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Agriculture for Achieving Sustainable Development Goals

The Context

Globally, poverty and hunger are still the twin challenges before human civilization despite specific temporal and spatial efforts. Though extreme poverty has been reduced by more than half since 1992, more than 800 million people live on less than US$1/day and roughly half of the world's population lives below US$2.50/day. One in nine people is undernourished. Poor nutrition is the cause of 45% of the deaths among children under the age of 5, nearly 3 million each year. Every 3.5 seconds a child dies due to poverty. Therefore, it is necessary to produce affordable, nutritional, safe and healthy food more efficiently and sustainably.

Agriculture is facing a bigger threat now than ever before on account of degradation of natural resources, especially land and water, as well as the adverse impact of global climate change. Hence combating climate change, reducing emissions and conserving natural resources, without compromising economic development, especially on the food front, would require a new set of policies, institutional reforms and additional investment in the agricultural sector (NITI Aayog, 2015). Modern agriculture has achieved much over the last century. Whilst the global population has grown from less than three billion in 1950 to more than seven billion today, the levels of hunger have not followed this trend. Of the estimated 805 million people experiencing chronic hunger globally, around three quarters live in rural areas and are overwhelmingly dependent on agriculture for their food and livelihood. Some 526 million people (65% of the total) of these live in Asia and the Pacific region. Most of them live in south Asia. Tackling hunger is not only about increasing food production; it is also about increasing incomes and strengthening markets so that people have ready access to food. The Food and Agriculture Organization of the United Nations (FAO) has predicted that hunger levels are likely to decrease considerably by 2030.

Revisiting the Millennium Development Goals

To address these concerns, global leaders revisited the Millennium Development Goals (MDGs) to formulate a new action plan. It was a unique effort by the national leaders to combat poverty, hunger, undernourishment and other issues of global concern. Earlier, MDGs were the world's time-bound and quantified targets for addressing extreme poverty in its many dimensions. In all, there were eight MDGs. The first was to eradicate extreme hunger and poverty; the second was to achieve universal primary education; the third was to promote gender equality and empower women; the fourth was to reduce child mortality; the fifth was to improve maternal

health; the sixth was to combat HIV/AIDS, malaria and other diseases; the seventh was to ensure environmental sustainability; and the eighth was to develop a global partnership for development. Most of the developing countries made good progress in achieving these goals, especially that of reducing poverty by half between 1992 and 2010. Between 1990 and 2002, average overall income increased by over 21%. The number of people living in extreme poverty declined by an estimated 130 million. Child mortality rates fell from 103 deaths per 1000 live births to 88 per 1000. Life expectancy rose from 63.03 years (2001) to 68.78 years (2017). An additional 8% of the developing world's people received access to water and an additional 15% acquired access to improved sanitation services. The world did make significant progress in achieving the goal of reducing poverty. However, across countries the decline was uneven. In Asia there were about 740 million poor people in 1990–92, which declined to 565 million in 2010–12. In this context, China did remarkably well, where poverty declined from above 60% to around 10% by 2008. Other east-Asian and Pacific countries also did quite well. However, a lot still needs to be done in south Asia where the most poverty still exists, despite Green, White and Blue revolutions (IFPRI, 2017; Paroda, 2017).

Adopting the Sustainable Development Goals

After 20 years of collective efforts, globally, the world leaders again met and reviewed the efforts towards the MDGs and decided, collectively, to lay yet greater focus on sustainability. Poverty eradication, promoting sustainable patterns of consumption-production and protecting and managing the natural resource base for economic and social development were considered the overarching objectives for sustainable development. Accordingly, on 25 September 2015, the UN adopted a set of goals to end poverty, protect the planet and ensure prosperity for all as part of new Sustainable Development Goals (SDGs) to be achieved by 2030. India was one of the 193 UN member states to adopt the SDGs and commit to meet them within the timeframe. At the UN Summit for the Adoption of the Post-2015 Development Agenda, Prime Minister Shri Narendra Modi reaffirmed India's commitment, saying: 'Today much of India's development agenda is mirrored in the SDGs.'

The resolution adopted by the UN has much broader intergovernmental agreement, which, while acting as the post-2015 Development Agenda, builds on the resolution popularly known as The Future We Want. In all, there are 17 SDGs with 169 targets covering a broad range of sustainable development issues. Over half of the SDGs relate to global food security and nutrition and four are directly related to hunger. These four are: 'no poverty', 'zero hunger', 'climate action' and 'life on land'. At present, there is a projection of producing 70% more food, which is needed to feed 9.7 billion people by 2050. Thus the global food systems have to be reshaped if we are to achieve the SDGs in general, and those related to agriculture in particular. Similarly, agriculture's demand for water could rise by over 30% as availability shrinks. Additionally, per capita arable land is expected to decrease by 50% by 2050, and about 30% of food is wasted every year.

