



Indian Farming's Next Big Moment: Farming as a Service

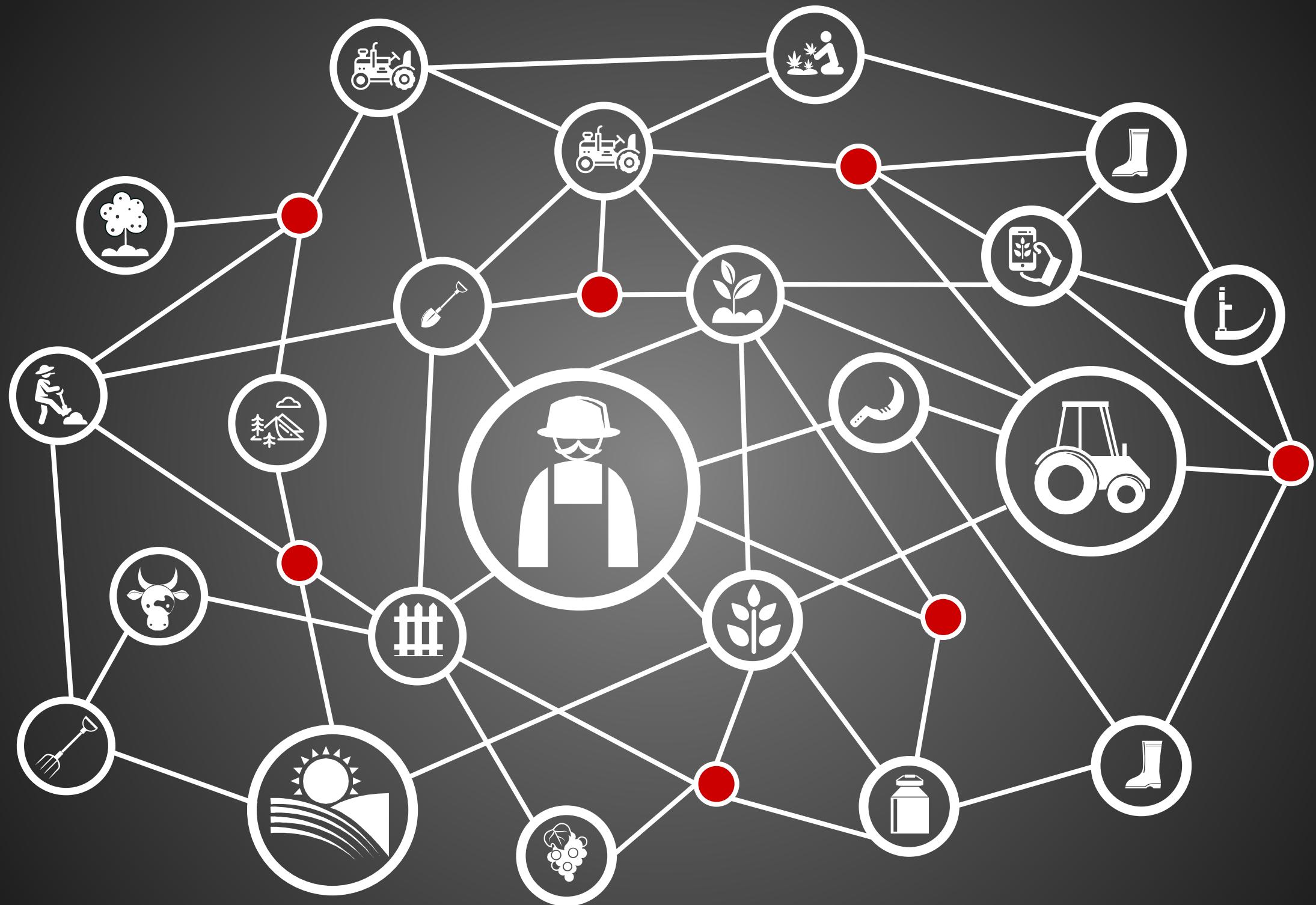
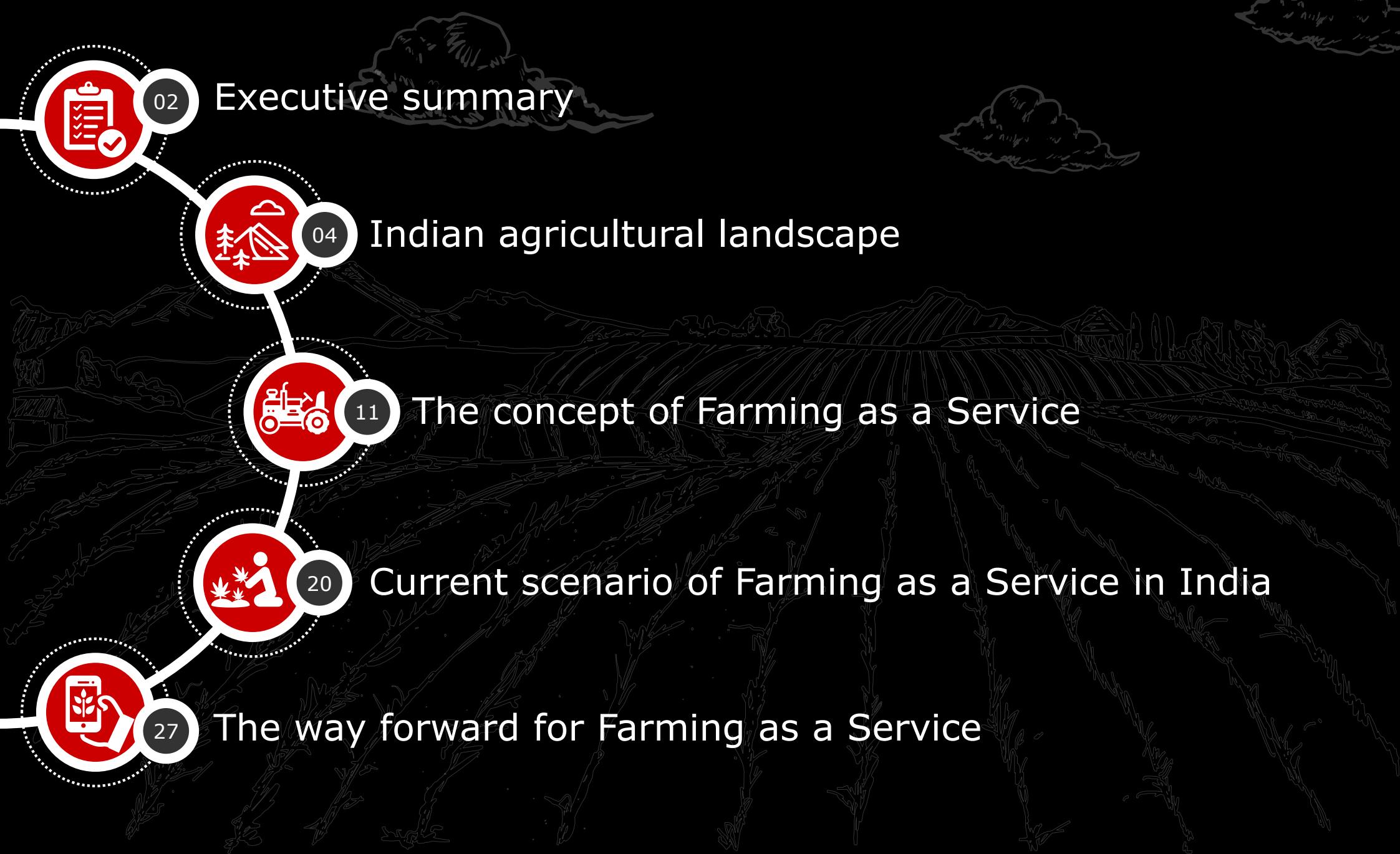


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Executive summary



India is predominantly an agrarian economy. Farming contributes about 17% to India's GDP, and about 60% of the country's rural households depend on agriculture and its associated industries. Despite having the second-largest arable land parcel—its 160 million hectares make it second only to the US—India is way behind some developed, as well as developing, countries in terms of productivity.

Low productivity in the sector is the result of various structural challenges, including heavy dependence on rainwater for irrigation, small-farm land holdings and lack of access to technology and real-time information.

Around 70% of the agricultural households in India (mostly small farmers with average land holdings of less than one hectare) struggle to make ends meet and depend on loans for their farming activities.

The demand for food in India is growing. That trend is likely to continue as disposable incomes increase and changes in consumption patterns favour value-added foods. However, supply is constrained by marginal productivity gains in a majority of crops, the shrinking amount of arable land, erratic monsoon patterns, climate change effects and inherent supply chain inefficiencies that lead to waste. And the reduction of available labour in the agricultural field makes the situation worse.

Given the importance of agriculture in India, both the government and private players are working to improve the efficiency and productivity of Indian agriculture and exploring how Farming as a Service (FaaS) solutions can play a role. FaaS seeks to provide affordable technology solutions for efficient farming. It converts fixed costs into variable costs for farmers, thus making the techniques more affordable for a majority of small farmers. Its services are available on a subscription or pay-per-use basis in three broad categories, which are crucial across the agriculture value chain.

- **Farm management solutions:** Information sharing, analytics and precision farming tools
- **Production assistance:** On-site resources to aid production, such as equipment rentals
- **Access to markets:** Virtual platforms that connect farmers with suppliers of seeds, fertilisers and other agrochemicals, as well as consumers of their produce

Executive summary *(cont'd)*



FaaS has a lot of potential. India has seen an increase in the number of start-ups and an influx of funds to the sector. Total investor funding for FaaS in India is currently \$105 million to \$115 million. More than 40% of funding rounds are at a “series stage,” indicating investors’ high level of confidence in investing more money in the growth stage. Further, the number of start-ups evolving to growth stage funding has increased as investors become more confident in the viability of these business models and the returns.

