



**National Conference on
Sustainable Development Goals
*India's Preparedness and the Role of Agriculture***

Proceedings and Recommendations



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National Conference on
Sustainable Development Goals
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Trust for Advancement of Agricultural Sciences (TAAS)
Indian Council of Agricultural Research (ICAR)
International Food Policy Research Institute (IFPRI)

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Acronyms and abbreviations

AMUL	Anand Milk Union Limited
APMC Act	Agriculture Produce Market Committee Act
AR4D	Agricultural Research for Development
CGHS	Central Government Health Scheme
DARE	Department of Agricultural Research and Education
e-NAM	Electronic-National Agricultural Market
GAP	Good Agronomic Practices
GCF	Green Climate Fund
GDC	German Development Corporation
GHG	Green House Gas
GIS	Geographic Information System
GM Crops	Genetically Modified Crops
GPS	Global Positioning System
FPO	Farmer Producer Organization
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICDS	Integrated Child Development Scheme
ICT	Information and Communication Technology
IFPRI	International Food Policy Research Institute
INDC	Intended Nationally Determined Contributions

MDGs	Millennium Development Goals
MGNERGA	Mahatma Gandhi National Rural Employment Guarantee Act
NABARD	National Bank for Agriculture and Rural Development
NARS	National Agricultural Research System
NGO	Non-Governmental Organization
NICRA	National Initiative on Climate Resilient Agriculture
NRHM	National Rural Health Mission
NRLM	National Rural Livelihood Mission
PDS	Public Distribution System
PHCR	Poverty Head Count Ratio
RKVY	Rashtrya Krishi Vikas Yojana
AU	Agricultural Universities
SDGs	Sustainable Development Goals
TAAS	Trust for Advancement of Agricultural Sciences
UN	United Nations
UPNRM	Umbrella Program on Natural Resources Management
VCRMC	Village Climate Risk Management Committee
WADI	Watershed Development and Tribal Development
WTO	World Trade Organization



I

Preamble

Despite specific temporal and spatial efforts, poverty and hunger are twin challenges still faced by human civilization globally. Although extreme poverty has been reduced by more than half since 1992, more than 1 billion people continue to live on less than \$1 a day. Additionally, roughly half of the world’s population lives below \$2.50 a day, and one in every nine persons is undernourished. Among children below five years of age, nearly 3.1 million (nearly 45 percent) die every year due to poor nutrition. In fact, every 3.5 seconds, a child dies because of poverty. All these statistics underline the imperative need to produce affordable, nutritive, safe, and healthy food more efficiently and sustainably. Agriculture today faces a bigger threat than ever before due to degradation of natural resources, especially land and water, and climate change. It becomes important to combat these threats, but without compromising on economic development. This requires a new set of farm policies, technologies, and institutional reforms.

In 2015, global leaders came together to chart their progress and evaluate where they stood with regard to the Millennium Development Goals (MDGs). It was a unique joint effort by leaders of different countries on combating poverty, hunger, undernourishment, and other global issues. It is a matter of satisfaction that most of the developing countries have made substantial efforts to achieve various goals, especially poverty reduction. They reduced poverty by half between 1990 and 2010, although the decline in poverty was uneven across countries. In 1990-1992, the number of poor people in Asia was about 740 million, which declined to 565 million in 2010-2012. China has done remarkably well – poverty declined from 60 percent in 1990 to less than 10 percent in 2008. Other East-Asian and Pacific countries have also done quite well.

Within Asia, the largest concentration of poor is in South Asia, which houses nearly 304 million poor. In South Asia, India has the largest poor and food-insecure population — 71 percent of the poor in South Asia live in India. Like other countries, India could accomplish most of the MDGs well before 2015, but the pace has been far slower compared to China and other countries in South East Asia. Also, the progress in achieving some of the development goals has been rather inconsistent. The official estimates reveal that while India achieved the target of poverty reduction, it fell short when it came to reducing undernourishment.

To continue the global collective efforts more vigorously, the countries adopted a post-2015 agenda, which included a renewed set of goals to end poverty, protect the planet, and ensure prosperity for all as part of the new Sustainable Development Goals (SDGs). The resolution

adopted by the United Nations (UN) has a much broader inter-governmental agreement, which, while acting as the new agenda, builds on the Resolution, popularly known as “The Future We Want”. There are 17 aspirational “Global Goals”, with 169 targets under SDGs. Among these, the goals having direct relevance to agriculture are: ‘No Poverty’, ‘Zero Hunger’, and ‘Climate Action’, besides the one related to ‘Life on Land’.

