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Phygital Tech-based & Policy-driven Strategy for AGRI SUPPLY CHAIN

Agricultural supply chains and global trade flows have grown substantially, driven by technological progress, trade liberalisation, and rising global demand. Major producing and importing countries dominate these flows, with commodity crops and high-value products such as fruits and nuts leading this growth. However, geopolitical tensions, protectionist policies, and supply chain disruptions pose significant challenges to stability and market access, particularly for developing countries. Innovations in digital trade facilitation and proactive policies for smallholders offer pathways to enhance sustainability and resilience in global agricultural trade. This dynamic landscape requires ongoing policy attention to balance trade liberalisation, sustainability goals, and social inclusion to ensure global food security and economic development. Let's dig deeper.

The EU is India's largest trading partner, accounting for €124 billion in goods trade and nearly €60 billion in services trade in 2023. Trade has grown by about 90 per cent in the last decade. Despite growth, EU-India Free Trade Agreement (FTA) negotiations have stalled mainly due to disagreement on agriculture and regulatory issues, despite strong trade volumes and growth. Higher import duties mean increased import costs for Indian businesses, resulting in higher freight, customs, and warehousing expenses. This leads to reduced import volumes and potentially decreased demand for logistics services. Investing in and upgrading infrastructure, including cold storage, warehousing, and transportation networks, is crucial to reduce post-harvest losses, enhance efficiency, and meet international quality standards, improving overall logistics performance. Adopting technological solutions like IoT, AI, and digital platforms could enhance supply chain transparency, improve tracking, optimise routes, and reduce wastage, ultimately boosting efficiency and competitiveness.

India is balancing trade liberalisation pressures with the protection of domestic agriculture, aiming to enhance productivity and market access while managing import surges and negotiating tariffs.

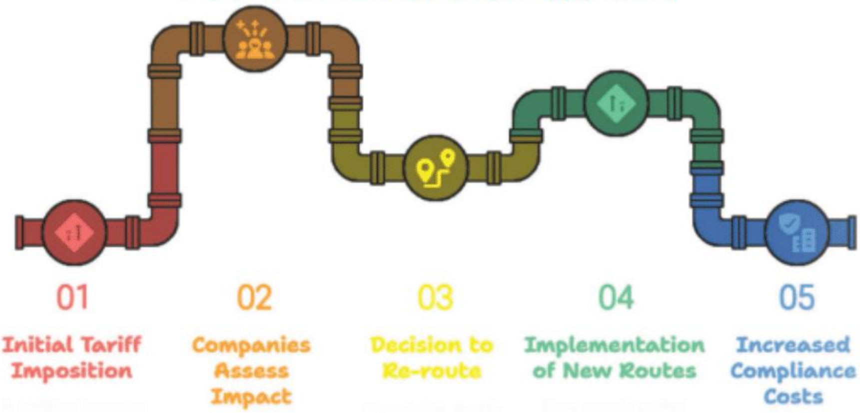
As international partners amend tariffs or introduce non-tariff barriers, India must proactively engage in bilateral and multilateral platforms to ensure the interests of its agricultural exporters are safeguarded. Ongoing negotiations, such as the EU-India Free Trade Agreement, should aim to harmonise standards rather than dilute domestic priorities. A cooperative approach, focusing on aligning quality expectations and easing documentation protocols, can unlock significant market access without compromising local livelihoods.

The government must, at the same time, invest in strengthening the physical and digital logistics backbone of the agricultural export ecosystem. Incentivising the development of scientific warehousing facilities, cold storage units near farm clusters, and multimodal connectivity infrastructure, which can reduce post-harvest losses and cut lead times. Public-private partnerships (PPPs) can also help accelerate this development, particularly in underserved regions with high agricultural potential.

Recent policy measures, including digital trade facilitation platforms and customs duty exemptions on select goods, are streamlining international trade processes and reducing clearance times for agri products. This leads to improved efficiency in logistics operations and lowers overhead costs, making Indian agriculture more competitive globally.

Introduction of new tariffs or non-tariff barriers can complicate supply chains, resulting in increased compliance costs, shipping delays, and reduced operational predictability. Conversely, liberalization—such as simplifying export procedures or reducing duties—can boost

Impact of tariff change on agri supply chains



volumes and attract logistical investments.

Policy reversals (such as sudden bans or tariff hikes) impact export volumes and reliability. The unpredictability of such changes discourages long-term investment in infrastructure, warehousing, and technology for agri logistics.

