30

A Strategy for Doubling Farmers' Income

All the nations facing problems of poverty, hunger and malnutrition will need to accelerate their agricultural growth for achieving SDGs, especially while aiming at no poverty, zero hunger and a safe environment for all (Paroda, 2017). The Green Revolution not only led to food self-sufficiency but also helped to reduce poverty and hunger. And yet, despite a five-fold increase in foodgrain production, as against a four-fold increase in population, India still has around 250 million people who live in poverty and about 45 million children below age 5 who are malnourished. Moreover, after 50 years of the Green Revolution, India is also facing second-generation challenges like decline in factor productivity growth, poor soil health, loss of soil organic carbon, ground and surface water pollution, water-related stress, increased incidence of pests and diseases, increased cost of inputs, decline in farm profits and the adverse impact of climate change. On the demographic front, India adds annually almost one Australia (about 15–16 million) to its population. Thus, any progress gets nullified by an overall increase in population. Also, around 48% of the population is currently dependent on agriculture and allied fields and the agriculture sector contributes around 17% to national GDP. Moreover, public sector capital investment in agriculture and rural development has declined from almost 20% during the Green Revolution period to currently less than 10%. In the process, many states have remained deprived of growth and development. As a result, most farmers are not benefitted, especially since the majority of them are smallholders and find agriculture not profitable any more.

Why Double Farmers' Income?

Today, around 138 million Indian farmers' main concern is about declining farm income on the one hand and the increasing cost of inputs on the other. A recent study by the National Institute of Agricultural Economics and Policy Research (NIAP) has shown that around 70% of farmers in the country have annual per capita income of less than Rs 15,000 (around US$250). Birthal *et al.* (2017) have further analysed the situation and found that their geographical distribution is widespread, but mostly concentrated in Uttar Pradesh (27.4%), Bihar (11.4%), West Bengal (9.9%), Odisha (6.3%), Rajasthan (5.8%), Madhya Pradesh (5.3%), Maharashtra (4.9%), Assam (3.9%) and Jharkhand (3.2%). Most of these states lack the required infrastructure for agricultural income growth. Moreover, around 70% of farmers are marginal (owning less than 1 ha), and 77% of them earn a meagre income of Rs 6067 per capita p.a. Further, about 40 million farmers have around just 500 sq. m of land, which is not sustainable. Accordingly, the distress of small and marginal farmers has drawn specific attention of policy

makers lately. The Prime Minister, considering this as a national priority, rightly called for doubling farmers' income by 2022. It is often argued that the Green Revolution mainly helped the country to achieve national-level food self-sufficiency, whereas it seems to have bypassed the majority (almost 86%) of smallholder farmers having less than 2 ha. Further, besides the second-generation problems of the Green Revolution, farmers are now faced with twin global challenges: (i) global climate change; and (ii) globalization of agriculture. The average land holding is around 1.1 ha, whereas many have much less than even 1 ha, which is not sustainable for a farm family. To make farming profitable, these farmers require both new technologies that can save cost of agricultural inputs while increasing productivity, and the policy support for getting credit at low interest and also higher income by linking them directly to the markets.

Farmers' Income Trend

It is argued that to achieve the set goal, a holistic approach would be needed to reap the benefits from all possible sources of growth, both from agriculture and outside the agriculture sector. Doubling farmers' income by 2022 would require some specific policy and institutional reforms that take into account identification and targeting of low-income farmers, particularly from the regions that were bypassed by the Green Revolution, like eastern, north-eastern and western regions of the country where the capital investment somehow was not made to build the required infrastructure for overall agricultural development. Further, it is also argued that the information on farmers' income, being so crucial to understand the income dynamics of farm households and to devise strategies to improve farmers' income, is not available, except the two surveys in the past – one in 2002/03 and another in 2012/13 conducted by the National Sample Survey Office (NSSO). Chand (2017) has provided estimates of the total income and per cultivator farm income (not farmer's income) for the period 1983/84–2011/12. According to him, farm income was reported to be inadequate to escape poverty for 53% of farm households who operated on less than 0.63 ha of land holdings. As per estimates, between 1993/94 and 2015/16, real farm income had only doubled (Table 30.1) and farm income per cultivator saw a slightly higher increase mainly due to a decline in the number of cultivators after 2004/05, since the younger generation seems to have opted out of agriculture and in to employment in urban areas.

Further, the low income of farmers compared to non-agricultural workers (almost 50%) is one of the reasons for agrarian distress. The low and highly fluctuating farm income is detrimental to investment and forces the cultivators, particularly the youth, to leave farming. Even the labour cost for cultivation has gone up considerably since the implementation of the scheme under the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA).