Investors’ enthusiasm is visible globally; FaaS-based start-ups have gained popularity as investors pump millions of dollars into them. Total venture capital (VC) or private-equity (PE) funding has increased about 5.5 times in the last three years. The majority of the investments are in start-ups that offer farm management solutions that are primarily influenced by developed markets with high mechanisation. Many start-ups are in the digital or technology space, which is already attracting investments from tech giants—even those that lack an agricultural background.

In addition, both the central and state governments have launched initiatives to address challenges and promote innovation. The government is actively pushing FaaS-based services through customer hiring centres (CHCs) and soil testing. The government’s focus on increasing institutional credit to farmers, improving infrastructure (such as investment in cold storage areas) and promoting digital transactions will also expand FaaS-based solutions.

FaaS will not only bring economic benefits but will also have a vast social impact on the rural agrarian economy in which small and marginal farmers are the primary beneficiaries. FaaS will push much-needed process and product innovations in Indian agriculture, including multipurpose agricultural equipment, tools for real-time data capturing and analysis, aggregation of farmland and farm produce, and financial technology for farmers.

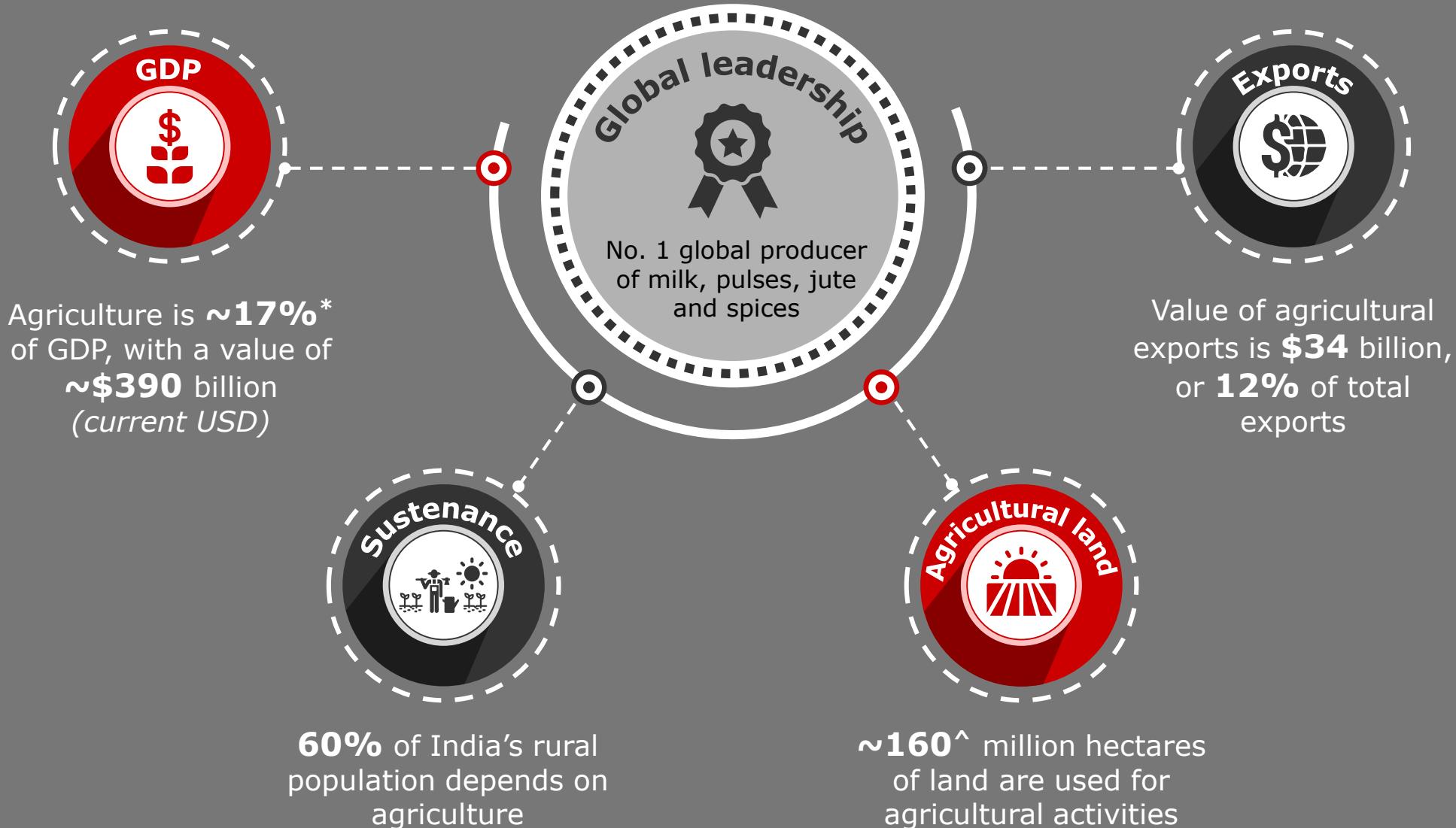
FaaS entrepreneurs have the opportunity to build scalable business models, which can be relevant not only to India but to other parts of the world. Initially, VC funds will help expand the scale at local or regional levels. Funds with strong domain expertise and a deep understanding of agricultural supply chains will be more successful in creating value for the stakeholders. In the long term, PE firms and corporations will push national or global expansion and lead to the consolidation of various FaaS models.



Indian agricultural landscape

- Agriculture contributes about 17% to India's GDP. With a value of approximately \$390 billion, it is one of the most important economic activities in India. Around 60% of India's rural population depends on agriculture.
- Although India is the leading producer of multiple crops, there is potential to improve sector performance as the country trails its international peers in various aspects and faces multiple challenges throughout the production cycle.
- India lags far behind major economies in, for example, its cereal yield, which is less than half the output of the US. Its mechanisation rate is also low: In 2011, it was about 40%, compared with greater than 90% in developed countries and greater than 70% in other developing countries, such as Russia and Brazil.
- Land holdings are small and segregated, labour is inefficient and insufficient, and there are excessive layers of middlemen between the farmers and end consumers.
- Private sector participation could redefine the sector through innovative solutions (such as Big Data and FaaS) and make it more efficient via improved access to technology, capital and entrepreneurial skills.

India is the leading producer of multiple crops, and agriculture is one of its most important economic activities



*Share of agriculture and allied sectors

[^]Based on agricultural census, 2010-2011

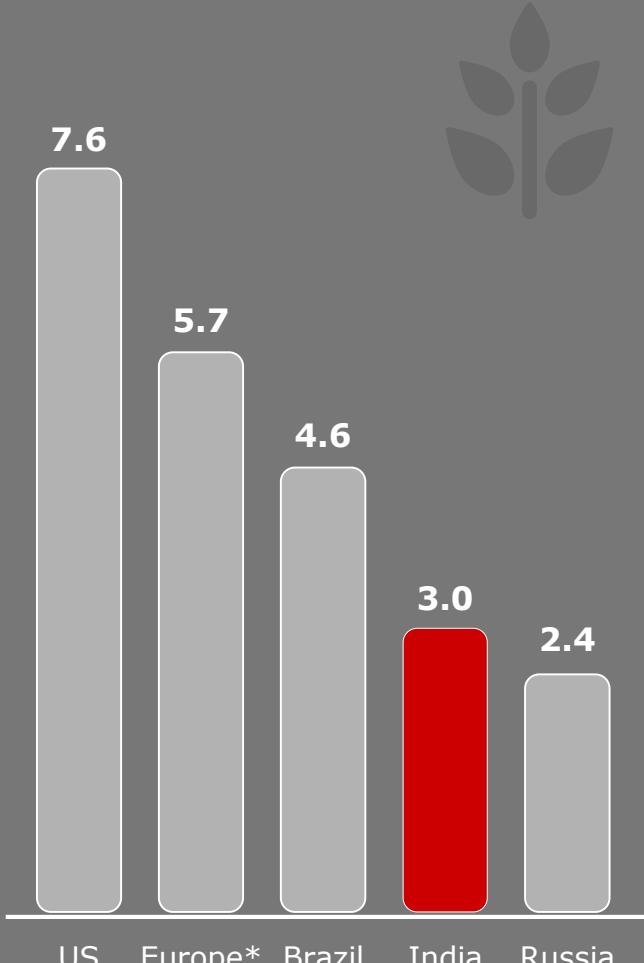
Note: All metrics from 2016 unless otherwise stated

Sources: Ministry of Commerce and Industry; Ministry of Agriculture; World Bank; IBEF

India is behind its peers, though there is potential to improve sector performance

