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# India's Century: Sustainable and inclusive growth

A FICCI-McKinsey multi-year forum

Agriculture Committee Report

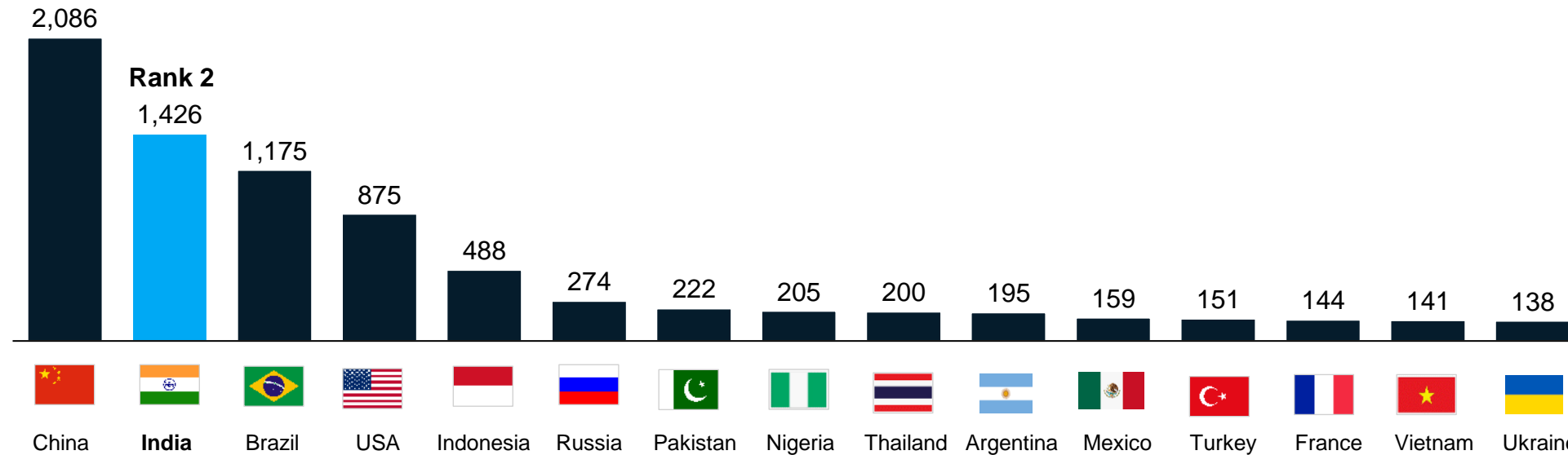
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# India is the 2<sup>nd</sup> largest agriculture producer in the world and leader across multiple categories

Gross agriculture production by country, Million Tonnes, 2020



**Key competitive advantages in agriculture**

**2<sup>nd</sup> largest arable land** at ~156Mn hectares

**Primary source of livelihood** for ~54.6% of the population

**All 15 possible agro climatic conditions** enabling diverse crop portfolio potential; **two cropping seasons**

Relatively **low-cost labor and crop production**

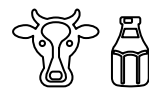
**Rising income** in the large urban and rural population driving demand

Strategic geographic location and **proximity to food importing nations**

Global leader in production of **mangoes** (24 million tons), **papayas** (6 million tons), and **bananas** (31 million tons)



Largest population of **buffalos** (108 million)  
Largest **milk producer** in the world (177 million tons)



Largest **pulses** producer in the world (23 million tons)  
Second in the world in terms of **vegetable** production (186 million tons)

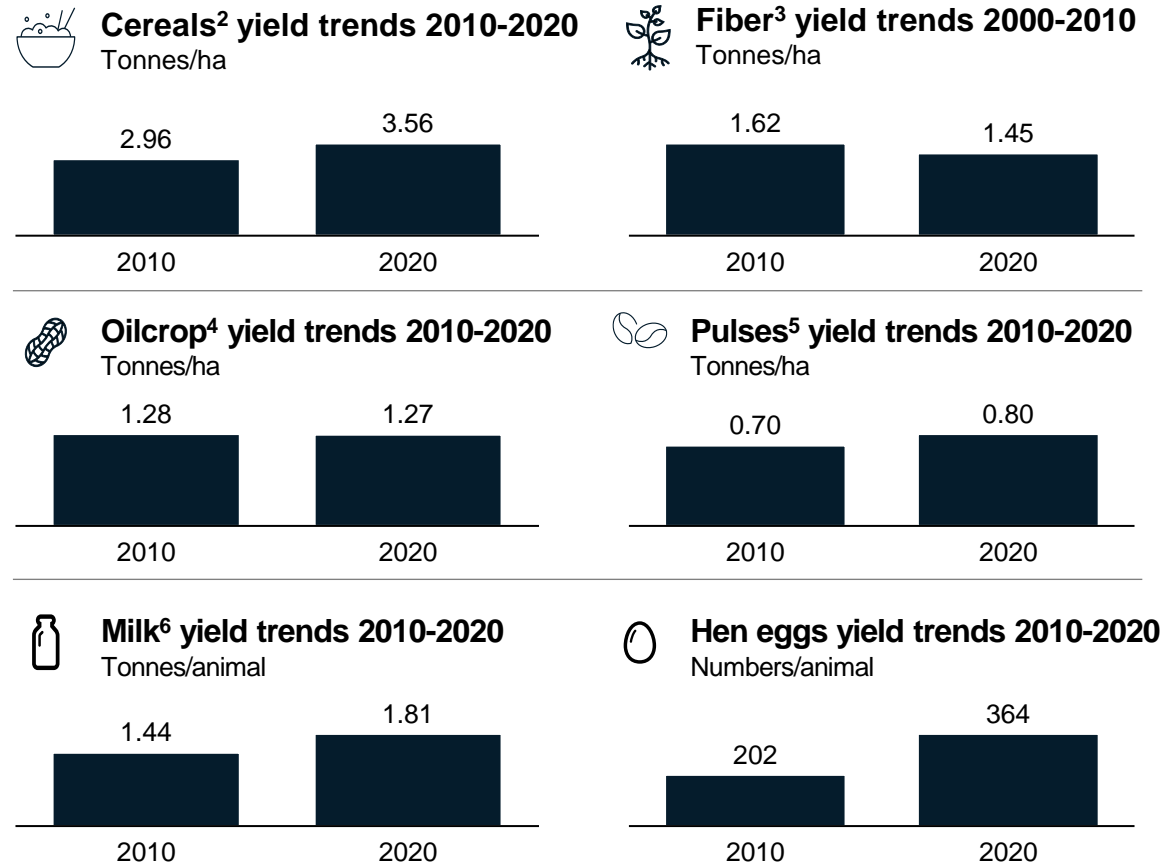


Largest producer of **sugar and cotton**  
Second largest producer of **rice and wheat**



# Within the last decade, India has witnessed improvement in crop yields and agriculture productivity

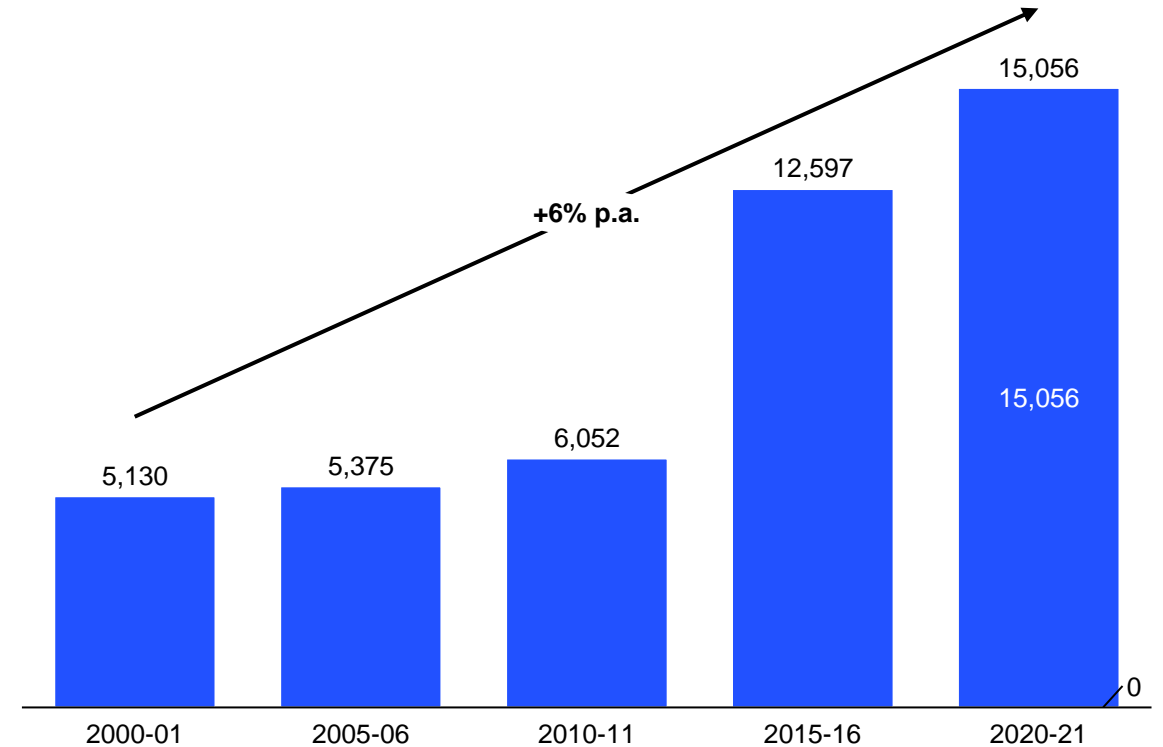
## The last decade witnessed yield<sup>1</sup> increase across most crop categories



