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INDIA'S AGRITECH REVOLUTION: EMPOWERING THE INDIAN AGRICULTURE INDUSTRY

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INDIA'S AGRITECH REVOLUTION: EMPOWERING THE INDIAN AGRICULTURE INDUSTRY

"During the Amrit Kaal, India is focussing on inclusive growth along with higher agriculture growth."

- PM NARENDRA MODI

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To give wings to MeitY's vision of promoting technology innovation, start-ups and creation of Intellectual Properties, a nodal entity called MeitY Start-up Hub (MSH) has been setup under its aegis. MSH is a dynamic, singular and collaborative platform for tech startup community towards building meaningful synergies in the Indian start-up space. MSH's quick value additions to domestic tech startups in terms of improving scalability, market outreach and domestic value addition and setting up innovative partnerships with various stakeholders has been a key differentiator in MSH's efforts to catapult the tech startup ecosystem in the country.
MSH is acting as a hub and ensuring synergies among all the TIDE 2.0 Centres, theme-based incubation centres, domain specific Centre of Excellences on Emerging Technologies and other existing platforms for facilitating criss-crossing of technology resources, sharing best practices and ideas across the entire gamut of innovation and startup ecosystem.

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A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. FICCI encourages debate, engages with policy makers and civil society, and articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

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Contents

1. INTRODUCTION

Deeply rooted in a rich tradition of agriculture, India has witnessed a dramatic transformation in this vital sector over recent years, underpinned by the widespread adoption of AgriTech solutions. Such technological integration has been a boon to Indian farmers, as India positions itself as one of the leading global exporters of agricultural products. The 2020-21 year marked an 18% increase in the country's export of agricultural and allied commodities from the preceding year, reaching an unprecedented zenith of US$ 50.2 billion in 2021-22.[1]

This impressive success story is spearheaded by the commendable endeavours of the Indian Kisan, steadfastly ensuring the provision for India's burgeoning population. The Indian agricultural sector has maintained a robust average annual growth rate of 4.6% over the last six years, contributing significantly to the nation's larger growth trajectory. Even amidst the global tumult of the COVID-19 pandemic, this sector remained a beacon of resilience, primarily due to the government's decisive actions to bolster farmer-producer organisations, stimulate crop diversification, enhance productivity, support mechanised farming, and fortify financial resilience through the establishment of a Rs 1 lakh crore Agri Infrastructure Fund.[2]

Over the last few years, India's AgriTech landscape has seen a phenomenal metamorphosis. An explosive growth in startups, from less than 50 to well over a thousand, marks this exciting evolution. The AgriTech market in India is teeming with potential, forecasted to deliver a near 50% compound annual growth rate over the ensuing five years.[3] A study conducted by Ernst & Young[4] underlines the immense potential, estimating the Indian AgriTech sector to be valued at a staggering US$ 24 billion by 2025.[5]

This vibrant sector can be divided into various segments, namely supply chain tech and output market linkages (US$12.0 billion), Financial Services (US$4.1 billion), precision agriculture and farm management (US$3.4 billion), quality management and traceability (US$3.0 billion), and market linkages - farm inputs (US$1.5 billion). The Impact Investors Council report revealed a remarkable leap in investment value in AgriTech startups, soaring from $ 412 million in 2020 to $ 889 million the following

1. Ministry of Finance Economic Survey 2022-23. Agriculture And Food Management: From Food Security To Nutritional Security. India Budget. https://www.indiabudget.gov.in/economicsurvey/doc/eschapter/echap08.pdf
2. Prime Minister's Office, PM launches financing facility of Rs. 1 Lakh Crore under Agriculture Infrastructure Fund, Press Information Bureau, (2020 August 9) https://www.pib.gov.in/PressReleasePage.aspx?PRID=1644529#:~:text=Agriculture%20Infrastructure%20Fund,-The%20Agriculture%20Infrastructure&text=The%20duration%20of%20the%20scheme,2%20Crore.
3. Avendus Capital (2022 December 14) Indian AgriTech to become a USD34 Billion market by 2027, growing at a CAGR of 50% over the next 5 years. Retrieved on July 15, 2023 from https://www.avendus.com/india/reports/55 or https://community.nasscom.in/communities/agritech/rise-agritech-ecosystem-2023
4. Madan,A. et al (2020 August) Agritech - towards transforming Indian agriculture, Ernst & Young. Retrieved on July 15, 2023 from https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/start-ups/2020/09/ey-agritech-towards-transforming-indian-agriculture.pdf
5. Ernst & Young. (2020, September 7). Indian agritech startups are operating in a market with an estimated potential of US$24b by 2025: EY. Retrieved July 12, 2023, from https://www.ey.com/en_in/news/2020/09/indian-agritech-start-ups-are-operating-in-a-market-with-an-estimated-potential-of-us-24-billion-dollars-by-2025

year, although experiencing a slight dip to $ 846 million in 2022.[6] This marked growth underscores the sector's durability and potential, making it an enticing investment proposition.