In view of the above, the government's intention to double farmers' incomes by 2022 is indeed laudable. Once achieved, it would reduce agrarian distress and bring in parity between income of farmers and those in the non-agricultural sectors, thus possibly arresting or reversing the current migration trend. The target period to double farmers' income in real terms has been fixed as seven years, i.e. from 2015 to 2022. Hence, considering the past trend, it will require a minimum annual growth rate of 10.4%. Again, it is important to know what is to be doubled; is it the income of farmers or the output/income of the sector or the value-added or GDP of the agriculture sector? If the technology, input prices, wages and labour used could result in per-unit cost savings then farmers' income would possibly rise at a faster rate than the output. In this context, the doubling of farmers' incomes has to be viewed differently to the doubling of farm output.

Table 30.1. Trend of farmers' income in India (1993/94–2015/16). (From: Chand *et al*., 2015)

Year	Total real farm income of all farmers (Rs 10 million)	Real farm income per cultivator (Rs)
1993–94	303,814	21,110
1999–00	372,923	26,875
2004–05	434,160	26,146
2011–12	632,514	43,258
2012–13	596,695	41,553
2013–14	602,922	42,760
2014–15	597,020	43,106
2015–16	598,764	44,027

It is also argued that if inflation in agricultural commodities is high, farmers' income in nominal terms can be doubled in a much shorter period, but the government's intention appears to be to double the real income of farmers. Unfortunately, the latest data on the number of cultivators is available only up to 2011/12. Therefore, while calculating per cultivator income, it is assumed that farmers would continue their withdrawal from agriculture at the rate observed during 2004/05–2011/12. It is rather contradictory that on the one hand we want farmers' income to be doubled so that they find agriculture attractive, and on the other, economists and policy makers expect them to withdraw from agriculture. This process should remain evolutionary and not be made revolutionary. The real strength of Indian agriculture lies in the fact that it currently sustains around 48% of the population of India.

Initiatives by the Government

For quite some time now, the distress of small and marginal farmers has been drawing the attention of policy makers. In 2004, the government had set up a National Commission on Farmers, headed by Dr M.S. Swaminathan. The Commission had submitted a report in 2006 (Government of India, 2006) aiming at 'faster and more inclusive growth'. It came out with several useful recommendations to revitalize agriculture and protect farmers from the vagaries of nature and price volatility. The key recommendations were: (i) improving farmers' income from farm and non-farm sources; (ii) enhancing efficiency in the use of resources; (iii) minimizing expenditures on non-renewable inputs; and (iv) remunerative prices to farmers at 50% higher than the minimum support price (MSP). Somehow, the last recommendation, which is directly linked to farmers' income, has not yet been implemented. On the contrary, the price fluctuations in the market of farmers' produce and the higher cost of inputs have caused widespread discontent among farmers, resulting in protests and even suicides, thus drawing urgent attention of the policy makers to the need to draw up a strategy for doubling farmers' real income.

As a first step, the government changed the name of the ministry to Ministry of Agriculture and Farmers' Welfare. It also initiated programmes like Attracting Rural Youth in Agriculture (ARYA), Mera Gaon Mera Gaurav, National Skill Qualification Framework, Skill Training, Value Addition and Technology Incubation Centres in Agriculture (VATICA), Knowledge Systems and Homestead Agricultural Management in Tribal Areas, Nutri-sensitive Agricultural Resources and Innovations (NARI), Climate-Smart Villages, and web and mobile advisory services. The potential role of farmer-producer organizations (FPOs) in innovation and scaling for increasing overall income has also been given due importance.

The present government has taken many new initiatives for increasing farmers' income such as: (i) 'per drop, more crop'; (ii) availability of quality seeds; (iii) soil test-based nutrient management distribution of soil health cards; (iv) post-harvest crop losses – large investment in warehousing and cold chains; (v) value addition by the farmers; (vi) creation of a national agricultural market by removing distortions and having e-markets to link farmers to market; (vii) Pradhan Mantri Fasal Bima Yojana; (viii) high priority to diversification towards high-value activities – horticulture, dairying, food processing, poultry, sericulture, bee-keeping and fisheries.

Also, the government, in its budget of 2014–15, had established a National Adaptation Fund for Climate Change, a long-term Rural Credit Fund, provision of financial assistance of Rs 5,00,000 for Bhoomi Heen Kisan (landless formers) through National Bank for Agriculture and Rural Development (NABARD), launching of soil health cards, Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) and the Agri-Tech Infrastructure Fund. In its budget of 2015–16, the government had emphasized rural infrastructure development and created a Long-term Credit Fund, Short-term Cooperative Rural Credits Refinance Fund and Paramparagat Krishi Vikas Yojana (PKVY) to promote organic farming. Further, in the budget of 2016–17, a provision for a Long-term Irrigation Fund was made and the Union Budget of 2017–18 made some special provisions: (i) Rs 10 trillion allotted to ensure adequate flow of credit to under-serviced areas; (ii) Rs 90 billion allotted to increase the coverage under Pradhan Mantri Fasal Bima Yojana (PMFBY); (iii) contract farming emphasized for strengthening and linking the horticulture sector and agro-processing units; and (iv) Rs 20 billion allotted for dairy processing

and infrastructure development to NABARD for modernizing milk-processing units. Besides these, several other measures were taken in the past to promote agriculture and farmers' income such as MGNREGA, Rashtriya Krishi Vikas Yojana (RKVY) etc.