In this context, the Indian scenario is no different; while it has made considerable progress in reducing poverty, hunger and malnutrition, millions of people go to bed hungry. Similarly, malnutrition is another aspect of hunger that leads to many types of diseases, especially among children, thus affecting the economy of the country. As stated earlier, within Asia, south Asia has the largest concentration of poor people (nearly 304 million). As much as 71% of the poor and food-insecure population of south Asia live in India. Like other countries, India also met most of the MDGs well before 2015, but the pace had been much slower compared with China and other countries in south-east Asia. Also, the progress for some of the development goals had been rather inconsistent. The official estimates reveal that while India achieved the poverty reduction target, it fell short of reducing hunger, mainly on account of economic access to food and not because of shortage of foodgrain availability.

We all know that food security is influenced by a number of factors, including those that determine food availability – domestic food production and the capacity to import food – as well as determinants of food access, including the distribution of food among various segments of the

population. The estimated financial requirement for India to meet the cost of food security is around Rs 46 trillion (US$729 billion) from 2015 to 2024. This cost includes the financial requirements for providing access to safe and nutritious food for all and investments in irrigation, soil and water conservation, wasteland improvement and rainfed farming. Continuous shrinkage of land for agriculture due to land demand for industry, infrastructure and cities may increase the costs of food production. Climate change may also influence the productivity of crops. It is now clear that there are almost 5–10% losses in foodgrains.

India is currently faced with high population pressure on land and other resources to meet its food and development needs. The natural resource base of land, water and biodiversity is under severe pressure. Food-demand challenges that lie ahead are also formidable considering the non-availability of favourable factors of growth, fast-declining productivity in major cropping systems and a rapidly shrinking resource base. On the contrary, sustainable agriculture deals with conservation and sustainable use of land, water, plant and animal genetic resources in ways that are environmentally non-degrading, technically appropriate, economically viable and socially acceptable. The process of sustainable agriculture must, therefore, meet the following criteria:

- to ensure that the basic nutritional requirements of present and future generations, qualitatively and quantitatively, are met while providing a number of other agricultural products;
- to provide durable employment, sufficient income and decent living and working conditions for all those engaged in agriculture;
- to maintain and, where possible, enhance the productive capacity of the natural resource base as a whole, and the regenerative capacity of renewable resources, without disrupting the functioning of basic ecological cycles and natural balances, without destroying the sociocultural attributes of rural communities, and without causing contamination of the environment; and
- to reduce the vulnerability of the agricultural sector to adverse natural and socioeconomic factors and other risks, and strengthen self-reliance.

Aiming for Sustainable Development Goals

India has, since the adoption of the SDGs in September 2015, directed its development pathway to meet specific priorities of employment; economic growth; food, water and energy security; disaster resilience; and poverty alleviation. It has also aimed to restore its natural resources and adopt transparent and robust governance along democratic lines. However, emerging challenges of climate change, increasing inequities and lagging human development indices are well recognized by both the people and the government. The post-2015 UN Sustainable Development Agenda framework thus provides an opportunity to renew and integrate efforts in order to meet, to a considerable extent, the national and global aspirations in a defined timeframe (i.e. until 2030).

The pressing need for India, therefore, is to effectively execute the new agenda through much-needed partnership with key stakeholders. This involves the participation of the public sector/government, corporate entities who are skilled in managing and multiplying resources, non-governmental organizations (NGOs), social enterprises and other development actors who are acquainted with implementing, evaluating and scaling up social development projects. The National Institution for Transforming India (NITI Aayog) is the national body primarily responsible for implementing the SDGs in India. Hence NITI Aayog must have an implementation plan drawn up, which is well monitored and executed. In the process, the government could tap regional and local partnerships and build stakeholder capacities to gather measurable track data as indicators of change. Achieving the SDGs in a country as diverse as India will be a Herculean task, yet not unachievable. There is a need to clearly identify priorities, follow locally relevant and people-centric development policies, and build strong partnerships. The government also needs to have a focused plan for tracking and evaluating impact and scaling up successful interventions. The SDGs are thus a direction and a vision for India to ensure prosperity and growth, both social and economic. It is quite clear that for meeting SDGs, India is centre-stage globally, and it would need concerted effort to achieve all

17 goals, considering the current levels of poverty and hunger that exist in India (NITI Aayog, 2015).

Meeting the Targets of Sustainable Development Goals

In order to meet the SDG targets, India will have to: (i) double its agricultural income by 2030 from small-scale food producers, particularly women, family farmers, pastoralists and fishermen, through secure and equal access to land, other productive resources, inputs, knowledge, financial services, markets, and opportunities for value addition, as well as non-farm employment; (ii) maintain, by 2020, available genetic diversity of seeds, cultivated plants and domesticated animals and their related wild species, and promote access to and fair and equitable sharing of benefits arising from their use; (iii) increase investment in rural infrastructure, agricultural research, technology development and extension services; (iv) correct trade restrictions and distortions in world agricultural markets, including possible elimination of agricultural subsidies; and (v) adopt measures to ensure proper functioning of food commodity markets and their derivatives, and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility. The goal of SDG1 relates to elimination of poverty and SDG2 calls specifically to 'end hunger, achieve food security and improved nutrition through sustainable agriculture'. Sustainability means using fewer natural resources to produce food and reducing food waste and loss. Improved nutrition means reducing both hunger and obesity through improved education, and access to and availability of good-quality foods (Farming First, 2015; Paroda, 2017).