The Indian government, cognisant of the transformative power of digital and hi-tech solutions in agriculture, has rolled out several initiatives to introduce advanced services to farmers. The 2023 Budget earmarked a generous Rs 450 crore for the Digital Agriculture Mission and an additional Rs 600 crore to stimulate the agriculture sector through technology.[7] This progressive strategy underlines the government's commitment to employ technology and cultivate alliances to empower farmers, thereby improving productivity and overall welfare. Simultaneously, the regulatory environment in India has progressively adapted, facilitating the growth and assimilation of digital technologies in agriculture.

AgriTech promises to revolutionise agricultural supply chain processes, from the farm to the dining table, optimise farmers' capacities, utilise resources efficiently, and address the emerging challenges of climate change. Innovations, supported by various governmental measures, are recalibrating how food is grown and distributed. AgriTech presents myriad opportunities throughout the value chain, potentially easing input market linkages, enabling precision agriculture to bolster yield, instituting quality management and traceability, streamlining post-harvest supply chains, and giving farmers access to credit and insurance.

6. Suvarna, A. (2023, March 31). Impact investors flock to startups in agritech. Mint. Retrieved July 12, 2023, from https://www.livemint.com/companies/start-ups/impact-investors-flock-to-startups-in-agritech-11680203735266.html

7. Ministry of Agriculture and Farmers Welfare. (2023, February). Many key provisions for agriculture and farmers' welfare in the budget. Press Information Bureau. Retrieved July 12, 2023, from https://pib.gov.in/PressReleasePage.aspx?PRID=1895533

2.

INITIATIVES TO BOOST UPTAKE OF AGRITECH IN INDIA

The vital role of agriculture and allied sectors as the cornerstone of the Indian economy cannot be overstated. Beyond its indispensable contribution to rural employment and food security, several industries, such as consumer packaged goods, retail, chemicals, and e-commerce, rely heavily on the products derived from this sector. Recognising its significance, the Indian government has consistently championed the agricultural industry over recent years, providing robust support to farmers through various schemes and measures to unlock their full potential.

Among the more significant initiatives, the Union Budget 2023 features notable efforts such as the agricultural accelerator fund and establishment of digital public infrastructure for agriculture.[8] These initiatives seek to boost the burgeoning AgriTech sector and foster innovation that will fortify it against future challenges. As the agricultural sector and AgriTech evolve, they will depend on strategic, evidence-based, and policy-driven government support to achieve their growth potential.

To this end, the Indian government has embarked on several transformative schemes and initiatives to stimulate technology and innovation within the agricultural sphere, as discussed below.

2.1. Agristack

One of the most ambitious government initiatives is the development of AgriStack, formally known as the India Digital Ecosystem of Agriculture (IDEA). AgriStack endeavours to build a consolidated database of agricultural data sets anchored by farmers' land records. Its primary purpose is to address pressing challenges, such as inadequate access to credit and inefficiencies in the agricultural supply chain. In a landscape where most farmers possess limited resources and have restricted access to formal credit or transformative technologies, AgriStack is poised to be a game-changer. It has the potential to help farmers enhance their productivity and secure better market prices.

AgriStack incorporates a wide range of digital farming technologies and services, from employing drones to assess soil conditions — a step that can guide sustainable pesticide use and enhance crop yields — to providing bespoke recommendations to farmers. These include advising on the optimal seeds for specific soil types, suggesting the best practices to boost yield, and offering regular updates on weather, insurance, and other crucial factors. Such insights will facilitate expedient and informed decision-making for farmers.

While AgriStack is designed to evolve over time, its initial framework[9] comprises several key components, detailed as follows:

8. Ministry of Finance. (2023.). Union Budget 2023-24. India Budget | Ministry of Finance | Government of India. Retrieved July 6, 2023, from https://www.indiabudget.gov.in/
9. Ministry of Agriculture and Farmers Welfare. (2023). The Central Core of Agri Stack. Agri Stack. Retrieved July 12, 2023, from https://agristack.gov.in/

1. Farmer and Farmland Plot Registries

This is a unified registry that encompasses all farmers in the country, compiled by the individual states based on common standards and maintained by the centre. Each farmer will be given a unique FarmerID, a functional ID based on Aadhaar as per InDEA 2.0, and a digitally verifiable credential. The farmer registry will strictly be dynamically connected to their respective farmland plot records for non-legal, planning, advisory, and scheme delivery purposes. These registries will lay the groundwork for efficient and transparent services and scheme delivery by government authorities.