1. Source FAOSTAT: all figures are weighted average on basis of production
2. Includes Barley, Maize, Millet, Rice, Wheat and Sorghum
3. Includes Bastfibres, Coir, Hemp tow waste, Jute, and Seed cotton
4. Includes castor oil seed, groundnut, linseed, rapeseed, safflower seed, sesame seed, soybeans and sunflower seed
5. Includes Peas dry, Chickpeas, Pigeon Peas, Beans, Lentils and Pulses nes
6. Milk yield for cows, goat, buffaloes, sheep and camels

## Productivity of India's agricultural workers grew 9% over the last two decades

### Per capita GDP<sup>7</sup> from agriculture (constant prices), INR/year

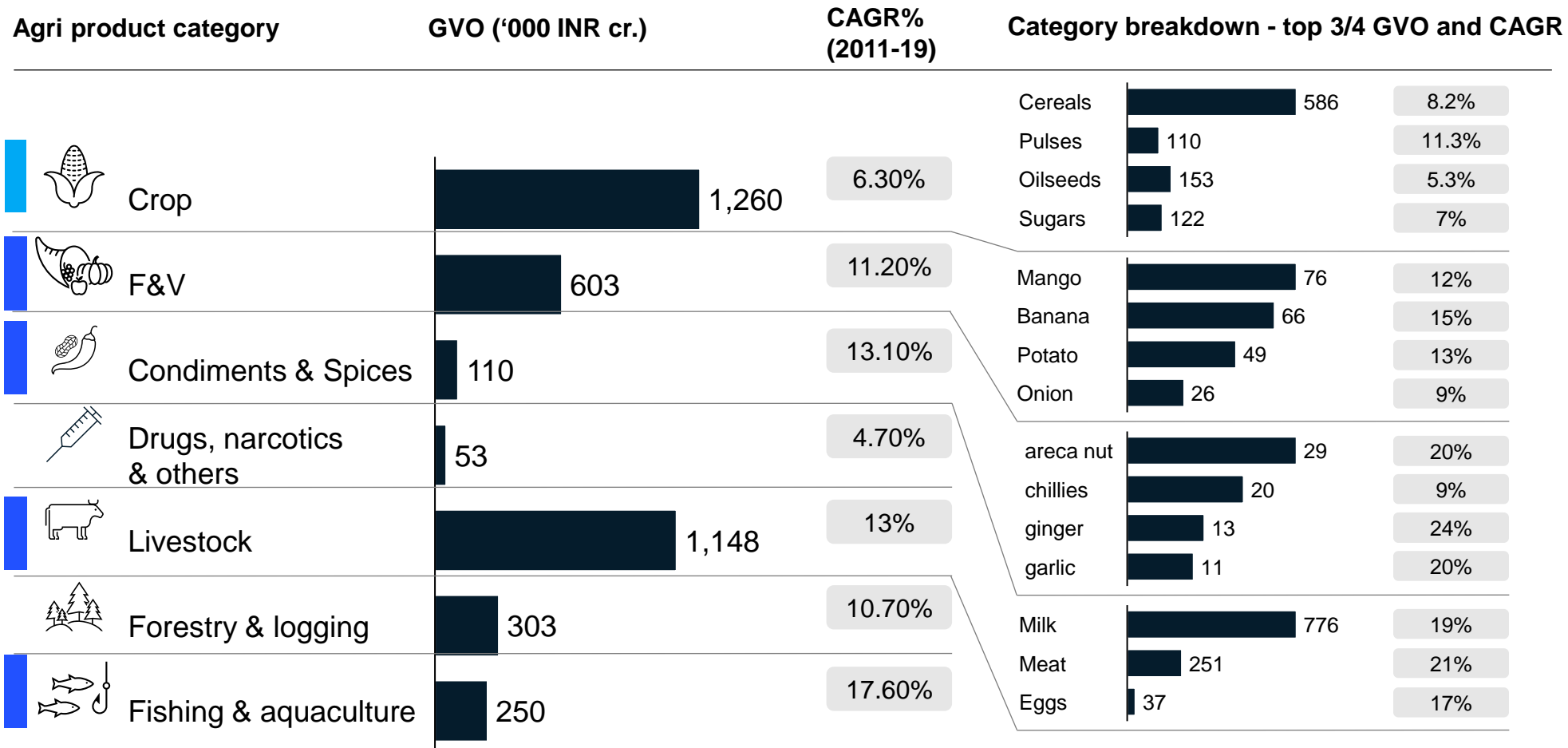


7. Inflation adjusted; Base year is 2004-05 for 2000-01, 2005-06, 2010-11. Base year is 2011-12 for 2015-16, 2020-21

# Farmers' income mix is expected to shift further away from 'Crops' towards high growth sub-sectors such as F&V, Livestock, Spices

■ Largest segment
 ■ Fast growing segment

## GVO<sup>1</sup> of agricultural sub-sectors



- Crops while the biggest are gradually becoming a smaller segment of the agriculture sector
- Non-crop sub-sectors - **Fruits & Vegetables, Condiments & spices, Livestock and Fishing & aquaculture** are growing rapidly

1. Ministry of Statistics and Programme Implementation, GoI; all output numbers are based on current prices (i.e., inflation adjusted)

# Several tailwinds are set to drive Indian agriculture

## Adoption of Digital / new practices in Agriculture

- **Digital tool/platforms across value chain** (input sourcing, farm lending, logistics, online marketplace, insurance)
- **Better Agri Practices** – farm mechanization, IoT remote sensing, precision agriculture
- **AI / ML solutions** leveraging huge data libraries (spanning across soil & water consumption, weather impact, markets demand/supply etc.)

## Changing demand dynamics

- Increased focus on **pulses, F&V, dairy** etc. and **away from cereals**
- **Higher per capita** income driving focus on **healthy eating choices**

## Strengthening of market linkages

- **Impetus to food processing:** various subsidies / incentives provided by the Government<sup>1</sup>, setting up of mega food parks, high export potential, limited market competition etc.; private investments on top could be huge impetus
- **Proxy aggregation to enable scale** by creation of FPOs, CBBOs
- Emergence of **Farm to Fork / D2C start-ups**, Agritech Investors, stronger market-linkage

## Growing awareness on sustainability

- Government Schemes – for subsidizing micro-irrigation (Per Drop More Crop, Micro-Irrigation Fund), preserving soil health (Paramparagat Krishi Vikas Yojana, Soil Health Card) and host of initiatives under **National Mission for Sustainable Agriculture**
- **Crop Residue Management (CRM) Scheme** – for incentivizing CRM machines, rapid bio-decomposers, alternate stubble use in North India
- Focused efforts towards wastage reduction in agriculture and its end-use

1. PMKSY, One District One Product, PM FME, PLI scheme for Food Processing, Special Food Processing Fund for Mega Food Parks, Priority Sector Lending

# Given its endowments, India can aspire to become a leading player in global food supply while ensuring sustainable & inclusive growth



From USD 50 Bn  
in FY22 to

**\$90-100Bn<sup>1</sup>**

Agri products exports  
by 2030



From ~40%<sup>4</sup>  
currently to

**<20%**

Reduction in food waste /  
spoilage by 2047



From 5-10%<sup>2</sup>  
currently to

**40-60%<sup>2</sup>**

Precision farming adoption  
(by 2030)



From ~40%<sup>5</sup>  
currently to

**60%**

Farm Mechanization by  
2030



From \$300<sup>3</sup> Bn  
in 2020 to

**\$600+Bn<sup>3</sup>**

Increase in food  
processing industry (by  
2026-27)



From 38%<sup>6</sup>  
currently to

**~60%<sup>6</sup>**

Water use efficiency by  
2030



**45-50%<sup>3</sup>**

*reduction in GHG  
emissions from agri by  
2047 vs. 2019 emissions*



From 43%  
currently to

**>60%<sup>6</sup>**

Irrigation coverage by  
2050

1. In nominal terms; Current export number as per FAOSTAT; aspiration in line with HLEG report on Agriculture exports

2. MGI – India's Turning Point

3. Report – Unlocking value for Indian Food Processing Sector

4. Food and Agricultural Organization (FAO); food produced in India wasted every year due to fragmented food systems and inefficient supply chains

5. Based on NABARD sectoral report – Farm Mechanization

6. Ministry of Water resources, RD & RR report on 'Water Use Efficiency'

# However, there are several challenges across the agriculture value chain that constrain the sector (1/2)

## 1. Inputs

- **Access to Formal Credit** – 30%+<sup>1</sup> farmers take loan from informal sources, paying 10% percentage points higher interest rate than bank rates
- **Low Farm Mechanization** (40% only<sup>2</sup> - limited largely to tractors only) due to lack of awareness, availability of market finance
- **Low awareness on cropping patterns** – for farming high value product choices, production imbalance with undue focus on cereals etc.