SDG1 and SDG2 resonate strongly with the Indian development agenda since elimination of poverty and hunger continues to be a major goal in the future. Fortunately, the database for poverty indicators is robust and India has adopted some of the elements of a social protection network. Food Security Act India is justly proud of its success at the food front but this has not taken care of existing hunger. If India succeeds in its goal of poverty reduction, it will contribute substantially to the elimination of hunger. Indian policy, however, has placed too much emphasis on hunger measured in terms of low dietary energy intake. The country faces a serious problem of poor nutrition. Many of its children are stunted and weigh less than the children in many other countries in the region. This could be partly due to the young age at which girls marry and their poor nutritional status. This is a principal challenge today, and if we can address this, it would take us a long way to meeting the SDGs. Interestingly, SDGs concerning hunger, decline in poverty and average per capita calorie intake seem to have been addressed well in recent years. For the country as a whole, rural poverty declined from 45.61% in 1983 to 28.30% in 2004–05, and urban poverty declined from 42.15% to 25.70% in a similar period. During the intervening period, the average calorie intake per capita declined from 2220 to 2040 and from 2089 to 2020 kcal in the rural and urban sectors, respectively. In fact, as regards calorie deprivation, its extent has increased from 69% to 85% in rural India and from 60% to 65% in urban India (NITI Aayog, 2015).

Urbanization comes with challenges to agriculture and nutrition. Higher urban incomes are associated with a dietary transition to more fruits and vegetables, animal-sourced food, fats and oil, and refined grains, which require more intensive use of natural resources. Urban lifestyles tend to increase consumption of processed foods and the urban poor are often limited to cheap, unhealthy foods. At the same time, as the urban population grows, hunger and malnutrition will increase. In addition to access to healthy and nutritious foods, access to clean water, toilets and sanitation will also present challenges. Yet rapid urbanization brings opportunities, as the rise in demand for increased and diversified food production in rural areas can contribute to improved farmers' livelihoods. To take advantage of these opportunities, strong rural–urban links are needed. Where links are strong, rural farmers can sell larger shares of produce in urban markets, and labourers can migrate or commute to nearby towns for seasonal work and have better options for their livelihood.

The agriculture sector in India is currently facing numerous challenges such as: decline in the size of land holdings, natural resources (especially soil and water), adverse impact of climate change, factor productivity decline, costly

inputs, fluctuating markets and decline in income. In the country there is a huge gap between the actual yields and the potential yields, and this yield gap is more in the case of pulses, oilseeds and other neglected crops. At the same time, we have to look into the public distribution system (PDS) by plugging the leakages and the diversions. There are various factors for low yields of crops in the country as compared to most of the developed countries. With the passing of time there is a decline in yield and these varieties become susceptible to diseases and pests. There is also the problem of low seed replacement rate (SRR) in the country, mostly of pulses and oilseeds. As such, greater emphasis is needed on increasing the seed replacement rate using high-yielding varieties and hybrids. The main questions before us now are:

- How can agriculture contribute towards achieving SDGs?
- What should be the strategy to promote agriculture for achieving SDGs?
- What lessons can other developing countries, especially in south Asia, learn from India, or vice versa?

We have to achieve the SDGs with limited and shrinking resources, and with a changing climate scenario. We have considerably harmed our agro-ecology and lost considerable diversity of our flora and fauna; many insect and weed species have become resistant to various antibiotics; many new weed species have emerged; many new diseases are taking their toll and soils have become sick and degraded. Thus, to achieve SDGs, we have to mainly focus now on climate-smart agriculture, like zero- or no-till cultivation, rainwater harvesting, practices that make best possible use of available resources with minimum loss of natural resources, and, above all, the loss of agrobiodiversity. The role of improved varieties/hybrids and management practices have immense potential in achieving the SDGs. It is encouraging that the National Agricultural Research System (NARS) has developed several technologies that promise to increase income, reduce production costs, conserve natural resources, improve food quality and nutrition, and minimize various risks. The need now is to create an enabling environment to scale out useful and efficient innovations like conservation agriculture (CA) for greater adoption and large-scale impact on the income of our smallholder farmers. Farm mechanization also saves a lot of energy and labour. Our policies and institutions should support the marginal and small farmers to adopt farm mechanization. The financial institutions must provide better credit at lower interest rates. Similarly, more farmers and more crops should be brought under insurance cover. Mobilization of farmers by organizing them into farmers' cooperatives, producer companies or commodity interest groups should now be the major aim of all developmental institutions. These groups could then be linked to the markets to increase their income substantially.

The Indian Council of Agricultural Research (ICAR) coordinates research and education conducted by 107 specialized institutes/research centres and 67 agricultural universities across the country. Technological innovations are the backbone of productive and resilient farms, fisheries and livestock operations, and a safe, wholesome food supply. They contribute to improvements in the quality of seeds, animal stock and inputs, labour-saving devices, effective production and conservation practices, reduction of post-harvest losses, efficient price discovery mechanisms, and control of pests, diseases and contamination. Access to these innovations will be essential if farmers and producers along the value chain are able to meet the rising global demands of climate change. Climate change, resource constraints, and storage and distribution of food are some concerns that threaten India's food security. With increasing population and socioeconomic development needs, access and availability of resources for food production can be seen as a critical constraint in ensuring food security. Agriculture is undeniably a resource-intensive sector, and this fact comes along with a need for efficient and effective management of finite resources in order to ensure long-term sustainability of agriculture and food security for all.