2. Unified Farmer Service Interface

This interface is the key component that allows for interoperability among Agristack's stakeholders. It incorporates a standardised schema and API definitions, together with their respective specifications.[10] This interface is intended to be utilised by government bodies and authorised private entities such as banks, AgriTechs, and agriculture value-chain companies.

3. Crop Sown Registry

This registry aims to document the crops being cultivated across the country every season, on each farm by each farmer. The Crop Sown Registry will overhaul and enhance the formerly prevalent paper-based methods of surveying crops by incorporating smartphone and image-based techniques, including future use of drone and satellite images. This innovative system will enable state and central governments to swiftly and accurately estimate crop production, comprehensively understand the crops grown, and plan targeted interventions and support to address crop-specific issues. Additionally, it will empower government and private service providers to tailor schemes, services, seeds, fertilisers, pesticides, farm machinery, advice, and credit to the specific needs of individual farmers.

4. Agristack Sandbox

Promoting innovation in the agricultural ecosystem is at the heart of Agristack's objectives. Consequently, it is essential to provide various stakeholders, such as individuals, start-ups, private companies, and public entities, access to the services aggregated by Agristack. Moreover, these stakeholders need a secure and controlled environment to test their ideas, products, and services without influencing real-world operations.

5. Consent Manager

Since the registries handle farmers' personal data, ensuring data privacy and adherence to the prevailing data privacy norms and regulations is paramount. The Consent Manager serves as a robust consent architecture that is both easy and convenient for the

[10] Ministry of Agriculture & Farmers Welfare (2021 February 12) National e-Governance Plan in Agriculture (NeGPA): Towards the Mission of Digital Agriculture. Press Information Bureau. Retrieved on July 15, 2023 from https://pib.gov.in/PressReleasePage.aspx?PRID=1697526

data principals, namely, the farmers. It enables the secure sharing of personal data solely with those individuals or entities to whom the data principal (the farmer) has granted permission. Furthermore, once given, consent may be revoked, thereby preventing any future data sharing.

Through the fundamental architecture of Agristack, the government is aspiring to achieve several significant objectives. These are:

- Enhance the delivery of government benefits and schemes, ensuring they reach Indian farmers swiftly and with ease.
- Establish a presence-less layer to facilitate prompt identification and authentication of farmers.
- Diminish both the cost and risk associated with agricultural services for farmers and other stakeholders, including agri-credit providers, finance institutions, and input providers.
- Facilitate simpler convergence of schemes between agri-allied ministries and state governments, thus better serving Indian farmers.
- Fuel innovation in products and services offered by AgriTechs through facilitated access to high-quality data.

2.2. National Agriculture Market (eNAM)

A crucial initiative driving AgriTech uptake in India is the National Agriculture Market (eNAM), a nationwide electronic trading platform. Designed to connect existing Agriculture Produce Market Committee (APMC) mandis, eNAM eliminates information asymmetry between buyers and sellers. It harmonises national markets for agricultural goods, ensuring fair prices for farmers and facilitating real-time price discovery driven by actual demand and supply dynamics.

The overriding objective of eNAM is to streamline marketing and transaction processes across the country, promoting the efficient operation of markets. It creates better opportunities for farmers and sellers, ensuring consumers gain access to quality products.

In 2016, Prime Minister Narendra Modi launched the eNAM portal, stating, *"I firmly believe that now my farmers will decide where, when and at what price their produce will be sold. And it is my belief that there would be no burden on the consumer."*

Table 1: Stakeholder-wise Advantages of eNAM[11]

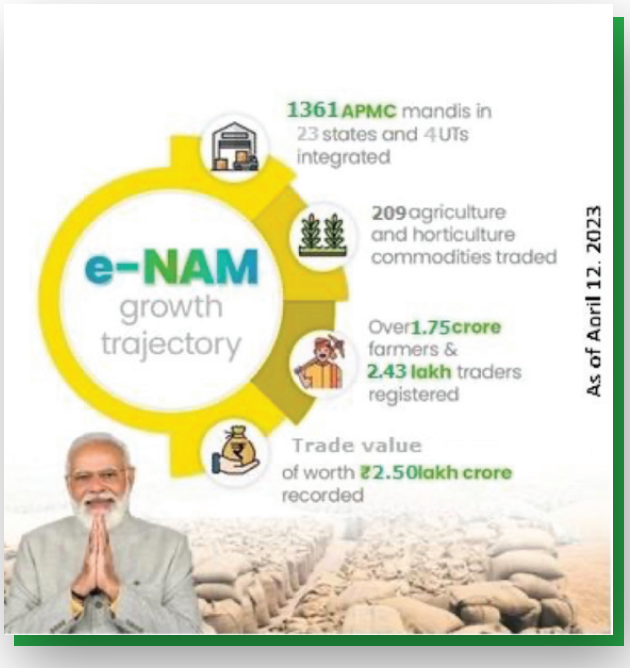
Stakeholder	Advantages
Farmers	• **Direct Selling:** eNAM allows farmers to sell their produce directly, eliminating broker or middlemen interference, and therefore ensuring they receive better returns on their investment. • **Access to Multiple Markets:** Through the eNAM, farmers can partake in secondary trading across various Agricultural Produce Market Committees (APMCs) in India, thereby expanding their market reach and creating greater opportunities.
Traders	• **Expanded Market Reach:** eNAM's platform allows traders to engage in secondary trading across multiple APMCs, which opens up a wider range of commodities and markets. • **Transparency and Regulation:** Thanks to eNAM's transparent system, effective monitoring and regulation of traders and commission agents is achievable, ensuring fair market practices.
Consumer	• **Stable Prices:** eNAM's increased competition amongst traders results in price stability, ensuring that consumers enjoy affordable and readily available commodities. • **Improved Quality:** The efficient sourcing and delivery encouraged by NAM foster higher-quality products for consumers.
Buyers, Processors, and Exporters	• **Enhanced Sourcing Options:** eNAM allows buyers, processors, and exporters to source commodities from any mandi in India, offering a broader range of options and reduced intermediation costs. • **Cost Savings:** The streamlined processes and reduced intermediation costs lead to operational cost savings for buyers, processors, and exporters.

