altered its nature from subsidies related to output and prices to a system of separate direct income payments. The main objectives of these transformations are stabilising farm incomes, providing food security, and supporting sustainable rural development in the member countries. With the CAP, farmers receive the payments that are given to them irrespective of production volumes in the current period; hence, the incentive to overproduce is lessened, the provision of a safety net for agricultural households is promoted, and price-sensitive markets are allowed to function. The latest reforms within the CAP framework also focus on the integration of environmental conservation and resource management measures with the ultimate goal of making agriculture less of a contributor to climate change.

These payments mean a good share of the yearly income for many European farmers, thus indicating the importance of the CAP in stabilising farm revenues without causing major distortions in global trade. The EU model is an example of how decoupled income-support measures, along with sustainability incentives, can provide a compromise solution in the farmer welfare, environmental protection, and trade efficiency triangle.

Regional Lessons within India:

Looking at policy experiments at the state level in India offers significant understanding about the ways agricultural aid systems might change and move away from typical MSP-focused ones. Various states have implemented different measures tailored to their cropping patterns, climate risks and market situations. These cases highlight the possibilities of a range of different measures instead of a single national policy.

Bhavantar Bhugtan Yojana: It is an innovative scheme first launched in Madhya Pradesh, is a price-deficiency payment system where the government pays the difference to farmers if market prices are lower than a pre-announced Modal Price. The state does not procure the commodities like in the case of MSP procurement; instead, farmers sell their produce in the open market, and the government pays them the difference between the reference price and the market price.

The idea kept the doors open for market-based price discovery while at the same time lessening the pressure on the government storage and procurement systems. Besides that, it gave an incentive to move away from the wheat and paddy monoculture and thus made farmers more responsive to the demand conditions. Unfortunately, the uneven implementation and the delay in payment also pointed to the necessity of better monitoring and transparency mechanisms.

Punjab and Haryana serve as examples of what can happen when one relies on MSP (Minimum Support Price) procurement for a very long time. Fixed purchase of wheat and rice was the main way to ensure food security at the national level in the past, but it has led to structural changes over time, such as over-extraction of groundwater, reduced diversification, and fiscal burden due to large grain stocks, especially as climate shocks increase the risk of crop failure.

Although productivity is still high, the region's agriculture is still susceptible to climate-induced variability. In fact, unseasonal rainfall and heatwaves have damaged rabi and kharif crops more and more, which is a clear demonstration of the risks of monoculture dependence.
Over-reliance on MSP procurement for a limited crop basket not only limits the possibility of adaptation but also increases climate vulnerability. Regional diversification strategies are indispensable for achieving long-term resilience.

Tamil Nadu, on the contrary, presents a different story. The rapid expansion of the dairy sector after the rise of private players like Hatsun Agro Products and Milky Mist Dairy is a clear example of how competitive market systems and efficient supply chains can be a great advantage to producers. With the money being spent on processing, value addition, and cold-chain infrastructure, the incomes of the farmers went up through stable purchase contracts instead of subsidised procurement. The flexibility of the sector helped it to be less affected by climate change compared to staple-grain systems: the diversified livestock income was one of the ways that farming risk was alleviated when crop yields were low due to erratic monsoons. Value-added, market-linked agriculture, if there is infrastructure to support it, can be a means of income stabilisation, a way to lower climate risk, and a tool for integration into domestic and export markets.

Challenges in the agriculture sector of India can best be understood through the lens of different states. Experiences from various states reveal that these issues cannot be solved by a single nationwide mechanism. For example, the case of Punjab-Haryana illustrates how a continuous reliance on Minimum Support Price (MSP) can be problematic under conditions of climate change, while the Bhavantar model is a good example of how price-linked income can provide a viable solution. Moreover, the dairy sector in Tamil Nadu is a telling example of how competitive value-chain development can work effectively.

These three cases collectively convey that a rigid, uniform national policy would not be sufficient to address these challenges. Instead, there should be a provision for flexibility in the policies, allowing for regional differences and being responsive to the market is the key to strengthening agri-sector resilience in the face of climate unpredictability and changes in trade patterns.

POLICY GAPS

9

Policy Gaps

India's Agricultural Trade Policy has greatly benefited the farmers in certain places, helping them through measures like MSP and the Bhavantar Scheme. But certain major gaps in the policy ought to be resolved as soon as possible. The source of these gaps is the government's focus on short-term relief, and thus, due to this narrow focus, the long-term export reliability and reputation in global trusts is tarnished. Let's discuss these in brief:

1. **Limited Coverage & Unequal Access:** The MSP (Minimum Support Price), which is a key pillar among the protectionist measures that the government has employed, covers a low quantum of crops (23), with major focus on rice and wheat, leaving farmers producing diverse crops in dismay. These farmers face problems in accessing both the subsidy and proper markets, and thereby, crop diversification is discouraged to a great extent by these measures. Income inequality widens, too, and this, in the long term, leads to unrest among the farmers, giving rise to protests.

