

## Future Challenges and Opportunities in Agriculture

---

Since the Green Revolution, a paradigm shift has been noticed from food scarcity to self-sufficiency, monocropping to crop diversification, flood irrigation to drip irrigation, conventional varieties to hybrid seeds, saplings to tissue-culture plants and traditional to secondary and speciality agriculture. The pressure on land and water is continuously increasing, and it is a daunting challenge to feed the growing population, which is currently 1.34 billion. Along with these, an unprecedented increase has been observed in consumer demand for more diversified and nutritious foods – fruits, vegetables, meat, fish etc. Above 6% growth over the last decade in the fishery and horticultural sectors is indeed remarkable. Through R&D initiatives, farmers harvested a record 277.49 million t in 2017–18. The average agricultural sector growth over the last three years has remained at around 4.7%.

India will need 70% more foodgrains by 2030; that, too, from declining natural resources. Thus, to produce more from less is an enormous challenge, especially when the farmers are facing second-generation problems of the Green Revolution as well as the adverse impact of climate change. These are: factor productivity decline, poor soil health, loss of soil organic carbon, ground and surface water pollution, water-related stress, increased incidence of pests and disease, increased cost of inputs and decline in farm profits. The major concerns in agriculture are the declining total factor productivity, diminishing and degrading natural resources,

increased incidence of diseases and pests, and stagnating farm income. The impact of trade liberalization on agriculture and global climate change are also new challenges. Other challenges are: (i) weakening of input delivery and local agri-governance systems; (ii) increasing risk in agriculture due to weather, prices and trade policies, including the impact of globalization; (iii) small, declining and fragmented holdings; (iv) growing marketing inefficiencies and increasing agri-waste; and (v) limited employment opportunities in non-farm sectors. These challenges have serious implications for farm income and the future of Indian agriculture. In many ways, these can neutralize even the contributions of many technological breakthroughs. If not addressed immediately, these challenges may adversely affect national food and livelihood security.

In spite of the enormous challenges, Indian agriculture continues to remain at the forefront of development and providing livelihood to half of India's population. Despite liberalization and fast growth in services and manufacturing sectors, the contribution of agriculture is still around 17.4% of national GDP, which compares fairly well with the contribution of the industrial sector, which is currently 18%. In the present scenario, increasing productivity and farmers' income are two major challenges when land holdings are diminishing among the majority of farmers. Other critical areas needing priority are access to good knowledge and required appropriate infrastructure in rural areas. Problems

related to infrastructure for irrigation, power, markets and roads affect the farming sector adversely, mainly in eastern India. Unlike other business enterprises, agriculture is prone to risks on account of factors beyond the control of farmers. At the same time, the number of initiatives undertaken for agricultural development does not translate into effective delivery mechanisms at ground level in terms of increasing productivity, decreasing cost and increased income by linking farmers to markets. For effective delivery of products and knowledge, we need reforms in agriculture to encourage participation of the private sector through the creation of an enabling environment, which is crucial in this context.

How we meet the emerging challenges is a question before all. Will technology-led agriculture succeed in producing more from less? Historical experiences of producing more through various revolutions are a testimony to inspire farmers to take up new challenges to be successful. The emergence of new sciences like biotechnology, information technology, nanotechnology, bioinformatics etc. provides new hope. The need of the hour is to embrace climate-smart agriculture, precision agriculture and good agronomic practices. Innovations like CA, micro-irrigation, protected cultivation, tissue culture, GM crops, hybrid technology, aeroponics, precision nutrient management and IPM offer greater opportunities for outscaling and for greater impacts, provided they are supported well by the right policies, development-related activities and higher investments (at least 1% of agricultural GDP from the current level of 0.4%) (ACIAR, 2016; Tangermann, 2016).

On the greener side, new opportunities are unfolding in the form of increased demand for agricultural commodities in both domestic and global markets as a result of higher economic growth and rising consumer income level. The growing international demand for rice, wheat and maize, besides cotton, soymeal, fruits, vegetables, fish, meat and poultry, have opened up enormous opportunities for boosting exports. In addition, the increasing demand for high-value commodities such as fruits, vegetables, milk, meat, flowers and agri-processed products in the domestic market points towards potential prosperity that can be brought about in the farm sector. The entry of the corporate sector in developing and delivering market-driven technologies,

contract farming, processing agri-products, developing organized retailing and exploring markets for exports is providing a new dimension to Indian agriculture. Some of these encouraging developments are taking place around the value chain from farm to plate. But the main question still remains as to how to involve the farming community, especially small-scale farmers, in capitalizing markets and sharing benefits arising from new opportunities. Failing to address these issues can lead to further exploitation of the farming community, culminating in distress to smallholders. Innovative policies, appropriate institutional arrangements and market-driven initiatives can, on the contrary, harness untapped opportunities and provide much-needed benefits to smallholder farmers, representing 80% of the 141 million farming households (Government of Telangana, 2015).