## 2. Ag. Production

- **Fragmented Land Holdings** – 86%<sup>3</sup> of Indian farmers are categorized as Small and Marginal (with land holding < 2 hectare), together capturing 50%<sup>3</sup> of total cultivated area. The average land holding size is ~1.1 hectare<sup>3</sup>
- **Degradation in soil health** – 55%<sup>4</sup> of the country's soil is deficient in nitrogen, 42%<sup>4</sup> in phosphorus and 44%<sup>4</sup> in organic carbon. Soil organic matter content in most cropland soils of north-western India and elsewhere is often less than 0.5%<sup>4</sup>
- **Burgeoning Water Stress** driven by low penetration of modern irrigation techniques (micro-irrigations, precision agriculture) and unsustainable cropping patterns (focus on rice, sugarcane).
- **Low Productivity (yield)** is significantly lower than Asian averages (35-50% lower against global benchmarks); **room for 2x improvement**<sup>5</sup> – impact on land requirement and farmer incomes.
- **GHG emissions:** India is the largest contributor to global agricultural emissions driven by lack of modern agri practices<sup>6</sup>
- **Expected reduction in labor availability** due to opportunities in non-farm jobs combined with reduction in average landholding size. **Re-Skilling of labor moving out of Agriculture** to jobs higher up in the value chain<sup>5</sup>

1. NAFIS Report 2016-17

2. Against ~95 % in US, ~75% in Brazil and ~60% in China; NABARD – Farm Mechanization report

3. Agricultural Census (2015-16)

4. 2019-20 Soil Health Survey by GoI, Healthy soil has about 2.5% to 3.0 % by weight in the root zone

5. Average rice yield is 3.6 t/Ha compared to 6.7 t/Ha in China

6. 0.7 GtCO<sub>2</sub>e in 2018; as per Total Agricultural Emissions data published by CAIT

# However, there are several challenges across the agriculture value chain that constrain the sector (2/2)

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## 3. Trade, primary processing, ingredients

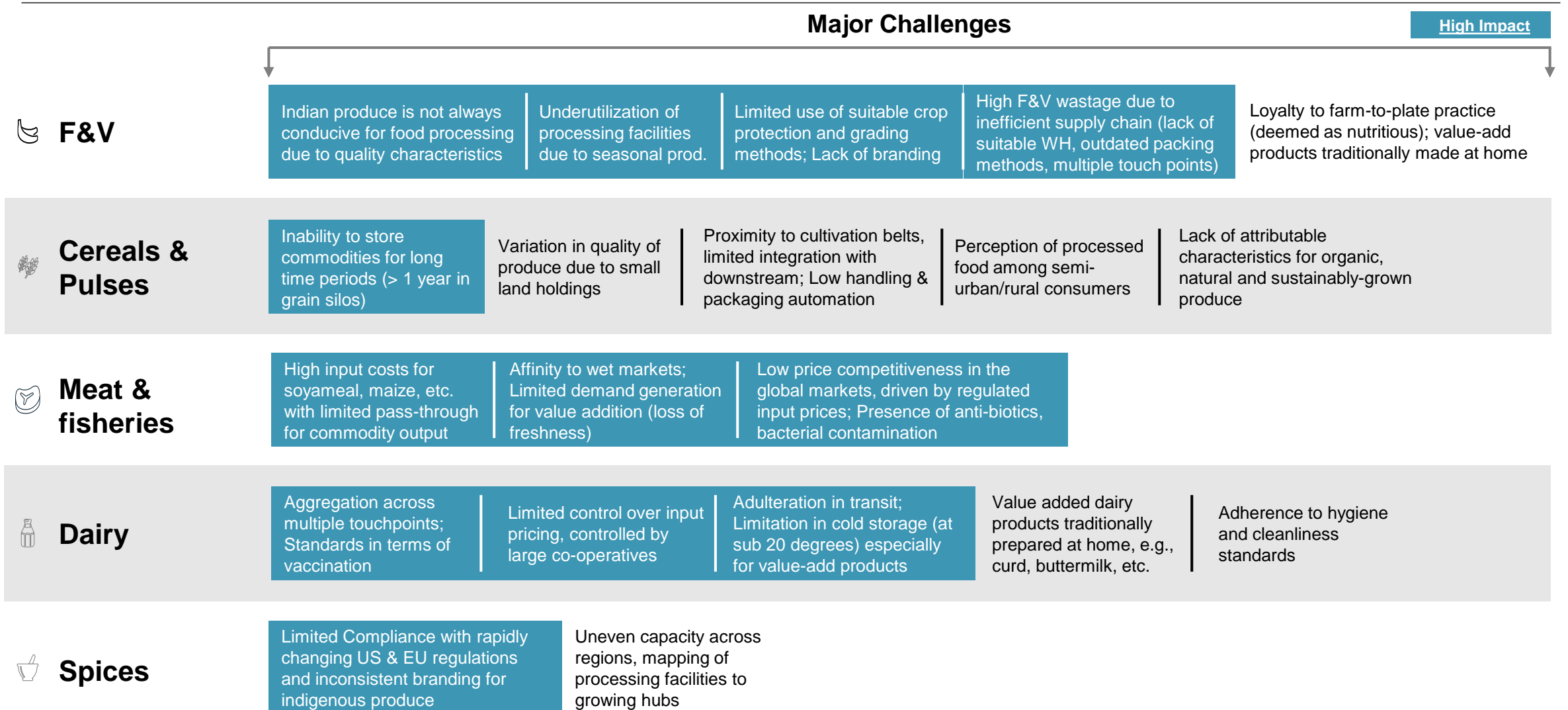
- **40% of agricultural outputs spoils** before reaching the customer<sup>1</sup>. The key challenge lies in adequate storage infrastructure (including farm level infra) and low market transparency (distress sales, multiple middlemen).
- **Low translation to Exports:** India's Agri Exports constitute only 2.5%<sup>1</sup> of Global Exports, despite India ranking 2<sup>nd</sup> globally in terms of total agricultural production and occupying leading position in many high-value foods (F&V, dairy, poultry etc.). Key challenges lie in weak market linkages, low exposure to export markets, inadequate cold chain infra (transport & storage) facilities, high logistics costs etc.

## 4. Secondary processing / CPG

- **Low conduciveness of Indian produce to food processing**, mainly due to quality characteristics demonstrated by a majority of the national produce, e.g., in the case of tomatoes, the "Extra Class" variant demonstration firm flesh and must have appearance/color characteristics is produced scarcely in India
- **Limited awareness on food processing** to support demand creation for the domestic market, mainly **due to limited branding & marketing**
- **Underutilization of processing units** owing to seasonality of agricultural produce, leading to distressed assets



# Deep dive: Impact of structural challenges on major food processing sub-sectors



# Key imperatives for India in agriculture

Deep-dive exhibits in backup

-  **Increase productivity** through focus on farm mechanization and optimal usage of ag inputs (seed, fertilizers, pesticides, water, power, preventing soil degradation)
-  **Enhance market linkages to promote food processing and exports** through a value chain approach and demand backed production
-  **Leverage digital solutions** across farming, market access, finance enabled via agri stack, IoT devices
-  **Increase share of Food Processing** to increase farmer incomes, create jobs and meet evolving customer needs
-  **Re-wire agri supply chains** and reduce inefficiencies through cooperativities (e.g., through FPOs) and ecosystem approach
-  **Drive sustainable agri practices** to address water stress, reduce GHG emissions and improve soil health

# 1. Increase Productivity through farm mechanization, optimal use of agri inputs – Key unlocks

**UNLOCKS**

**Now** – fix the basics

**Next** - explore adjacencies

**New** – explore frontiers

**UNLOCKS**

■ **Company Level** (incl. Farmers' cooperatives, agri startups, food processing companies, logistics companies, banks etc.)