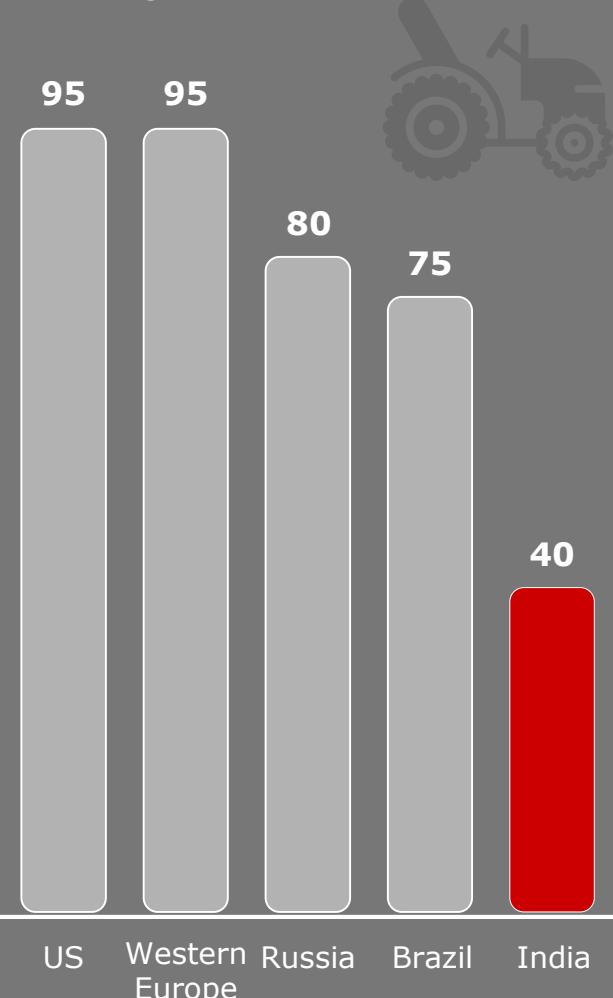
Cereal yield

Tonne/hectare, 2014



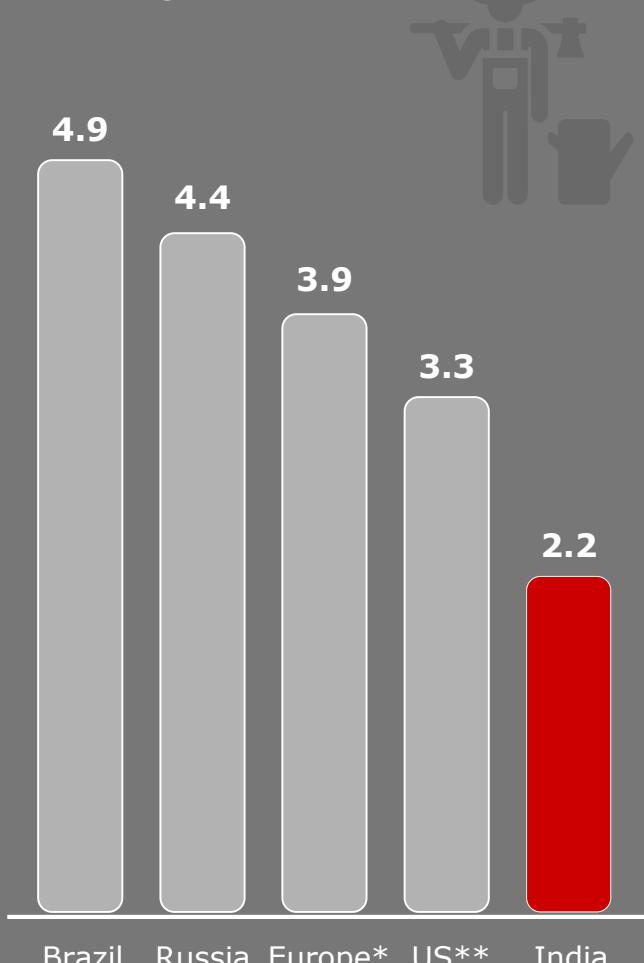
Mechanisation in agriculture

Percentage,[^] 2011



Growth in value added per agricultural worker

Percentage, 2006-16



*Refers to EU

[^]Percentage of farms or farmers with equipment such as tillers, tractors, thresher and pumps

**Growth rate 2006-15

Sources: Ministry of Agriculture; World Bank

The agriculture sector in India faces multiple challenges throughout the production cycle

Pre-production

- Small land holdings
- Degrading soil quality
- Limited access to quality seeds, fertilisers and pesticides
- Limited market information and knowledge lead to poor crop selection and inefficient use of seeds, fertilisers and pesticides



Production

- Low mechanisation rate compared with comparable developing countries
- Insufficient and inefficient labour; seasonality of employment leads to shortage or surplus of skilled and unskilled labour
- Underdeveloped supporting infrastructure: only ~45% of net sown area has access to irrigation facilities



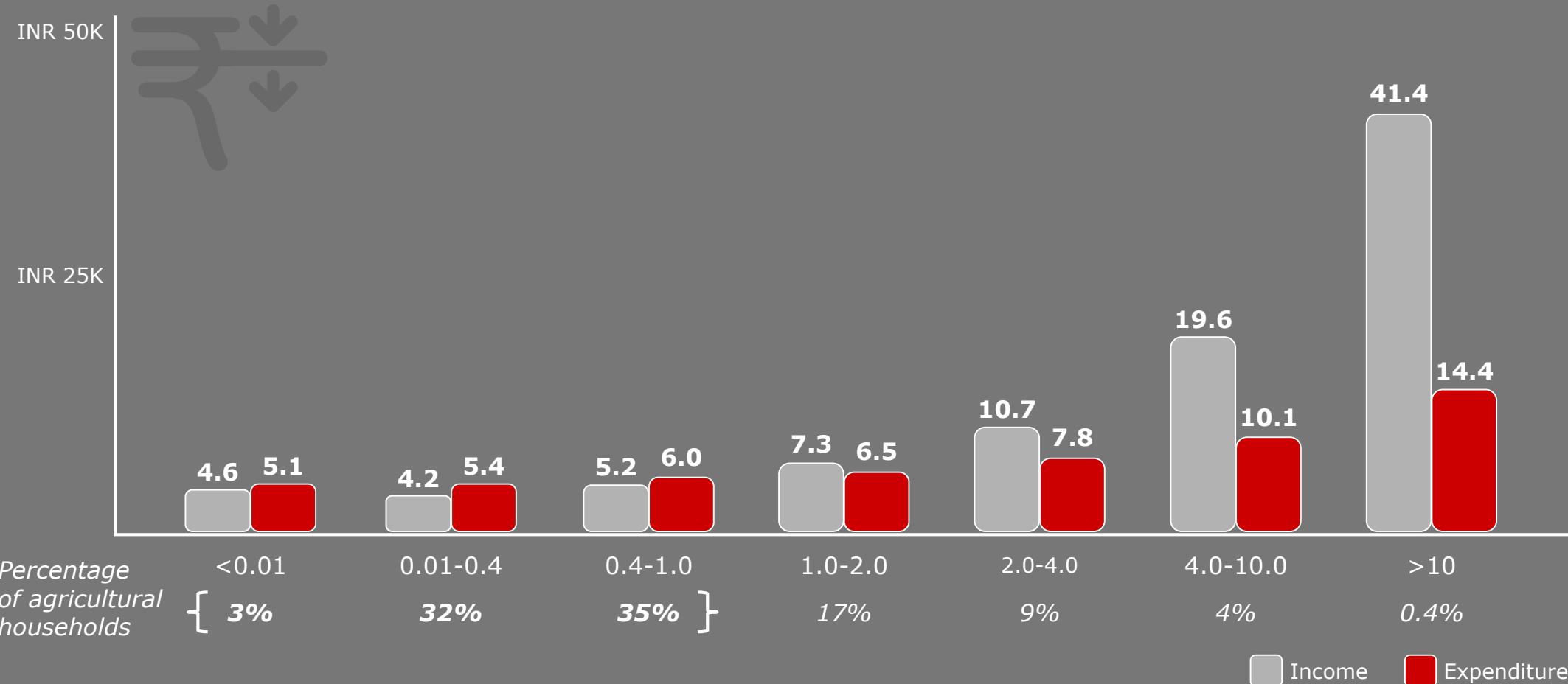
Post-production

- Inadequate storage and transportation facilities lead to post-harvest waste
- Excessive layers of middlemen lead to high prices for the end consumer while farmers receive only a small portion of the final price
- Inability to market products due to low scale of production per individual farmer



The majority of farmers struggle to make a living and depend on loans for farming

Agricultural monthly household income and expenditure by farm size (hectares), July 2012-June 2013

