# Charting the Future of Agriculture from Fields to Global Markets

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## Expert's Insight into India's Agri-Tech Boom, International Diplomacy and the Path to Sustainable Food Security

Intro: In an era of transformative change, the global agricultural landscape is evolving rapidly. Technology, innovation, and international cooperation hold the keys to addressing pressing challenges such as food security, climate change, and rural-urban disparities. At Socio-economic Voices this week we have Dr. Minakshi Chakraborty, DGM-Economist in conversation with senior journalist Mahima Sharma as she helps the readers with insights into the innovative strategies, emerging technologies, and policy considerations that are shaping the future of agriculture. Join us as we explore how India, as a major agricultural player, is navigating this ever-changing terrain and contributing to the world's food security while balancing the delicate rural-urban equilibrium.

MS: The typical landholding in India stands at a mere 0.5 hectares per household. These tiny plots, accounting for 86.21% of total land holdings, are unsuitable for farming and fail to offer a sustainable livelihood. What strategies can transform these small plots into viable and sustainable sources of income for their owners?

MC: While strategies for transforming small plots into viable sources of income are in place, the key challenge lies in effective implementation. In my view, the two prerequisites are:

a. Remove the heterogeneity in the functioning of Farmer Producer Organizations(FPOs) that are recognised as one of the most effective tools of aggregation globally. The Government of India launched the central sector scheme titled 'Formation and promotion of 10,000 FPOs.' In February 2021, with a clear strategy and committed resources to promote 10,000 new FPOs in the country with budgetary provision of ₹6,865 crore. However, there is significant heterogeneity in the functioning of FPOs which have limited the success so far. Infrastructure, ease of doing business are the key prerequisites for proper functioning of FPOs. Karnataka and Madhya Pradesh are examples of efficient functioning of FPOs while Bihar, Kerala fare poorly.
b. Ensure economic stability by addressing location specific agro-parameters because economic stability is essential for any transformation. As precision farming or smart agriculture is gaining prominence in India, global majors are adopting innovative solutions and customised models to help small and marginal farmers whose investment capacity is limited. It uses information technology or other technological innovations such as GPS, GNSS global navigation satellite systems, even drones to accurately predict what crops and soil need for optimum productivity. The Government of India has recently announced a new drone policy as a potent solution for crop monitoring and crop insurance. However, the application of these models would require location specific agro parameters and observed field data.

MS: Indian farmers encounter widespread issues such as inadequate infrastructure, limited access to credit and insurance, unstable income, and uncertain water rights and supply. How can the rural economy of India progress at the global level to address and overcome these challenges?

MC: For any investment to have a positive impact on production, productivity and real income, it must contribute to capital formation at the farm level. In this respect, the investments made by farmers themselves are indispensable. Public investment in agriculture should create an enabling environment that helps farmers re-invest in their land. Most developed countries spend a significant share of the agriculture investment on essential public goods, such as

rural infrastructure, including roads and electricity. The significance of capital formation in agriculture for growth is evident from the fact that investment in machinery and equipment augments labour and renders it more productive. Further, the concept of investment to augment productive capacity of agriculture entails not merely investment in physical assets, but investment in human capital, science and technology, social capital build-up and in infrastructure. Private investment in agro-industries complement farm-level investment but such capital cannot substitute for the investments that need to be made by the farmers themselves.

MS: What innovative economic models can be created to sustain India's agriculture sector in the midst of rural-to-urban migration and increasing climate change impacts, ultimately preventing a looming food crisis in the coming decade, thus safeguarding the nation from the challenges faced by smaller nations?

MC: In 1990, IPCC noted that the single greatest impact of climate change will be on human migration. India's status as a developing country mainly on agriculture makes it particularly susceptible to effects of climate change. Various studies confirm how climate change caused human migration during and after the Indus Valley Civilization. However, the window for migration is gradually closing. It is getting increasingly difficult for the 'economically well-off' places to absorb migrants of relatively 'less developed neighbourhoods. Also, looking at the migration statistics (PLFS, 2021), it is evident that income levels impact the ability to migrate. People with low income are mainly short-term migrants and lack the resources to migrate for permanent settlement. It is only the skilled -with higher income and higher education level have the scope to migrate. Thus, migration is no longer the solution to many. Climate change is a spatial phenomenon and therefore micro-level understanding is key to make the economy ready for this inevitable change. Well-developed rural economies have seen more resilience to the variability in monsoons by shifting to climate resistant crop varieties or adapting to mechanized solutions (farm implements), which speed up the time taken for harvesting, sowing and land preparation. Globally several technological innovations are taking place to address the risk from climate change but adoption in India is possible only when the problem is addressed at the grassroots level.