In India, agriculture is the major provider of livelihood to the poor, especially in the rural areas. However, the agricultural sector is facing big challenges like declining size of landholdings, deteriorating natural resources (especially soil and water), adverse impact of climate change, declining factor productivity, rising input costs, fluctuating markets, and declining farm income. All these factors make agriculture a riskier means of livelihood. The questions that arise 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 of South Asia, learn from India or vice-versa?

The development of improved varieties/hybrids and adoption of better 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 incomes, reduce production cost, conserve natural resources, improve food quality and nutrition, and minimize various kinds of risks. The need is to create an enabling environment to scale-out useful and efficient technologies/innovations for wider adoption and large-scale impact on production and income of smallholder farmers.

The Government of India gives high priority to the agricultural sector and plans to make it more efficient, competitive, sustainable, and resilient. ‘Doubling Farmers’ Income by 2022’ is the latest policy initiative of the government. The other programs that aim to increase farmers’ income, conserve soil and water resources, improve resilience, and reduce risks include Prime Minister’s Irrigation Program, Prime Minister’s Agricultural Insurance Scheme, National Food Security Mission, National Horticulture Mission, National Mission on Sustainable Agriculture, National Agricultural Development Plans, and National Livestock Mission. There are initiatives to connect farmers with remunerative markets through e-NAM (One Nation-One Market) and consolidate farmers to derive benefits of economies-of-scale through Farmer Producer Organizations/Companies. All these efforts demonstrate India’s commitment to accomplish the SDGs related to agriculture. There is, however, an urgent need to ensure reorientation of on-going efforts toward higher efficiency and effectiveness of various initiatives by developing a road map by which to achieve the goals well before 2030. The organization of ‘National Conference on Sustainable Development Goals: India’s Preparedness and the ‘Role of Agriculture’, was an attempt in this direction.

Objectives

The specific objectives of this conference were to:

- Document the status of poverty, hunger, malnourishment, natural resource degradation and climate risks.
- Explore the potential of improved technologies (including varieties/hybrids and efficient management practices, farm mechanization, etc.) to achieve SDGs.
- Develop an inventory of various programs, policies and institutions that have direct and/or indirect bearing on achieving one or more SDGs and to ensure effective implementation.
- Develop a road map for the agricultural sector to reduce undernourishment and poverty, control degradation of land and water resources, and manage the existing risks on account of weather uncertainties and climate change.

Organizers and Participants

The conference was organized jointly by the Trust for Advancement of Agriculture Sciences (TAAS), Indian Council of Agricultural Research (ICAR), and International Food Policy Research Institute (IFPRI). The conference was attended by about 160 delegates from India and abroad, representing professionals, policy researchers, policy planners, students, and representatives of private institutions, banks, and research institutions.



II Inaugural Session



Dr. P K Joshi, Director-South Asia, IFPRI, welcomed the delegates and shared a brief background of the Conference, including its significance and expected outcomes as has been outlined in the Preamble section. Dr. Trilochan Mohapatra, Secretary, Department of Agricultural Research and Education (DARE) and Director General, ICAR, remarked that agriculture has a direct and indirect links with most of the SDGs. He stressed that strengthening of the agricultural sector will significantly contribute in achieving the SDGs. He opined that the agricultural sector cannot be looked at in isolation; it is linked to several segments, and women constitute one such segment, encompassing farm women in livestock rearing, fisheries, and marketing activities. He stressed on the importance of enhancing investments in agriculture, including developing technology, infrastructure, and the right kind of policy framework for accomplishing the SDGs in India.



In his keynote address, 'Reshaping Agri-food Systems to Achieve Multiple SDGs in India', Dr. Shenggen Fen, Director General, IFPRI, mentioned that the global food system is becoming increasingly vulnerable and a new approach in the agri-food system is needed to achieve multiple SDGs. The new agri-food system should be productive and efficient, inclusive, environmentally sustainable and climate smart, nutrition and health-driven, and business friendly. He observed that reshaping the agri-food system is critical and the challenges are (1) prevalence of hunger and malnutrition, (2) rapid urbanization, (3) persistence of poverty, (4) impact of climate change on agriculture, and (5) land degradation. More importantly, for each of these changes, Dr. Fan presented the following potential solutions:

(1) encourage investment in agriculture to produce more food and nutrition with less inputs; (2) support technologies that promote diversification of food production; (3) advance frontiers for nutrition-driven technologies; (4) encourage policy changes to reshape agriculture; (5) strengthen rural-urban linkages that will help propel economic development, food security, and nutrition status; (6) increase public investment in health, education, infrastructural development like roads, markets, etc.; (7) promote sustainable intensification technologies and practices; and (8) promote good governance of natural resources. According to Dr. Fan, agriculture-led growth is the key to pro-poor growth because agriculture reduces poverty by raising farm incomes, generating employment, stimulating the non-farm economy, and lowering prices of staple foods.