Recent Government Initiatives

The Indian government is giving high priority to the agriculture sector to make it more efficient, competitive, sustainable and resilient. Doubling farmers' income by 2022 is a recent policy initiative of the government. In this context there are several programmes that aim to increase farmers' income, conserve soil and water

resources, improve resilience and reduce climatic risks. These programmes include: the Prime Minister Irrigation Programme, the Prime Minister Agricultural Insurance Scheme, the National Food Security Mission, the National Horticulture Mission, the National Mission on Sustainable Agriculture, the National Agricultural Development Plans, the National Livestock Mission, the Midday Meal Scheme, and the Anganwadi Centres, contributing to tackling food and nutrition insecurity. To strengthen value chains of agricultural commodities and improve market efficiency, a provision has been made to develop e-NAM (One Nation, One Market). However, to establish efficient and inclusive rural-urban value chains, institutional arrangements that support the participation of marginal and smallholder farmers, who often have little marketable surplus, are needed. Production in urban and peri-urban areas is shifting towards resource-intensive foods such as vegetables, dairy, meat and poultry to meet the rapidly growing demand. To veer production to rural areas, thereby reducing pressure on increasingly scarce urban and peri-urban lands, rural agri-infrastructure such as cold chains, cold storage and processing facilities are necessary. Leveraging towns and intermediate cities to facilitate economic and social connections between rural and urban areas, and improving rural infrastructure, is therefore crucial. All these efforts demonstrate India's commitment to accomplish the SDGs that relate to agriculture. There is, however, an urgent need to ensure reorientation of ongoing efforts towards higher efficiency and effectiveness of initiatives by developing a road map by which we are able to achieve the goals well before 2030. To end hunger and malnutrition in India and beyond, we must find solutions that take account of the ongoing trend of urbanization. Doing so is key in India where, despite progress, 20% are still hungry and around 39% of children are stunted. Improving links between rural and urban areas is therefore a critical start.

Indicators of Achieving Sustainable Development Goals

Major dimensions of hunger include calorie deprivation and protein hunger (including hidden hunger). Some specific policies to achieve sustainability include: focus on hunger (including hidden hunger) and malnutrition, taking a 'zero hunger' by 2025 challenge; links between agriculture and nutrition; increased investment; raising the productivity of small farmers; assessing climate change and thereby improving productivity and resilience in agriculture; and gender-sensitive policies in agriculture and health. The time has come to focus on small farmers, rainfed agriculture, the plight of women farmers and youth, and also on biofortified crops for nutritional security. It has also been observed that there was intense desertification through the warming of cold desert areas and land degradation in the eastern region between 1975 and 2006. Due to this, agriculture is becoming distressed due to crop failures. Also, in the southern region, the coconut-based farming system has become uneconomical. Due to land degradation there is an increase in arsenic and fluoride contamination, a shift in rivers, a shift in the Sundarban delta, and increased aridity and incidence of drought, floods and cyclones, which aggravate the situation further. There is a need to develop site-specific information through land resource inventory (LRI) on a 1:10,000 scale, along with the use of balanced fertilizers, boosting rainfed agriculture, and land management in hills. Land use plans need to be developed for plateaux, the drought-hit area of central India, the coastal region, the flood plains and areas with potential for carbon sequestration and geoportal or mobile apps.

The impact of climate change is clearly visible across the globe and tropical countries like India are most vulerable. In the past 15 years the country has observed simultaneous occurrence of drought and floods affecting agriculture, food and nutrition, and the livelihoods and sustainability of smallholder farmers. Setting up integrated farming systems (IFS) models for households, use of community participation, zero tillage, stopping burning of crop residues, and expanding climate-resilient villages could be major solutions for climate risk reduction. Contingency plans are required to be in place, such as water-saving cultivars, crop diversification, rainwater harvesting and conservation, building large farm ponds, sustainable vegetables and horticulture systems, and increased production of pulses and fodder, so as to increase household farm income.