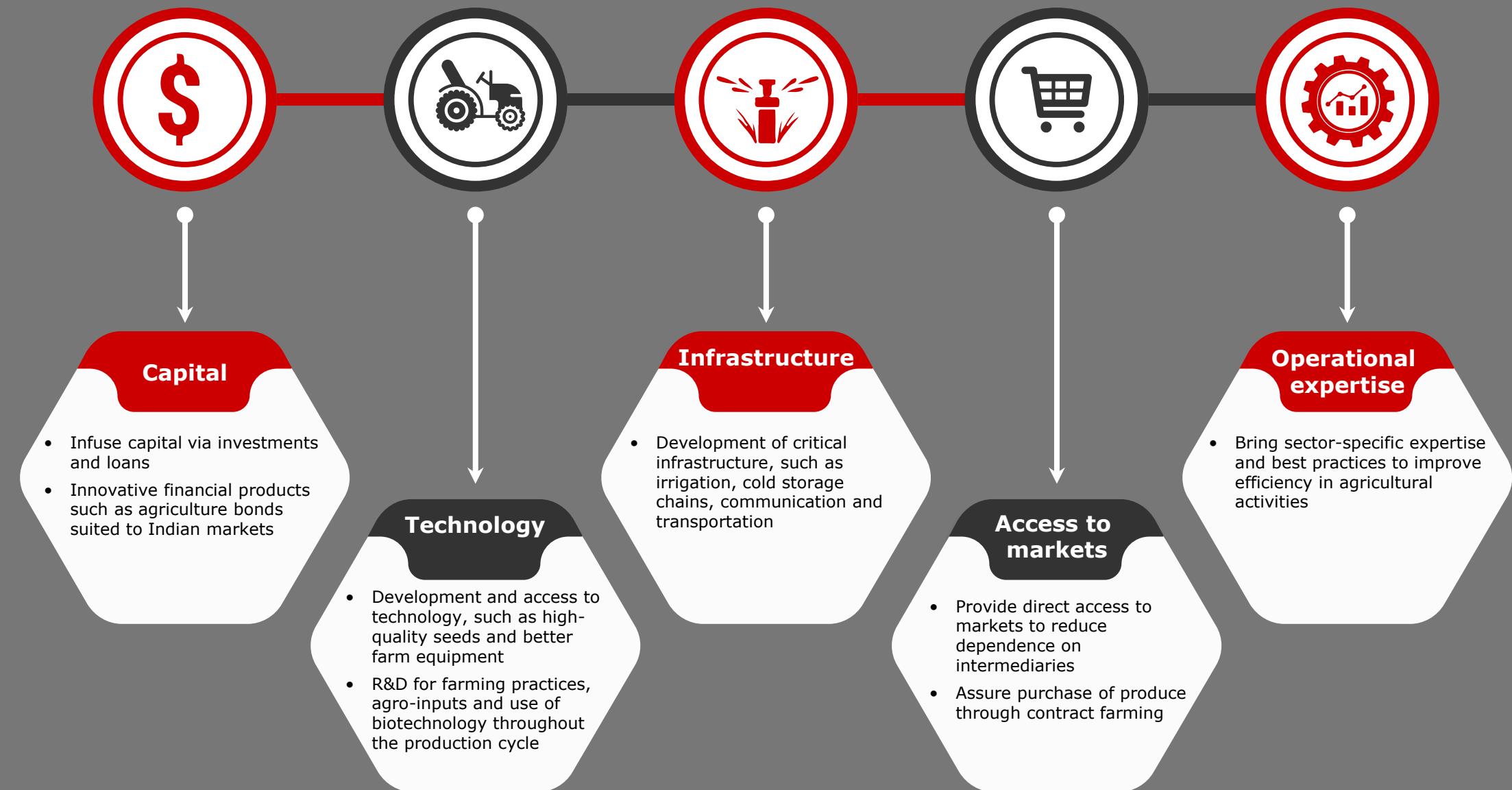


~70% of agricultural households, with less than 1 hectare of land, are not able to make ends meet

Note: Expenditure excludes debt repayments

Sources: Ministry of Statistics and Programme Implementation; National Sample Survey Organisation (NSSO)

The private sector could play an important role in redefining Indian agriculture



Agriculture in India could become more efficient and market-driven by adopting innovative models

Contract farming



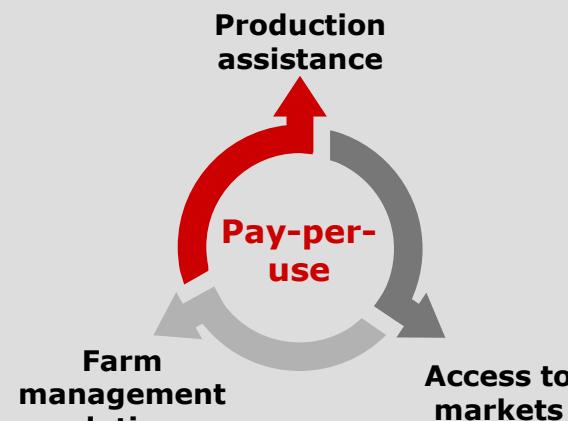
- Corporations engage farmers to grow crops using specific agro-inputs at fixed quantity and prices, leading to assured produce for corporations and assured income for farmers

Cooperative farming



- Farmers pool resources from their private farms and eventually split profits to achieve economies of scale

Farming as a Service



- Provide farming services on a pay-per-use model to improve productivity and boost farmers' income
- Provide technology that is out of reach at the lower strata

Big Data



Field sensor data
Weather reports
Market demand

- Combination of technology and advanced analytics create timely and useful information
- Enable farmers to use precision tools to increase yields, reduce inputs and improve sustainability



The concept of Farming as a Service

- Farming as a Service offers innovative, professional-grade solutions for agricultural and allied services via a subscription or pay-per-use model.
- Some solutions are organized, efficient reinventions of existing practices, while others are tech-driven innovations.
- The first FaaS category is farm management solutions, which offer information sharing, analytics and precision farming tools. This involves information management between farmers, government, corporates, financial institutions and advisory bodies.
- The second FaaS category is production assistance, which offers on-farm resources to aid production. This involves equipment rental, labour services and utility services.
- The third and final FaaS category offers access to markets—platforms connecting farmers with suppliers of agrochemicals and consumers of their farm produce.
- These solutions have been adopted globally to provide a gateway to innovations across the agriculture value chain.

Farming as a Service refers to agricultural services provided on a pay-per-use or subscription-based model

FaaS-based solutions



Farm management solutions

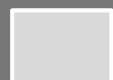
- Allow for data-driven decision making

Production assistance

- Equipment rentals
 - Provide equipment services, typically including the operator
- Labour services
 - Provide unskilled labour or skilled labour for value-added services
- Utility services
 - Offer irrigation and off-grid power services

Access to markets

- Marketplace platforms connecting directly
 - Supplies to farmers (such as seeds, fertiliser, pesticides)
 - Farmers to end market, such as retail consumers and retailers



Emerging solutions
Novel solutions that are upcoming in the market



Reinvented models
Solutions that existed in the market on a small, unorganized scale

Farm management solutions: Allow stakeholders to make data-driven decisions to boost productivity and efficiency

Aid information dissemination between farmers and market players

Operating model



Data collection

- Information collected directly through high-tech equipment (drones, satellites), farmers, market agents, government agencies
- Primary data gathered regarding quality of supplies (such as seeds, fertilisers), associated costs, soil quality and weather



Data processing and information dissemination

- Process and analyse data and disseminate information via mobile alerts or dashboards
- Train various stakeholders using assimilated data



How the information will be used by various stakeholders

- **Farmers:** Adopt precision farming practices to boost productivity
- **Government:** Empower field officers to provide timely support
- **Corporate:** Optimise input application and real-time monitoring of crop output
- **Financial institutes:** Facilitate loan provisions, risk management, fast-track crop insurance claims
- **Advisory bodies:** Allow experts to provide real-time advice

Requirements

- Extensive on-the-ground knowledge and reliable information sources
- Skilled professionals with extensive tech expertise collect, aggregate and disseminate data on a large scale, accurately and in real time
- Literacy and connectivity among farmers; high penetration of broadband or mobile communication

Production assistance: Provide on-site access to affordable equipment, labour and utilities

On-site production resources increase accessibility and affordability

Operating model



Type of services

- Equipment rentals, with or without expert operator
- On-demand workforce, such as skilled and unskilled labour, on-demand equipment repair, veterinary services
- Utility services, such as provision of off-grid electricity and water



Service delivery

- The company acts either as an aggregator platform or as a service provider
- The company provides doorstep service delivery to farmers
- Farmers pay per use or lease for fixed time period; EMI options tailored to farmers' repayment ability



Implications for farmers

- Farmers are able to supplement their workforce and capabilities to increase their yield

Requirements

- Proximity to farms to be economically viable
- 24/7 reliability, quality assurance in order to increase adoption
- Assure higher utilisation of assets such as tractors
- Access to spare parts and repair stations

Access to markets: Connect farmers to agricultural suppliers as well as to consumers

Direct connectivity aids access to quality products at fair prices

Operating model



Input-farmer

- Virtual platforms such as mobile apps or online stores to connect farmers with suppliers for timely procurement of seeds, fertiliser, pesticides



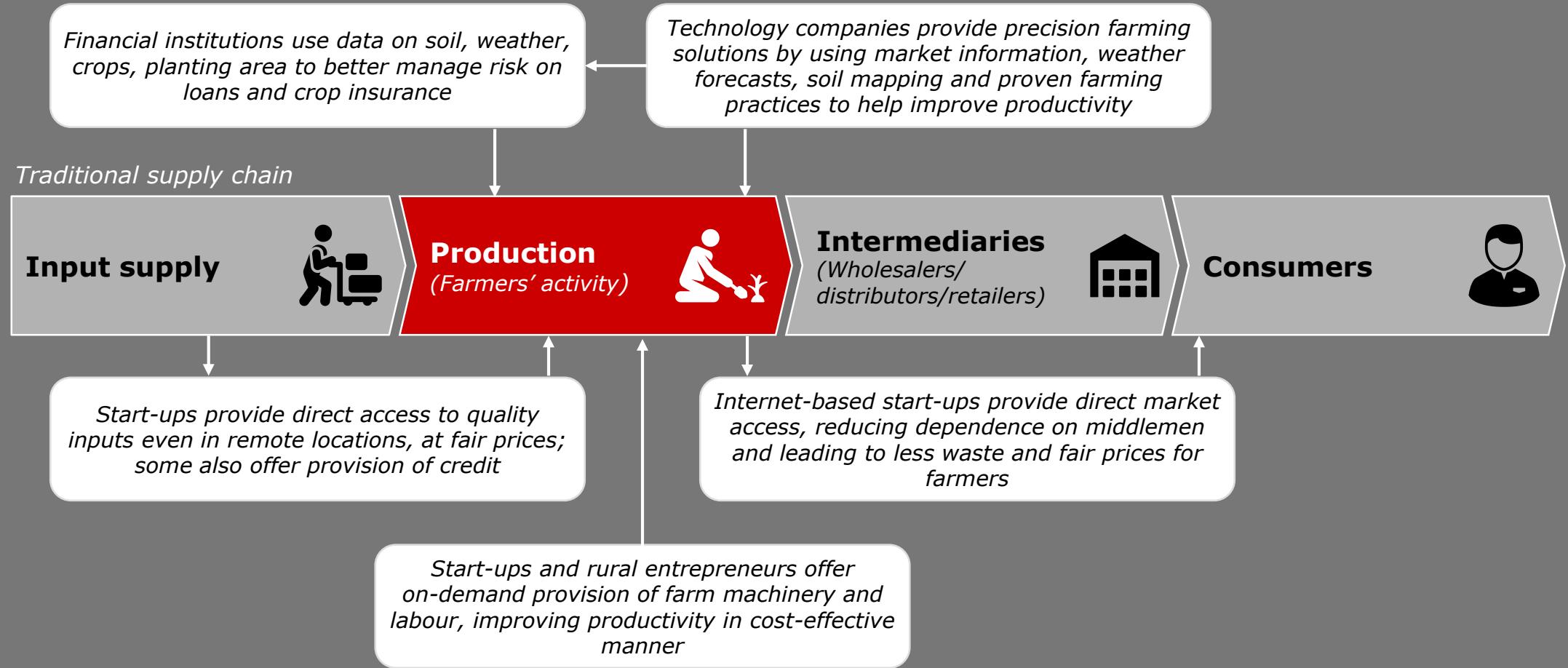
Farmer-end market

- Virtual platforms such as mobile apps or online stores connect farmers with consumers of their produce, eliminating excessive layers of intermediaries and helping farmers get a fair price for the produce