Moreover, only agriculture can liberate India from the triple burden of poverty, hunger and malnutrition while ensuring conservation of natural resources and sustainability of environment. It can address effectively concerns of poor health and nutrition of children and empowerment of women, being important SDGs. Thus agriculture should be seen as an important sector of the national economy, sustaining as it does around 55% of the population.

Agri-business is currently the single largest sector in India, worth around Rs 20,000 billion. Hence, India needs to focus more on agri-business, a generic term for many businesses involving agriculture and food production, including cooperative/contract farming, seed supply, agrochemicals, farm machinery/equipment, wholesale distribution, food processing and marketing. In future, agri-business may contribute to approximately 27% of India's GDP, involving both production and processing components. The agri-business segment may nearly double in future years driven largely by growth in per capita income related to higher consumption and changes in consumer preferences towards value-added and processed foods. Hence, a greater focus on post-production-related activities through processing, value addition and efficient marketing, including export, would go a long way in accelerating agricultural growth as well as farmers' income. We must, therefore, promote low-cost, rural-based agri-processing and value-chain-related technologies/approaches.

A few scattered successful models have taken advantage of new options and have addressed key challenges. It is a daunting task to upscale such successful models, and to reform the agricultural sector, which urgently requires an enabling policy environment. Considering past successes of the Green, White and Blue Revolutions, based on policy support, including higher capital investment, it is now evident that appropriate policies, institutions and technologies must play a key role in facing the challenges. The following are key suggestions for the way forward to ensure higher and inclusive growth in Indian agriculture (MoA and FW, 2015; MoE and CC, 2015; CHAI, 2016; FAO, 2017):

1. Increasing agricultural productivity is the key challenge for ensuring national food security. To increase production, exploitation of the potential existing yield gaps offers tremendous opportunities. Hence, a mission-mode programme on Bridging the Productivity Gap, employing real missionary zeal and effective monitoring, is required to be launched with meticulous planning for each state as a matter of priority. For this, attention to agriculture in science policy is needed, and the existing technology dissemination and input supply system needs to be revitalized and tuned to meet emerging needs of smallholder farmers. Special emphasis on the seed sector, input-use efficiency, financial and insurance institutions and a paradigm shift in technology-transfer mechanisms involving both private sector and NGOs are critical in achieving desired goals.

2. Rainfed areas have a huge potential to raise production and increase farm income. These 'grey' areas can be made 'green' to harness a second Green Revolution. The role of technologies, policies and infrastructure would be very important in realizing the potential of rainfed agriculture. In this context, it has to be ensured that public policies and technologies have the appropriate synergies to move forward. The initiative of the Government of India to establish a National Rainfed Authority of India was a welcome step. However, this authority needs a proper policy framework, legal and funding support as well as empowerment for effective coordination and monitoring of all rainfed-related programmes run by various ministries/departments. The earlier it is ensured, the better it will be for the national interest.

3. Linking farmers to markets is a prerequisite for augmenting farm production and farmers' income. The role of innovative institutions like e-NAM will be critical in this context to reap the benefits of emerging opportunities. A silent revolution of innovative institutions is already taking place in the Indian agricultural production and marketing system (farm-to-plate continuum), encompassing effective functioning of value chains and marketing efficiencies. Therefore, our current need is to replicate such best practices through the formation of producers' associations, self-help groups, cooperatives or farmers-producer companies. Krishi Vigyan Kendras (KVKs), being an existing institutional mechanism at district level, could play an important role in the entire supply chain through access to best practices in the production-to-marketing continuum. ICT also offers new opportunities to support this.

4. Agricultural extension in India and elsewhere requires constant transformation. The current transitional phase also needs a renewed interest and policy attention. The public extension system, therefore, needs revamping towards 'translational research', requiring outscaling of innovations through an 'out-of-the-box' extension system. Also, conscious deployment of rural youth, women and progressive farmers may help in much speedier transfer of technology for needed impact on the livelihood of smallholder farmers. For this, farmers' participatory approach for testing, refinement and adoption of farmer-led innovations is to be ensured. Also, empowering youth (both men and women) through vocational training and building a cadre of technology agents to provide technical backstopping as well as custom-hire services to smallholder farmers would go a long way in linking research with extension, and thereby accelerating agricultural growth. Linking 'land with lab', 'village with institute' and 'scientists with society' is essential to ensure faster adoption of efficient resource-utilization technologies, benefiting both producers and consumers. In the transformation process, the agricultural technology agents need to be job creators and not job seekers and provide best technologies as well as quality inputs on farmers' doorsteps. Another strategy could be to create agri-clinics, where technology agents can join hands to ensure a single-window system of advisory services for

farmers, so that they need not run from 'pillar to post' to obtain best technical inputs.

5. To ensure inclusive growth in agriculture through innovative and synergistic approaches for achieving sustainable food and nutrition security, AR4D would require a paradigm shift to ARI4D, with increased (at least double) resource allocations, accountability and monitoring. In the process, complacency that has crept into public research, education and the extension system has to be overcome. This necessitates greater vibrancy in the NARES, requiring active involvement of stakeholders (farmers, NGOs, private sector, scientists and policy makers) to remain technology-wise and globally competitive.