New Technologies and Innovations

There is a need to accelerate the breeding of self-pollinating crops with a wider gene pool, to develop and deploy high-yielding, nutrient-rich hybrids in both field and horticulture crops, especially vegetable crops, and to promote biofortified crops and the use of genome engineering/gene editing to gain more yield and to resist drought and disease more effectively. Crop intensification, rainwater harvesting, recycling of wastewater, managing blue water, mechanization and value chain/crop cycle (from tillage and seedbed preparation to post-harvesting) to enhance crop productivity also need to be addressed. Scaling-up farm mechanization by promoting both pre- and post-harvest machineries brings efficiency in the food value chain by improving cropping intensity, reducing the cost of production and drudgery, enhancing farm power supply and maintaining a socially desirable mix of human labour, animal power and mechanical power. IT-based skill development programmes for extension workers, decision support systems, appropriate technologies for mechanizing horticultural crops, especially in hilly areas, and cost-effective technologies like smart tractors, unmanned aerial vehicles and wireless technology are some areas that need attention. Also, a pluralistic extension approach needs to be promoted along with empowerment models like commodity groups, farmers' organizations and producer companies to strengthen market links. Programme delivery mechanisms in disadvantaged areas need to be streamlined with emphasis on socioeconomic mapping. Extension services in allied sectors like horticulture, animal husbandry, fisheries, poultry, sericulture etc. need to be strengthened. The competency of extension agencies, especially youth as 'technology agents', needs to be improved by systematic training and capacity-building programmes, enabling them to respond to emerging issues like climate change adaptation, use of ICT, input-use efficiency, integrated nutrient management (INM) and integrated pest management (IPM) technologies. Agricultural extension planning at block or cluster level needs to be addressed jointly by agricultural technology management agencies (ATMA), Krishi Vigyan Kendras (KVK), non-governmental organizations and the private sector, at micro level, keeping in view the specific requirements to meet the SDGs.

India must again strengthen conventional plant breeding (including pre-breeding) and pursue the adoption of GM technology both in field and horticultural crops, for which policy support is badly needed. Availability of good-quality seed, including hybrids and planting material, is the pressing need. Research on pre- and post-harvest losses also needs to be strengthened. Besides characterization of bioresources, a multidisciplinary/multifunctional approach will have to be followed in natural resource management in a way that enables farmers and scientists to work in unison on a long-term basis. In the livestock sector, India may expand successful models like Amul Dairy with still better efficiency and investigate the reasons for not scaling up this model in other states. Also, there is a need to reduce the number of non-productive animals, to conserve and improve indigenous breeds, to reduce methane emissions through better housing and feeding of large animals, to promote backyard poultry and to enhance feed resources that can be produced locally.

Role of Public Policies

Changing goals and approaches have invariably led to the failure of policies to reduce poverty and inequality. Many times, administrative incapacity, and uncoordinated and duplicate efforts have resulted in not achieving the targets. There is a need to bring in socioeconomic reforms to insulate the poor from adverse shocks. The strengthening of institutions for the effective implementation of policies is required. A different mindset is necessary to set targets commensurate with the right policies. We know that agricultural spending is still low in India (0.4%, to be raised to a minimum of 1% of AgGDP). Also, more capital investment in agriculture-related activities is necessary in high-income states, middle-income states and low-income states. High-income states need investment in agricultural R&D, health and education, with greater focus on non-farm employment opportunities; whereas rural infrastructure development is required in low-income states. Rationalization of subsidies/reduction in input subsidy and technology interventions are also required to

improve the efficiency of public spending. To meet the target of doubling farmers' incomes by 2022, an innovative strategy is required for increasing the livelihood of resource-poor marginal farmers through diversification towards sub-sectors of agriculture like livestock, horticulture and fisheries, and to move towards secondary and speciality agriculture with a focus on marketing reforms, including price management. Also, there is a need to put in place policies to promote low-volume, high-value crops, through market links, and for exports and value addition.

Climate Change-related Policies

India faces many climatic challenges, such as serious droughts in one region and dangerous floods in another. The reason it is so vulnerable is because it is a large country with many citizens living in poverty, inadequate infrastructure and lack of government planning to deal with complex weather systems. Recently, a World Bank report emphasized how India will be subject to irregular monsoons, flooding, rising sea levels and higher temperatures. The monsoon season is vital to the Indian economy. Preparation for weather irregularities is thus essential in order to protect the lives of Indian people and the growth of the Indian economy.

Climate change can have a dramatic impact on natural resources, economic activities, food security, health and physical infrastructure. The threat is especially severe in places where people's livelihoods depend on natural resources. In such areas, climate adaptation measures take on a special significance for safeguarding rural livelihoods and ensuring sustainable development. The Indian government launched the country's first National Action Plan on Climate Change (NAPCC) in 2008, with the main themes of: (i) further expansion of solar power generation; (ii) further increases in energy efficiency; (iii) measures to sustain India's environmental and water assets; (iv) further expansion of forests for carbon sink purposes; (v) sustainable agriculture; and (vi) developing a knowledge base for dealing with climate change issues. India's NAPCC recommended that the country should generate 10% of its power from renewable sources by 2015 and 15% by 2020. There are three main areas of policy, focused on targeting, mitigating and adapting to climate change. First, energy access is a priority. Providing energy to 400 million people who do not have access to electricity is a necessity; using off-grid solutions such as solar energy is key to reaching these people and providing sustainable, clean energy sources. Secondly, India has adopted an NAPCC, and many of its smaller states are developing state action plans (SAP) that include climate change adaptation. Many of the policies are already being implemented as part of the centralized economic plan drawn up by India's Planning Commission (now NITI Aayog). Thirdly, India is keen to further develop its economy and to continue its policies aimed at poverty alleviation, and it appears determined to pursue these goals in addition to policies aimed at reducing greenhouse gas (GHG) emissions.