The Chairperson, Dr. R S Paroda, Chairman of TAAS, presented his vision by covering a wide range of issues related to food and nutrition security, efficient and sustainable use of natural resources, adoption of hybrids and biofortified seeds, expansion of irrigation and market networks, development of the livestock sector, and agri-business management. On the issue of enhancing farmers' income, Dr. Paroda suggested focusing on raising farm profitability, reducing cost of production, and strengthening producer-market linkages. To achieve SDGs, there is a need for higher investment in research for development, strong public-private partnerships, and search for pro-poor innovations and their effective implementation. To face these challenges, he stressed that for 'out-of-the-box thinking and strategy.





III

Status of Development Goals



Agriculture is a major contributor to food, nutrition, and livelihood security in India, but it is affected by numerous factors, including technology penetration, natural resource management, climate change, policies, and institutions. As stated earlier, this conference focussed on four SDGs, namely ‘No poverty’ (SDG 1), ‘Zero hunger’ (SDG 2), ‘Climate action’ (SDG 13), and ‘Life on land’ (SDG 15). The first session was devoted to better understand the existing status of poverty, hunger, climate change and land degradation. The information drawn in this section is based on the paper presented by S Mahendra Dev, SK Singh, Ch Srinivas Rao).

1. Poverty and Food Security

The all-India Poverty Head Count Ratio (PHCR) was 23.9 percent in 2015, having dropped from 47.8 percent in 1990. A World Bank study also shows that poverty declined by 1.36 percent

per year in the post-1991 period compared to that of 0.44 percent per year prior to 1991. Also, within the post-reform period, poverty declined faster in the 2000s than in the 1990s. The annual decline in the poverty ratio at the all-India level was 0.74 percent during the period 1993–1994 to 2004–2005, which increased to 2.18 percent during 2004–2005 to 2011–2012.

The key factors that helped in a higher decline in poverty during 2004–2005 to 2011–2012 included: (1) a higher economic growth of 7–8 percent per annum, (2) agricultural growth of around 4 percent per annum, (3) increase in rural non-farm employment from 23.7 percent in 1999–2000 to 35.9 percent in 2011–2012, (4) high growth in agriculture and rural real wages, and (5) launch of several social protection programs like Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA). According to projections, if the recent trends

continue, India would be able to achieve the SDG on poverty by 2030 based on both global (\$1.25 earlier or \$1.90 now) and national poverty lines.



2. Hunger and Nutrition

Hunger has three major dimensions: (1) calorie deprivation which is due to less energy consumption, (2) protein deprivation which is due to inadequate consumption of protein-supplying food commodities like pulses, milk, eggs, fish and meat, and (3) hidden hunger, which is caused by the deficiency of

micronutrients such as iron, zinc, iodine, vitamin A and vitamin B12. India has a considerable number of people having these deficiencies. Therefore, achieving ‘zero hunger’ by 2030 is a big challenge for India.

In the 1990s and till the mid-2000s, the progress in reduction of stunting, underweight, and wasting was ‘slow’. The stunting rate in children below three years declined from 53 percent in 1992–1993 to 48 percent in 2005–2006 and further to 38% in 2015–2016. This decline in stunting rate could be due to expansion, launch, and reforms in several programs such as Integrated Child Development Services (ICDS), launch of National Rural Health Mission (NRHM), MGNREGA, Maharashtra Nutrition Mission, and reforms in Public Distribution System (PDS) in several states. The high economic and agricultural growth rates have also contributed in improving the nutritional outcomes in the country.

Despite achieving considerable progress, 48 million out of 159 million stunted children of the world are from India (about 30 percent). In order to achieve the SDG on hunger and malnutrition, India will have to make concerted efforts in improving agricultural linkages, women empowerment, healthcare, sanitation, drinking water, nutrition awareness, and education by adopting a convergence approach. There is a need to: (1) improve economic and physical access to diverse, nutrient-rich foods through bio-fortification and nutrition-sensitive

food processing, (2) leverage existing platforms, for example RKVY, NRLM, NRHM, and (3) empower women in agriculture by ensuring land and property rights to them and formation of women's cooperatives/self-help groups for improving convergence of health, nutrition, agriculture, and other social sector initiatives.