2. **Distorted Cropping Patterns**: Due to the excessive focus of the MSPs on certain crops, the diversification into different crops is discouraged. Producers refrain from going into the production of pulses, oilseeds, etc., and don't indulge in horticulture or cattle farming. This leads to shortages and price volatility for these crops, and eventually leads to the creation of a "food security paradox", whereby overall grain production is increased, but the production of pulses and oilseeds, vital for nutritious reasons, is decreased. Thus, India exports Rice and Wheat, but on the other hand, imports pulses and oilseeds.

3. **Erosion of Global Competitiveness:** Frequent employment of protectionist measures by the Government leads to a severe impact on India's competitiveness in the global agricultural market and makes the country unreliable for future trade agreements. This makes the country lose its market share to neighbouring countries. High rates of tariffs lead to inefficiency in the production system, leading to farmers becoming habituated to these measures. They demand these measures to be implemented very frequently, thereby reducing the resilience of the Indian agriculture system.

Also, as mentioned in the previous sections, MEP and export bans not only hurt the farmers of the country by destroying opportunities to earn higher revenues by exporting, but also cause

problems for other countries dependent on India for fulfilling their food needs (like Bangladesh, which was greatly affected due to the Onion Export Ban in 2019). Overall, the current policy promotes protectionism to an unhealthy level, thereby reducing India's integration into the GVCs (Global Value Chains).

4. **The Fiscal Burden:** India's agricultural subsidies, particularly those on fertilisers, consume a significant portion of the entire agricultural budget. The MSPs imposed also lead to a humongous fiscal burden, as the government has to buy a large part of the excessive supply, and also create warehouses and incur transportation costs to maintain the buffer stock. Subsidies also lead to inefficient use of fertilisers, thereby increasing government costs, degrading soil fertility, and eventually harming both the government and the farmers.

5. **Diminishing Trade Surplus and Export Resilience:** As the MSPs focus on Rice and Wheat, production of other commodities gets hindered, thereby reducing self-reliance and increasing the need for imports, again adding to the fiscal deficit. As policies are framed with a narrow point of view, infrastructural development suffers, short-term stability is preferred over global integration and competitiveness, and thus, India suffers from export reduction and an unwanted increase in imports.

Institutional Constraints

Split Duties Across Agencies

Different ministries and state agencies in India have divided the agriculture and trade functions amongst themselves. However, as they do this without delineating the roles, it results in a very big problem in the implementation of policies. The Ministry of Agriculture, mainly through its procurement department, purchases crops from farmers and provides them with the required support. The Ministry of Commerce, through its trade directorate, sets export rules while the Food Corporation of India stores and distributes foodgrains to stabilise supplies.

For example, when wheat is scarce at home, and hence export approvals are getting stuck as agencies are pulling in different directions- one is eager to sell abroad for dollars while the other is to keep stocks local for ration shops. In Bihar, the state teams frequently confront the national procurement plans over the control of local buying, which results in the delay of food delivery to the poor and the half-empty condition of the warehouses. The COVID-19 lockdowns made the situation worse as the sudden travel restrictions made it difficult for the central teams to coordinate with the states, which resulted in procurement disorder and empty shelves in the public distribution system.

Shortages in Storage and Transport

India doesn't have proper storage and transport systems to save food from going bad, and this causes food to be wasted and the trade to be disrupted every season. Modern warehouses controlled for aspects like humidity are only able to store a small portion of the foodgrains produced, and a lot is left piled up outside where it gets spoiled by rain, heat, or rats. The situation is even worse for the storage of vegetables and fruits, especially in villages that do not have a stable supply of electricity, proper roads, and refrigerated trucks to transport them to cities. For example, farmers growing apples in Himachal Pradesh have to discard huge quantities of their produce as they are not able to keep it fresh for a long enough period to take it to markets in the cities or exporters, hence, both sales abroad and meals at home are affected.

The same goes for potato farmers in Uttar Pradesh whose produce gets spoiled due to bad roads and power cuts before it reaches wholesale markets, thus reducing the earnings of farmers and increasing prices for the rest. The transport links were blocked due to a shortage of migrant workers and lockdowns during COVID-19, which resulted in perishables being piled up in the fields and exposing the chain that are weak and cannot handle stress.