Under the Paris Convention, countries responsible for more than 80% of global greenhouse gas emissions made specific commitments to reduce their emissions by 2020. The Paris agreement also includes commitments going beyond 2020, and this reflects a greater level of ambition than was seen in previous agreements. Countries' emissions reduction commitments reflect their various levels of development and capability. The Indian government has voluntarily agreed to reduce the emissions intensity of its GDP by 20–25%, from 2005 levels, by 2020. It also has agreed that its GHG emissions from one unit of GDP will reduce by one third by 2030, from what they were in 2005. India intends to produce about 40% of its electricity from non-fossil fuel-based sources, like solar, wind and hydropower, by 2030. These promises have been made in an action plan that India submitted to the UN's climate body, the United Nations Framework Convention on Climate Change (UNFCCC), outlining the steps it wants to take, up to 2030, in the global fight against climate change. India has sought international help of at least US$2.5 trillion, at current prices, in order to implement these plans.

India is the nation that made the key efforts to impress the international community with its intent to shift to a sustainable, low-carbon path that will confront climate change, improve human health and foster prosperity for all. In India, climate change-related action seems to be the most successful since it is integrated with efforts

to tackle existing challenges of energy access, water security, agricultural productivity, disaster resilience and broader economic development goals. India is now better prepared to deal with the multifaceted nature of climate change. However, the current challenge is to develop a cross-sectoral, integrated approach. In common with other developing countries, India considers that the solution to the world's climate change problems are primarily the responsibility of the developed, industrialized world. It has resisted calls for a limit to be placed on its own GHG emissions. It is concerned to further develop its economy and continue its policies aimed at alleviating poverty, and it appears determined to pursue these goals in addition to policies aimed at reducing GHG emissions. India is the world's fourth-largest producer of greenhouse gases.

Addressing climate change effectively will be the key to achieving the SDGs. Many investments in mitigation and adaptation, such as low-carbon energy plants or climate-resilient infrastructure, are operationally indistinguishable from investments in 'development', and the two must be structured and executed together. Some of the policy action points related to climate risk management are: to invest in climate-smart technologies and capacity-building with a synergy of food security and integrated/scientific land-use policy. Also, there is a need to review the SAP for climate change. Emphasis needs to be placed on proper analysis and effective adoption of soil health cards (SHC) and soil-testing laboratories (STL), at least at the block level, to enhance risk-coping abilities of resource-poor farmers to deal with weather and market fluctuations. Capacity-building and the adoption of efficient irrigation systems like drip and sprinkler irrigation to reduce excess water use and increase productivity are vital. The rationale for climate-smart agriculture (CSA) has to be appreciated by decision makers and scaled to benefit smallholder farmers.

Towards 'No Poverty' and 'No Hunger'

Income inequalities continue to grow and poverty remains largely a socioeconomic problem. Approximately three quarters of the world's poor live in rural areas, with the share even bigger in low-income countries. In addition, certain groups are disproportionately represented among the poor: women, the disabled, children and people living in tribal areas. The degradation of the productive assets of the poor, exacerbated by lack of access to modern infrastructure and amenities, creates a poverty trap that reinforces further degradation and worsening of poverty. While its extreme manifestations are in low-income countries, developed countries also need to address problems of poverty and malnutrition. Reducing by half the number of poor people, as defined nationally, and ending all forms of malnutrition requires developing countries like India to initiate focused action, including addressing the structural causes of poverty, hunger and malnutrition. Feeding the growing world's population, expected to exceed 9 billion by 2050, will require food production to increase by 70% at a time when agriculture is already facing unprecedented pressures from a degraded natural resource base, coupled with the effects of climate change. What is more, the investment gaps in agriculture and the social sector are substantial.

'The Future We Want' has set out SDGs to end poverty in all its forms, everywhere, to end hunger, to achieve food security and improved nutrition, and to promote sustainable agriculture, ensuring healthy lives for all, at all ages. It aims to ensure sustainable consumption and production patterns and to take urgent action to combat climate change and its impact. Hence, alleviation of poverty and hunger is of the utmost importance. Hunger can be removed only when households have a continuous flow of income. For this to happen, there is an urgent need for agricultural diversification. Skills development of young people can help them to get jobs and provide regular income for their families. Hence, vocational training and entrepreneurship are urgently needed; India needs young entrepreneurs who are job creators rather than job seekers.

The Indian government passed the National Food Security Act (also known as the Right to Food Act) on 10 September 2013 with the objective to provide food and nutritional security by ensuring access to adequate quantities of quality food at affordable prices so that people may live a life with dignity. The Act provides for up to 75% of the rural population and 50% of the urban population to receive subsidized foodgrains under a targeted public distribution system