Requirements

- High penetration of broadband or mobile communication
- Team presence in the target markets to allow for change in farmer behaviour
- Efficient transportation, storage network
- Proximity of farms to physical marketplace for perishable produce

FaaS technologies and platforms are helping farmers improve productivity and economics across supply chain



In addition to farmers, cooperatives and corporations (particularly commodity or food & beverage players) are well placed to benefit from FaaS. These can act as aggregators and offer FaaS to smallholder farmers to improve quality, quantity, price and consistency of inputs to their products.

FaaS innovations are highly adoptable and scalable; capex requirement depends on the business model

Value chain applicability	Farm management solutions	Production assistance	Access to markets
	Pre-production	Production	Post-production
Scalability	High 	Medium 	Medium 
Adoptability	Medium 	High 	High 
Capital expenditure	Low-High 	Low-High 	Low-High 

Farm management solutions

- Scalable across geographies given heavy reliance on software-based solutions

Production assistance

- Significant effort to be economically viable, as it is crucial to establish operations in the farmers' locations and develop a variety of skills

Access to markets

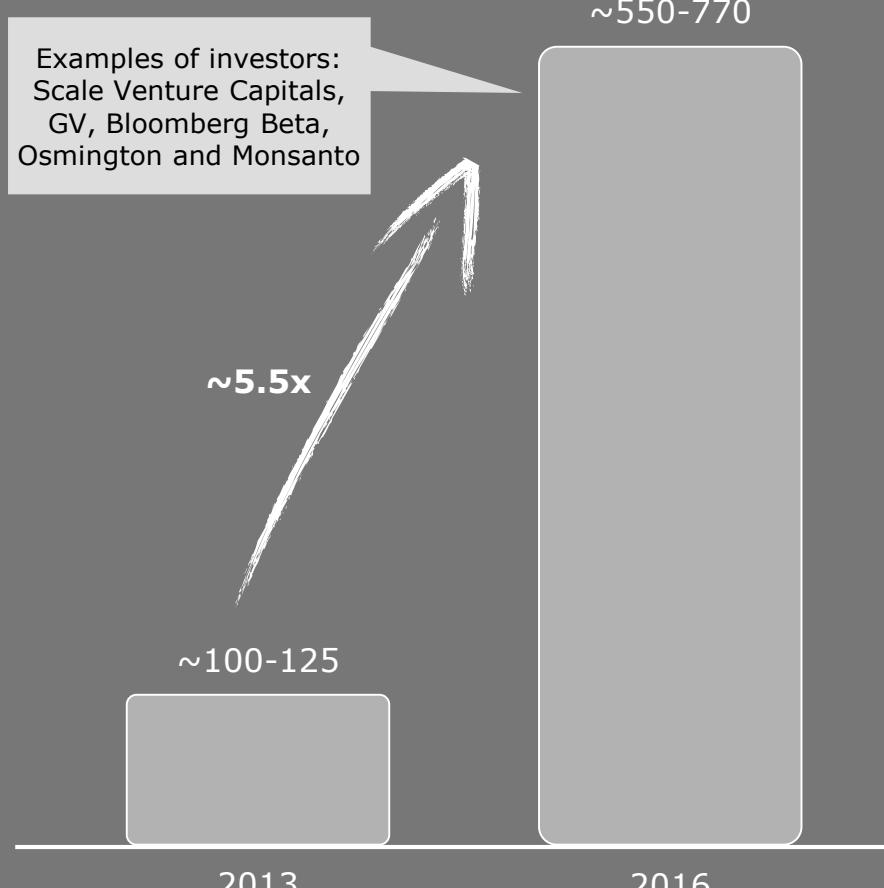
- Need significant supply chain intervention and control along with technology application

Sources: Bain analysis; expert calls

FaaS solutions have been adopted globally and VC funding for FaaS-based start-ups has grown substantially

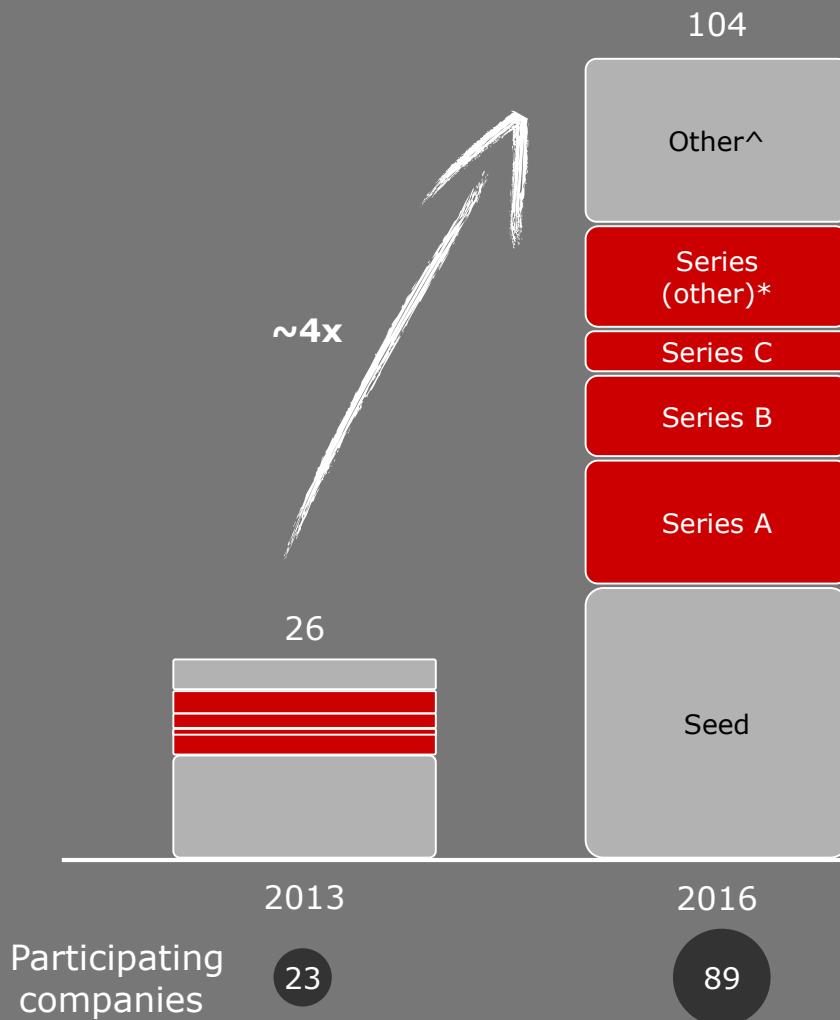
VC funds to FaaS based start-ups

USD million



VC funds to FaaS-based start-ups

Funding rounds



*Series (other) includes companies which do not mention the exact stage of series funding

[^]Other includes angel funding, convertible notes, grants, non-equity assistance, post-IPO equity, private equity, M&A, debt financing and bootstrapped