The resources of NABARD are also being augmented substantially following the Parliament's nod to a six-fold increase in its authorized share capital to Rs 300 billion. The Development Financial Institution (DFI) is eyeing a balance sheet size of Rs 7 trillion by 2023 as against Rs 3.9 trillion as at present. The rural India-focused DFI plans to achieve this balance sheet by stepping up focus on providing support to irrigation projects, dairy farming, improving market infrastructure in rural areas (so that farmers get good prices for their produce), enhancing credit flow to deprived areas such as central and eastern states, and support for rural housing.

Despite these initiatives, the agricultural economists have differing views; some have even expressed doubts and consider the goal unrealistic and unachievable since there is negligible information available on farmers' income and there is no clarity as to how to double their income (Gulati and Saini, 2016). This is because the real income in the past has increased by only 5.2% p.a. between 2002/03 and 2012/13. At this rate, it may take at least a decade to double the real income of farmers, unless a new and dynamic strategy is put in place and implemented in a mission mode to achieve higher than 10% income p.a., which appears to be a gigantic task. NITI Aayog has indicated that doubling farmers' income may take a little longer than the target year of 2022, unless needed reforms are expedited (Chand, 2017). Also, the combined effect of growth was found to be 75.1% in seven years and 107.5% in ten years. According to him, if the farmers' income growth is considered to rise at the same rate as experienced between 2001 and 2014 (except price factor), income will rise by 66% by 2022/23 and will possibly double in ten years, i.e. by 2025/26.

Strategy for Faster Agricultural Growth

It is quite clear that 'business as usual' will not achieve the target of doubling farmers' income; nor the suggestion by some to take farmers out of farming. What would farmers do without the new skills and where would they find employment? Instead, it is better to retain farmers in agriculture by making the profession more attractive and rewarding through diversified options, including post-production management and value addition-related activities. Obviously, out-of-the-box thinking with focused efforts on outscaling innovations linked to higher productivity, sustainability and profitability through the most appropriate diversified, secondary and speciality agriculture linked to post-harvest management, especially around proper storage, value addition and better access to market, would help achieve the goal of doubling farmers' income.

It has also been established from past trends that to achieve 8% growth in GDP, a minimum of 4% growth in the agriculture sector is a must. Hence, there is no room for complacency just because India had achieved Green, White and Blue Revolutions in the past and the problem of food scarcity has been resolved. On the contrary, the problems of smallholder farmers have magnified and real income has declined. To reverse this trend, we need a clear strategy, including a road map, that can lead us to sustainable and profitable farming using innovative approaches to harness opportunities. Also, as stated earlier, accelerating agricultural growth is critical for achieving the SDGs, especially to remove poverty, have zero hunger and ensure environmental security. Moreover, the greater the emphasis on agricultural research for innovation, the higher will be the growth of agricultural GDP (Pratt and Fan, 2010). In fact, the Green Revolution in itself was an innovation-led initiative around use of high-yielding dwarf wheat and rice varieties that responded favourably to higher inputs leading to a quantum jump in productivity. The cradles of success were: (i) political will; (ii) good institutions and human resources; (iii) availability of critical inputs (seeds, water, fertilizer etc.); (iv) enlightened extension workers and hard-working farmers; and (v) partnership at the global level.

Considering the current challenges of factor productivity growth decline, depleting natural resources, increasing cost of inputs, higher incidence of diseases and pests, higher cost of inputs, less profit to farmers and, above all, the

adverse impact of climate change, the task of increasing income, especially of 86% of farmers who are small and marginal (Government of India, 2018), would require technologies by which they can save costs on inputs and have more income by higher productivity and by linking themselves to markets. Therefore, the strategy to double incomes would demand sustainable intensification, diversification, improved resource-use efficiency and resilience in farming that is economically rewarding. In this regard, the following three-pronged strategy needs to be pursued:

- improved productivity and production efficiency;
- agricultural diversification including secondary and speciality agriculture; and
- policy support and linking farmers to market.

Improving Productivity and Production Efficiency

Bridging the yield gap

India's cropped area has been stagnant at around 141 million ha for over a decade, whereas net irrigated area is currently 65.3 million ha and the gross cropped area is 195 million ha with cropping intensity of 135%. Of this, almost 55% is still rainfed. Since there is no scope for horizontal expansion, vertical expansion through increased productivity is the only way forward, for which considerable scope exists. In this context, a clear strategy was suggested for productivity enhancement state-wise/crop-wise, projecting an increase of 80 million t of foodgrains (Hooda Committee Report, 2010). Some states have productivity less than the national average, whereas some can achieve yet higher productivity in view of rich resources and availability of technological options.