■ **Industry Level** (includes consortia of food processing companies, logistics companies, banks etc.)

■ **Central Government**

■ **State government**

## Farm infrastructure

(Now)

- Farm equipment manufacturers, can partner with banks / financiers to **adopt innovative financing models (Equipment as a service)** for rental/ shared utilization of farm equipment with focus on driving mechanization beyond tractors, for e.g., Agri start-up, Agribolo offers equipment rentals to farmers
- OEMs / service providers could partner with RE players to adopt **renewable energy** in powering farm equipment, irrigation, storage infrastructure. Collaborate with regulators to **set standards for electrification of farm equipment** such as tractors and electric equipment.
- Centre (E.g., AIF, PM KTS under DA&FW) and State (E.g., Kisan Audhan Yojana) could provide financing options or credit guarantees on **equipment & machinery loans** and continued support through PSL to enable affordable credit

## Farmers' awareness and training

(Now)

- **Ecosystem Partnerships** – Major Food Processors could create ecosystem partnerships<sup>1</sup> (with banks, ag inputs players, logistics players) including new-age Agtechs to provide information on inputs, climate or weather, crop demand, govt. schemes to farmers, impart training programs for adopting best practices along with support in new technology investments, e.g., Partnership b/w Sahyadri Farms and Tata Strive to set up Skill Development Centres
- ICAR<sup>2</sup> could collaborate with industry players and states to address talent gap in Agri through concerted efforts on skilling such as design & **induction of Agri curriculum at school level<sup>2</sup>** and **training programs for farmers (especially on use of technology)** to plan for the future, for instance, **encourage GAP** and educate farmers on **judicious usage of pesticides, IPM, PHM and GMP**

## Farm technologies

(Next)

- Agri-tech startups could focus on developing India relevant new **precision farming technologies** and **AI and IoT driven autonomous / semi-autonomous robots** to take over routine tasks (weeding, spraying, harvesting, pruning etc.) and perform them with better efficiency
- **Government institutions such as ICAR<sup>3</sup>, IARI<sup>3</sup>, NABARD<sup>3</sup> etc. could provide incentives and promote research** in development and deployment of precision farming tech, robotic systems – to adapt technologies in Indian context, enable prototyping and commercialization of new technologies

## Biotech Revolution

(New)

- **Government institutions such as ICAR, IARI, NABARD etc. could promote R&D in following areas by allocating dedicated funds to research institutions:**
  - **Gene editing / GMO crops** – with focus on addressing changing market & nutritional requirements, climate change resilience, higher productivity, reducing water usage.
  - Adoption of **microbial / organic solutions** for crop protection, nutritional supplement (moving away from synthetic chemicals)

1. Case in point: e-Choupal launched by ITC

2. In line with National Education Policy, 2020

3. Indian Council of Agricultural Research, Indian Agricultural Research Institute, National Bank for Agriculture and Rural Development

# 2. Enhance market linkages to promote food processing and exports through a value chain approach – Key unlocks (1 of 2)

## UNLOCKS

Now – fix the basics

Next - explore adjacencies

New – explore frontiers

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## E2E Value Chain Cluster Approach (Now)

- focus on making single crop value chain attractive as a successful case example

- **Setup two-part centre-state institutional framework** wherein the **state identify clusters**, attract investors and operationalize the Food parks / **M-APECs<sup>1</sup> / export focused clusters** (preferably closer to supply hubs to reduce wastage & delays), e.g., Maharashtra grapes cluster, Chilli value chain development in Andhra Pradesh, while centre support their efforts through inter ministerial coordination for cross-cutting enablers and provide funding.
- Agri value chain players<sup>2</sup> to partner with centre / state govt. in enabling creation of **e2e crop value chain clusters<sup>3</sup> / Food Parks** for lighthouse value chains (e.g., shrimp, mango, spices, milk) with focus on states with high primary food processing (e.g., **Maharashtra for oilseeds, F&V, livestock, Andhra Pradesh for shrimps, Tamil Nadu for Potato & Onion etc.**) to support farmers on input/crop selection, provide credit, address critical infra gaps (e.g., cold chain logistics at shrimp farms), **catapult value-add activities (e.g., mango processing) & strengthen market linkages**, For instance, A leading consumer goods company entered a PPP with Horticulture Department, govt. of AP to set up Chilli value chain to improve productivity, quality, sustainability etc.
- Agri-tech players to develop **platform / solutions enabling “Farm-to-fork”** (both internal and global markets) to **reduce inefficiencies and help farmers access higher prices** from their customers – run pilots with farmers / FPOs to showcase the impact and provide training relating to use of technology, export standards etc. e.g., Sahyadari FP Co., one of the nations largest FPOs is implementing blockchain technology for full traceability of its products from farm-to-fork
- Food processing players / agri-startups / agri-equipment players, etc. to partner with **Ag R&D institutions for developing export market oriented/processing** suited seed varieties, climate resilient and water efficient varieties. e.g., UPL Ltd. Partnered with GB Pant University to promote sustainable agriculture research. NEC corp. India partnered with TN Agricultural university to resolve agricultural issues using AI and analytics

1. Mini / Micro Agri-processing centers (M-APECs) at district levels

2. Producers, Agribusinesses, food processing companies, financiers, corporates etc.

3. Crop value chain cluster serves to build “vertical” relationships along the value chain among input suppliers, processors, exporters and buyers. It also builds “horizontal” relationships at each link between producers and facilitating organizations such as technology providers, trainers and research institutes. These stakeholders come together along the entire value chain to reduce transaction costs, minimize the cost of doing business including regulatory compliance and factor costs of production, improve quality across production, processing, logistics, establish market linkages, thus benefitting farmers and agri-businesses alike

## 2. Enhance market linkages to promote food processing and exports through a value chain approach – Key unlocks (2 of 2)

### UNLOCKS

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### Enable unified Indian brand building and ensuring quality to promote exports

(Now)

- Central export agencies (MPEDA, APEDA, EIC, etc.) to promote export by re-designing engagement with countries and buyers along with strong end-customer promotion. **Harmonize domestic food quality (FSSAI) benchmarks with international standards such as US FDA, EMA** to assist in decreasing rejections by importing nations and enter into **G2G Equivalence Mutual Recognition Agreements (MRA)**. .
- **Central bodies such as MPEDA, APEDA etc.** could invest in establishing relationships with foreign importing companies and aim to export directly to QSRs and retailers. Consortiums such as AISEF (Spices), State agricultural marketing boards (e.g, TNSAMB) **to extend reach for MSMEs** by focusing on **branding and advocating for specific products abroad**
- Product-specific consortiums / forums to create commodity specific digital platforms (e.g., shrimps, mangoes, bovine, milk products etc.) and increase awareness on existing platform (e.g, Agri Xchange) to connect directly with international buyers and ensure adherence to **export requirements** by **better traceability via GPS enabled tracking systems**, awareness about SPS standards of importing markets, investment in R&D and treatment facilities (e.g., common mechanized drying infrastructure). For instance, Spices Board launched 3D virtual platform aimed at connecting India's spice exporters with buyers from around the world
- Product-specific consortiums (E.g., NECC) to invest in creating **strong unified brands for rich indigenous commodities**<sup>1</sup> (leverage Advertisements, celebrity endorsements etc.), with support from Government to push for GI tagging and agreements with importing countries.
- **Agriculture / Food processing players to use processing and innovation** to create a new product category altogether - beneficial in creating additional demand through an untapped/underpenetrated market, e.g., Dairy players created a new category of fermented products - Dahi, Lassi, Chaas

### Create supporting agri-logistics Infra

(Now)

- Agri-logistics players to reduce spoilage across value chain by deploying **integrated cold storage infrastructure near-farm aggregation points where fresh harvest is brought), reefer trucks, ripening units etc.** with focus on states with medium to low cold chain capacity against demand (e.g., Maharashtra, Madhya Pradesh, Karnataka, AP, Tamil Nadu, Rajasthan etc.) along with use of **standardized pallets** (to reduce unpacking / re-packing, contamination) and use of CO2 (for extending shelf life)
- **Improve cold chain efficiency** by shifting from single-product to multi-purpose storages to reduce market risk and improve utilization; Invest in alternate energy technologies like solar-powered systems, explore chemical treatments to extend the shelf-life of produce, set up pack houses and reefer transport

1. For instance, Basmati rice, Nashik grapes, Kerala cashews, Ratnagiri Alphonso, TN Shrimp, Guntur Chillies. Source: "Unlocking value in India's food processing sector" CII & McKinsey, August 2022