(TPDS). This represents about two thirds of the total population. Eligible persons will be entitled to receive 5 kg of foodgrains/person/month at subsidized prices of Rs 3, 2, and 1/kg for rice, wheat and coarse grains, respectively. The existing Antyodaya Anna Yojana (AAY) households, which constitute the poorest of the poor, will continue to receive 35 kg of foodgrains/household/month. The Act also focuses on nutritional support for women and children. In addition to meals for pregnant women and lactating mothers, during pregnancy and for six months after childbirth, women will be entitled to receive maternity benefit of not less than Rs 6000. Children up to 14 years of age will be entitled to nutritious meals as per the prescribed nutritional standards. In the case of non-supply of entitled foodgrains or meals, the beneficiaries will receive a food security allowance. The Act also contains provisions for setting up a grievance redress mechanism at district and state levels. Separate provisions have also been made in the Act for ensuring transparency and accountability. At present, 32 states/union territories (UTs) are implementing the Act – Andhra Pradesh, Assam, Bihar, Chandigarh, Chhattisgarh, Daman & Diu, Delhi, Goa, Haryana, Himachal Pradesh, Jharkhand, Karnataka, Lakshadweep, Madhya Pradesh, Maharashtra, Odisha, Puducherry, Punjab, Rajasthan, Sikkim, Telangana, Tripura, Uttarakhand, West Bengal, Uttar Pradesh, Meghalaya, Jammu & Kashmir, Andaman & Nicobar, Mizoram, Dadra & Nagar Haveli, Gujarat and Arunachal Pradesh.

To achieve 'no hunger' status by 2030, the government must build on the approaches that have proved to be effective. These feature three important elements:

- promoting immediate access to food and nutrition-related services for hungry people through a social protection net;
- creating opportunities for the poor and hungry to improve their livelihoods by promoting decent labour conditions, and increasing investment to improve farm productivity, rural infrastructure and better market access; and
- increasing the sustainability of food production and consumption systems by conserving natural resources, adopting sustainable agricultural practices, reducing food losses, diversifying dietary preferences, reducing levels of food waste, and reducing emissions of GHGs from agriculture and other sectors so as to slow down the pace of climate change and ensure better food security for future generations.

Investing in agriculture is the best way to increase the productivity of agricultural labour and the land. Productivity increases enable better remuneration, thus contributing to raising the living conditions of food-insecure people while helping to reduce pressure on scarce natural resources. Public investment in institution-building, productivity-enhancing research, rural transport, markets, health, education and social protection is needed to ensure food security, nutrition and inclusive growth as well as sustainable development.

Role of Institutions

There is a need to empower farmers with the right information to enable them to improve agricultural productivity as well as efficiency. Input providers should be competitive. The government should make increased investment in ARI4D and in strengthening rural institutions and farm services, integrating approaches to germplasm improvement, building capacity for knowledge integration and dissemination, and promoting competitiveness of technology-based input markets for access by small farmers to improved technology and reforms in land, market and trade, to realize desired outcomes. There is an urgent need to address the following areas:

- strengthening ICAR as an apex organization by tripling its budget;
- achieving autonomy of state agricultural universities;
- promoting the Institution Village Linkage Programme (IVLP) through farmers' participatory approach; and
- fostering vocational training/informal education.

The role of agri-markets is essential to increase farmers' income through price realization and crop diversification. A policy needs to be put in place to denotify fruit and vegetable crops from the Agricultural Produce Marketing Committee (APMC) Act, to promote perishable produce

markets, to focus on soil health and water management and to develop more direct links with farmers. Institutions need to be more vigilant in the implementation of policies through effective monitoring and oversight and for coordination and convergence of ongoing programmes and activities.

Public–Private Partnership

There is a need for the private sector to start focusing on R&D to deliver better services and products and to involve themselves thoroughly in research, development and policy planning. The agricultural sector – dairy, animal husbandry, poultry etc. – managed by private enterprise contributes 32% of domestic GNP and provides employment for 67% of the working population. Over the years, the public sector has played a key role in agriculture in India in setting up guiding policies and providing goods and services such as fertilizers, extension and marketing. The National Agricultural Policy (NAP) 2000 also envisaged promoting private sector participation in agriculture through contract farming, land-leasing arrangements, direct marketing and setting up of private markets to allow accelerated technology transfer, capital inflow and assured markets for crop production. The private sector can offer their services through various ways throughout the agricultural value chain. Conducting research, introducing improved technologies, provision of credit through cooperatives and self-help groups, creating infrastructure (for seeds, fertilizers, pesticides, transportation and processing), helping with extension services, passing on accurate and timely information, and diffusing crop insurance are key areas where the private sector can further enhance their engagement.

India is now one of the fastest-growing economies with a target annual growth rate of over 8%. For the economy to grow at this rate there is a need to upgrade the country's infrastructure. Public–private partnership (PPP) has been recognized as one of the most effective mechanisms to achieve this. There is scope to leverage PPP as a relevant vehicle in the agriculture sector. Enhanced yield and productivity is needed, with India still battling food insecurity and poverty. Improved technology, better inputs and improved farming practices can make this possible. Over the past 65 years, Indian agriculture has recorded an average growth rate of 2.7% p.a., making it the slowest-growing sector. The failure to consistently hit 4% growth, as targeted in the five-year plans, indicates the challenges that are faced in agriculture. Agriculture is a key sector for research, investment and development. There is an urgent need to innovate via PPP and between farmers and the government to meet India's agricultural needs through new technology and intervention models. Several partnerships have already been developed between the public and private sectors with the objective of achieving these goals. Monsanto India Limited (MIL) is an important stakeholder in the agricultural PPP space through its multiple partnerships with state governments. India has reached out to more than 900, 000 farmers through PPP alone and has helped improve yields and rural incomes significantly in the areas where these partnerships have been implemented.