The existing yield gaps can also be bridged by increasing seed replacement rates/the area under seeds of improved varieties, especially hybrids, by adopting large-scale use of biotechnology, including the use of GM food crops and by adopting good agronomic practices that are based on natural resource conservation and both water- and nutrient-use efficiency.

Globally, the use of GM crops has benefitted farmers in reducing costs on pesticide use and for increased productivity. More than 189.8 million ha was cultivated, globally, in 2017 under GM crops, whereas India has, so far, released only cotton, covering around 11 million ha, with considerable benefits to millions of smallholder farmers. Moreover, it has reduced the use of pesticides by almost 40% and has increased both production and productivity of cotton leading to exports worth around US$3 billion annually. Thus, the government must come out with a clear strategy in support of using these innovations in crops like maize, soybean, canola, rice and brinjal, which can help farmers to raise their incomes while reducing costs on inputs and getting higher productivity.

Conservation agriculture

In addition, there is a possibility of increasing cropping intensity through efficient water use. Also, there are options for improved input-use efficiency, especially of fertilizers, pesticides and energy to ensure resilience in agriculture. For this, conscious efforts are needed to swap unsustainable elements of the conventional tillage-based monoculture production practice with temporally and spatially highly productive, profitable and sustainable intensification through large-scale adoption of CA as a vehicle of change. It is well-established, globally, that over 180 million ha, CA helps in achieving sustainable and profitable agriculture through three principles – minimal soil disturbance, permanent soil cover and proper crop rotation. CA-based management practices also help in adapting climatic risks and in lowering environmental footprint. CA technologies have been developed, adapted and promoted over the past two decades, primarily to conserve resources and increase farm income. The CA-based management optimization in the cereal-based cropping systems in south Asia have helped in increasing crop productivity, input-use efficiency with economic returns, improving soil health, increased adaptive capacity of production systems to climate risks, reducing emissions and enhancing soil-carbon sequestration (Jat *et al.*, 2016).

Conceptually, CA-based sustainable intensification (CASI) is not a single technology; it is an

innovation for sustainable farming, assimilating effective germplasm/crops, integrated nutrient/pest management, minimal and efficient farm mechanization and efficient soil and water management practices. Therefore, it requires application of farming systems-related coherent interventions that would increase both income and adaptive capacity of farmers for diversified as well as resilient agriculture. Additionally, its infusion is seen to sustain ecological services and provide greater environmental benefits to a landscape (TAAS, 2017).

Scaling innovations

There are some major innovations that currently need to be outscaled as a matter of priority, keeping in view the expected impacts on production and productivity. These are: (i) hybrid rice – the current area coverage (over the last two decades) is only around 2.5 million ha, whereas scope exists for covering at least 10 million ha in the next decade; (ii) single-cross maize hybrids – the area covered under these hybrids is less than 60%, whereas scope exists to double maize production in the next decade provided more than 90% of maize area is brought under promising single-cross hybrids; (iii) the area under CA in rice-wheat cropping systems in the Indo-Gangetic plains is about 3.5 million ha, whereas scope exists for almost 10 million ha. CA innovation also has vast scope under rainfed farming covering around 55% of the total 141 million ha of cultivable area in India; (iv) protected cultivation – the current area under protected cultivation in India is only around 50,000 ha, compared to more than 2 million ha in China; (v) micro-irrigation – out of a total irrigated area of 64.7 million ha, the area so far covered under micro-irrigation is around 8.6 million ha, which can certainly be doubled by 2022 provided direct subsidy support to the farmers is enhanced for adopting practices such as: drip, sprinkler, laser levelling, plastic mulching, raised-bed planting and direct seeding of rice. Also, the current initiatives by the government to augment and complete irrigation schemes may add an additional 2 million ha area under irrigation. However, for more efficient water use, both free supply of water and flood-irrigation practices will have to be stopped as a matter of national policy. It will also be a bold decision if water is brought under concurrent list (like Israel), to resolve inter-state disputes and enhance water productivity in the larger national interest, and to bring more area under irrigation.

Increasing nutrient-use efficiency

One of the reasons for higher productivity in irrigated areas has been the increased use of chemical fertilizers. Today, India uses, on average, around 105 kg/ha of nutrients and total consumption of chemical fertilizers is around 32 million t, of which nitrogenous fertilizers are around 25 million t. On the contrary, nutrient-use efficiency (NUE) is not more than 30%. Thus, increasing fertilizer-use efficiency is one of the biggest challenges for which there is a need to adopt innovative ways like use of seed-cum-fertilizer drill, adopting effective use of soil testing/soil health cards and decision-support systems for soil-/plant test-based use of nutrients, use of *neem* coated urea for slow release and better uptake, use of customized fertilizers, fertigation etc.