# 3. Leverage digital solutions across farming, market access, finance enabled via agri stack, IoT devices – Key unlocks

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## Digital Solutions

(Now)

- Ag-tech startups could focus on developing **deep-tech, AI powered subscription products / services (e.g., scientific warehousing)** which build up on IoT remote sensors and compilation of digitized data<sup>1</sup> (**farm, weather, soil, warehouses, cold storage**) to offer customized right solutions at the right time. For e.g., SLCM group has patented platform that can reduce post-harvest losses from 10% to 0.5%
  - The products could be augmented with **Agtech solutions leveraging drones, ICT, blockchain** and investment in analytics to provide targeted insights at farm-crop level
  - Further, Government can support Agtech in terms of implementing **pilot partnerships<sup>2</sup>, providing access to agriculture data** (fertilizer sales, fungicide usage, mandi data etc.), providing funding to accelerate new technologies in agriculture.
  - Develop **e2e electronic lending solutions** accounting for both **financial and non-financial data** (weather, field size, soil quality, crop potential etc.) of farmers, employ digital disbursement and contact-less processing to **improve underwriting process** and provide **customized financial products**
- Agri-startups, software companies could collaborate to develop **AgriStack** with immutable audit trail and **integration of state wise applications and platforms for farm and farmer data along with open source APIs** for private enterprises to leverage the data and develop on-top applications / solutions

## Precision Agriculture

(Next)

- Ag-tech startups / SaaS companies to build **'Farm of the future'** combining farmer's data (through 'Agri stack') and hardware & software solutions (geo tagging & imaging, IoT sensors, AI/ML enabled crop advisory & planning solutions etc.) to identify ideal crop locations and varieties, sowing windows, optimum usage of agri inputs, and crop-specific pest/disease prevention solutions to increase farming productivity E.g., Indian Agritech company superplum built modern-supply chain using proprietary IoT based transport system to minimize wastage. Ministry of Agriculture MoU with 5 companies – CISCO, Nijacart, Jio Platforms, ITC Ltd., NeML to push pilot projects involving AI and blockchain to modernize countries agriculture sector

1. Under RKVY of the MoA&FW, MoU signed with NRSC (National remote sensing center) for geo-tagging of agricultural assets. Government owned NABARD under process of geo-tagging all warehouses and cold-storage locations, that will be made available to farmers through app

2. Case in Point: Investment assistance announced by Agriculture Ministry for deploying agri drones under Sub-mission on Agricultural Mechanisation (SMAM)

# 4. Increase share of Food Processing to increase farmer incomes, create jobs and meet evolving customer needs – Key unlocks

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## Catapult food Processing

(Now)

- State government could **accelerate creation of food parks by relaxing mandates around land allocation**, processing of grants, planning accessible location in proximity to supply inputs, and creating adequate logistics and ancillary infrastructure
- Create **localized pre-processing centres<sup>1</sup>** in proximity to production farms to aggregate produce, perform basic processing functions to reduce spoilage, deploy innovative low-capex processing methods (ripening chambers for mangoes, standardized bags for storing spices, osmo dehydration for pineapples etc.). Such centers can provide quality shared infrastructure and be supported by FPOs, M-APECs.
- **Improve utilization<sup>1</sup>** of food Processing facilities from 60-70% to >90% by using fresh produce during season and cold-stored / processed / frozen produce during off-season, planning **multi-product processing facilities** which leverage seasonality, coordinating with local facilities to inter-deploy capacity with **structured changeovers for a range of F&V inputs**
- **Demand backed production<sup>1</sup>** – Provide clarity on ag growing practices to produce products conducive to food processing through public/private channels – through combination of incentive-based programs that link growers to market buyer, awareness campaigns for best practices, evolving crop mix etc. (e.g., Use of F1 hybrid tomato seeds for produce firmness and color characteristics; Use of mechanized pumps to maintain shrimp density, etc.)

## Ensuring quality and traceability standards

(Now)

- State government could incentivize investment in **quality related infrastructure<sup>1</sup>** (steam sterilization, Quality Evaluation Labs), reduce use chemicals / fertilizers / pesticides usage where it affects quality / exportability. This can be implemented via dedicated, well-market programs to spread awareness on best practices, quality standards, income potential from improving quality
- FPOs and Ag-tech startups to Innovate using **geo-tagging, distributed ledger technology for improving traceability** of agricultural products.

# 5. Reduce inefficiencies through cooperativities (e.g., through FPOs) and ecosystem approach – Key unlocks

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## Support for scaling FPOs

(Now)

- **Promote FPO creation** by eliminating differential treatment between different types of FPOs (Producer company vs Cooperative, etc.) and giving them **agri-startup / MSME status** to accelerate benefits like tax exemptions, easy access to credit-guarantees, collateral-free loans, favorable public procurement norms, etc. Policymakers could also set up a national board for FPOs (NBFPO) on the lines of the MSME board to promote, impart necessary skills, provide a network, and monitor progress of FPOs and **link each FPO with KVK/Agri-university/ development institutions** (ICAR, IARI, etc.) for continuous technical support and guidance
- **Design and offer structural training programme** to inculcate entrepreneurial mindset into FPOs focusing on capacity building in the areas of Market study, Customer analysis, Business models, Sales and marketing, ROC compliance etc.

## Credit and insurance for farmers & FPOs

(Now)

- Large Banks could tap into the **large opportunity for rural agricultural financing** by creating **banking footprint, expanding KCC across farmers**, adopting digital lending solutions etc. e.g., HDFC bank looking to double rural coverage to 2L villages over the next couple of years to capitalize on fastest growing lending segment
- **Special schemes oriented towards FPOs / Farmer Collectives / entities engaged with FPOs** can be introduced, promote co-lending structure which has significant potential to align the strengths of Banks & NBFCs to accentuate flow of credit to FPOs



# 6. Sustainable Farming Practices to address water stress, reduce GHG emissions and preserve soil health – Key unlocks

## UNLOCKS

Now – fix the basics

Next - explore adjacencies

New – explore frontiers

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## Now

- Collaboration among central / state-Implementation-Agency, project concessionaire and FPOs to drive significant investment in agriculture irrigation infrastructure including efficient irrigation, reservoir management, watershed management & rainwater harvesting programs to improve water accessibility, **crop seeding through conversion from flood to drip/sprinkler, low/no tillage through shallow cultivation / fewer tillage operations** to minimize top-soil impact. Setting up a metric to measure the crop productivity with respect to water usage so as to regulate water consumption
- Train farmers in **silage preparation** to mitigate year-round availability of green fodder, new age practices that upcycle stubble, rice straw, use of bio-gas and growing less water **intensive crops such as millets**

## Next

- Animal Feed industry to enable improved **livestock feeding through awareness on animal feed-mix optimization, feed additives usage, feed grain processing** for digestibility to abate methane-driven emissions
- Govt. along with agri-players to drive efficient rice cultivation through usage of **sulfate fertilizers, alternate wetting and drying (AWD)** to reduce flooding, mechanized straw removal, dry direct seeding through
- Financial Institutions, auditors, agricultural firms and ag-techs to collaborate with government research organizations to provide **carbon credits to farmers adopting sustainable residue management practices<sup>1</sup>** which could be redeemed against lower interest loan, subsidies etc. For e.g., GrowIndigo India Ltd., collaborative effort between agricultural firms Mahyco and Indigo AG, executing project with IARI and CIMMYT to develop marketplace for carbon trading for Indian farmers
- Build awareness **through FPOs, agri universities etc.** around **soil protection practices** such as residue mulching, no-till farming, growing a cover crop or forage, managed grazing, using compost and bio-fertilizers, drip sub-fertigation, agro-forestry, integration of crops with trees and livestock, recycling of all bio-waste on land etc

## New

- Fertilizer industry to promote efficient use of **Synthetic Fertilizers by reducing N-overapplication, controlled release & stabilized fertilizers**, variable-rate fertilization and specialty crop additives
- Collaborate for research to enhance **livestock productivity through GHG-focused breeding & genetic selection and advanced technologies** in animal health monitoring and growth promoters

1. Special mechanism for procuring from farmers following sustainable practices – in forms of buyback could also be introduced