3. Land Degradation

Land degradation refers to temporary or permanent decline in ecosystem function and productive capacity; deterioration of soil health by affecting the associated biodiversity, natural ecological processes and ecosystem resilience; and reduction or loss of biological/economic productivity and complexity of croplands, pastures, woodland, forests, etc. In 2009, the extent of degraded lands in India under different categories was 120.72 Mha, comprising lands degraded by water erosion, 82.57 Mha; wind erosion, 12.40 Mha; salt-affected soils, 6.74 Mha; acid soils, 17.94 Mha; and others, 1.07 Mha. About 64 Mha area of cropland is affected by land degradation.

Land degradation adversely affects crop production and reduces the production potential of existing fertile lands. The increasing degradation is intensifying desertification in western Rajasthan, polluting coastal areas (441 thousand hectares in West Bengal and 147 thousand hectares in Odisha), and is intensifying degradation in the eastern region of India, comprising the states of Bihar, Jharkhand, Odisha, and West Bengal. Due to land degradation, arsenic and fluoride contamination is increasing, particularly in West Bengal, and coconut-based farming has become uneconomical in Kerala. The long-term impact of land degradation is viewed as the major obstacle in achieving SDG 1 and 2.

To control land degradation, the first step is to develop and regularly monitor the Land Resource Inventory on 1:1000 scale, which would help to implement situation-specific interventions for scientific land-use planning. Some other measures to control land degradation at site-specific levels are: (1) increasing fertilizer- and nutrient-use efficiency on a mega scale in different agro-ecoregions of the country, (ii) developing protocols for non-destructive method of soil analysis, (iii) effective implementation of Soil Health Card Program based on testing of individual plot soil by sensor-based technology, and (iv) identification of 'prime land'—best soils for high response—which is estimated to be 58.8 Mha, constituting 32.1 Mha irrigated and 26.7 Mha rainfed agricultural land.

Developing location and/or situation-specific recommendations include: (1) boosting rainfed agriculture through a scientific soil conservation plan, (2) improving water harvesting potential under different rainfall scenarios, and developing micro-watersheds, (3) optimizing land use plans for different eco-regions through knowledge-based technology application for arresting/reversing land degradation.

4. Climate Risks and Agriculture

In India, agriculture is one of the sectors most vulnerable to climate change. The impact of climate change on Indian agriculture is clearly visible—eight out of past 15 years had been drought-affected years; and in recent years, especially 2014 and 2015, the country has

experienced simultaneous occurrence of droughts and floods. The episodes of heat wave and hailstorms are increasing, and water shortage is being experienced both for human and livestock uses. The precipitation during seasonal monsoon is decreasing; it was deficit by 12 percent in 2014 and 14 percent in 2015 at the all-India level.

The empirical evidence on district-level vulnerability of Indian agriculture to climate change has revealed that most districts along the eastern and western coasts, and the north-eastern states are less vulnerable, but by mid-century (2021-2050), several districts in Rajasthan, Gujarat, Madhya Pradesh, Karnataka, Maharashtra, Andhra Pradesh, Tamil Nadu, eastern Uttar Pradesh and Bihar may experience greater vulnerability.

The projected maximum changes in temperature and rainfall in India are 1.3°C and 7 percent by 2035, 2.5°C and 26 percent by 2065 and 3.5°C and 27 percent by 2100. The projected changes in crop yields during maximum changes in temperature and rainfall reveal a decline in yield of all major crops in the range of 1-10 percent by 2035, 3-18 percent by 2065 and 4-26 percent by 2100. Scientists and policy makers have taken several steps to manage climate risks. These include implementation of technology packages, comprising in-situ moisture conservation, land treatments, farm ponds, drought-tolerant cultivar, and soil-test-based nutrients application. The other actions include launch of institutions like Village Climate Risk Management Committee (VCRMC), seed banks, custom-hiring of farm machines, water users' groups, etc. The observed impact of these measures are resilience in adaptation to droughts, enhancement in household food and livelihood security, a positive village carbon balance, and reduced green-house gas (GHG) emission.

The adoption of conservation technologies, such as zero tillage, direct seeded rice, laser land levelling, etc., have the potential to minimize the risk of climate change, reduce the GHG emissions, and enhance carbon sequestration. There is a greater need for awareness about suitable technologies and their benefits in increasing yields, reducing costs and addressing the challenges of climate change. The concept of climate smart and climate resilient villages needs to be promoted. The advantages are in terms of better stability in crop production, better nutrition through diversified systems, better integration of crop-horticulture-fodder-fishery sectors, reduction in climate risk and cost of production, reduction of GHG emissions, and carbon balance.



IV Technological Options



Improved technologies have a key role to play in accomplishing the SDGs. India has witnessed substantial increase in food production through sustained technological efforts and policies. Food grain production in India increased from a mere 82 Mt in 1960–1961 to a record production of 273.38 Mt in 2016–2017. This section documents important technologies in terms of crop development through genetic enhancement, natural resource management, and farm mechanization. The information drawn in this section is based on the papers presented by H S Gupta, SP Wani, and CR Mehta.