11. Tiwari, S. (2021, September 17). eNAM-Objectives, Eligibility & Advantages. Agriculture Wale. Retrieved July 12, 2023, from https://www.agriculturewale.com/enam/

Mandis	• **Operational Efficiency:** eNAM's electronic system eases the burden of bookkeeping, reporting, and tendering processes, leading to improved operational efficiency for mandis. • **Increased Revenue:** With the accurate accounting of all transactions in the market, mandis can anticipate an increase in market allocation fees.

Figure 1: How eNAM is making Farmers Atmanirbhar[12]

Figure 2: Growth Trajectory of eNAM[13]



2.3. Agriculture Accelerator Fund and Digital Public Infrastructure for Agriculture

In the Union Budget of 2022-23, the Indian government allocated provisions for the establishment of an Agriculture Accelerator Fund.[14] This fund is specifically designed to invigorate the efforts of youthful entrepreneurs and start-ups in rural regions, engaging in agricultural initiatives. It will create innovative, affordable solutions aimed at resolving the issues plaguing farmers. By leveraging modern technologies, these solutions will transform farming practices and boost productivity. Furthermore, it will fortify

12. Ministry of Agriculture and Farmers' Welfare. (2023, April). One Nation One Market for Agricultural produce. Press Information Bureau. Retrieved July 6, 2023, from https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/apr/doc2023414181301.pdf
13. Ministry of Agriculture and Farmers' Welfare. (2023, April). One Nation One Market for Agricultural produce. Press Information Bureau. Retrieved July 6, 2023, from https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/apr/doc2023414181301.pdf
14. Ministry of Agriculture and Farmers Welfare. (2023, February). Union Budget 2023 Agricultural Sector. Press Information Bureau. Retrieved July 6, 2023, from https://pib.gov.in/PressReleasePage.aspx?PRID=1895308

the AgriTech ecosystem, leading to wider acceptance of digital services and a plethora of technology-based solutions available to the agricultural community.

The government has unveiled plans to establish a Digital Public Infrastructure for Agriculture, characterized by its emphasis on open-source, open-standard, and interoperable public commodities. The primary objective of this infrastructure is to facilitate six key farmer-centric resolutions by offering relevant information services. These services encompass various aspects, including crop planning and health management, improved access to essential farming inputs, credit and insurance support, assistance with crop estimation and market insights, and the promotion of the AgriTech industry and startups. These endeavors are poised to equip young 'Agri-preneurs' with cutting-edge technologies, thereby laying a robust foundation for burgeoning innovation within the agricultural sector.

2.4. Digital Soil Health Cards

Digital Soil Health Cards represent a significant strategy within the government's soil health management scheme, aimed at endorsing integrated nutrient management via judicious fertiliser usage. Profiling the soil composition and quality is integral for agritech companies in India, enabling the promotion of precision-farming initiatives that cater to specific geographic locations and farmer collectives. The government is channeling efforts towards establishing a network of 7500 soil health 'agripreneurs' at the gram panchayat and block levels.[15] This network will be equipped with automated soil testing machinery, enabling doorstep soil sample collection and immediate report dispatch via SMS. Furthermore, the government has overhauled the Soil Health Card portal, designed to offer farmers a simple decision-making tool.[16] The portal provides reports with emoticons indicating soil health, and it exists as a web and mobile-based application that generates Soil Health Cards in 22 languages, five dialects, and local units, thereby benefiting farmers across the nation in a uniform and standardised manner.