# Additional policy related unlocks

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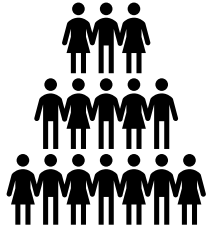
- **Formulate Agriculture council** with representation from centre and all states on the lines of GST council to enable harmonization of policies and processes pertaining to areas such as FPO, corporate farming, land consolidation, Mandis etc.
- Policy environment **that incentivizes investments in sustainable technologies** in India. This would require changes to the registration and licensing processes for new age molecules, data protection and, above all, a stable and predictable policy environment so that India continues to be a responsible and reliable supplier. Fasttrack registration of new next generation molecules which have smaller environmental footprint, are more efficacious and preserve the environment better.
- **Set up tighter regulations around protection of Intellectual Property** - strengthening enforcement mechanism under Plant Varieties and Farmers' Rights Act (PVP&FR) to protect against illegal copying of patents + Strong anti counterfeiting measures to protect farmers and innovators.
- **National water management strategy to mitigate impact of climate change** – set up a National water grid through river linking, dam and canal infrastructure and water bodies to mitigate surplus/deficit water situations through water mobility

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# Backup

# Overview of key parameters impacting Indian agriculture in 2050

Premise for all upcoming measures



## Increasing population

- As per the UN estimates, world population is expected to reach **9.8 Bn** by 2050
- Similarly, India's population is expected to reach **1.6 Bn** by 2050



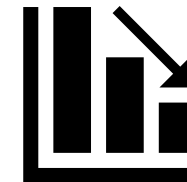
## Increase in urbanization

- As per UN estimates, the level of urbanization in India is likely to increase from the present 31% to nearly **52%** by 2050



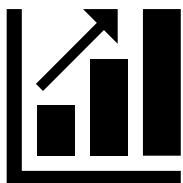
## Increase in GDP

- Out of the total projected GDP of **USD 13 Trillion** for India, agriculture is expected to contribute about **5%** in 2050



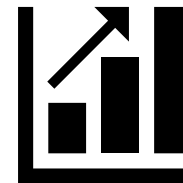
## Decrease in labour availability

- It is estimated that the labour force employed in agriculture in India is set to decrease from 54.6% in 2011 to **25.7%** by 2050



## Shifting dietary pattern

- In 2050, the projected consumption of poultry meat in India will be **2.3 times** higher and that of other livestock products will be 1.4-1.8 times higher than current levels
- Milk demand is also projected at **401 Mn MT** in 2050



## Mechanization

- The level of farm mechanization is inversely related to the population involved in agriculture, hence the level of mechanization is expected to increase significantly to compensate for the labour availability

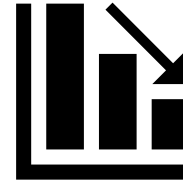
# Overview of key parameters impacting Indian agriculture in 2050

Premise for all upcoming measures



## Lesser land availability

- The average land holding has been decreasing significantly over the years and is expected to drop to **0.30 ha** by 2050 in India
- As per estimates, **5.3 Bn MT** of soil is degraded each year due to incorrect fertilization in India



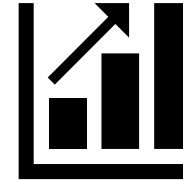
## Water resources

- India is projected to be a water stressed country in 2050 on the basis of per capita water availability at only **686** cubic meter/year
- Water required for irrigation purpose has nearly 75-85% share in the total demand which indicates a significant stress on water availability for agriculture in 2050



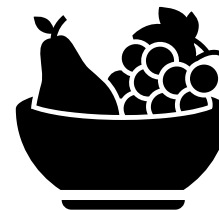
## Adverse impact of climate changes

- By 2050, portions of northern India could begin to experience increasingly frequent heat waves leading to decrease in the capacity for outdoor work. Along with this, an increased incidence of droughts/cyclones has also been predicted
- The severity of climate change is likely to increase in future and there could be drop in crop yields by 10 to 25% by 2050



## Influence of Varietal Improvement

- Shifting to hybrids in vegetables has the potential to increase yields by 1.5 to 3 times and provide a significant increase in income

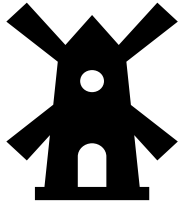


## Reduction in food wastage

- To significantly reduce greenhouse gas emission globally, the food loss and waste would need to be reduced from about 33% in recent years to <20% by 2050

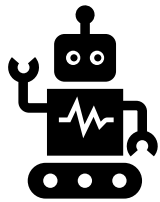
# Overview of key parameters impacting Indian agriculture in 2050

Premise for all upcoming measures



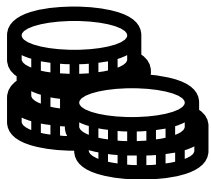
## Increase in use of cleaner energy sources

- It is estimated that India will generate **75%** of its overall electricity from renewable energy in 2050



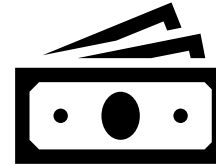
## Increase in digitization & automation

- By 2030, internet access will be universal in rural India, this will help usher the acceptance of digitization initiatives in agriculture
- Climate smart agriculture, early warning systems, ICT, blockchain will be enablers in agri-modernization



## Increase in credit availability

- Credit availability is expected to rise with increasing financial inclusion across segments



## Markets & capital investments

- Globally demand for food will increase by 70% by 2050; at least \$80 billion annual investments will be needed to meet this demand
- AgriTechs in India have received cumulative investments of **>USD 1.5 Bn** in the period of 2010-2020. It is estimated that investments worth USD 10 Bn will be recorded in this sector in between 2020-2030