1. Genetic Enhancement

Genetic enhancement to increase yields, reduce risks of biotic and abiotic stresses, build resilience and improve nutritional levels, has the potential to help achieve most of the SDGs. The promise lies in accelerated breeding of self-pollinated crops with a wider gene pool, development of high-yielding nutrient-rich hybrids in field and vegetable crops, deployment of genetically modified (GM) crops, and promotion of biofortified crops. Genetic engineering,

phenotyping, and tissue culture will play an important role in increasing food production and reducing both poverty and hunger.

India has a strong program in public sector research on major food grain crops. The research attempts to accelerate productivity in two of its major food crops—wheat and rice. To support this endeavor, several (>400) semi-dwarf landmark varieties of wheat have been developed; the recent variety being HD 2967, which is resistant to all the three rusts, and provides yields of 6.6–6.7 t/ha. The area covered under this variety during 2016–2017 was about 8 million hectares and the approximate value of additional wheat yield is computed to be ₹40 billion/year (@ ₹14,000/t). For rice, high-yielding varieties are being combined with short duration varieties of Basmati rice.

Attempts are being made to develop and deploy hybrids of rice, maize, pearl millet, sorghum, pigeon pea, sunflower and mustard. Promising hybrids for most of the crops have been developed. In the case of rice, efforts are being made to increase the area under released hybrids, but there has been little success – the area under hybrid rice is a mere 3 Mha despite significant yield advantage of almost 1 t/ha. We also need to learn from the successes of super hybrid rice in China. For maize, hybrid vigor and uniformity have been found to be in single-cross hybrids. India has developed single-cross hybrids of maize that have productivity levels of about 6.0 to 7.0 t/ha. As for vegetables, the hybrids have invariably shown distinct yield advantage.

The future lies in GM and bio-fortified crops. There is a need to deploy GM crops that have proven potential around the globe. Globally, 18 million farmers in 28 countries have planted 181 million hectares area with GM crops, whereas India planted only 11.6 million hectares. With exception of cotton, the GM crops policy in India is still at crossroads. There is a need to seriously consider release and adoption of GM technology in agriculture. Biofortification is a cost-effective and sustainable approach to address malnutrition in the country. The first biofortified high-iron variety of pearl millet, *Dhanashakti*, was released in 2012. Another high-iron pearl millet variety, ICMH 1201, having 75 mg/kg Fe and 40 mg/kg Zn along with 30 percent higher grain yield than *Dhanashakti*, has also been developed. Other biofortified crops that are ready or in progress include (1) Orange flesh sweet potato (β -carotene), (2) Wheat (Fe & Zn), (3) Lentil (Fe), (4) Rice (Zn), (5) Maize (β -carotene), and (6) Cauliflower (β -carotene). Beside these crops, lycopene-rich tomatoes have been developed in a polyhouse of the Indian Agricultural Research Institute (IARI). India is also encouraging the consumption of soybean as a food crop rich in good quality protein, which is also the cheapest source of protein.

The challenge ahead is to re-prioritize the research agenda around farming systems with an aim to achieve the SDGs. Rather than spreading the resources thinly, research system should target backward areas and unprivileged social groups.

2. Natural Resource Management

Sustainable management of natural resources has a huge potential to contribute toward SDGs. As part of this endeavor, efforts are being made through land and water management, adoption of good agricultural practices, agricultural diversification, promotion of kitchen gardening, women empowerment, and strengthening of collective actions.

Water management: Watershed development is the best way to harvest, conserve and utilize rain water for crop production. The Parasia Sindh Watershed Development in Bundelkhand is a case in point. Due to watershed interventions, the groundwater level increased by 3 m; the base flow continued for 100 days and water became available for domestic/livestock use throughout the year. Another aspect of water management is the spread of field-based technologies like contour cultivation, broadbed and furrow, conservation agriculture, field bunds, and vegetative bunds.

Land management: One-third to one-half of the earth's agricultural land has degraded due to water erosion, gully erosion, wind erosion, etc., making land management an important part of natural resource management. There is a widespread deficiency of micronutrients in fields across India. Organic carbon building is an effective measure to improve soil health and land productivity, which may be achieved through in-situ generation of organic matter and recycling of farm and animal residues. Another measure is adoption of good agricultural practices. In fact, productivity of several crops like groundnut, 48 percent; finger millet, 45 percent; pigeon pea, 75 percent; and paddy 35 percent has increased through these practices.