6. There is an urgent need for agricultural diversification by identifying key crops/commodities that can help small-farm holders to raise their income. Incremental gains in income through diversification would help capital formation, which would be instrumental in attaining higher productivity and profitability. In this context, agro-ecological zone-wise planning; adoption of scientific land-use planning, such as new-areas new-crops approaches using GIS; land-use planning; and effective district-level implementation of the strategies by involving grassroots organizations and stakeholders would be the best options to move forward. Towards agricultural diversification, many horticultural crops, especially perennial fruit trees, spices and plantation crops and agro-forestry species have an important role and would help in carbon sequestration as well as mitigating climate change. Promoting agro-horticulture and agro-forestry would ensure sustainable agriculture. In addition, we shall have to promote both urban and peri-urban agriculture, and adoption of post-harvest practices including grading and packaging, processing, value addition, and cool-chain marketing and export. All these would ensure higher economic returns to farmers. Also, emphasis now should be on secondary and speciality agriculture as well as on peri-urban agriculture for higher productivity and income. In this context, promoting precision farming and protected cultivation on a larger scale would need major policy support in an aggressive mode.

7. Water is the most critical natural resource for future agricultural growth. Currently, the water sector for irrigation is invariably neglected both

at central and state level. High inefficiencies in water delivery, distribution and on-farm use adversely affect agricultural production. Irrigated areas can be expanded easily, up to 30%, with improved micro-irrigation techniques and by discouraging flood-irrigation practices. Innovations in governance and pricing of surface and ground water for desired water-use efficiency through an integrated approach among irrigation and agriculture departments, private sector and farmers' water-user associations are urgent issues for coordinated action.

8. Precision nutrient management using decision-support systems, aimed at targeted yields, keeping in view site-specific nutrient availability in the soil, would help achieve much-needed resilience in agriculture. Nutrient-use efficiency needs to be improved, which is invariably quite low (30% for N fertilizers). Also, use of biofertilizers, organic matter recycling, CA and organic farming would help achieve sustainable/ever-green agriculture.

9. To address biotic stress of diseases and pests, outscaling of available IPM technologies, while keeping pests below the economic threshold level (ETL), is an emerging option to be harnessed. Also, increased use of biopesticides, at least up to 10% from the present 3% of total pesticides used (60,000 t of active ingredient), would help greatly in reducing environmental load due to pesticides.

10. Biotech crops hold considerable promise for smallholder farmers. For crops that are proven to work for both consumers and producers, regulatory uncertainties and excessive restrictions surrounding biotech crops must be removed in order to widen the technology options and provide both private and public sectors with the confidence to invest.

11. The food-processing and food-distribution sectors need to be strengthened further by proper policies for greater private sector or farmers' cooperatives'/self-help groups'/producer-companies' participation in the entire value chain. Incentives, through appropriate tax structure and exclusive rights, such as agro-processing, especially in rural areas, becomes a lucrative option for farmers as well as the private sector. Current post-harvest losses in foodgrains are also to be minimized, for which construction of modern silos for foodgrain storage is a matter of national priority. Also, primary processing and

value addition in rural areas would need a different tax structure and support for building infrastructure.

1.2. There is a dire need to significantly enhance capital investment in agriculture by both public and private institutions in non-Green Revolution regions, particularly in eastern and north-eastern India, where there is a great potential

for agricultural growth. Hence, investment priorities should now be orientated towards the realistic growth of agriculture to meet the emerging needs of the people. Therefore, public policies should be such that these trigger much-needed private sector investment for infrastructure development. Unfortunately, this has not happened.

## References

- ACIAR (2016) *The Future of Agriculture in Development: Challenges and Opportunities for Australia in the Asia-Pacific*. Organized by the Australian Centre for International Agricultural Research, Canberra, December.
- CHAI (2016) *Future Challenges and Options in Agriculture*. National Agricultural Conference 2016 organized by the Amit Singh Memorial Foundation, Confederation of Horticultural Association of India and Jain Irrigation Systems Ltd, Jalgaon, 28–30 May.
- FAO (2017) *The Future of Food and Agriculture – Trends and Challenges*. Food and Agriculture Organization of the United Nations, Rome.
- Government of Telangana (2015) *Task Force Report: Agricultural Challenges and the Way Forward*. Submitted to NITI Aayog by the Government of Telangana, Agriculture and Cooperation Department.
- MoA and FW (2015) *State of Indian agriculture*. In: *Indian Agriculture: Performance and Challenges*. Ministry of Agriculture & Farmers' Welfare, Government of India, New Delhi, pp. 1–20.
- MoE and CC (2015) *Development Goals in India: A Study of Financial Requirements and Gaps*. Ministry of Environment, Forest and Climate Change, Government of India.
- Tangermann, S. (2016) *Agriculture and Food Security: New Challenges and Options for International Policy*. E15 Expert Group on Agriculture, Trade and Food Security – Policy Options Paper. E15 Initiative. International Centre for Trade and Sustainable Development (ICTSD) and World Economic Forum, Geneva.