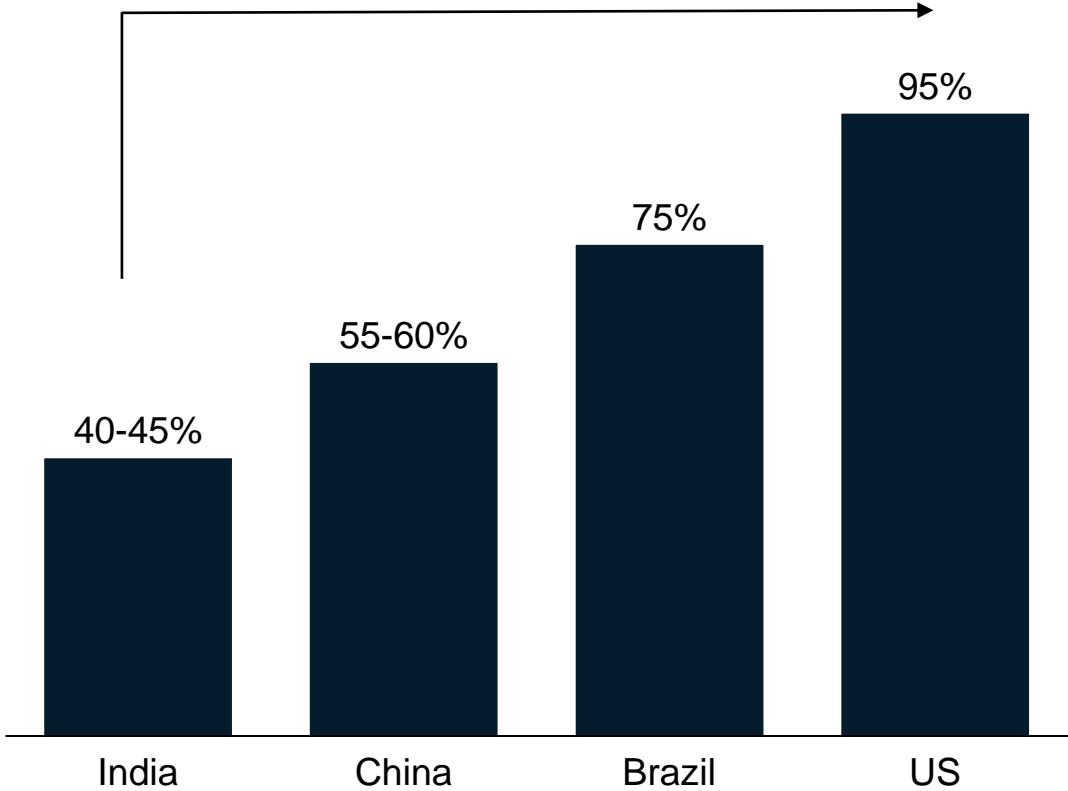


## Demand for fodder crops

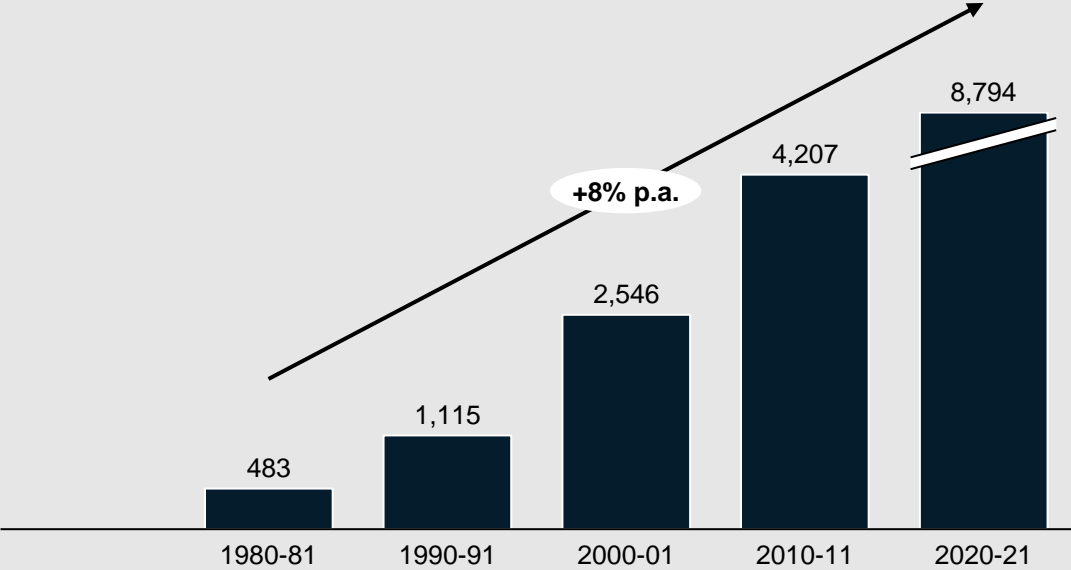
- The demand of green and dry fodder will reach to **1,012 Mn MT** and **631 Mn MT** by 2050
- At the current level of growth in forage resources, there will be **18.4 %** deficit in green fodder and **13.2%** deficit in dry fodder in the year 2050

# India has potential to double farm mechanization level in India in line with developed countries like Brazil and US

Farm Mechanization level, 2018-19



Tractor population in India, '000

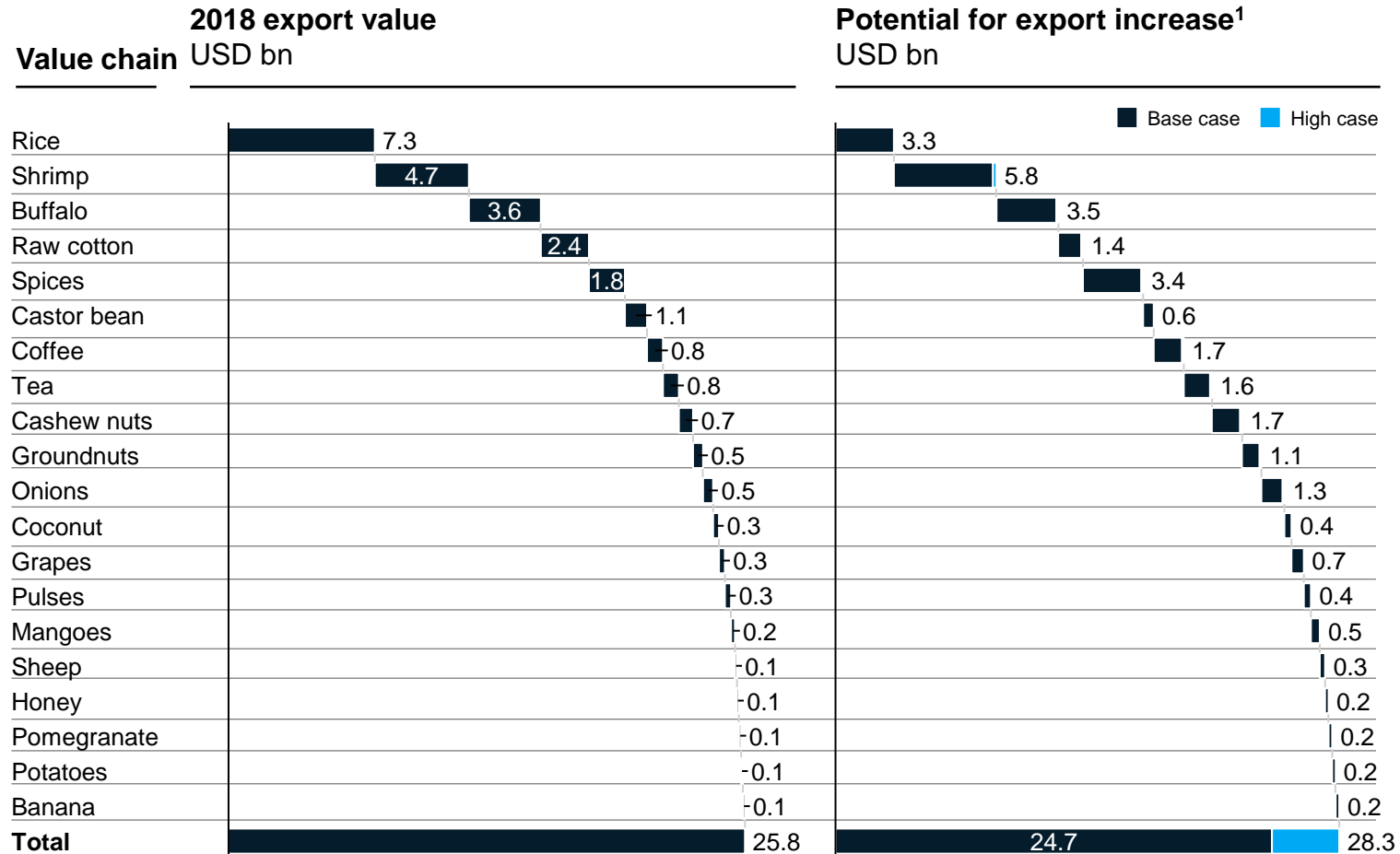


- The mechanization rate in India is highly influenced by tractor usage, *~45% of farm power used in tractors, followed by 25% of electric motor*
- The tractor population has grown at 8%p.a. in last 30 years, with >2% growth in agri yield

1. Yield calculated as weighted averages using FAOSTAT yield data with production quantity as weights. Sugarcane and a few F&V products not included.

# 20 value chains comprising ~70% of exports value in 2018 could be prioritized to drive India's exports to \$63-66 bn by 2025

The 20 value chains prioritized for export potential can drive incremental India's agricultural exports of \$25-28 Bn by 2025
























- Significant whitespaces exist in critical global food value chains where India has the potential to increase its exports
- India can double its exports in 20 key value chains (comprising 70% of exports value in 2018) in next 5-7 years - top 5 being, Rice, Shrimp, Buffalo, Raw cotton, Spices
- There is opportunity for India to export more to Europe and Americas:
  - **Europe:** accounts for \$4.4Bn and 25% of total value from top 25 countries of incremental export value
  - **USA:** accounts for \$2.2Bn and ~13% of total value from top 25 countries of incremental export value

Source:

1. International Trade Center Export Potential tool assumes 5 year time horizon, Export potential represents recurring additional export revenue in 2025



# Of these, 5 value chains are “Must-wins” for India which are expected to drive ~\$25Bn over next 5-7 years

	 <b>F&amp;V</b>	 <b>Bovine</b>	 <b>Shrimp</b>	 <b>Rice</b>	 <b>Spices</b>
 <b>Indian exports, 2021</b>	\$2.9B	\$3.3	\$5.7B	\$9.6B	\$2.7B
 <b>Global trade, 2021</b>	\$169B	\$57.7B	\$17.7B	\$18.3B	\$8.8B
 <b>India's rank in exports, 2021</b>	16 <sup>th</sup>	6 <sup>th</sup>	1 <sup>st</sup>	1 <sup>st</sup>	1 <sup>st</sup>
 <b>Other major exporters, 2021</b>	Spain, USA, Netherlands, Mexico, China	USA, Brazil, Australia, Netherlands, Canada	Ecuador, China, Netherlands, Denmark, Spain	Pakistan, USA, China, Italy, Brazil	China, Guatemala, Netherlands, Sri Lanka, Spain
 <b>Major Importers (%)</b>	USA, Germany, China, Netherlands, UK	China, USA, Japan, Italy, Germany	USA, China, Japan, Spain, UK	China, Philippines, USA, Benin, Malaysia	USA, China, Germany, Netherlands, UK
 <b>Competitiveness<sup>1</sup></b>	Medium	Medium	High	High	High–Medium
 <b>Global demand growth<sup>7</sup> (%)</b>	2%	10%	7%	6%	5-15% <sup>4</sup>
 <b>APEDA list</b>					
 <b>2018 export policy</b>					