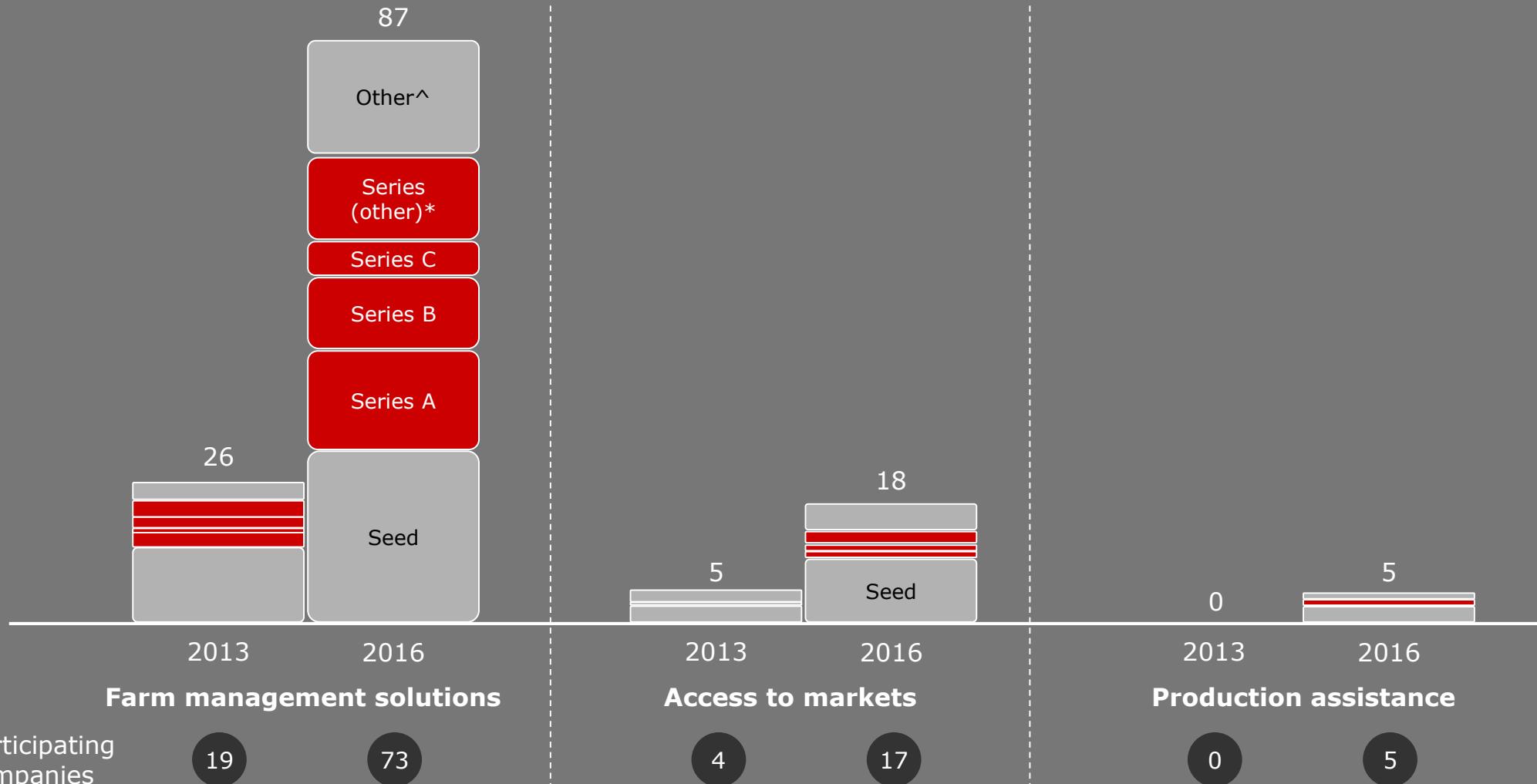
Notes: Based on a sample of 23 (2013) and 89 (2016) FaaS-based companies; companies classified at their current stage of funding

Sources: Crunchbase; Tracxn; company websites; Bain analysis

Globally, start-ups that offer farm management solutions received highest number of funding rounds

FaaS categories' funding rounds by funding type

Funding rounds



*Series (other) includes companies which do not mention the exact stage of series funding

^Other includes angel funding, convertible notes, grants, non-equity assistance, post IPO equity, private equity, M&A, debt financing and bootstrapped

Notes: Data is directional; the number of start-ups across different categories may not add up to total number of firms as some provide multiple services

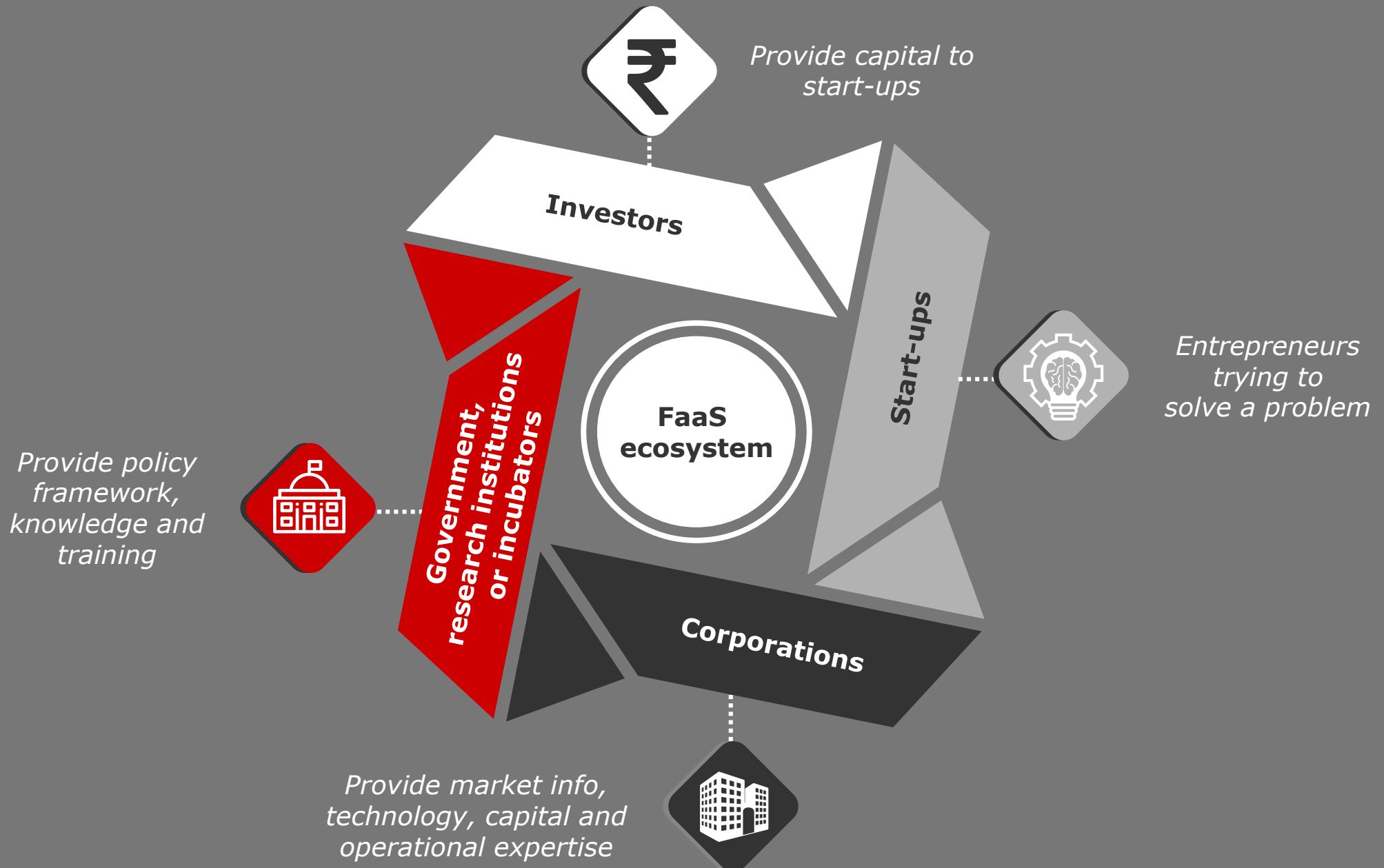
Sources: Crunchbase; Tracxn; company websites; Bain analysis



Current scenario of Farming as a Service in India

- As with other regions, FaaS in India has witnessed considerable growth, with the number of FaaS-based start-ups doubling since 2013.
- Total investor funding in India in the sector currently stands at \$105 million to \$115 million, with more than 40% of funding rounds at the “series stage,” indicating a high level of investor confidence in investing more money in the growth stage and lack of sufficient capital at seed stage.
- Major investors currently include Accel Partners, IDG Ventures, Aavishkaar, Ankur Capital, Aspada, Global Innovation Fund, IvyCap Ventures, Sophia Investment ApS and Infuse Ventures.
- Several corporations have started using their initiatives to support FaaS. Mahindra & Mahindra, TAFE, John Deere and ITC have launched major initiatives in the production assistance and access-to-markets space. Some of these corporations are planning to offer farm management solutions as well.
- Given the importance of agriculture in India, both the central and state governments have been taking steps to address the various challenges and promote innovation.

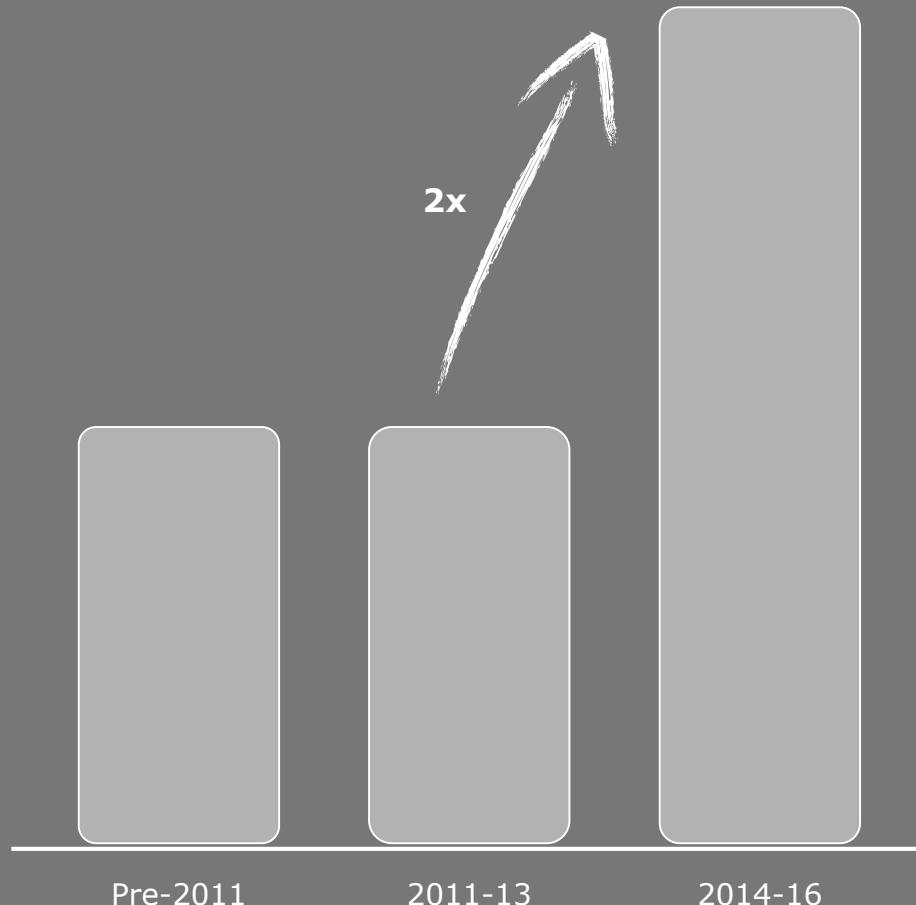
In India, four stakeholders make up the FaaS ecosystem