Scaling innovations: Some large-scale programs to improve land and water management have been launched in Andhra Pradesh and Karnataka. These include *Bhoochetana* (Andhra Pradesh), *Rythu Kosam* (Andhra Pradesh), and *Bhoosamrudhi* (Karnataka). The overall aim of these initiatives is to increase farmers' income through skill development, public-private partnerships, science-led development and collective action through farmers' organizations, producers' groups, self-help groups, etc. The *Bhoochetana* initiative has benefited 4.75 million farmers, increased crop yield by 20–66 percent, and contributed to 5 percent agricultural growth per year since 2009 with a benefit-cost ratio of 3.14:1 for the farmers in Andhra Pradesh. The other initiative, *Rythu Kosam*, through its modus operandi of skill development, value chain approach, public-private partnerships and collective action through Farmers' Producers Organizations, has been able to raise farmers' incomes significantly in Andhra Pradesh.

3. Farm Mechanization

The number of agricultural workers is showing a declining trend, from 263 million in 2010–2011, the projected numbers are 230 million by 2020 and 202 million by 2050. The shortage of agricultural labor is raising wages and triggering farm mechanization in the country. The adoption of farm mechanization can ensure improved input-use efficiency, enhanced cropping intensity, reduced cost of production, and less drudgery for agricultural workers, especially women. An overview of the different farm equipment being used in India across the agricultural value chain, from land preparation to harvesting, reveal accelerated developments in farm mechanization. Some examples are: (1) Zero till drill and its variants, strip till drill, roto till drill and slit till drill, providing saving of 40–70 percent in time and 50–70 percent in fuel. (2) Happy Turbo seeder, which is suitable for sowing under heavy residue condition and can control burning of rice residue after combine harvesting. It provides savings of 78 percent in time, 68 percent in fuel, 77 percent in labor, and 72 percent in cost of operation. (3) Eight-row rice transplanter, which is a tractor-operated equipment with a capacity of 0.24 ha/hour and field efficiency of 58–63 percent. (4) Multi-purpose equipment for sugarcane, which

is a tractor-operated implement, used for planting of sugarcane setts (0.2 ha/hour), facilitating inter-culture (0.8 ha/hour), and earthing up operations (0.4 ha/hour). (5) Variable rate urea applicator, which can apply urea @ 18.5-65.0 kg/ha and requires an android smartphone with GPS for operation. (6) Harvesting and threshing equipment, including a tractor-operated reaper binder, flail type fodder harvester-cum-chaffer, tractor-mounted root crop harvester-cum-elevator, and self-propelled rice combine.

The government has also established a National Mission on Farm Mechanization. The Mission seeks to increase the access of small and marginal farmers to farm mechanization, offsetting the adverse 'economies of scale' and 'higher cost of ownership' of high-value farm equipment by promoting 'custom hiring' for agricultural machinery by creating hubs for such equipment. To promote farm mechanization, there is critical need for public-private partnership both for research and development. In future, agriculture will be dominated by precision and conservation agriculture. Therefore, there is a need to develop equipment that is suitable for small landholdings and horticultural crops in hilly areas, and cost-effective technologies like smart tractors, unmanned aerial vehicles and wireless technology.



V

Policy Options



The role of policies in achieving SDGs is outlined in terms of government initiatives on social protection programs, investments, subsidies and enhancing farmers' income. The following are some of the policies and programs. The information drawn in this section is based on the papers presented by RS Deshpande, Seema Bathla, and Pratap S BIRTHAL.

1. Role of Social Safety Net Programs

To provide food, nutrition and livelihood security, the Government of India has, from time-to-time, been launching different social programs. These include the Indira Gandhi National Old Age Pension Scheme in 2007 (for elderly poor), the Indira Gandhi National Widow Pension Scheme in 2009 (for poor widows), the Indira Gandhi National Disability Pension Scheme in 2009 (for the disabled), *Swavalamban* in 2010 (merged with APY in 2015), the *Atal Pension Yojna* (APY) in 2015, the *Janani Suraksha Yojna* (JSY) in 2005 (maternity benefits), and *Annapurna* in 2000 (food security).

The employment-based programs, (which directly address SDGs 1, 2, 8 and 10), include the *Sampoorna Grameen Rojgar Yojna* (SGRY) (merged with MGNREGA), the National Rural Employment Guarantee Act, 2001 (which became MGNREGA), the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA), 2006, the *Swaranjyanti Gram Swarozgar Yojna* (SGSY), 1999 (subsidized rural credit for employment), and the *Deen Dayal Upadhyaya Grameen Kaushalya Yojna*, 2014 (to support traditional arts, handicrafts, etc.)