MS: In your experience of the last five years in India, amid various policy changes given the diverse agro-climatic zones in India, how can agricultural policies be tailored to maximize productivity and income for smallholder farmers across different regions while considering the global trade dynamics?

MC: Indian agriculture budget has been largely dominated by subsidies or direct-benefit transfers. The PM-KISAN scheme which aims at providing financial assistance to cultivable landholding farmers across the country covers ~52% of the agriculture budget. On the other hand, the schemes that are directly linked to enhancing agricultural productivity witnessed meagre allocation. For instance, allocation on soil and water conservation accounts for only 2% of the budget. Food storage accounts for about 8% of the total outlay. Clearly, there is a need to shift focus from short-term solutions to long-term growth. Agriculture policies should prioritise schemes that lead to higher productivity, reduction in cost and strategize for effective dissemination. Globally, technology has taken over a large portion of the agricultural sector. Post-Covid, the need for technological upgradation across the agricultural value chain has become even more imperative. This implies the agriculture budget should focus more on research and development of the sector and integration of the entire value chain into a single system. The effects of agriculture credit growth spills over entire rural infrastructure growth which in turns generates higher income and higher household expenditure. Therefore, for sustainable development, it is critical to enhance long term credit which is key for farm investment.

MS: In the context of food security, how can international cooperation be enhanced to address global challenges, and what role can India play in contributing to food security at a global level?

MC: The issue of food and nutrition security is a multidimensional aspect and therefore requires international cooperation. As FAO highlighted, the resolution of the food security issue depends not only on the development of food and agriculture sectors, but on other factors as well, climate change being among the most important ones. Also,

food security is an inseparable part of the system of overall indivisible security, stability, and development. Take example of rice which has long been the staple food item, as well as the major source of calorie intake, for about one-half of the world's population, but production has remained skewed and concentrated majorly in Asia accounting for 80% of the world supplies. Apart from this, the global rice economy is one of the most politically distorted markets with significant border protection through tariffs. As a result, any disruption in production levels in any of the key rice economies translates to global food insecurity. Growth in global rice production requires a more open economy with judicious provision of an increasingly diversified stock of social, economic and institutional infrastructure to address the rising risks from climate change. Enhancing productivity and improvement in the global rice economy necessitates concerted government efforts to upgrade the quality and range of domestic human resources and technological capabilities. It requires commitment not only from the international organisations but also from individual countries.

MS: As agriculture transitions to more sustainable practices, how can India leverage its agricultural diplomacy to access global markets for organic and environmentally friendly produce?

MC: Organic agriculture is often perceived as more sustainable than conventional farming. Body of literature suggests organic farming is less polluting than conventional farming when measured per unit of land. In India, natural or environmentally friendly farming practices are not new. The transition to chemical farming was mainly to increase yield and improve food security. However, the excessive use of chemical farming caused several ecological imbalances. While reverse transformation to organic or environmental friendly practices is being propagated and India can take the lead in this, question still remains whether complete transition to organic farming is feasible. Organic farming, which currently accounts for only 1% of global agricultural land, is lower yielding on average. Due to higher knowledge requirements, observed yield gaps might further increase if a large number of farmers switch to organic practices. Widespread upscaling of organic agriculture would cause additional loss of natural habitats and also entail output price increases, making food less affordable for poor consumers in developing countries. Organic farming is not the paradigm for sustainable agriculture and food security. Combinations of organic and conventional methods could contribute toward sustainable productivity increases in global agriculture.

MS: India is all set to discuss Food Security with Brazil in November. What should be ideal points of discussion and global trade in general between the other developing nations and India, to fasten its food security belt?

MC: See, Brazil, the fifth largest country in area and population and the largest in terms of arable land, is also amongst the top 5 producers for 34 commodities and is the largest net exporter in the world. Since the mid-2000s, Brazil has accelerated its transformation from an exporter of mainly tropical agricultural products such as coffee, sugar, citrus, and cacao to a major global supplier of commodities, including soybeans, grains, cotton, ethanol, and meats. Brazil's transformation was driven by agricultural research that has increased yields, expansion of the arable land base, ability to harvest two to three crops a year, large investments in production technologies etc.

In the upcoming discussion in November, the focus of both the countries should be on an open and unrestricted agriculture economy not only on the supply chain but also on research, innovations and advancement in technologies. India should focus on increased cooperation on climate resilient and nutritious crops, like, millets, quinoa and sorghum, in addition to traditional staples, like, rice, wheat, maize. At the G20 summit, both Brazilian and Indian leaders noted the vital role of biofuels and flex fuel vehicles in decarbonizing the transportation sector. Cooperation on ethanol and biofuels is expected to be the focus area for both sides.