2.5. Easier digital reach through Farmer Producer Organisations

Farmer Producer Organisations (FPOs) comprise a collective of active farmers pursuing agribusiness activities in unison. They strengthen the economic prowess of farmers and enhance market linkages, consequently improving their income. The government has pledged support for the establishment of 10,000 FPOs by the 2027-28 year,[17] aimed at bolstering farmers' incomes. Additionally, 713 Krishi Vigyan Kendras and 684 Agricultural Technology Management Agencies are being set up to disseminate technology amongst the farming community. By consolidating the otherwise fragmented farmer base, FPOs facilitate agritech companies in scaling their business models and fueling the growth of the AgriTech ecosystem. NITI Aayog also posits that FPOs can serve as key focal points for empowering local institutions and fostering the development of local agricultural

15. Das, P. (2023, April 14). Centre to revamp soil health card initiative to aid farmers. Mint. Retrieved July 6, 2023, from https://www.livemint.com/news/india/government-invests-596-51-crore-in-revamped-soil-health-card-initiative-to-aid-small-farmers-50-million-soil-specimens-to-be-analyzed-in-3-years-11681408045050.html

16. Ministry of Agriculture & Farmers Welfare. Soil Health Card Portal A Card for Soil Health Management. National Informatics Centre | Govt. of India. Retrieved July 6, 2023, from https://www.nic.in/products/soil-health-card-portal/

17. Ministry of Agriculture & Farmers Welfare. (2021, July). Farmer producer organizations (FPOs). Press Information Bureau. Retrieved July 6, 2023, from https://pib.gov.in/PressReleasePage.aspx?PRID=1739593

infrastructures.[18] These measures will enhance the sustainability of AgriTech start-ups and escalate the acceptance of various technological advancements in the agricultural sector.

2.6. Other government initiatives

In addition to the above-mentioned measures, the Indian government has initiated a range of complementary programmes to accelerate technology integration into the agricultural sector. Each of these initiatives uniquely enhances the ecosystem for AgriTech in India, empowering farmers, streamlining processes, and facilitating agronomic innovation.

Table 2:
Government Initiatives to enhance the AgriTech ecosystem[19]

Unified Farmer Service Platform	• This comprehensive tool amalgamates core infrastructure, data, applications, and utilities that ensure the smooth interoperability of various public and private IT systems within the national agricultural ecosystem. Similar to the role of UPI within e-payments, Unified Farmer Service Platform functions as the central fulcrum within the agri-ecosystem. It also facilitates data exchange amongst various schemes and services, enabling the holistic delivery of services to farmers.
Agriculture Grand Challenge	• This ambitious project aims to buttress the technological foundation by offering financial and incubation support to the most ground-breaking concepts. It fosters innovation, encouraging talented minds to explore pioneering avenues at the frontier of technology. This initiative grants start-ups access to priority infrastructure, rendering agriculture an appealing sector for the country's brightest minds.

18. Outlook India. (2023, April 21). Niti Aayog pitches for a distinct Agritech start-up policy. Retrieved July 6, 2023, from https://startup.outlookindia.com/sector/policy/niti-aayog-pitches-for-distinct-agritech-start-up-policy-news-8189

19. Ministry of Agriculture & Farmers Welfare. (2022, August). Digital technology in agriculture. Press Information Bureau. Retrieved July 6, 2023, from https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1847506

Kisan Suvidha Mobile Application	• Designed to facilitate the transmission of crucial information to farmers, this application provides updates on pivotal parameters such as weather, market prices, plant protection, input dealers, farm machinery, soil health, cold storage facilities, and veterinary centres. Equipped with this wealth of information, farmers can make well-informed decisions regarding the most profitable time and place to sell their produce.
Use of Space Technology	• A series of government initiatives utilise space technology for various agricultural benefits. These include forecasting agricultural output, agro-meteorology, land-based observations, horticulture assessment and management, drought assessment and monitoring, rice-fallow area mapping, geo-tagging of infrastructure, and crop insurance.
Sub Mission on Agricultural Mechanisation	• This project is designed to 'reach the unreached'. It promotes 'Custom Hiring Centres', creates hubs for high-tech and high-value farm equipment, and encourages the distribution of various agricultural machinery. It also aims to raise awareness amongst stakeholders through demonstrations and capacity-building activities, whilst ensuring performance-testing and certification at designated testing centres nationwide.
Indian Council of Agriculture Research	• The Council has assembled a collection of over 100 mobile apps spanning numerous areas such as crops, horticulture, veterinary, dairy, poultry, fisheries, natural resources management, and integrated subjects. These apps provide invaluable information to farmers, including best practice guidelines, market prices of various commodities, weather updates, and advisory services.