Poor Local-Level Monitoring and Compliance

At the state and local levels, it is still difficult to find people who check and stop cheating due to a shortage of workers, outdated tools, and low training. Market committees, which are supposed to ensure fair prices and weights, often fail to detect trader hoarding or fake scales because staff arrive late or turn their backs. Officials who are supposed to enforce stock limits on pulses or onions are taking bribes instead of raiding illegal godowns full of hidden grains.

Take onion farmers in Maharashtra, for example. If there were proper daily watches, traders would not be able to hold back supplies during export bans, thus forcing growers to sell cheaply at farm gates while city prices are going up for regular buyers. In Madhya Pradesh, local teams that are responsible for tracking middlemen who mix low-quality wheat into government stocks are failing. As a result, this wheat reaches poor households, and thus, trust in the entire food system is broken.

Disconnect Between Trade and Home Needs

Trade rules and home food needs are like two different languages that do not understand each other well, resulting in sudden policy changes that farmers and buyers are not able to anticipate. For instance, trade imposes export limits or bans without taking into consideration what the Food Corporation requires for building up emergency stocks in ration shops, thereby leading to sudden rice bans that saturate local markets and lower farm incomes overnight. Exports are increased to meet the global demand for oil from countries like China; however, locals have to pay more for the same product, i.e., cooking oil, because domestic mills are few and in short supply.

NITI Aayog mentions that these gaps are the reasons why prices keep changing from one extreme to another, and this is not good for long-term trade agreements with other countries, as well as for ensuring that families get their daily meals without interruptions. (Kumar & National Institution for Transforming India (NITI) Aayog, 2018). For example, during drought periods in Karnataka, the decision to push exports at the cost of spices will leave less for local curry powders, thus illustrating how weak connections that are less discussed but affect everyday cooking just as much as large shipments.

The pandemic situation came as a catalyst for this problem as well, with the holding up of exports conflicting with the hurried

domestic allocations, thereby leaving both global buyers waiting and home stocks being non-uniform.

Weak Data and Planning Tools

Poor data gathering and analysis result in policies that are essentially guesswork, which cause the wrong moves that not only fix one problem but also create two more. Workers in the villages do crop surveys manually on paper, but due to too much work and the absence of phones or apps, numbers are coming late, are incorrect, or do not represent certain areas like small farms.

In Uttar Pradesh, inaccurate predictions of rain-fed crops once led to wheat imports, which were unnecessary, thus causing the partners with whom trade was done to get angry since they considered it unfair play and that it led to the increase in global prices. This can be seen in the case of millet areas of Rajasthan, where the lack of information about yields affects the local mills' processing activities, and thus, leaves the grains to rot while urban stores are empty.

Improved instruments like satellites or quick apps could detect these problems at an early stage, but the limited skills and funds have kept the old ways going, making food security a matter of chance.

Challenges in Policy Constraints

In the previous sections of the report, we have learned about the functioning of the Indian agriculture sector and the major obstacles faced by the export sector on the international forum. It is often wondered why the government doesn't come up with effective policies and a plan of action to solve the situation at hand and ensure sustainable development of the sector, which acts as the backbone of the entire economy. Although it is vital to implement effective policies that encourage investment and consolidation of the agriculture sector to ensure food security and profitable trade surplus in the future, it is equally important to consider a retrospective approach and scrutinise the existing policies.

A majority of the obstacles that the sector is currently facing are due to various constraints of the existing policies themselves, which often overlap with each other and, instead of fostering development, nullify the impact of other policies and may even result in being counterproductive. This section highlights the major challenges in policy constraints and analyses their impact to gauge the importance of strategically reviewing the policy stance of India, while bearing in mind that it is not merely affected by socio-economic factors but is largely dependent on the political landscape of the country.

1. **Skewed government spending:** A significant portion of the government expenditure goes into providing subsidies to the farmers, which restricts the flow of funds to channelise further R&D in the sector. Additionally, it has been observed that, to secure subsidy benefits, the majority

of farmers restrict themselves to growing those crops on which they can avail themselves of these benefits.

As a result, it hampers long-term productivity because, firstly, it reduces the expenditure on agriculture infrastructure and development and also cancels out the incentive for farmers to grow a variety of crops, thus leaving the domestic agricultural market dependent upon foreign players for the procurement of various crops. This could severely impact small and marginal farmers, as they can easily be displaced in the market due to high competition, thus impacting the livelihood of millions of people and weakening the country's macroeconomic structure. In certain cases, these subsidies are important to protect farmers from an inescapable debt trap and provide an incentive to them to grow certain crops; however, the problem is that these policies negate other crucial parts of the agriculture sector, which play an integral role in its development in the long run.

Trade distortions: India's agricultural exports have grown significantly over the past decade, reaching approximately $50 billion annually (Kumar, 2025).