Agricultural Diversification Including Secondary and Specialty Agriculture

New options

It must be understood that unless smallholder farmers adopt diversified agriculture in a farming systems mode, including both secondary and speciality agriculture, the expected doubling of their income will not be possible. Fortunately, India has made great strides in sectors like horticulture (now the second-largest producer in the world in fruit and vegetable production with more than 304 million t), livestock (the White Revolution achieving the highest milk production in the world, at 155 million t) and fisheries (the Blue Revolution achieving 11 million t of total fish production). All these sectors have shown much faster growth (5–7%) compared to foodgrains over the last two decades. Also, considerable scope exists to increase the income of farmers by adopting agroforestry; rural based, low-cost primary processing for

value addition; cool chain; secondary and speciality agriculture such as protected cultivation; mushroom production; bee-keeping; sericulture; growing low-volume, high-value crops like nuts, spices, medicinal plants and nutri-crops; seed production of vegetable hybrids; nursery raising to provide disease-free saplings; fish-seed production; growing of flowers; vegetable seedlings to promote peri-urban agriculture; use of plastic culture; post-harvest processing; rural-based, low-cost value addition etc.

These new options would certainly provide opportunities to enhance farmers' incomes substantially, and attract youth (including women) to agriculture, provided the right knowledge is disseminated, competent human resources are built and enabling policy support and incentives are provided. Youth can also play an important role as technology providers and input suppliers, besides being rural entrepreneurs. For increasing income, farmers would need a change in their attitude/perception towards adoption of diversified agriculture.

Innovations in extension

In fact, enlightened farmers of India are more interested today in getting the right knowledge rather than to have subsidies. In this context, agricultural extension needs transformation. The public extension system played a key role during the Green Revolution phase, but it remained confined to irrigated areas. The success was also due to a holy alliance among researchers, extension specialists, farmers and policy makers. At that time, the technology-dissemination approach remained top-down, focusing on demonstrations on individual farmers' fields. As already mentioned, the current scenario of Indian agriculture is confronted with multifaceted challenges arising out of inefficient management of natural resources (soil, water, agrobiodiversity). All these have led to considerable deceleration of factor productivity and decline in farm profitability. Apparently, this complexity cannot be overcome by routine transfer of technologies. Rather, more serious efforts are now needed towards translational research requiring outscaling of innovations through 'out-of-box' extension systems. Also, conscious deployment of rural youth, women and progressive farmers would help in speedy transfer of technology and the needed impact on the livelihood of smallholder farmers.

Moreover, farmers' welfare needs to be ensured through a 'farmer first' approach to benefit equally producers and consumers. In view of the diverse demand for new innovations, new products, new information and new extension services, there is a need to shift from top-down to a bottom-up approach, involving farmers' participation at grassroots level, while ensuring confidence-building among farming communities to take risks and adopt more scientific and resilient agriculture. In the process, knowledge-sharing on good agricultural practices (GAP), without dissemination loss, and incentives for timely supply of inputs become highly critical to double farmers' income. At the same time, partnerships among key stakeholders, especially the private sector, become vital for promoting agricultural growth. In the process, care is also needed to overcome complacency that has crept into the public extension system, and greater vibrancy in the National Agricultural Research and Extension System (NARES) is required with active involvement of stakeholders (especially the private sector, NGOs and farmers) and a policy shift in the extension approach towards farming communities rather than individual farmers.

Attracting youth to agriculture

Empowering youth 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, thereby accelerating agricultural growth (TAAS, 2015). There is also a need to link 'land with lab', 'village with institute' and 'scientists with society' to ensure faster adoption of efficient resource-utilization technologies that would benefit both producers and consumers. In the suggested transformation process, the agriculture technology agents will need to become job creators and not job seekers, and provide best technologies as well as quality inputs on farmers' doorsteps. Another important action that can change the game is to promote the establishment of 'agri-clinics' where technology agents

are able to join hands in providing a single-window system of advisory services to farmers.

Another helpful approach would be to involve innovative young farmers as knowledge providers. Their own innovations, once recognized, could help in outscaling economically efficient farming practices. The concept of a demand-driven extension approach around integrated farming systems should henceforth be pursued.