The food security programs that focus on SDG 1 and 2 include provision of subsidized food through (1) PDS (wheat, rice, coarse cereals), (2) mid-day meal program, 1995 (mid-day meal for school children), and (3) provision of ready-to-eat food through schemes like *Amma kitchen*, *Anna thali*, etc. There are some health care schemes which include the *Rashtriya Swasthya Bima Yojna* and RSSY, 2008, and the Central Government Health Scheme for government employees (CGHS), 1954. There are a few schemes which cover risks. These include the *Pradhan Mantri Suraksha Bima Yojna*, *Pradhan Mantri Jeevan Jyoti Bima Yojna*, 2015, *Pradhan Mantri Jan Dhan Yojna*, 2014, and the Livestock Insurance Scheme, 2008.

The implementation of the various safety-net programs face problems like failure to reach the targets due to semi-permeability of society, uncoordinated and duplicated efforts, poor operational efficiency, efforts falling short of demands, etc.

2. Targeting Less-Favored regions

India is a large country with several states and public investments, and input subsidies vary from time-to-time and across the state. For example, a relatively higher public investment was made in the northern and southern states during the 1960s, and a significant increase (>6% per annum during 2000-2014) was seen in both public investment (irrigation) and input subsidies from 2002-2003. To understand the inequities, a comprehensive analysis was done on the public expenditure at the disaggregate state level in India.

Six main public expenditure heads were selected for analysis, viz. roads–transport, education, health–nutrition, energy, irrigation, and agricultural R&D; and four subsidies, viz. irrigation, power, fertilizer, credit (interest), and well irrigation (private investment). The analysis revealed that spending on private irrigation and power subsidy holds more importance in less-favored areas. Spending on agricultural research and development, health and education has high potential to accelerate agricultural growth and poverty reduction in less-favored areas. Similarly, land productivity, non-farm employment and agricultural prices have a significant impact on poverty reduction.

A small trade-off is observed between productivity and poverty reduction from public spending and subsidies within each group of states. There is a strong need for location-specific public expenditure policy. The policy challenge is whether to focus on rationalization or reduction of input subsidies or increase investment for creating productive assets. There is a need to revisit the investment strategy that has benefited a few better-off regions but not much the less-favored states and regions.

3. Enhancing Farmers' Incomes

The main aim is to enhance farmers' incomes and empower them to achieve SDGs. A detailed analysis was undertaken targetting farmers' categories, regions, and pathways for increasing their income. The study revealed that marginal farmers, who comprise 70 percent of the total farmers and have an annual per capita income of less than ₹15,000, should be the focus of the development strategies. Approximately 80 percent of the low-income marginal farmers are concentrated in the eastern (58 percent) and western (21 percent) regions. Therefore, these regions, which have been lagging behind in agriculture and economic development, should be given high priority when it comes to implementing income-enhancing strategy and initiatives.

In view of the limited scope for income growth through area expansion, which stagnates at around 140 million hectares, the focus now should be on raising cropping intensity, reducing inefficiency in production, diversifying the production portfolio towards high-value agriculture and enhancing water-use efficiency. The rapid growth in demand for high-value food commodities, including animal products, is an opportunity for the farmers to diversify their production portfolio and capture the benefits of value addition in agriculture. The policy should provide for higher allocation of resources to these high-value and high-growth sectors by developing inclusive markets and value chains. There is a distinct need to develop the livestock sector that remains constrained by poor breeding, healthcare, and extension services, inadequate supply of feeds and fodders, and inadequate allocation of resources. The insurance cover is also negligible in the animal sector. Therefore, developing the livestock sector aggressively will help increase farmers' income and household nutrition security.

The role of ICT (information and communications technology) is very important in augmenting farmers' income. There is an urgent need to further enhance mobile telephone connectivity—the country is well-linked, with more than 90 percent villages in 20 states having mobile connectivity. The need is to bundle all types of information that farmers need in a format and language that they comprehend, and link them with modern networks for faster dissemination.

The non-farm sector is another important pathway for raising incomes of smallholder farmers and reducing excessive employment pressure on agriculture. The expanding non-farm sector will create opportunities for investments in ancillary industries related to inputs, equipment, machines, and other support services.



VI Role of Institutions



Institutions do play an important role in improving governance, optimizing resource allocation and mobilizing key stakeholders. There are four key areas that could contribute towards achieving SDGs. These include: (1) agricultural R&D, (2) land reforms, (3) agricultural financing, and (4) agricultural market reforms. The information drawn in this section are based on the papers presented by Suresh Pal, Avinash Kishore (for T Haque), MV Ashok and Sukhpal Singh.