High import tariffs on Indian agricultural goods (e.g., shrimp, rice) by countries like the US threaten the viability of established supply chains, potentially forcing Indian logistic operators to seek new export destinations and routes. Reciprocal tariffs (US-India) could hinder the movement of select products, raising logistical costs and compliance workloads for agri exporters. Non-tariff barriers, such as new sanitary or licensing standards, often have an equal or greater disruptive impact, especially for perishable agricultural goods which require quick, efficient logistics.

Persistent high tariffs—both inbound and outbound—breed inefficiency, raise operating costs, and expose Indian products to retaliatory measures, risking market access and operational scale. Changing trade regulations and tariffs significantly impact India's agricultural logistics industry, leading to both challenges and potential opportunities.

Higher import tariffs lead to increased costs for freight, customs, and warehousing, impacting businesses that rely on imported agricultural components and potentially causing lower import volumes. Tariff changes create potential delays at customs due to increased paperwork and processing time, prolonging clearance and disrupting shipment schedules. This can also increase demurrage charges for containers and require more warehouse space.

Frequent tariff modifications necessitate continuous monitoring and adaptation to regulatory changes, intensifying bureaucratic pressures on logistics service providers (LSPs).

Volatile international trade environments compel India's agri-logistics sector to diversify export markets and adopt more flexible, resilient supply chains.

Sudden regulatory changes erode confidence, undermining investment in logistics technology, storage, and digital infrastructure critical for modern agri supply chains. To remain competitive amidst regulatory shifts, logistics firms increasingly deploy digital tracking, predictive analytics, and automation, supporting faster customs processing and optimised routes.

"At the industry level, exporters, logistics providers, and financiers need to collaborate more closely to manage risk and build resilience. For example, designing more flexible warehousing contracts, adopting just-in-time inventory models, and expanding collateral-free credit for export-linked procurement can smooth disruptions during policy shifts."

Sandip Sabharwal, Group CEO, Sohan Lal Commodity Management Limited

Tariff changes alter competitiveness by affecting product pricing. High tariffs in importing countries restrict market access and reduce price attractiveness, while reductions enhance competitiveness. However, some foreign tariff cuts, such as in the proposed India-US trade agreements, raise concerns over cheap subsidised imports threatening Indian farmers, especially in sensitive food security sectors (e.g., grains, dairy).

Non-Tariff Barriers (NTBs) and Regulatory Compliance:

Beyond tariffs, stringent sanitary and phytosanitary (SPS) standards and other regulatory requirements pose critical challenges, especially for perishable agri-products needing rapid logistics and cold chain support. Such NTBs often have an equal or greater impact than tariffs on Indian agri exports, requiring logistics systems to ensure compliance, thereby adding complexity and cost.

Regulatory delays at customs, inconsistent tariff application, and complex documentation slow supply chains, increase spoilage risks for perishables, and raise costs. SMEs are especially affected due to lack of infrastructure like cold storage or reliable transport, directly impacting profitability and sustainability of agri exports.

Policy Uncertainty and Investment Impact:

Frequent or unpredictable changes—such as export bans, sudden tariff hikes or reversals—create uncertainty, discouraging investment in agri logistics infrastructure and technology needed for efficient trade facilitation.

Influence of changing tariff and trade regulations on Agri export supply chain

BY ABHAY DANDWATE,
Chief Risk Officer & Head Strategy with National Bulk Handling Corporation (NBHC)

In April 2024, the US introduced a dual-tier tariff structure targeting imports from countries such as India, imposing a baseline tariff of 10 per cent, and 26 per cent reciprocal tariff on Indian agricultural exports. Although, later the implementation on reciprocal tariff was deferred to August 2025, allowing time for bilateral negotiations as India seeks to reduce these tariffs to a comfortable level. As of yet, no final agreement has been reached.

If negotiations are successful, India will benefit from US agricultural market access, while safeguarding its domestic producers. Otherwise, Indian agricultural exports will likely face higher tariffs in the US, diminishing their competitiveness and significantly reducing US-India agricultural trade volumes. In response, exporters may look toward the EU or the UAE as alternative markets.

The US, influenced by American corn and soybean industries, has been pressing India to allow imports of GM crops. India, however, remains reluctant. The main concern is of the possible negative effects on domestic farmers' livelihoods, the disruptive potential of subsidized imports, and lingering uncertainties regarding the environmental and public health implications of GM products.

For once, Indian authorities considered permitting GM soybean seed imports, with processing restricted to coastal facilities, domestic sale of oil, and export of GM soymeal. However, experts highlighted the difficulty of enforcing such controls due to India's limited regulatory capacity and fragmented supply chains, resulting in the proposal's abandonment.