Policy Support and Linking Farmers to Market

National Mission on 'Farmer First'

As stated earlier, a large number of initiatives and new schemes have been started by the government to support farmers, but there appears to be a need to have better coordination and convergence mechanisms to ensure effective outcomes and impact. Accordingly, concerns for collaboration, convergence and synergy need to be addressed along with issues of optimizing institutional arrangements of prevailing pluralistic agricultural extension and farm advisory. Agricultural extension systems urgently need a radical change. For this, a policy reorientation towards farmers' welfare through innovative and efficient technology-delivery systems, remunerative rural-based, low-cost value chains and assured market linkages would help in achieving the 'farmer first' objective. For this, a 'National Mission on Farmer First', by additional funding support and integrating different interrelated ongoing programmes under the Ministry of Agriculture and Farmers' Welfare and other ministries should be established to meet the objective of doubling farmers' incomes. The proposed national mission can oversee the coordination and convergence of various inter-ministries' programmes and have a key role to promote innovations through Krishi Vigyan Kendras (KVKs), the Agriculture Technology Management Agency (ATMA), agri-clinics, Agriculture Technology Information Centres (ATIC) and active involvement of private sector institutions. Hence, a mission on farmer first, with an initial allocation of Rs 100 billion should be mandated to promote the establishment of agri-clinics by encouraging well-trained groups of young individuals as small-scale private entrepreneurs. At least one agri-clinic per district could be targeted to begin with, linked to performance-based incentives and funding support in a phased manner. Also, under this mission, a farmers' innovation fund could be established for the validation and refinement of cost-saving/efficient technologies for outscaling. This mission should also be mandated to support the self-help groups/associations of progressive farmers/cooperatives or even farmers' producer companies to link them with markets. In addition, it must oversee and support the initiatives related to knowledge-/technology-sharing and capacity-building by private entrepreneurs using ICT, media, TV, smart phones and market advisory services. As the information needs of the farmers are exploding, and presently accessible to only 45% of farmers, innovative ways need to be found with the greater involvement of youth in agriculture. The initiative of DD Kisan, a dedicated TV channel for farmers, is indeed a good beginning, but its programmes need to be made more innovative and attractive, especially to attract youth around new options by which they can enhance income while adopting sustainable and diversified agriculture. Penetration of mobile phones and the use of the internet in rural areas can be another goal under the proposed mission on farmer first.

It is a fact that despite being the custodians of the country's food security, Indian farmers, especially smallholders (around 86%) are stuck in a low-income rut. As already stated, their per capita income (Rs 15,000 p.a.) is just one fifth of the national average. Only around 7% of marginal farmers earn more than Rs 50,000 per capita p.a. In their case, 60% of the income comes from non-farming sources. Also, they are engaged in diversified agriculture like animal husbandry, horticulture and growing cash crops. Unfortunately, allocation of R&D resources to these allied sectors like livestock, fishery and agro-forestry are not proportionate to their actual contribution to agricultural GDP, which, as a matter of policy, needs urgent attention (Government of India, 2018).

Increasing funding support

As already emphasized, in the long run, the boost to farmers' incomes must come from technological

breakthroughs that raise yields and resource-use efficiency, reduce cost of production and ensure resilience in agriculture (Government of India, 2018). It is also a fact that those developing nations that have supported their agricultural research for development (AR4D) have made faster progress. China currently spends almost twice that spent by India on agricultural R&D, whereas challenges before Indian agriculture are equally daunting (Lele, 2017). Current funding of 0.4% of its agricultural GDP on AR4D is indeed much less than many developed and developing countries. This, therefore, calls for an immediate increase in resource allocation (almost tripled) to address the emerging challenges in agriculture. India would do much better if the government allocated a minimum of 1% of its agricultural GDP on R&D.

It is also clear that for successful scaling of innovations there is a need to enable the following: (i) institutional policies for facilitation of farmers' collectives like self-help groups, cooperatives, FPOs (commensurate with a legal framework), establishment of a cadre of agri-business professionals at the village level, creation of agri-clinics, provision of credit at low interest rates (<4%) to the farmers across the value chain, machine rental services etc.; (ii) promotion of ecoregional research, marketing and trade policy, agro-processing, value-chain development, sustainable livelihood, new funding models for translational research by the state governments etc.; (iii) price policies like a minimum support price (MSP) for most crops/commodities, incentive support around efficiency, avoidance of risk through provision of insurance, compensation for ecosystem/environmental services etc; (iv) investment policies to ensure higher capital investment (around 15–20%) in the states needing critical infrastructure like roads, irrigation, power, markets etc.; gradual reduction in subsidies but linked to incentives that are performance-orientated, promoting the private sector; and (v) policies on land and water use that encourage more efficient use of these natural resources. There is also considerable scope for attracting the private sector and youth for developing wholesale markets, warehouses, cold-storage facilities, rural-based agro-processing infrastructure, promoting micro-irrigation systems, sale of quality inputs, and providing agricultural extension services.

Market reforms

It is urgent that perishable commodities like fruit and vegetables are immediately delinked from centralized sales through Mandis, as at present, by revisiting and amending the Agriculture Produce Marketing Committee (APMC) Act. The initiative to implement the new Model Agricultural Produce and Livestock Marketing (APLM) Act 2017 is a right step but its implementation by all states is to be facilitated and monitored by NITI Aayog. Also, for the proposed electronic network for agricultural marketing (e-NAM), it is necessary that movement of agricultural produce is not restricted by the state governments. We need bold export-import (EXIM) policy, keeping in view long-term goals to take advantage of globalization of agriculture. Present short-term policies of allowing exports sometimes and putting restrictions on them is counter-productive. This has happened in the recent past by imposing restrictions on export of cotton, meat and foodgrains. Even creating positions of agricultural attachées in the embassies of selected countries would be a great help in boosting agricultural exports, thus benefitting indirectly the farmers.