These multifaceted initiatives underscore the government's commitment to uplift the Indian agricultural sector. By refining farming methodologies, enhancing market accessibility, ensuring financial stability, endorsing sustainable agricultural practices, and stimulating innovation, these measures have significantly fortified the position of farmers in India. The government remains steadfast in its endeavours to broaden the reach of these initiatives and launch new ones to amplify farmer support and expedite the nationwide adoption of AgriTech. The overarching objective is to create a thriving AgriTech ecosystem that caters to the farmers' immediate needs and gears them for the future of farming.

3.

AGRITECH STARTUPS ECOSYSTEM: SHAPING THE FUTURE OF AGRICULTURE

India's distinctive array of 15 agro-climatic zones allows for a vast diversity of crops to be grown, given the variety of soil types and weather conditions across the country.[20] This variability has led to the rise of AgriTech startups providing vital information and innovative solutions during the pre-production stage to address the many challenges farmers face. With time, a surge of AgriTech startups has emerged, disrupting traditional agricultural management practices by offering inventive and cost-effective solutions for the agricultural sector's hurdles across the value chain - at pre-production, production, and post-production stages.

According to the Economic Survey of India 2022-23, the nation's agricultural sector has demonstrated robust growth of 4.6% over the past six years, with over 1000 AgriTech startups making their mark.[21] The Indian government acknowledges the AgriTech sector as a critical pillar in building a sustainable future, as its pioneering solutions, streamlined value chains, mobile applications, drones, and online marketplaces are aiding producers in securing better prices for their produce, accessing resources easily, and minimising wastages.

Today, AgriTech startups are propelling extensive tech adoption among farmers and eliminating many obstacles by enhancing the supply chain through innovative solutions. They aim to revolutionise the agricultural sector by offering affordable solutions to the challenges confronted by farmers throughout the agricultural value chain.

Table 3: Stage-wise challenges and solutions in the agricultural value chain[22]

Pre-Production Stage	• Farmers grapple with several challenges at this stage, including limited knowledge about quality inputs (seeds, fertilisers), inconsistent pricing for inputs and machinery, and lower mechanisation due to restricted access to resources.

20. Startup India. (2022, June). The Growth of Agri-Tech Startups in India. Retrieved July 7, 2023, from https://www.startupindia.gov.in/content/sih/en/reources/startup_india_notes/industry_insights/the_growth_of_agritech_startups_in_india.html

21. Department of Economic Affairs (2023 January) Economic Survey 2022-23, Ministry of Finance, Government of India./ Retrieved on July 16, 2023 from https://www.indiabudget.gov.in/economicsurvey/doc/echapter.pdf

22. Madan, A. et al.(2020, August). Agritech - towards transforming Indian agriculture. Retrieved July 7, 2023, from https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/start-ups/2020/09/ey-agritech-towards-transforming-indian-agriculture.pdf

	• AgriTech startups are addressing these issues by assuring quality inputs, offering tailored advisory services for procurement, providing direct access to input manufacturers, and making mechanised equipment and technologies accessible at lower rental costs.
Production Stage	• Over-reliance on informal credit sources leading to debt traps and increased input prices, limited information sources for environmental factors, soil health, excessive dependence on chemical fertilisers, and overuse of water constitute major challenges at this stage.
	• AgriTech startups counter these hurdles by offering cheaper and innovative financing opportunities, early disease detection through data-driven crop advisory and satellite imagery, and using deep-tech, agricultural biologics, and precision agriculture techniques to mitigate weather variations and improve yields and quality.
Post-Production Stage	• Farmers at this stage face challenges such as unfair pricing mechanisms limiting their earnings, lack of sufficient supply chain infrastructure, inefficiencies like wastages, multiple intermediaries, and suboptimal demand-supply matching.
	• AgriTech startups address these issues by promoting effective price realisations through intermediary removal, building transparent, trust-based platforms for supply and demand matching, modern warehousing and quality assessments, and complete supply chain traceability.

AgriTech startups have significantly contributed to the development of the AgriTech industry by offering affordable solutions to various bottlenecks faced by the agricultural sector in diverse areas. Specific segments within AgriTech have shown considerable promise in terms of investment received and the proliferation of multiple AgriTech startups. A few significant segments and key AgriTech startups involved[23] are listed in the table below.

Table 4: Major Segments of AgriTech startups

Precision Agriculture	• Startups in this sector enable the application of precise amounts of inputs for increased crop yields. Services include smart irrigation, nano-fertilisers, farm data analytics via drones, satellite imagery for crop health monitoring, and rapid quality testing using AI-based systems. Prominent startups in this segment include Plantix, mKrishi, Intello Labs, KisanRaja, and Fibsol.
Farm Management	• Startups here provide end-to-end services for production, quality certification, and marketing of agricultural products. They also utilise blockchain-based technologies for tracking and tracing the entire value chain. Notable startups include TraceX, JeevaBhumi, and Cropin.
Market Linkages and Mechanisation	• Startups in this sector offer platforms for farmers and merchants to buy agricultural inputs and sell products without intermediaries. They also provide an online agricultural marketplace connecting farmers, traders, and processing companies. Some startups offer affordable rental access to farm machines, remotely operated seeding machines, and harvesting robots. Prominent players include KamalKisan, Ninjakart, DeHaat, and KrishiHub.
Farming-as-a-Service	• These startups offer farming services and machinery on rent, reducing capital expenditure and increasing affordability. They provide services such as on-demand harvesting and enable technology to reach farmers. Key startups include Oxen Farm Solutions, AgirBolo, and GoldFarm.