Corporate Social Responsibility

India is the first country in the world to make corporate social responsibility (CSR) mandatory, following an amendment to the Company Act 2013 in April 2014. Businesses can invest their profits in areas such as education, poverty, gender equality and hunger. The Act advocates that those companies with a net worth of Rs 4.96 billion or more, or an annual turnover of Rs 9.92 billion or more, or a net profit of Rs 50 million or more, earmark 2% of their average net profit over three years for CSR. The agriculture sector can benefit from CSR to a great extent.

The Way Forward

SDGs present a unique opportunity for the entire agricultural sector to become aligned to achieve a better tomorrow. If India can accelerate its pace to achieve the SDGs, then globally we could soon eliminate hunger, achieve food security and improve household nutritional security. At the same time it is imperative that policy makers give high priority to ARI4D, ensure enhanced allocations (a minimum of 1% of agricultural

GDP) to NARS and strengthen physical and economic access to food for resource-poor people residing in rural and urban areas. In fact, the agricultural sector can be seen as an important sector for achieving the goals of eliminating poverty and hunger as well as ensuring nutrition, environmental security and protection of fast-degrading natural resources. However, success in achieving the SDGs will require a 'mission-mode' approach in implementing and effectively monitoring the progress towards the defined goals. Strategies to accomplish SDGs must therefore address the following:

- Despite witnessing Green, White and Blue Revolutions, and having attained impressive food production of 277.49 million t, milk production of 165 million t and inland and marine fish production of 11.4 million t, India ranks 100 out of 113 countries on the global hunger index (GHI), and the prevalence of poverty is around 20%. Despite physical access, its major aim should now be to provide economic access to food through effective implementation of the National Food Security Act and other safety-net initiatives, especially in the regions/states where maximum poverty and hunger still persist.
- Ensure meaningful engagement of all stakeholders in the formulation of national strategies, implementation plans and monitoring of progress towards achieving SDGs, using baseline data for defined goals.
- The functioning of NARS, involving ICAR institutes and the SAUs, must involve other stakeholders such as NGOs, farmer-producers organizations (FPOs), private-sector institutions, farmers and agribusiness entrepreneurs.
- Continuous prioritization as well as re-prioritization of the development research portfolio is needed in tune with fast-changing global, regional and national needs. The 'top-down' approach adopted in the past will have to be changed to a 'bottom-up' approach. A shift from project to programme mode, and also from commodity/crop to farming system mode is urgently needed. In this context, the focus on crop diversification, hybrid seeds/high-value crops, biotechnology, ICT, GIS and good agronomic practice (GAP) would help double farmers' incomes and obtain resilience in agriculture with efficient inputs (water, fertilizers, chemicals for pesticides).
- Adopting ecofriendly and climate-resilient technologies, with emphasis on efficient farming systems in different ecoregions, strengthening of activities for improving soil health through organic matter recycling, conservation agriculture, efficient and needs-based use of nutrients, using decision support systems and soil test results, improved water-use efficiency using micro-irrigation techniques etc., would foster resilience in agriculture.
- Make best use of available knowledge and technologies through: (i) defining recommendation domains (technology targeting); (ii) increased investment (doubling) in managing land and water resources efficiently; and (iii) strengthening input delivery as well as market linkage mechanisms.
- The National Livestock Mission should focus on: quality feed and fodder; improved risk coverage including animal insurance; conservation and improvement of indigenous breeds; higher productivity and production; value addition; enhanced livelihood opportunities; increased awareness; and better availability of quality animal products for consumers at affordable prices.
- There is a need to develop new agri-food systems for pre- and post-production management through processing and value addition and by ensuring minimum wastage of food during storage, transportation and consumption.
- Knowledge update for farmers concerning new technologies, practices and recent advancements is a must, rather than merely providing subsidies. Building multilateral and multisectoral technology-transfer mechanisms for linking science to society, with greater emphasis on attracting and retaining youth in agriculture, especially through diversification, secondary and speciality agriculture, needs to be pursued in order to empower farmers.
- Dissemination of available high-value technologies; market linkages through e-NAM; revision of APMC; provision of pledged storage; developing and providing need-based technologies for immediate use and also for anticipatory long-term needs of

farmers/industries/consumers is needed. We need to remain competitive in order to take full advantage of the globalization of agriculture and to be prepared for the emerging new WTO regime.

- India must increase its capital investment in creating much-needed infrastructure, by involving the public and private sectors, especially in the eastern and north-eastern regions, so as to capitalize on rich natural resources that we have the potential to hasten agricultural growth and the 'evergreen revolution' (MoE and CC, 2015).
- SDGs have several interconnected goals, and thus require effective coordination and convergence mechanisms at all levels through an interdisciplinary and inter-institutional/departmental approach, to draw collective strength for desired impact. Such coordination mechanisms have to be top-down for effective monitoring and evaluation.
- Widening the policy space with much-needed faith in agricultural science and new technology, without fear and with a human face, is greatly needed to accelerate growth. Therefore an aggressive approach on policy advocacy and reform is warranted to scale innovation to achieve the SDGs in the given timeframe, i.e. 2030.

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