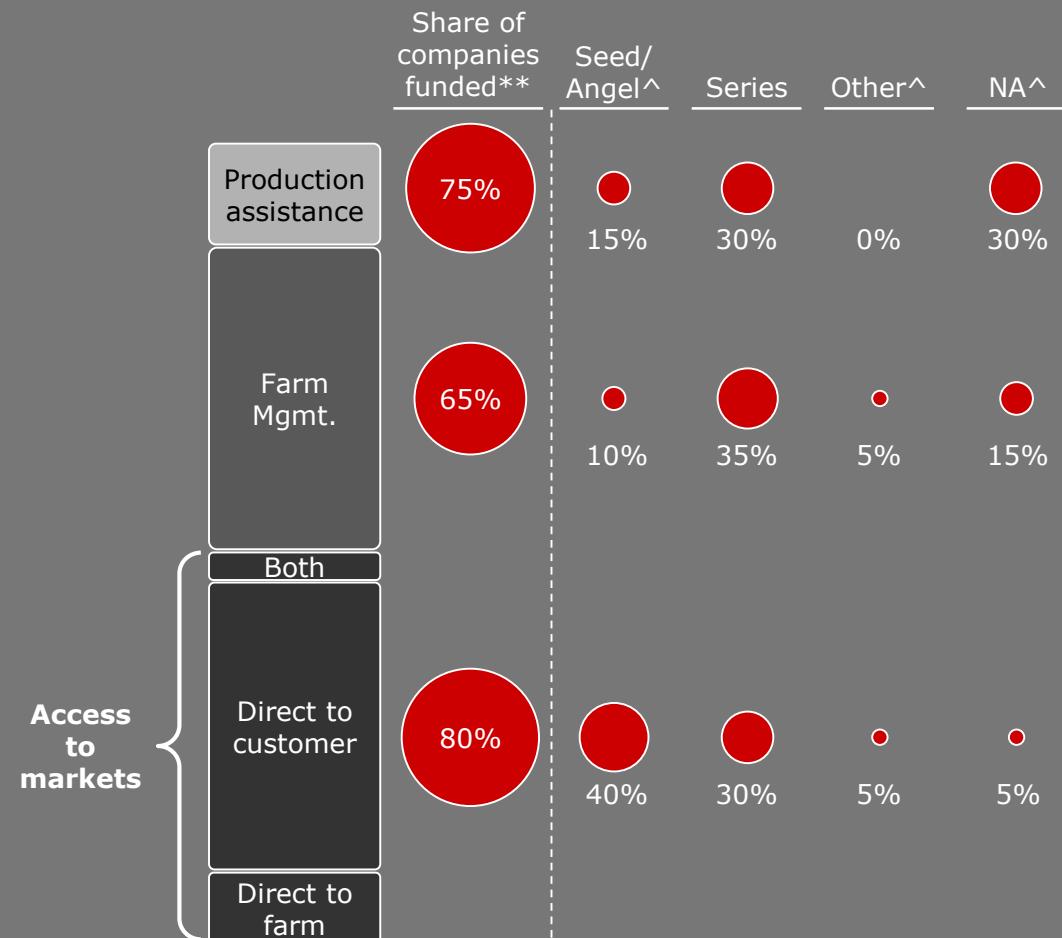
About 50% of FaaS start-ups began after 2013; most provide market access or farm management solutions

Evolution of FaaS-based start-ups in India

Number* of start-ups founded



Breakdown of current FaaS start-ups by type of services offered and funding received*



*Directional data based on a sample set of about 50 start-ups

**Some start-ups offer multiple services

^Companies which are only at seed stage; excludes companies which have moved to Series A stage; other includes M&A or PE deals; NA denotes that the start-up has received funding but funding information is not available

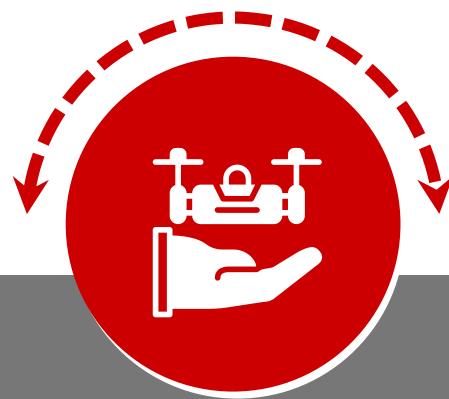
Notes: Based on data available in public domain; it is possible that other start-ups may have funding but have not been captured as data is limited

Sources: Crunchbase; Tracxn; company websites; Bain analysis

Existing start-ups have been trying to address some of India's agricultural challenges

Farm management solutions

- Improve the dissemination of information to increase technical knowledge
- Improve yield and productivity



Production assistance

- Make machinery more affordable
- Overcome lack of technical know-how and shortage of skilled labour
- Increase farmers' access to technology



Access to markets

- **Input to farm:** Reliable and timely procurement of quality seeds, fertilisers, pesticides, insecticides
- **Farm to consumer:** Increase farmers' income and customer reach; eliminate unnecessary layers of middlemen



Corporations involved in agriculture and allied activities are also showing interest in FaaS

Farm management solutions



Mahindra & Mahindra

- Mahindra & Mahindra Group is exploring the use of drones for soil mapping and testing, which in turn can help grow suitable crops

Production assistance from corporations



Mahindra & Mahindra

- Trringo, a Mahindra & Mahindra Group venture, is an equipment rental start-up which operates a franchisee-based and marketplace-based model
- Recently provided seed funding to Gold Farm, a farm equipment aggregator

John Deere

- John Deere India promotes custom hiring centres across multiple states
- Partnered with EM3 to provide technical support to EM3's tractor and harvester fleets

Access to markets



Mahindra & Mahindra

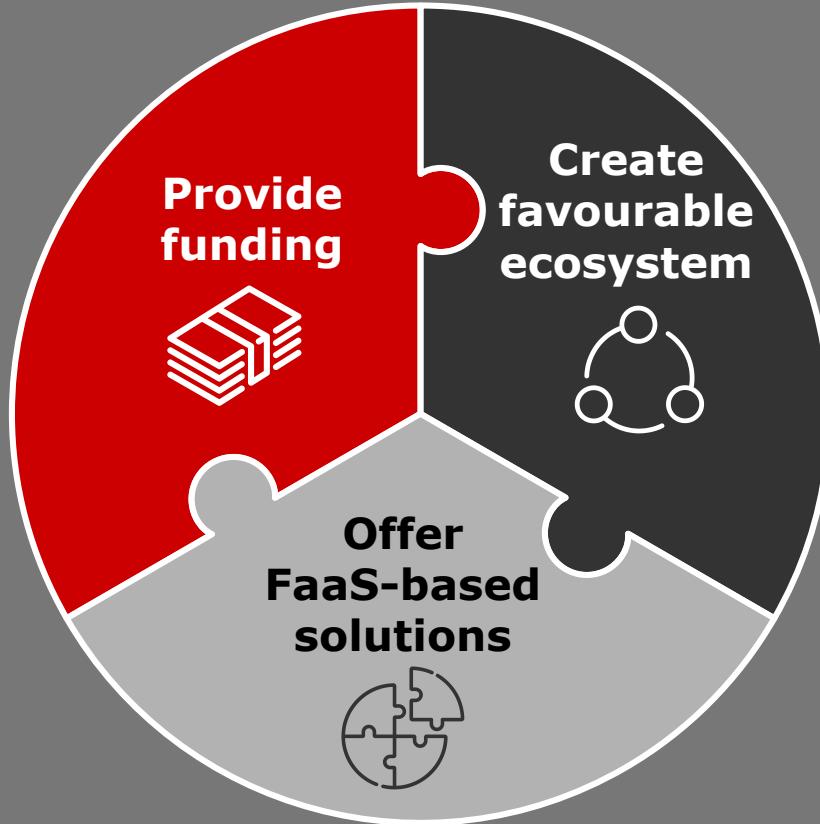
- Mahindra & Mahindra Group's agribusiness unit has invested in MeraKisan, an e-commerce platform which sells fresh vegetables and fruits directly to consumers

ITC

- Through its initiative E-Choupal, procures produce directly from farmers
- Currently looking to expand and convert itself into an aggregator of agricultural and other related services

Government is actively promoting FaaS via funding, policymaking and direct provision of services

- Offers financial assistance to small- and medium-size enterprises via several institutions such as National Bank for Agriculture and Rural Development
 - Farmer financing target increased to ~\$147 billion in last Union Budget



- Custom hiring centres (CHC):
 - Various state governments rent farm machinery (under PPP model) to small farmers
- Soil health card:
 - Provides soil nutrient status to farmers and advice on fertiliser dosage
- eNAM:
 - Pan-India electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities

- Academic and research institutions create incubators to provide early-stage support for start-ups:
 - CII at IIM Ahmedabad, one of the notable incubators, incubates and invests in early-stage start-ups
 - IIM Ahmedabad also offers a two-year programme on Food & Agribusiness Management

Investors' interest in FaaS-based start-ups in India has increased significantly over the past couple of years

VC funding in FaaS-based start-ups in India

USD million

~105-115

Funding post-2016

Funding prior to 2016

Cumulative funding

Start-up examples	Investor	Investment (USD)
AgroStar <i>(Access to Markets)</i>	Accel Partners	~\$10M (Series B, 2017)
	IDG Ventures	
	Aavishkaar	
	IDG Ventures (lead)	
	Aavishkaar*	
	Kunal Behl and Rohit Bansal (Snap Deal fame, Angel Investors)	
EM3 <i>(Production Assistance)</i>	Global Innovation Fund	~\$10M (Series B, 2017)
	Aspada	
	Aspada	~\$3.3M (Series A, 2015)
CropIn <i>(Farm Management Solutions)</i>	Beenext	Undisclosed (Pre-Series A, 2016-2017)
	Ankur Capital	
	Invested Development	
	Sophia Investment ApS	~\$4M (Pre-Series A, 2016)
	Invested Development (Lead)	
	Ankur Capital	~\$680,000 (Seed, 2014)
	Seeders Venture Fund	

*Aavishkaar also participated in a previous round, but funding data is unavailable

Notes: Based on a sample set of about 50 FaaS-based start-ups in India; ~\$105-115 million is extrapolated data based on 35 large start-ups which account for ~\$105 million funding

Sources: Crunchbase; Tracxn; VCCircle; company websites; PR Newswire; Bain analysis



The way forward for Farming as a Service

- FaaS can help address inefficiencies across the agricultural supply chain, such as low productivity, lack of farm mechanisation, access to markets and data asymmetry.
- FaaS will encourage product innovations such as multipurpose agricultural equipment and tools for real-time data capturing and analysis.
- FaaS has the potential to spark an economic and social revolution by improving the status of small and marginal farmers.
- Coordination between all the direct stakeholders (start-ups, investors, governments and corporations) and indirect stakeholders (local entrepreneurs, implement suppliers, agronomists and IT vendors) is critical for the success of FaaS.
- Addressing the key structural challenges, such as the lack of infrastructure, technology and financing, the resistance from the ground level and regional differences, is critical to realising the concept's full potential.
- In the future, all the FaaS solutions—farm management solutions, production assistance and access to markets—are expected to converge into a single model, as the end customer is the farmer.

FaaS could potentially address inefficiencies across India's agricultural supply chain

Pre-production

- **Land:** Avoid soil degradation by adopting farming practices suitable to soil composition
- **Consumable supplies:** Make quality seeds, fertilisers and pesticides more accessible
- **Information:** Teach farmers to plan better for demand, crop selection and cropping patterns

Production

- **Equipment:** Solve the problem of low farm mechanisation
- **Labour:** Overcome the shortage of skilled labour and low productivity
- **Utilities:** Offer better irrigation and power facilities

Post-production

- **Storage and transportation:** Reduce post-harvest food waste
- **Supply chain:** Eliminate middlemen, allowing farmers to earn fair profit on their crops
- **Marketing:** Decrease costs associated with sales and distribution



FaaS has the potential to spark an economic and social revolution by improving the status of small farmers

Increase income in rural areas

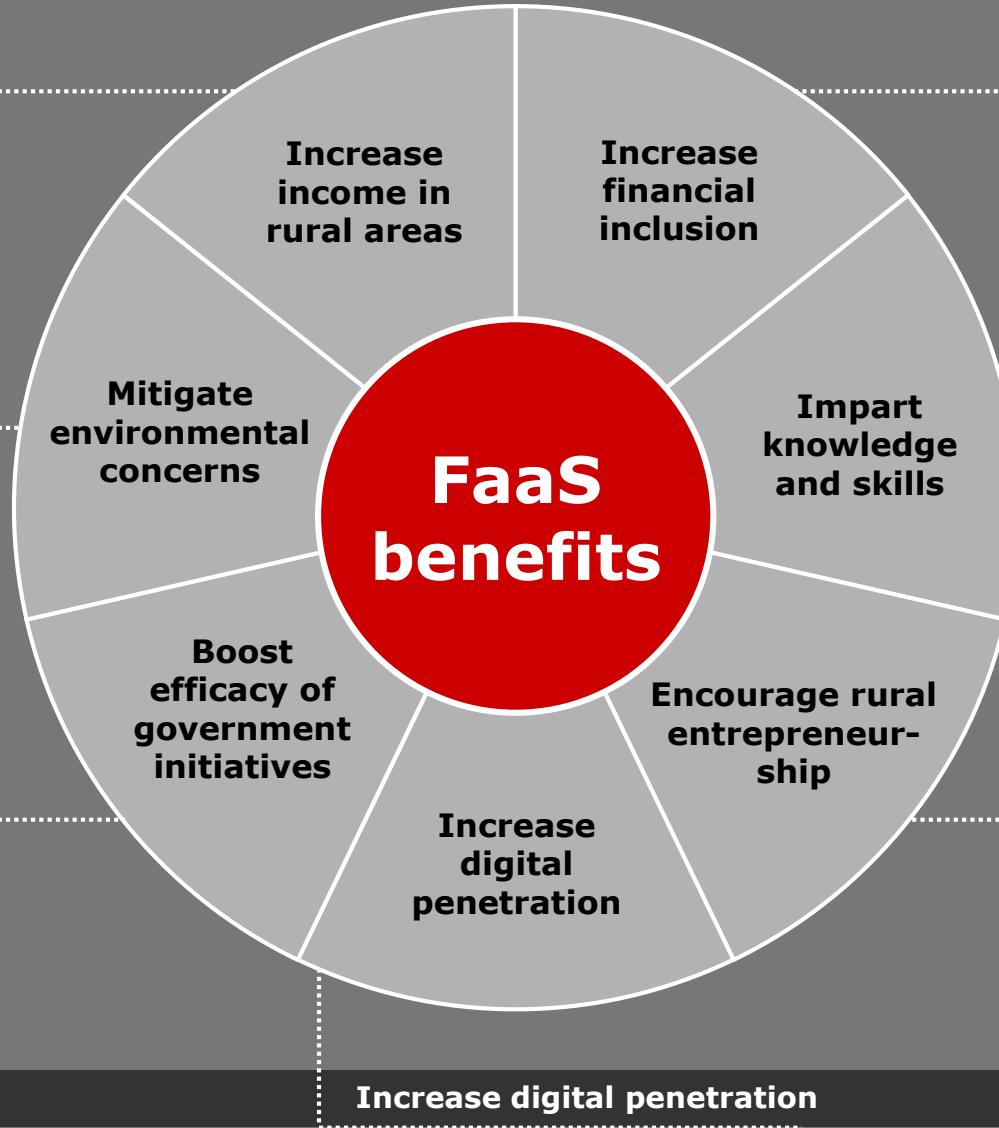
Generate employment and limit migration of labour to urban areas

Mitigate environmental concerns

Promote agricultural practices to improve water use, restore soil fertility and reduce carbon footprint

Boost efficacy of government initiatives

Collaboration with FaaS centres for delivery of various social programmes and benefits for the rural population including government subsidies



Increase financial inclusion

Improve access to institutional credit driven by improved availability of data about farms and farmers

Impart knowledge and skills

Empower farmers to make informed decisions, thereby reducing uncertainty and unpredictability of their yield

Encourage rural entrepreneurship

Promote rural entrepreneurship as rural entrepreneurs will be vital link for delivery of FaaS to smallholder farmers

Close coordination among all stakeholders is key to the success of FaaS

Investors

- Nurture and mentor start-ups
- Improve collaboration among portfolio companies via experience sharing
- Support government initiatives and urge favourable policies



01

02

Areas of potential contribution

03

04

Start-ups

- Offer tailor-made solutions for small-scale farmers
- Spread awareness to encourage participation
- Ensure quality control and fair prices



Government

- Provide easier access to credit in form of low-interest loans
- Involve private sector in developing critical infrastructure
- Set up regional agro-dedicated start-up incubators



Corporations

- Manufacture equipment that is cheaper for marginal farmers
- Increase competitiveness in the FaaS industry through independent business units
- Use CSR funds to provide capital to start-ups

Certain challenges must be addressed before the full potential of FaaS-based solutions are realised

Infrastructure

- Poor transportation and logistics infrastructure make access to markets unaffordable and inconvenient for start-ups
- Communication networks such as the Internet are underdeveloped in rural areas, leading to inaccessibility of services



Technology

- Limited understanding of technology is a barrier to adoption of tech-based FaaS services such as farm management solutions



Resistance

- Resistance from existing stakeholders
 - The traditional agriculture suppliers' business will be negatively affected by "access to markets"-based start-ups, for example
- Farmers are reluctant to adopt solutions with unproven benefits



Regional variations

- Varying legal environments across states impede start-ups' growth
- Diversity in agricultural topography, cropping pattern, cultural and linguistic behaviours



Financing

- Limited availability of funds for start-ups
- Longer gestation periods for asset-heavy model



As FaaS matures, the consolidation and expansion of services becomes inevitable

Product convergence

From multiple providers



to a single provider

Consolidation and expansion

From local scale



to global consolidation

State or local

- Venture capital rounds (<\$10M) to scale the operations

National or global

- PE firms, corporations and other strategic players to encourage sector-wide consolidation and expand operations nationally or globally

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