Land laws for tenancy, contract/collective farming, long leases (so that farmers/tenants are encouraged to invest in land development), consolidation of holdings with no more fragmentation below 1 ha, being uneconomical, must be revised and put into implementation at the soonest. Also, the implementation of the Model Land Leasing Act (2016) should be a high priority for state governments. Similarly, for better value and efficient use of precious water resources, both pricing of water and banning of flood irrigation systems must be considered, and incentives for micro-irrigation for greater area coverage must become a national priority. Obviously, bold policy decisions are required and 'business as usual' will not suffice.

Given the limits on land holdings, income growth has to be by raising cropping intensity, improving resource-use efficiency and agricultural diversification. Expansion in agriculture needs to exploit intensive cultivation, as only 40% of crop land is cultivated more than once. This can be enhanced by improving farmers' access to quality seeds of short-duration, high-yielding crop varieties/hybrids and by adopting efficient

cropping systems that are more sustainable. More area coverage under quality seeds of improved varieties and hybrids would need reforms, as proposed under the Seed Bill 2004, which has been pending for a long time in Parliament. The needed incentives and handholding of the private seed sector, especially for making available seeds of promising hybrids of different crops, would go a long way in bridging the existing yield gaps and for increasing farmers' income.

The focus should also be on diversification towards high-value crops/commodities, especially horticulture, by bringing a minimum 10% area in each of the states into play. Also, increased support for the animal husbandry and fishery sectors will be of great benefit. Demand for these commodities is growing fast and there is considerable potential for their value addition, including export. These enterprises have, however, not received much policy support, except horticulture. For example, animal husbandry receives just 5% of total public investment and institutional credit to the agricultural sector, though it contributes more than 30% to agricultural GDP. Higher allocation of resources would thus be justified to accelerate the growth of these highly potential sectors. Further, there is a need to create required infrastructure, focusing on improving complementarities, since lack of any of these may restrict farmers in capturing the benefits of investment in others. A typical case is that of Bihar and north-eastern states, where despite some improvement in road networks, farmers have not benefitted much owing to poor electricity supply, irrigation infrastructure and marketing facilities.

Linking farmers to market

There is no doubt that linking farmers to markets is critical for improved livelihood of smallholder farmers and beneficial for consumers. Smallholders are more efficient in production, yet they face serious disadvantages, mainly on account of marketing their produce. As a result, smallholders are often bypassed in the process of transformation of agriculture, agri-food and marketing systems. Although, it is relatively easy for smallholders to diversify towards high-value crops owing to their higher resource flexibility and better family labour availability, they face disadvantages in terms of scale in production and market. Moreover, they have small marketable surpluses that are costlier to trade in the distant urban markets due to higher transportation and transaction costs. Hence, efforts to improve productivity on small farms may not directly result in higher income unless these are appropriately linked with markets. Their integration into markets or value chains would thus require pro-smallholder policies that create an enabling environment for attracting various stakeholders to act together in processing, marketing and sharing the benefits on account of emerging market opportunities. As stated, these include innovative institutional mechanisms, better infrastructure, greater involvement of the private sector, easy access to agricultural and market-related information and risk-management mechanisms, and, above all, a favourable business environment through stable marketing and trade policies (TAAS, 2013).

The Way Forward

To make agriculture both remunerative and attractive as a profession, and especially to double farmers' income, an action plan for implementing the three-pronged strategy proposed above is described below.

Policy interventions

- A national mission on Farmer First, with an annual allocation of Rs 100 billion to begin with, by merging/clubbing of various central schemes as well as new initiatives to empower farmers, needs to be initiated. This will help to catalyse the activities/programmes specifically designed for scaling innovations that will increase farmers' income and have direct impact on smallholder farmers through adoption of a three-pronged strategy defined earlier.
- Needed regulatory reforms in the existing acts, especially pertaining to land, water, seed, fertilizer, energy and market must be brought about as a matter of national priority by the government. Also, an effective

coordination and convergence mechanism for various schemes, programmes and activities by different ministries would help in achieving the desired outcomes much faster. For this, a high-level, inter-ministerial committee to be chaired by the prime minister and co-chaired by the vice-chairman of NITI Aayog and the agriculture minister will help ensure effective monitoring of the outcomes of various programmes aimed at Farmer First. This coordination committee will be assisted by a standing advisory panel of agricultural experts.