The country exports a diverse range of products, including rice, wheat, sugar, tea, coffee, spices, and fresh fruits. Major destinations include the Middle East, Southeast Asia, Europe, and increasingly, Africa. However, this impressive figure represents only a fraction of India's agricultural potential, highlighting the untapped opportunities that exist.

Trade distortions are mainly due to government interference, which often impacts international prices and has a profound impact on the market landscape. To ensure a lower cost of production for the farmers, the government rolls out various schemes to provide fertiliser subsidies. Though they may appear to help farmers in a short time period, they act as a major policy constraint in themselves, which severely impacts the objective of India's agricultural trade policy. These subsidies may be responsible for making our products less competitive in the international markets. For example, when the government provides fertiliser subsidies, it might reduce production costs domestically, but it doesn't necessarily translate to competitive pricing in global markets. These policies have also been criticised at various international forums by several member states and may also lead to long-term trade disputes, thus affecting the global economic structure.

Minimum Support Price (MSP), initially intended to encourage farmers to grow staple crops, such as wheat and rice, during the Green Revolution, has led to major distortions in the agricultural market, including undiversified agricultural

produce and negligence of the working mechanism of free markets. MSP also leads to a higher public procurement of white rice, thus increasing the stockpiles of the government. As a result, the market price in most states remains below the MSP. Furthermore, there is also a decreasing trend in the per capita consumption of rice and wheat, as people are increasingly favouring alternative food options (Mishra, Ayush. "Beyond MSP: Rethinking India's Age-Old Procurement Policy." ResearchGate, 2024). Thus, MSP also harms the farmer's ability to trade and perform efficiently in a competitive market.

3. **Agricultural Export Bans**: To ensure food security and stability of prices in the country, export bans have been an effective measure to discourage farmers from selling their produce outside the country. However, it has also led to negative consequences by impacting the competitiveness of Indian farmers in the international market and straining India's international relations. For instance, India imposed a ban on the export of non-basmati white rice in 2023 and a ban on the export of broken rice in 2022 to ensure sufficient domestic supplies and control rising food inflation.

Additionally, Minimum Export Price (MEP) has been one of the measures used by the government to control the export price of crops, in order to ensure domestic consumption of these crops at stable prices. MEP caps are always higher than the prevailing prices in global markets, thereby disincentivising the export of certain products. However, this policy has unintended consequences as it disincentivises the farmers from producing more, affecting the domestic and international supply, and they also lose an opportunity for remunerative prices. MEP also impacts international prices as India is a major supplier of crops such as rice and onions, which leads to a surge in global prices of these products.

Thus, the policy fails to address the domestic inflationary issue, contradicting its very own objective. Additionally, export bans act as a major constraint to market stability and create uncertainty among international buyers and restrict the farmers from getting their desired remunerative prices even from export-oriented crops.

There are a number of policy constraints that currently exist in terms of India's agricultural trade policy; however, they are subsets of the policies listed above. As discussed earlier, the agriculture sector requires effective investment to develop adequate infrastructure and technology to ensure the competitiveness of India's agricultural products in the international market.

POLICY RECOMMENDATIONS

10

Policy Recommendations

Recommendation 1:
Expansion of the Bhavantar Scheme

The Bhavantar scheme is a price deficiency payment scheme implemented by the Madhya Pradesh government to ensure the protection of farmers and, at the same time, reduce the fiscal burden on the government. The Bhavantar scheme includes the payment of the deficiency between the market price and the protected price of a crop to the bank account of the farmers. This scheme has shown positive results in Madhya Pradesh, and thus, expanding the scope of this policy would be extremely helpful for the farmers in the long run.

While implementing this policy on a national level, certain points need to be kept in mind, such as the problems faced in Madhya Pradesh. The government will need to ensure a seamless payment mechanism and an even, yet tailored implementation across the country. To solve these problems, the following steps can be undertaken:

- Mandate monthly payouts in DBT (Direct Benefit Transfer) form, using AgriStack for auto-verification of the land area owned, sales volume, and sown area by the farmers, eliminating the need for manual scrutiny of documents.

- The government should pre-allocate funds for this scheme, so as to ensure the availability of funds at the time of compensating for the deficiency. This ensures a smooth flow of funds towards the farmers post-verification.

- Integrating certain features of the Bharpai scheme (implemented in Madhya Pradesh), in order to fix registration glitches. This includes pre-sowing registration via multilingual mobile apps/online portals, to help in hassle-free registrations and a proper assessment of the total beneficiaries under this scheme.

The Bhavantar scheme should focus on maintaining a balance between the different types of crops, focusing on fruits and vegetables as well, along with staple crops such as rice and wheat. This balance is extremely important to ensure that farmers don't concentrate their resources towards the production of a few crops, which would increase the need for imports and reduce the exports of the crops left

out of the Bhavantar scheme. Also, a balance in the price deficiency compensation promised to the farmers ensures that there is no unnecessary exploitation of resources.