Agriculture supports over 700 million individuals in India. The legacy of the 2020–21 farmer protests continue to influence policy decisions, as do anxieties regarding cross-pollination, preservation of native crops, and public resistance to GM foods.

Heavy reliance on a few trade partners exposes Indian agriculture to geopolitical risks and tariff shocks. Enhancing participation in regional trade agreements and bilateral negotiations focused on agricultural concessions is crucial to mitigate risks and support logistics sector resilience.

The latest State Bank of India (SBI) research report (Published July 14, 2025) focused on India's export outlook. India and the US are on the brink of finalising an important mini-trade deal, expected to be announced by mid-July. India has already presented a solid proposal, covering \$150-\$200 billion in goods trade, now awaiting approval from the U.S. decision makers.

The SBI analysis has estimated that opening India's dairy sector to U.S. imports could lead to an annual loss of approximately \$12.3 billion (Rs 1.03 lakh crore) for Indian dairy farmers. This potential fallout highlights the immense vulnerability of a sector that directly employs an estimated 80 million people, largely small and marginal farmers, and significantly contributes to India's rural economy.

The evolving landscape of global trade policies, particularly tariff shifts and non-tariff regulatory barriers, is having a layered impact on India's agri logistics sector. For an industry deeply intertwined with the flow, quality, and timing of agri commodity movement, these changes are not just macroeconomic developments; they affect the operational rhythms of warehousing, transportation, and inventory management.

India's growing agri export portfolio spanning staples like basmati rice to high-value fruits, pulses, and spices has traditionally thrived on the back of liberalized trade access, cost

While agricultural products constitute less than 5 per cent of US exports to India, the US continues to press for market access. Indian policymakers are concerned that any concessions may set precedents for future US demands, potentially threatening core support mechanisms like the Minimum Support Price (MSP) and public procurement systems, both integral to India's food security. The US has already criticized India's MSP for rice and wheat as distorting global markets.

In the dairy sector, the US has objected to India's stringent requirements for GM-free feed and facility registration, arguing that these effectively exclude American dairy products. India, however, maintains these standards, citing religious sensitivities, particularly regarding products from animals fed with meat-based inputs.

If the United States and India fail to secure a trade agreement, India could lose its preferential status under the Generalized System of Preferences (GSP), resulting in higher tariffs on significant exports such as spices and processed foods.

Furthermore, the imposition of non-tariff barriers—such as stricter labelling requirements, more demanding pesticide residue regulations, and enhanced traceability standards—would increase compliance costs and have a disproportionate impact on smaller exporters, potentially limiting their participation in international trade. Necessary infrastructure upgrades, including cold chain development and modernized packaging, would further increase financial burdens.

Of particular concern is the 26 per cent tariff on Indian shrimp exports which places Indian shrimp at a disadvantage relative to Ecuador (10 per cent tariff) and Indonesia (32 per cent), with projections of a 20–30 per cent decline in export volumes. Such changes would directly affect farm-gate prices in key producing states like Andhra Pradesh and Tamil Nadu. Nevertheless, India's established strengths in bulk handling and packaging may help sustain long-term demand. To address losses, government interventions such as export subsidies, concessional credit, and branding strategies emphasizing antibiotic-free and sustainable production could be prioritised, especially for markets in China, Japan, South Korea, and the EU.

Similarly, India's rice export would face the risk of temporary disruption if tariffs increase from 9 per cent to 26 per cent. Despite this, India's strong market reputation and the tariff environment among competitors suggest continued long-term demand for Indian rice. However, India's rice export to the USA is not very significant as compared to countries like Saudi Arabia, Iran & other Gulf countries. AS

competitiveness, and reliable crop cycles. However, new trade dynamics, especially the resurgence of protectionism, sanitary and phytosanitary restrictions, and tariff recalibrations in key markets such as the EU, the U.S., and Southeast Asia, are creating bottlenecks across the logistics value chain.

Warehousing, being at the fulcrum of agri logistics, is particularly exposed. Delays in exports due to regulatory reviews or tariff hikes often lead to longer dwell times in warehouses, putting pressure on storage capacity and increasing holding costs for exporters and intermediaries. This unpredictability also affects inventory planning and crop procurement strategies. For instance, if a key export destination imposes new duties or regulatory requirements mid-season, the resultant pile up of produce disrupts everything from storage turnover to farmer payments.

Moreover, the uncertainty discourages long-term investments in export-oriented infrastructure, especially in rural and semi-urban areas. Private sector players are cautious about committing to additional storage capacity, cold chain facilities, or specialised logistics solutions without predictable demand cycles or policy clarity.