1. Competitiveness measured by RCA score and cost curves

2. Includes all bovine products

3. Import of vegetable oil for India

4. Demand growth depends on the spice

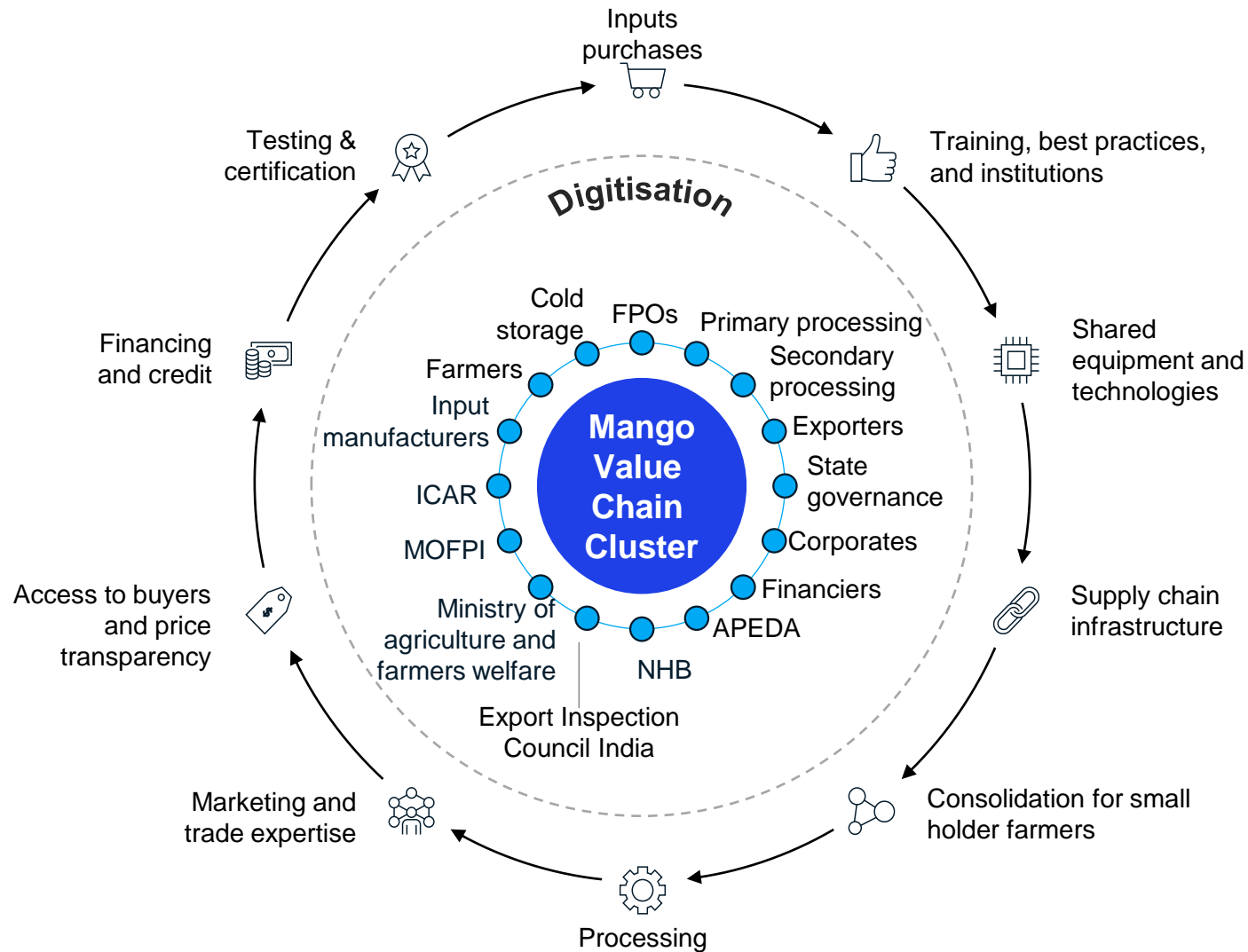
5. Using castor bean oil, which is India's largest oilseed export

6. Includes all fruits and vegetables featuring in the top 20 value chain – Onion, Grapes, Mangoes, Pomegranate

7. Used weighted average of individual commodities for value chain grouping

# Value Chain Cluster could address inefficiencies in infrastructure & logistics

Case example: Mango



Focus on making a single crop value chain attractive for all stakeholders through

- Reduce transactional costs
- Minimize the cost of doing business including regulatory compliance
- Improve quality across production, processing, logistics
- Establish market linkages

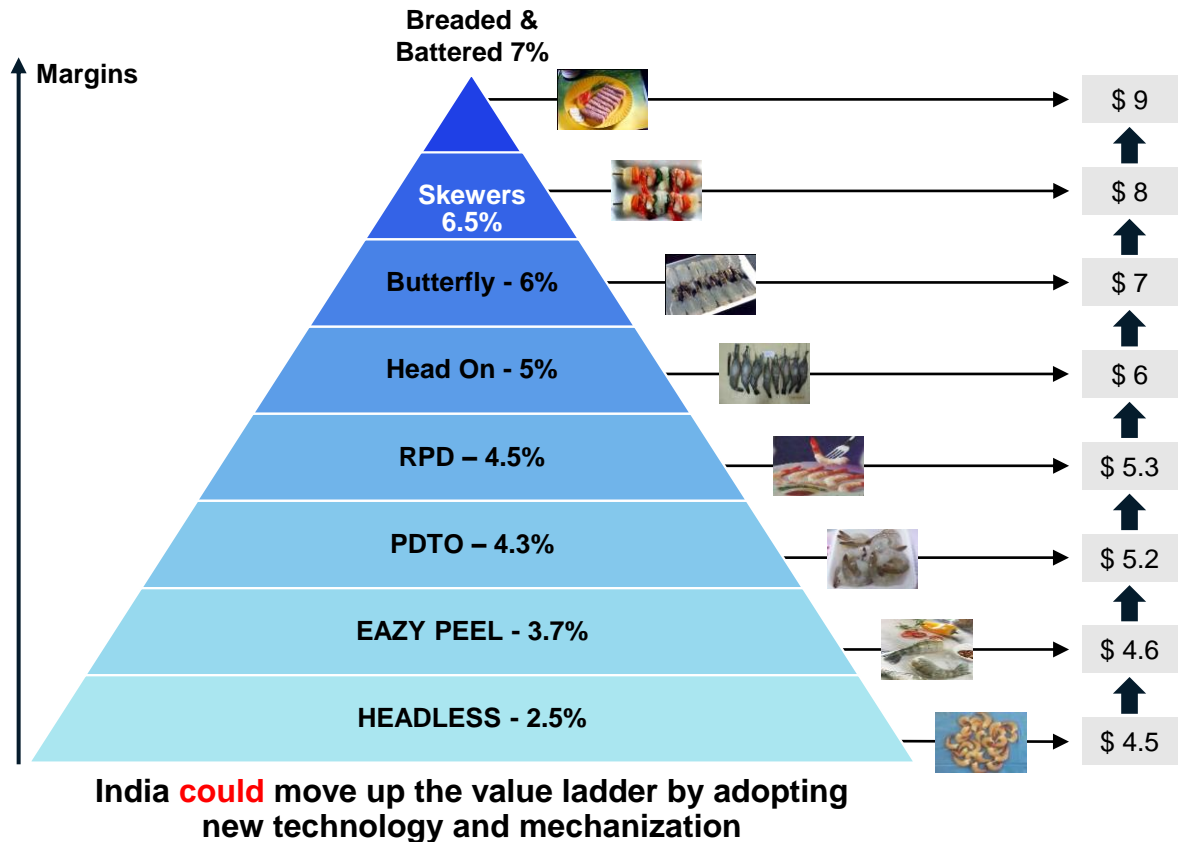
# Pivoting focus from exporting commodities to processed goods would enable higher value realization

Case example: Shrimps

India is the global leader in shrimp exports, however, India lags in terms of further processing shrimp to generate additional value-add



Opportunity for India to focus on exporting higher value addition shrimp products



# India is the largest contributor to global agricultural emissions indicating significant room for improvement

Top 5 agriculture emissions countries	Total Agriculture emissions 2018, GtCO2e	Per capita agriculture emissions 2018, tCO2e per capita	% contribution of agricultural emissions	Emissions per agriculture GDP	Rice production 2019 Mt/ya, % of global	Cattle population 2019 (for Milk) Mn, % of global	Cattle population 2019 (for Meat) Mn, % of global
India	0.7	0.53	19	1.6	178 24%	98 29.2%	9 2.7%
China	0.7	0.49	8	0.7	211 28%	12 3.5%	41 12.5%
Brazil	0.5	2.37	47	6.3	10 1.4%	16 4.9%	32 10%
EU	0.4	0.87	12	1.6	3 0.4%	22 6.8%	27 8.3%
US	0.4	1.18	15	2.2	8 1.1%	9 2.8%	34 10.6%
Global	14.7	0.77	20	4.3			