Recommendation 2:
Preparation to comply with CBAM:

The Carbon Border Adjustment Mechanism(CBAM) is a mechanism/tool used by the European Union to ensure that the goods imported from outside the EU face the same carbon costs as the goods produced within the European Union. Starting from 2026, exporters to the EU would have to purchase CBAM certificates equal to their emissions. To ensure compliance with this, the following steps can be undertaken:

- Establish a systematic and efficient CCTS (Carbon Credit Trading System): The government should work towards the establishment of a nationwide carbon credit trading system. These systems incentivise enterprises to comply with the emission targets and, on the whole, reduce their total emissions by providing them with a tradeable carbon credit certificate for the same. This process would involve the integration of certain schemes, such as the Soil Health Card and PM-KISAN, so as to help collect trustworthy farm-level data. This would help in better understanding the scope 2 emissions involved in the production of a commodity. Also, efforts should be made to ensure that the provisions of the CCTS are aligned with the CBAM reporting requirements.

- Make efforts to naturally increase the compliance of Indian produce with CBAM requirements: Encourage lesser usage of fertilisers and the practice of agroforestry, promote the practice of organic farming, undertake precision irrigation, and many such practices, which help reduce the compliance problems that Indian farmers face while exporting their produce to foreign countries.

- Use of FPOs: Use Farmer-Producer Organisations as compliance and reporting units. These associations can help collect emission data, aggregation of total carbon credits available to a farmer/producer, certification and verification of the data collected on the ground with the data collected from centralised platforms. This prevents the exclusion of small farmers and reduces the per-farmer compliance cost.

- Alignment between India's Climate Diplomacy and Trade Policy is essential for protecting Indian Agricultural Exports in an increasingly carbon-constrained world. India must actively involve itself in the affairs of the World

Trade Organisation (WTO) and negotiate with other countries bilaterally. India must also approve and recognise its domestic carbon markets and require/ensure that the Carbon Border Adjustment Mechanism (CBAM) is implemented fairly. The above approach allows Indian Agricultural Exports, through CBAM, to prevent exclusion from a global supply chain as a result of compliance while concurrently providing Indian Farmers with competitive advantages through market exclusion and building resilience towards climate change impacts, and providing for Global Market Integration and removing trade barriers.

Policy Recommendation 3:
Strategic Investment in Climate-Responsive AI Technologies:

Climate change has led to higher agricultural risks mainly through increased weather variability rather than a consistent decrease in productivity. Sudden severe weather events like heatwaves, droughts, and irregular rainfall patterns have become major factors of yield unpredictability, especially for small and rain-dependent farmers (IPCC, 2022). Furthermore, in a world with rising protectionism, such domestic supply instability frequently leads to sudden trade restrictions, thus further distorting markets.

For this purpose, public investment should primarily catalyse AI technology integration in agricultural risk management rather than perceiving them only as tools for raising productivity.

- AI-powered agrometeorological advisory systems that integrate satellite imagery, ground-level weather forecasts and crop-specific models can be created to provide farmers with timely advice on when to sow, irrigate and harvest crops. Such systems can also be equipped with AI-based early warning capabilities for climate-related hazards such as pest invasions, heat stress and drought, which can be linked to the already operating agricultural extension services for wider reach.

- Links between AI, generated risk assessments and crop insurance/disaster relief mechanisms could be established to provide quicker, more objective compensation during climate shocks.

- The promotion of public-private partnerships in agricultural AI is desirable, with governments guaranteeing free access to core datasets, while private enterprises are responsible for analytical and technical know-how.

Recommendation 4:
Promotion of Modern Climate-Adaptive Agricultural Practices:

Traditional, input-heavy agricultural methods have been less resilient to climatic stresses, especially in water-scarce areas, with degraded soils and subjected to rising temperatures. Climate reports point out that diversified cropping systems, agroforestry, and conservation agriculture can significantly reduce the risk of climate shocks by restoring soil health and increasing water-holding capacity (IPCC, 2019).

- Help the implementation of agroforestry systems by providing targeted financial and technical assistance, especially in areas that are vulnerable to climate change. Through extension services and pilot initiatives, help the adoption of conservation agriculture practices such as minimum tillage, crop rotation, and soil cover. Shift a portion of agricultural support away from price-based subsidies toward practice-based incentives that promote climate-resilient farming methods.

- Support locally suitable crop choices based on the local climatic conditions

sed on the local climatic conditions and water resources. These kinds of measures not only increase the resilience of production systems in the long run but also comply with international trade regulations since they are less trade-distorting than price support measures.