Digitalisation, which has shown promise in improving efficiency and transparency in Agri supply chains, also faces challenges under shifting trade norms. If international buyers or regulators introduce new compliance expectations around traceability or documentation, Indian logistics providers must adapt quickly, often at significant cost and without transition support.

The broader impact is also visible in the credit

Ramifications of retaliatory tariff change on Indian agri exports

and collateral ecosystem. When commodities are held longer than expected or become non-exportable due to policy shifts, the asset quality of warehouse receipt-backed loans can suffer. This impacts both NBFCs and banks engaged in Agri financing, tightening liquidity for the next season.

In sum, the impact of changing tariffs and trade regulations on India's agri logistics industry is both immediate and systemic. The sector is required to be far more agile and resilient, even as it navigates a lack of real-time visibility into policy changes abroad. This underscores the need for stronger alignment between trade negotiators, regulators, and logistics providers so that supply chains are buffered against sudden shocks. For India to sustain its momentum in global agri trade, it is imperative that logistics becomes a strategic lever, not just a support function, in the country's export planning.

While commenting on measures to be taken at both policy and industry levels to mitigate challenges in Agri export supply chains, Sandip Sabharwal, Group CEO, Sohan Lal Commodity Management Limited said, "At the industry level, exporters, logistics providers, and financiers need to collaborate more closely to manage risk and build resilience. For example, designing more flexible warehousing contracts, adopting just-in-time inventory models, and expanding collateral-free credit for export-linked procurement can smooth disruptions during policy shifts. Warehousing firms can also work with farmer producer organizations (FPOs) and aggregators to improve aggregation at the farm gate level, making smallholder produce more export-ready."

Sabharwal also emphasised the urgent need of trade policy predictability and faster response mechanisms. India's aspiration to emerge as a global leader in agricultural exports must be underpinned by resilient, agile, and scalable supply chains. As the international trade environment becomes increasingly volatile due to tariff renegotiations, geopolitical tensions, and evolving sustainability standards, both policymakers and industry stakeholders need to recalibrate their strategies. The goal should not only be to protect current trade volumes but to strengthen India's position as a preferred supplier in global food systems.

At the policy level, the first and most urgent requirement is trade policy predictability and

faster response mechanisms. As international partners amend tariffs or introduce non-tariff barriers, India must proactively engage in bilateral and multilateral platforms to ensure the interests of its agri exporters are safeguarded. Ongoing negotiations such as the EU-India Free Trade Agreement should aim to harmonise standards rather than dilute domestic priorities. A cooperative approach, focusing on aligning quality expectations and easing documentation protocols, can unlock significant market access without compromising local livelihoods, he mentioned.

"India is facing major challenges in agri supply chains like infrastructure gaps which include inadequate cold chain network and insufficient on-farm processing capabilities, that lead to wastage and reduced export quality. Additionally, the ongoing Red Sea crisis and geopolitical conflicts in the Middle East have escalated logistics costs, especially for air and ocean freight."

- **Abhishek Dev,** Chairman APEDA

Need for PPP model

In parallel, the government must invest in strengthening the physical and digital logistics backbone of the Agri export ecosystem. Incentivising the development of scientific warehousing facilities, cold storage units near farm clusters, and multimodal connectivity infrastructure can reduce post-harvest losses and cut lead times. Public-private partnerships (PPPs) can accelerate this development, particularly in underserved regions with high agricultural potential.

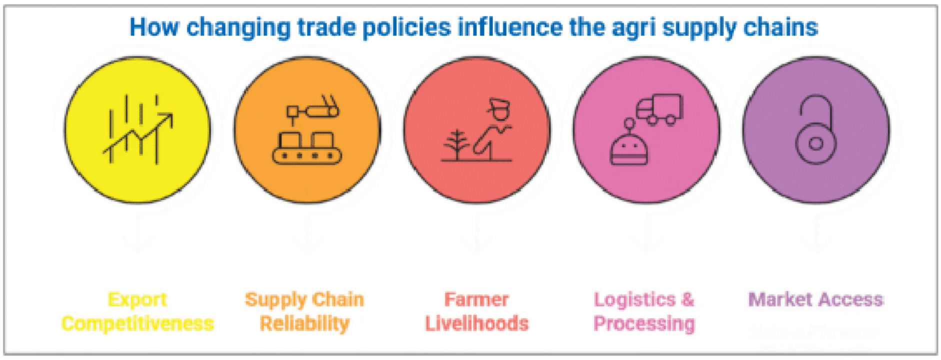
Digital integration is another vital enabler. Export-facing supply chains must be equipped with real-time traceability, electronic warehouse receipts, and integrated customs clearance systems. This not only ensures compliance with evolving global standards but also builds buyer confidence in the reliability and transparency of Indian agri shipments.

