AgTech for the Transformation of Agriculture in India

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India stands at a pivotal juncture in its agricultural development journey. With a cultivable area of over 157 million hectares—second only to the United States—and the pressing need to ensure both food and ecological security for a growing population, agriculture must evolve rapidly. The sector is confronting interlinked challenges: soil degradation, erratic weather patterns due to climate change, falling groundwater levels, and increasing air and water pollution. Simultaneously, farmer incomes remain low, and productivity growth has plateaued in many regions. These issues underline the urgency for a new approach—one rooted in technological transformation.

Historically, India has shown how technology, when deployed effectively, can trigger large-scale agricultural change. The Green Revolution of the 1960s and 70s, driven by improved seeds, irrigation, and chemical inputs, helped double cereal production and transform food security. Mechanisation—especially tractors and harvesters—played a key role, laying the foundation for more efficient farm operations. Today, India's agricultural mechanisation industry is valued at approximately USD 14 billion, yet overall mechanisation levels remain below 45%, which is still low when compared to countries such as the US (95%), Brazil (75%) and China (57%).

While traditional mechanisation has its place, the current moment demands a broader vision. Agricultural Technology, or AgTech, is emerging as a complementary and necessary force. India's AgTech industry has a potential of around USD 24 billion but is still in its infancy and remains largely untapped due to a low penetration of 1.5%. Yet its growth trajectory is rapid. Startups are leveraging artificial intelligence (AI), the Internet of Things (IoT), drones, robotics, and satellite imagery to redefine farming practices. These tools are not merely replacing manual labour; they are introducing a fundamentally new model of decision-making—one that is data-driven, precise, and sustainable.

IoT-enabled sensors, for instance, are enabling precision agriculture by monitoring soil moisture, nutrient levels, and micro-climate conditions in real time. This allows farmers to optimise irrigation and fertiliser use, increasing yields while reducing waste. AI and machine learning platforms are synthesising farm-level data with satellite imagery and weather forecasts

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to generate customised crop advisories. Such tools are helping farmers make timely decisions on sowing, input application, and pest control. Digital farming pilots have reported yield increases of up to 30%, alongside reduced input costs and improved environmental outcomes.

Drone technology is playing a transformative role in both monitoring and input application. Drones equipped with multispectral cameras can detect plant stress and disease early, while precision spraying minimises chemical overuse and human exposure. Recognising this, the Government of India has initiated the "Drone Didi" programme, aimed at training 15,000 women-led self-help groups to provide drone services to local farmers. This not only expands the reach of drone-based agriculture but also creates new rural livelihoods, particularly for women.

In addition to on-field technologies, AgTech is revolutionising the agricultural market ecosystem. Digital platforms now connect farmers to buyers, agri-input suppliers, financial services, and advisory content. Startups and established firms alike are building traceable farm-to-fork supply chains that meet the rising consumer demand for food that is safe, sustainable, and transparently produced. Digital marketplaces are also improving price realisation and reducing the role of middlemen. Platforms like e-NAM, private agri-commerce apps, and custom hiring centres are enabling even small and remote farmers to access markets and services previously beyond their reach.

Moreover, emerging digital tools are enhancing India's capacity to track environmental performance. Blockchain-based traceability systems and geotagged field data are being

used to record input use, emissions, and residue levels. These systems not only build consumer trust but can also support India's net zero goals by documenting carbon outcomes at scale. As global markets begin to demand evidence of environmental and social responsibility in food production, these digital ESG tools will become indispensable.

To unlock the full potential of AgTech, India must align practice with policy. Encouragingly, the government has taken important steps through initiatives like the Digital Agriculture Mission and AgriStack, which aims to create a digital public infrastructure for agriculture, including farmer registries, land records, and crop databases. The Agriculture Accelerator Fund, launched in the Union Budget 2023, supports early-stage AgTech startups, while the push to scale Farmer Producer Organisations (FPOs) can help aggregate smallholders into viable units for tech deployment.

However, mechanisation policy must now go beyond physical machinery to include digital and data-powered tools. Subsidy and procurement schemes under the Sub-Mission on Agricultural Mechanisation should be expanded to cover IoT kits, farm sensors, drone services, and smart implements. Extension systems and Krishi Vigyan Kendras must be modernised to train farmers not just in new equipment but in data interpretation and digital literacy. The private sector, too, must be engaged in building inclusive technology platforms that are affordable, multilingual, and tailored to diverse agro-climatic zones.

India's strength in digital infrastructure and human capital makes it uniquely positioned to lead the next wave of global agricultural innovation. With thoughtful investment, supportive policy, and collaborative public-private models, AgTech can reshape Indian agriculture—making it more productive, resource-efficient, climate-resilient, and farmer-centric.

As India aspires to become a developed nation by 2047 under the Viksit Bharat vision, transforming agriculture through technology will be non-negotiable. AgTech, embedded into our mechanisation strategy, is not just a tool for farm efficiency—it is a cornerstone of our national growth, sustainability, and food sovereignty.