MS: How can international trade agreements and policies be better aligned with the needs of small-scale farmers in developing countries like India? What role can agri-tech play in this alignment?

MC: Trade-compliant domestic policies that support sustainable and inclusive value chains, can strengthen the competitiveness of small-scale farmers. In addition, to support environmentally sustainable, nutritional, safe and

inclusive food systems, countries should jointly pursue trade agreements that reinforce non-market values, such as food safety, environmental quality or nutritional content, as well as decent labour conditions.

Digitization can undoubtedly support this alignment especially when production and supply involve millions of small and marginal farmers. The Indian agricultural ecosystem has undoubtedly changed a lot since Agri-tech start-ups came to the fore, working on solutions that are aimed at improving productivity, maximizing supply chain efficiency, and establishing better market linkages. Agri-tech not just has the potential, but also the responsibility to contribute to the development, betterment and growth of the sector. These developments include providing farm produce directly to customers, digitizing agriculture, improving access to real-time information for farmers, bringing transparency across the value chain, developing and supplying better tools and implements to farmers to increase yields and offering financial support in the form of micro-financing options to manage risks.

MS: In the context of global food security, what innovative strategies or technologies in your experience, will play a pivotal role in the coming decades ( especially in addressing challenges like climate change and population growth)?

MC: New, existing, and emerging technologies can address the four dimensions of food security.

a. Food availability - Genetic modification, methods for improving soil fertility, and irrigation technologies can increase food availability.
b. Food accessibility - Post-harvest and agro-processing technologies can address food accessibility
c. Nutritious food availability - Biofortification can make food more nutritious
d. Food instability - Climate-smart solutions anchored in science, technology and innovation (STI) – including the use of precision agriculture and early warning systems – can mitigate food instability.

Harnessing the potential of such technologies for food security requires investments in research and development, human capital, infrastructure and knowledge flows. Creating an environment for agricultural innovation also benefits from an enabling environment, gender-sensitive approaches to technology development and dissemination, regional and international collaboration, and technology foresight and assessment for agricultural innovations.

MS: With startups and AI moving to Agriculture, are we looking at a revolution or some threat? Please analyse the aspects in depth in tandem with the Rural-Urban Divide showcasing both sides of the coin.

MC: AI applications like advanced technologies assisted the industry in unlocking new opportunities and addressing the current issues in agriculture, which can significantly increase food production and profitability for all participants while lowering operating costs. Additionally, data and AI based innovations are also rapidly transforming the operations of agribusinesses. Voice activated transactions, smart packaging, robotised warehouse management are a few advancements that can be mentioned.

However, technological advancement also has a social dimension attached to it. Technological upgrades create productivity gains by efficiency which in turn requires reduced human labour. This poses a threat to developing economies, like India where ~46% of the country's employed labour force is in the farm sector.

Further, lack of public data pools, in the context of developing economies restricts entry of small startups and also has a direct bearing on the possibilities of public interest innovation. AI solutions that can expand and respond to static and dynamic knowledge needs of farmers and improve their farm-based practices and decisions are driven by larger and more entrenched players. These companies can afford resource intensive investments to consolidate the value chain. They can exercise complete control of the inputs or procurement segment and thus co-opt farmers into a marketized agricultural paradigm. This does bring some gains to farmers, but ultimately leads to corporatised takeover of agriculture, diminishing farmer autonomy over livelihoods. Additionally, such arrangements also give corporate players an unfair "knowledge premium".

About Dr. Minakshi Chakraborty

*Dr. Minakshi Chakraborty is an Economist in Mahindra & Mahindra. She is a research professional with more than 15 years of experience in Quantitative and Qualitative research. She was awarded a Ph.D in Economics from NEHU, Shillong in 2008 and was also recipient of Gold Medal for securing 1st position in MA (Economics). Minakshi has several publications to her name in journals, leading agri magazines and national dailies. She has won several accolades in conferences on multi-disciplinary research.*

*About the Interviewer*

*Mahima Sharma is an Independent Journalist based in Delhi NCR. She has been in the field of TV, Print & Online Journalism since 2005 and previously an additional three years in allied media. In her span of work she has been associated with CNN-News18, ANI - Asian News International (A collaboration with Reuters), Voice of India, Hindustan Times and various other top media brands of their times. In recent times, she has diversified her work as a Digital Media Marketing Consultant & Content Strategist as well. Starting March 2021, she is also a pan-India Entrepreneurship Education Mentor at Women Will - An Entrepreneurship Program by Google in Collaboration with SHEROES. Mahima can be reached at media@indiastat.com*