- A remunerative MSP for most of the commodities needs to be fixed and announced well in advance of planting season by the Ministry of Agriculture and Farmers' Welfare (MOA&FW) with assurance for either procurement or compensation directly to the producers for prevailing price differences in the market, so that the farmer does not lose out. Also, reforms in the methodology for fixing the MSP by the Commission for Agricultural Costs and Prices (CACP) is needed, for which a high-level external review committee of experts should be established immediately.
- For accelerating agricultural growth, needed incentives and rewards must be put in place quickly to attract youth (including women) to diversified, secondary and speciality agriculture as individual producers, SHGs, cooperatives, farmers-producer organizations/companies or as knowledge/service providers. In the process, farmer-led innovations should be scaled out through required validation, refinement and incentives in the form of credit at low interest rates (<4%), bank support for required commercialization, insurance to avoid any initial risks, and practically no or very low tax on rural-based value additions and marketing of produce/value-added products. Incentives to innovators/entrepreneurs could be in the form of state/national recognition and awards.
- The right policy support for an accelerated role of the private sector will change the game much faster. Hence, an enabling environment to embrace the private sector is the most critical need. In this context, support for hybrid seed production; fabrication of equipment/implements/tools for scaling CA and small-farm mechanization; micro-irrigation (drip and sprinkler); protected cultivation, including fertigation; agro-processing and value addition; fertilizers, including customized and biofertilizers; pesticides, including biopesticides etc. would help accelerate agricultural growth.

Research and development

- Besides the focus on productivity and production growth, we need increased R&D emphasis on post-production, value addition and market linkages (both domestic and foreign).
- There is an urgent need to improve the empowerment of targeted smallholder farmers and ensure delivery of last-mile services. Hence, technology dissemination-related programmes will have to be tailored and re-orientated according to present-day needs. In fact, a paradigm shift from public to private innovation extension systems is the need of the hour to provide much-needed knowledge, quality inputs and much-needed custom-hire services on the farmer's doorstep.
- Ensure that smallholder farmers, especially youth and female farmers, get their entitlements and are not sidelined.
- Identification of agencies/institutions responsible to take specific actions at the local, state and central level, and their effective coordination, will be very helpful. Also, an independent monitoring and evaluation process for much-needed impact will be extremely useful.

Capacity development

- Knowledge-sharing and capacity development (especially women and youth) need to be considered a top priority to bridge yield gaps, achieve diversification, scale innovations that can save on production costs and help in rational use of natural resources, ensure value addition and link farmers to market.

- Greater emphasis must be given to skill (on-farm as well as off-farm activities) development at all levels. This will greatly help the farmers, especially the smallholders, to raise their income.

Financial support

- There is an urgent need to triple the annual budget allocation for the Indian Council of Agricultural Research (ICAR), an apex AR4D organization with a proven track record, in order to continue meeting emerging challenges while providing national public goods for the betterment of farmers as well as Indian agriculture.
- Capital investment in agriculture for much-required infrastructure in the states that were left behind during the Green Revolution (especially the eastern region) must immediately be enhanced (at least to a minimum level of 15–20% from the current less than 10%) to create much-needed infrastructure to help farmers increase their production as well as their income. Such an effort will also help in achieving SDGs much faster.
- The state governments (as they have major responsibility, agriculture being a state subject) must provide necessary financial support and commitment for implementation of the above three-pronged strategy to double farmers' income. The role of NITI Aayog is thus very critical in this context.

Conclusion

In India, while farmers are the major producers, they also constitute the largest proportion of consumers. Hence, improving small-farm production and productivity, as a major development strategy, can make significant contribution towards elimination of hunger and poverty, provided farming is made efficient and remunerative. Experience of countries that have succeeded in reducing hunger and malnutrition shows that growth originating in agriculture, through smallholder farmers is at least twice as effective in benefitting the poorest as is the growth from non-agriculture sectors. The World Development Report of the World Bank (World Bank, 2008) has clearly emphasized that 'Using agriculture as the basis for economic growth in agriculture-based countries requires a productivity revolution in smallholder farming.' As stated earlier, higher productivity requires higher investment in agriculture and agricultural research – a fact that needs to be heeded by policy makers to make sure that 1% of agricultural GDP is invested in AR4D, as against the present level of just 0.4%. Hence, a three-fold increase in resource allocation for the National Agricultural Research System (NARS) must be considered a prerequisite to doubling farmers' income.

It is also a fact that India will remain predominantly an agricultural country during most of the 21st century. Therefore, we must have both vision and a national strategy for shaping the destiny of agriculture by making it highly productive, efficient and economically attractive for the smallholder farming community. The target of doubling farmers' income by 2022, not an easy, yet laudable, goal, augurs well for the government's intention to help farmers. It is also clear that if concerted efforts, as per the suggested action plan above, are made, the prospects of making agriculture the engine of national economic growth and a respectable profession for smallholder farmers are much brighter.

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