Recommendation 5:
Strengthening Digital Agriculture Missions

Digital agriculture initiatives have a huge potential to be the central point in linking up climate monitoring, decision-making at the farm level, and market reactions. Their success, however, will depend on whether or not they are conceived as integrated public systems as opposed to fragmented technology projects.

- Transform digital agriculture missions into a more unified and coherent approach through the integration of data on weather conditions, land ownership, crop production, and market information into interoperable platforms. Deploy digital means to foster climate, and adapt extension services that can provide farmers with timely advice, particularly during extreme weather events.

- Go for the establishment of well-defined data governance frameworks to uphold transparency, data security, and access of farmers and policymakers to data. Develop local-level capability to facilitate the use of digital platforms in an effective manner, especially for small-scale farmers. Efficient digital systems are, therefore, capable of enhancing the accuracy of supply forecasting and mitigating the odds of sudden trade embargoes during climate-related supply disruptions.

Agricultural investments need to be diversified according to regional climate risks if we want to make climate resilience work on the ground. A Climate Risk Weighted Agricultural Investment Framework can categorise districts based on the degree of climate variability their area has experienced over time by means of data from the meteorological and farming sectors. Subsequently, the government should focus its investment in the provision of extension services, digital tools, and the implementation of climate-adaptive practices in areas that are most vulnerable.

The framework is not to be seen as an additional palette of instruments but rather as an existing one whose allocation criteria are to be adjusted. By limiting the size of local production collapses, it paves the way for a less intensive use of emergency trade restrictions and a higher degree of policy predictability.

Recommendation 6:
BioE3 Framework

Enhancing climate resilience in agricultural policy calls for biological and ecosystem-based solutions that significantly lessen the vulnerability of the production level. The BioE3 framework is a tool that can facilitate that change by encouraging the use of bio-based inputs and climate-resilient crop practices that enhance soil health and lower dependence on chemical inputs. When such measures stabilise yields under climate stress, they reduce the necessity of reactive trade policies such as export bans or sudden tariff changes.

Biofertilisers and biopesticides help to increase soil moisture retention and make crops more tolerant to temperature and rainfall variability. These benefits become very crucial in non-irrigated areas where climate shocks almost immediately impact production and farm incomes. Research reveals that farms using bio-based inputs are less affected by yield fluctuations in drought years; thus, smallholders enjoy more stable incomes.

The BioE3 strategy also improves the competitiveness of exports as the sustainability standards are gaining importance in global agricultural trade.

Bio-based production is less likely to contain chemical residues and has a lower emissions intensity; thus, it helps exporters to meet the recurrent environmental requirements. This congruence lessens the possibility of trade disruptions due to sustainability issues and provides better market access predictability (OECD, 2021).

Recommendation 7:
Agroforestry systems

Agroforestry systems provide a complementary climate-resilient pathway by integrating trees into farming landscapes to enhance ecosystem stability. Trees improve microclimates, reduce soil erosion, and enhance long-term soil fertility, contributing to more stable crop yields. These benefits are especially valuable under increasing heat stress and irregular rainfall patterns.

Evidence from India shows that agroforestry increases soil carbon levels and provides additional income sources through timber, fruits, and fodder. This diversification reduces farmer exposure to climate-induced crop losses and supports livelihood resilience without compromising food production.

Recommendation 8:
Drones for farm management

Digital advisories in themselves can assist in decision-making; however, how effective these are during climate shocks is fundamentally dependent on timely and accurate information from the field. Normally, during extreme weather events like floods, pest outbreaks, or heat stress, ground-based inspections are drastically reduced and slower in real time. Besides that, drones could be used to get fast, high-resolution aerial images of the state of agriculture. Therefore, we can take the following steps:

- Promote the use of drones for precision farm management activities like monitoring crop health, detecting pests and assessing damage caused by climate change.
- Combine drone, collected data with AI, powered advisory systems and extension services to facilitate instant reactions during climate stress situations.
- Set up a drone, sharing facilities through Farmer-Producer Organisations (FPOs), cooperatives or local service providers that operate the drones in order to lower costs

and increase access for small and marginal farmers.

- Implement drone-based crop monitoring to facilitate quick and fair crop insurance claims, thus reducing delays in compensation after disasters.

Such interventions could drastically shorten response time in the event of climate shocks, lower the risk of crop failure, and improve the dependability of the food supply chain.

Recommendation 9:
Technology & Logistics

Climate shocks not only cause agricultural disruption but also influence storage, transportation, and market access, thereby increasing losses and price volatility. Poor logistics infrastructure results in higher post-harvest losses and greater chances of sudden trade intervention to meet domestic shortages.