Capacity building is another overlooked but necessary element. Training programs focused on post-harvest quality management, export documentation, and market intelligence can help agri-entrepreneurs navigate complex regulatory environments and reduce compliance failures.

Finally, a coordinated national agri export strategy that brings together the ministries of agriculture, commerce, food processing, and transport is essential. Fragmented policymaking often results in delayed implementation or conflicting objectives. A unified framework can align incentives, streamline approvals, and reduce friction in the movement of Agri goods across borders.

In conclusion, addressing challenges in agri export supply chains requires a shared commitment to modernising infrastructure, simplifying policy, and embracing digital transformation. A proactive, collaborative approach will enable India not only to weather short-term disruptions but to lead the next wave of growth in global agricultural trade.

While commenting on challenges in agri export supply chains Abhishek Dev, Chairman



"For decades, global trade benefited from declining tariffs and fewer barriers. But for now, that has been put on hold. Today's environment is defined by unpredictability, with newly imposed and suddenly postponed tariffs creating what many of our customers describe as 'tariff chaos'. Maersk Trade & Tariff Studio is our answer to bringing clarity, compliance, agility and cost optimisation to global supply chains when goods are crossing borders"

Lars Karlsson, Global Head of Trade & Customs Consulting at Maersk

APEDA said, "India is facing major challenges in agri supply chains like infrastructure gaps which include inadequate cold chain network and insufficient on-farm processing capabilities, that lead to wastage and reduced export quality. Additionally, the ongoing Red Sea crisis and geopolitical conflicts in the Middle East have escalated logistics costs, especially for air and ocean freight."

Internal transport costs are also disproportionately high in regions like the North Eastern Region and landlocked states. The knowledge gap among farmers regarding Good Agricultural Practices (GAP) is another hurdle which results in the presence of pesticide residues and affects produce quality, he added.

The role of digital technology in the agri-logistics sector is transformative and multifaceted, significantly enhancing the efficiency, transparency, traceability, and sustainability of agricultural supply chains. Changing tariffs introduce volatility in costs, supply routes, and documentation requirements, making logistics in the agricultural sector increasingly complex. Technology provides crucial solutions to adapt, mitigate risk, and maintain efficiency in this evolving landscape.

Digital tools such as fleet management systems, route optimization software, and real-time tracking streamline transportation, reduce post-harvest losses, cut costs, and minimise environmental impact. Better scheduling and coordination between production and shipping reduce delays and improve delivery accuracy.

Real-Time Data and Visibility

GPS Tracking & Telematics monitors vehicle locations, cargo status, and route progress in real time, allowing quick adaptation to tariff-driven route or border changes.

IoT Sensors offer insights into shipment conditions and automate compliance checks, reducing regulatory risks and customs delays.AI & Advanced Analytics analyse historical and live data to forecast the financial impact of changing tariffs, predict disruptions, and simulate various logistics scenarios. This enables agricultural businesses to shift strategies quickly and optimize total landed cost.

Predictive Analytics helps optimise delivery routes, anticipate demand and cost shifts, and adjust inventory or sourcing accordingly. Digital freight and supply chain platforms connect shippers to multiple carriers, allowing dynamic rerouting and supplier diversification to avoid highly tariffed trade lanes and to secure the best rates in real time. Automation & Blockchain automate customs declarations, documentation, and payments, speeding up clearance and improving transparency across borders.

Recently A.P. Moller Maersk launched 'Maersk Trade & Tariff Studio', a new digital solution designed to help global cargo owners regain control in an increasingly volatile trade environment. As global trade faces a paradigm shift marked by rising tariffs, regulatory scrutiny, and disrupted customs processes, this new platform offers a centralised, AI-powered approach to customs and tariff management.

While emphasising the importance of digital technology in supply chains Lars Karlsson, Global Head of Trade & Customs Consulting at Maersk said, "For decades, global trade benefited from declining tariffs and fewer barriers. But for now, that has been put on hold. Today's environment is defined by unpredictability, with newly imposed and suddenly postponed tariffs creating what many of our customers describe as 'tariff chaos'. Maersk Trade & Tariff Studio is our answer to bringing clarity, compliance, agility and cost optimisation to global supply chains when goods are crossing borders."

With the help of favourable policies for balancing trade liberalisation,better post-harvest infrastructure and digital technologies India can become a leader in agri supply chains. AS

Dipti Barve
dipti.barve@mmactiv.com