23. Kalaari Capital. (2022). AgriTech: India's Sunrise Sector, from https://www.kalaari.com/wp-content/uploads/2022/09/AgriTech-Indias-Sunrise-Sector.pdf

Access to Credit	• Startups in this domain offer applications and platforms that digitally connect farmers and provide them with financial and insurance-related services. Major players include Samunnati, JaiKisan, and Intellecap.

The Indian Agritech Startups are also looking to augment the efficiency across the agrarian supply chain.[24] The startups employ a range of marketplace models that leverage farmer data and details of geographic areas and crop seasons to facilitate highly efficient input sales. Past soil data offers farmers advisory services on input and access to various financial services during the pre-harvest stage. Once the crop is sown, farmers can utilise the precision agriculture and innovative farming technologies these startups provide for real-time farm management. Various startups also work to distribute food products efficiently, using design pricing models that predict consumer buying behaviours and offer targeted marketing. These interventions have significantly contributed to facilitating input market linkages, tech-enabled precision agriculture for yield improvement, instituting quality management and traceability, efficient post-harvest supply chain management, and access to credit and insurance.st supply chain management, and access to credit and insurance.

Technology plays a crucial role towards addressing some of the challenges associated with information scarcity which makes it difficult for policymakers and strategists to support the farmers. To bridge this concern, global tech companies like Google are developing remote sensing based solutions that can collect crucial farm data which can aid in understanding water resource accessibility, estimating cultivated areas for specific crops, and more. Traditionally, these processes have been manual. By leveraging technology, the insights generated are not only more accurate but also unbiased, thereby enabling more equitable support for the farming community. It is imperative that tech companies continue to channel investments into these welfare-driven innovations, ensuring that agriculture remains both financially sustainable and environmentally conscious.[25]

24. Maitra,C.B. et al. (2021). Agritech to drive the next green revolution in India. Retrieved July 7, 2023, from https://www.adlittle.com/sites/default/files/viewpoints ADL_Agritech_green_revolution_India.pdf

25. Google for India 2022: Driving impact with AI across Indian languages, the agricultural ecosystem, and digitizing your doctor's penmanship, 19 Dec, 2022, https://blog.google/intl/en-in/company-news/inside-google/google-for-india-2022-ai-announcements/

4.

SCALING INDIAN AGRITECH SOLUTIONS

India's potential to cultivate exportable AgriTech solutions offers a promising avenue to fortify its leadership in South Asia and other middle-income nations. Indian AgriTech firms have been making considerable progress, utilising technology to confront the agricultural sector's myriad challenges, from enhancing productivity to maximising efficiency and optimising resource utilisation. AgriTech solutions have played a pivotal role in addressing critical issues such as food security, supply chain efficiency, and climate change mitigation in the agricultural sector. Cross-border collaborations with South Asia and other middle-income countries aim to enhance farmers' livelihoods by improving access to quality inputs, markets, and information, reducing risks, and introducing a plethora of products and services. These initiatives not only bolster India's standing as a global AgriTech leader but also positions the country as a 'Vishwaguru', or a world leader, in agriculture.

4.1. Diverse Agro Climatic Conditions

India's diverse topography, housing 15 agro-climatic zones and various soil types provides the Indian AgriTech startups with a unique advantage in devising solutions adaptable across diverse agricultural climates. The insights gained in tailoring solutions to specific agro-climatic zones are invaluable when designing solutions for international implementation. The striking similarity between India's agricultural landscape and many countries in South Asia and other middle-income nations opens a vast window of opportunity for the successful cross-border scaling of AgriTech solutions, ultimately benefiting farmers worldwide.