- Technology-enabled logistics systems should be prioritised investments. For example, digitally tracking warehouses and transport networks will help facilitate coordination in times of climate-induced disruptions.
- Make technology-enabled logistics systems a priority investment, such as digitally tracking warehouses and transport networks, to facilitate coordination during climate-induced disruptions.
- Enhance decentralised storage facilities coupled with digital inventory management systems to lessen post-harvest losses in climates that are vulnerable.
- Advocate for the usage of climate-resilient cold chain infrastructure, especially for perishable products where applicable.
- Leverage real-time logistics data for better supply forecasting and decision-making on appropriate and timely policy interventions, which in turn helps to avoid the excessive use of emergency trade restrictions.
- Improved logistics resilience ensures that production gains from technological and climate-adaptive measures are not undermined by supply chain failures.

Political & Institutional Recommendations

India's agriculture sector employs the majority of the population and has a huge proportion of the total economy; however, its productivity is on the decline, mainly due to low realisations per hectare and per agri-employed person. At the macro level, the agricultural productivity may appear to be huge; however, when analysed at the micro level, it has been realised that several crucial factors are actually neglected at the macro level, despite directly affecting the agricultural economy at the root level. As discussed earlier, research and development in agriculture are far from satisfactory, which further leads to several problems among farmers. This situation is further worsened by limited accessibility to high-quality seeds, leakage and wastage due to inefficient processes and a lack of awareness regarding soil testing and advisory tools. Private investments in this sector are crucial to boost development and accelerate growth, as they offer flexibility, greater efficiency and long-term strategic support as compared to public market investments. These factors help to navigate through structural challenges and operate efficiently. However, recent decades have experienced a decline in private investment, due to greater government interventions and several other obstructions that directly impact the return on investment, which is the most crucial factor that induces private players to invest. Considering the need for private sector investment, it is pivotal to undertake certain reforms and reframe India's policies.

Targeted investments in the right resources: There is a positive relationship between capital intensity and the productivity of both land and labour. It is also important that investment is planned to boost overall growth and should not be targeted only towards specific activities in the sector. In the status quo, most investors prefer to invest in the technology part and infuse money into the supply chain and downstream activities. Almost 67% of agri investments currently take place in this sub-sector (Tilling the Soil: How Private Market Investments Can Bolster Indian Agriculture Sector's Growth, 2024b), followed by agri marketplace and financial technology, with around 17%. Though investment in downstreaming activities has a significant role, it leads to a fall in investment in the upstreaming activities that directly affect the productivity of the sector. Hence, the state must come up with favourable policies that induce the private sector to invest in the upstreaming activities, as the availability of the right inputs is a major problem faced by the majority of small and marginal farmers.

Crafting a stable and trustworthy policy environment: The government

of protectionist measures such as export bans, imposition of MEP, stock limits, etc. This helps create a predictable and stable environment, boosting the inflow of investment into the Agricultural Sector. Additionally, the state should emphasise designing trade policies and schemes that have a long-term, sustainable impact, instead of being driven by short-term political incentives, as sustainable policies allow investors to understand the market conditions and get clear insights, drawing them towards the agricultural sector. Shift from sudden, ad-hoc market interventions to a pre-planned, transparent rule-based policy system results in lucidity to the investor about the risk involved and the expected cash flows.

Strengthening India's credit mechanism: Availability of a formal credit system is still a long-distance dream for the majority of rural farmers. As illustrated in the previous sections, this directly impacts the yield of crops as it prevents them from buying quality inputs and deprives them of sufficient working capital to grow crops. At a micro level, it may appear to be concerning certain individuals, but this problem is commonly shared by millions of farmers, and as result, the cumulative impact results in huge losses for both the farmers and the agricultural export sector, thus imposing a huge burden on the country's economic growth. To ensure sustainable growth and continued investment, the farmers also need to be provided with the means to earn, which is only possible through sustained finance. The solution is not merely dependent on creating a widespread formal financial system, but is also based on the demand side, that is, ensuring a fall in default payments on the part of farmers and building a consolidated system.

Access to institutional credit is a major positive determinant of capital formation. Hence, a 'supervised credit system' needs to be implemented that not only fulfils the credit requirements but also provides technical guidance to farmers on investment choices, along with repayment of interest and principal amount.

Rationalising subsidies: The Indian government provides several subsidies to promote agricultural growth; however, lately, these actions are often driven by political incentives with a short-term goal but often end up having a long-term impact on the economic growth of the country. A significant proportion of the budget is allocated towards various subsidies, but it is essential to analyse the impact of these subsidies, as several economists have argued that the opportunity cost of these actions is huge. Hence, it is important to channelise these funds towards the research and development of the sector, as it will not

only accelerate productivity but will also allow India to consolidate its stance on the international forum, which is crucial for the stability of the export sector.