4.2. Developing Cost-Effective Agritech Solutions

The rise of various AgriTech solutions along the agrarian supply chain has been instrumental in curtailing costs. These solutions present the opportunity to procure mechanised tools at reasonable prices, assist farmers in optimising resource use, minimise wastages, and boost overall productivity. Cost-effective AgriTech solutions can significantly appeal to middle-income countries with comparable budget constraints for technology adoption. To retain such cost-effectiveness, it is incumbent upon Indian AgriTech startups to demonstrate favourable unit economics in at least four dimensions[26] within the agricultural sector:

- On a one-hectare farm (which is the average farm size in India)
- At multiple levels of the supply chain (input dealers, aggregators, processors, distributors, retailers, and consumers)
- Through environmental factors (optimising natural resources, particularly soil health and water)
- At their own business level by maintaining profitability while delivering on the first three points

[26] Mathur, H. (2022, September). Agritech startups have arrived. What will it take to scale impact and profits? Forbes India. Retrieved July 10, 2023, from https://www.forbesindia.com/article/agritech-special-2022/agritech-startups-have-arrived-what-will-it-take-to-scale-impact-and-profits/79619/1

Technologies in tune with ground realities and lower anticipated costs give Indian AgriTechs the potential to play a pivotal role in transforming the food systems in middle-income countries. Promoting AgriTech exports can benefit farmers in other nations and Indian farmers due to reduced prices arising from economies of scale.

4.3. Technological Expertise and Adaptable Solutions

India's extensive reservoir of technological talent and its formidable IT industry constitute a potent arsenal that can be mobilised to devise innovative AgriTech solutions. These span various domains, from precision farming to remote sensing, artificial intelligence, machine learning, data analytics, and blockchain. The challenges encountered with traditional agricultural solutions in India parallel those in other South Asian and middle-income countries, including fragmented landholdings that hinder access to credit and a scarcity of advisory services to guide the selection of suitable inputs for different soil types.

Addressing the export of AgriTech solutions necessitates the consideration of varying agricultural systems, diverse farming practices, and disparate levels of technological infrastructure in different countries. It is vital to devise solutions adaptable to different international settings. Improvements in digital infrastructure and rising internet penetration in middle-income countries equip AgriTech solutions to bridge the gaps left by conventional methods, offering superior quality and more affordable alternatives.

4.4. Strong Government Policy Support

The government's proactive drive to digitise agriculture and its substantial support to the AgriTech sector through policy initiatives, financial incentives, and regulatory frameworks create a favourable ecosystem for AgriTech companies to cultivate and export pioneering solutions. Several government-enforced reforms aimed at enhancing the ease of doing business indirectly bolster the growth of AgriTech enterprises.[27]

Initiatives like digitising land records, implementing single-window clearances, and simplifying regulatory processes have lightened administrative burdens, thereby stimulating innovation and investments in the AgriTech sector. Furthermore, the Krishi Vikas Kendras (KVKs), established by the Indian Council of Agricultural Research (ICAR), have been pivotal in promoting AgriTech solutions through training programmes, demonstrations, and field trials. They have also expedited the adoption of precision farming techniques, advanced irrigation practices, and inventive crop management strategies among farmers.

In order to optimise the export potential of AgriTech solutions, it is imperative to build robust partnerships, foster collaborations, and establish a strong market presence in target countries. Indian AgriTech startups can capitalise on their expertise and knowledge by engaging closely with local stakeholders, gaining a nuanced understanding of each region's specific needs and challenges, and fine-tuning their solutions accordingly.

27. National Institute of Agricultural Extension Management (MANAGE). (2019). Agritech Startups: The Ray of Hope in Indian Agriculture. Retrieved July 10, 2023, from https://www.manage.gov.in/publications/discussion%20papers/MANAGE-Discussion%20Paper-10.pdf

By leveraging its diverse agro-climatic conditions, cost-effectiveness, technology expertise, adaptable solutions, and government backing, India can consolidate its position as an AgriTech leader and significantly contribute to global agricultural development. Further investments in research and development, nurturing innovation, and promoting skill development within the AgriTech sector will help maintain India's technological ascendancy and competitive edge in the global market.

5.

CONCLUSION

India's agricultural sector is going through a dynamic change with the introduction of agri-tech solutions. The government's added impetus in policy initiatives, along with the increase in agritech start-ups with innovative solutions, has made this sector a lucrative destination for investments. Innovative technological solutions for this sector will help address supply chain inefficiencies, food security and climate change concerns. These solutions have the potential to be expanded and exported to other countries in Asia and Africa that may need more resources to develop such advanced solutions.[28]

As India presides over the G20 presidency this year, the agritech industry is uniquely positioned to showcase its innovative solution to the world. India should also actively engage with other countries on knowledge sharing and collaborative measures that can be undertaken in the sector. Initiatives such as AgriStack and E-NAM have the potential to become a global example in the agritech sector. India’s agritech prowess also allows other countries to learn from its experience in this sector and launch similar initiatives in their country to boost productivity.

28. Ministry of Agriculture and Farmers Welfare. (2023, April). AIM, NITI Aayog, and UNCDF team up to make India a global
agri-tech leader, expand innovations to developing economies. Press Information Bureau. Retrieved July 10, 2023, from https://pib.gov.in/PressReleasePage.aspx?PRID=1918352