Implications- Current policies related to subsidies and trade barriers.

Subsidy and trade policies at present have a major influence on India's ability to tackle climate and market volatility. However, they also create structural and institutional constraints.

On the one hand, input subsidies for fertilisers, power, and irrigation have helped keep production costs stable. On the other hand, they still encourage resource-intensive cropping patterns, which increase farmers' exposure to climate stress. Gradually, this results in a loss of adaptive capacity and an increased dependence on the intervention of the state.

Trade barriers like export bans and the imposition of tariffs from time to time are mainly aimed at controlling prices in the domestic market when there is a supply shortage. Although these measures are politically attractive, they make the policies less predictable and thus weaken the credibility of the institutions. The interventions, which occur over and over again, result in the disruption of export relationships, discourage private investment, and the uncertainty is passed on to the farmers, particularly during the years when the climate is harsh.

From the institutional point of view, distortionary subsidies combined with trade tools that are restrictive are a reflection of a governance style that is primarily concerned with short-term political stability rather than long-term resilience.

Moreover, the fragmented decision-making process between agriculture, food, and trade authorities is limiting the extent to which a coordinated response can be made to climate risk. A gradual transition from these distortive measures to targeted, climate-responsive support, along with more transparent, rule-based trade interventions, would not only alleviate these constraints but also keep food security objectives intact.

CONCLUSION

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Conclusion

India's agricultural trade policy stands at a defining moment in its economic trajectory, where it is not merely driven by one objective but faces unparalleled pressure from several ends, from ensuring domestic food security and mitigating climate uncertainties to matching global market expectations. Agriculture is the backbone of the Indian economy and is pivotal to the stability of the employment sector, as it employs the majority of the population. Small fluctuations in the agricultural economy directly impact the livelihood of millions of farmers, which is further worsened by the economic and social diversity deeply rooted within this sector. As detailed in this report, agricultural trade outcomes are not solely driven by India's agricultural productivity or export potential but are also largely affected by the policy environment within which the market operates. The trade policy lies at a crucial intersection of food security, social welfare of the farmers, and ensuring a stable and credible position in a globally competitive market.

The report reveals that the challenges faced by the agricultural sector are multifaceted and interconnected in nature. These are structural issues which can only be resolved by laying emphasis on long-term institutional clarity rather than executing policies that later result in short-term executive measures.

These are structural issues which can only be resolved by laying emphasis on long-term institutional clarity rather than executing policies that later result in short-term executive measures. shapes agricultural outcomes, affecting agricultural productivity, the supply chain stability and price volatility. These conditions compel the government to take immediate actions by imposing export controls, subsidies, and initiating several actions to protect the local farmers while ensuring price stability in the domestic markets. Though they may help in ensuring stability, they are merely short-term reactive measures, driven by political ambitions and not by the willingness to structurally consolidate the system, thus disrupting long-term trade relationships and indicating policy unpredictability. Additionally, this discourages private investment due to high uncertainties and a lack of adequate infrastructure, such as cold storage, logistics and weak market integration, amplifying the impact of these crises. This prevents farmers from enjoying the benefits of the global price signals and then leaves them as victims in the cycle of vulnerability, further constraining India's competitiveness in the global markets

Agricultural policymaking determines the stability of the agricultural economy, and it is also one of the major reasons behind instability in this sector due to

fragmented decision-making resulting in overlapping responsibilities and a lack of coordination among different spheres within the ecosystem, thus undermining the effectiveness of the policies. The protectionist measures, including minimum support prices, subsidies, etc., have played a vital role in ensuring stability and providing a livelihood for local and marginal farmers; however, this comes along with a huge trade-off. It has undermined India's position in the global markets while several trading partners have also accused it of price distortion at various international forums, including the WTO. Policymaking is highly influenced by political economy, which becomes the cause for various distortions to satisfy short-term incentives, while neglecting the rising fiscal burden, income gaps within the farmer community and deteriorating long-term structural stability.

This report details how domestic capacity directly affects trade outcomes. Strengthening procurement systems, storage facilities, credit accessibility and ensuring transparent market information are crucial for the sustainable growth of the sector. The policy recommendations within this report emphasise building a forward-looking policy framework, thus ensuring stability in the long run and are not characterised by impulsive measures which have a negative impact in the future. India's agricultural trade policy must evolve from a reactive system driven by crisis management to a system built on the basis of strategic insight, with policies planning to induce private investment in the sector. The success of the agricultural economy is determined by an effective system wherein agricultural productivity is deeply integrated with evidence-based policymaking and efficient institutional frameworks.

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