1. Implications for Agricultural R&D

Agricultural research can significantly contribute in accomplishing SDGs. India achieved 3.97 percent annual compound growth rate in agricultural sector during the period 2000-2001 to 2012-2013. For sustained agricultural growth and food production, it is necessary

to develop technologies and institutions for conservation of natural resources; innovate for better resource-use efficiency; modernize inputs, output markets and farm support services; and manage risk and vulnerability. Besides development of agricultural technologies, their dissemination and uptake by producers are equally important. It is also important to develop the agri-business sector by facilitating the regulatory environment, and improving fiscal incentives, and manpower development. The major developments in agri-business sector include rising share of purchased inputs, farmers' willingness to pay for quality and timely availability of inputs, and transformation from small family-owned enterprises to organized national and multinational companies.

The policy imperatives include higher investments for R&D; strengthening rural institutions and farm services; capacity building for knowledge integration and dissemination; land, markets, and trade reforms; and integrated approach for germplasm improvement, natural resource management, and institutional innovations.

2. Land Lease Reforms

Land policies do play an important role in technology adoption, investment to create productive assets, and development of land markets. Land is a state subject, therefore, there are no uniform land lease policies across the states. The policies can be grouped into three broad categories: those (1) which have a complete ban on leasing-out land, (2) which permit leasing-out only by certain categories of land-owners such as widows, minors, defence personnel, physically/mentally handicapped, etc., and (iii) which have no explicit ban on land leasing, but still have some restrictive clauses.

Recently, the Government of India developed a Model Agricultural Land Lease Act 2016, which takes care of the interests of land owners as well as tenant farmers. There is differential adoption of the Act across states in the country. For example, Uttar Pradesh and Uttarakhand have legalized leasing out by all categories of land owners. Madhya Pradesh has passed a bill which is pending for assent by the President. Odisha has drafted a new bill, which may be introduced shortly. Telangana and Karnataka are working on drafting a bill. Rajasthan has removed restrictive clauses on land-leasing. Haryana and Maharashtra have taken some initiatives to amend their land tenancy laws.

Legalising land tenure will increase leasing-out of land, which will increase the size of landholdings and consequently improve both agricultural efficiency and soil health. Many small and marginal farmers would also be economically better off by leasing out their lands because they will have income from wage employment and land rent. The legalization of land tenure/rent will enable the tenant farmers to access institutional credit, disaster relief, crop insurance and other support services, thus leading to capital investment for improving the soil and creating productive assets.

The farmers feel that leasing out of land should be made legal only for agricultural and allied activities. Care should be taken that legalization of land leasing does not result in the concentration of landholdings in the hands of a few. Also, leasing-in of land by women

farmer groups should be encouraged. The issue of recorded vs non-recorded and registered vs unregistered leasing-in of lands needs to be looked at carefully.

3. Agricultural Finance

Financing institutions and their policies facilitate investment and technology adoption, thereby contributing to achieving the SDGs. In India, the National Bank for Agriculture and Rural Development (NABARD) is mandated to implement programs related to agriculture and rural development. These programs relate to the formulation of Farmer Producer Organizations (FPOs)/self-help groups, development of agri-infrastructure, value chain development and managing climate change. NABARD has successfully facilitated the implementation of Watershed Development and Tribal Development programs (WADI). Recently, NABARD and GDC (German Development Corporation) have launched a unique financing program, the 'Umbrella Program on Natural Resources Management' (UPNRM) with the objective of improving rural livelihoods by using the community-based approach to encourage participatory NRM-related interventions. It encourages a shift from grant-based approach to loan-based funding support.

The program covers core sectors like soil and water conservation, plantation and horticulture, forestry and biodiversity conservation, farming systems management, and climate change adaptation. It also covers supplementary areas such as forward and backward linkages; livelihood-generation activities (dairy, poultry, fisheries, etc.; processing, storage, marketing, and supply chain; critical rural infrastructure like roads, drinking water, and minor irrigation; renewable energy; and information and knowledge management.

As of March 31, 2017, some 323 projects have been sanctioned across 34 sectors in 21 states and one union territory, of which 198 are already functioning. The total loan sanctioned is ₹5.89 billion, of which ₹3.70 billion has already been disbursed. The program aims to achieve one loan project per village in the country. It is expected to cover roughly 600,000 loan projects in the long-run. The program would cover around 330,000 persons directly and indirectly. Almost half the beneficiaries (46 percent) are extremely poor. The total number of beneficiaries under livelihood projects are around 157,000. It is important to note that 44 percent of the project participants are women and 78 percent represent SC/ST/OBC categories. Ninety percent of the projects are directly related to the conservation of natural resources. The agro-forestry projects cover about 420,000 trees, which will contribute to annual carbon sequestration of roughly 201,618 tons.

4. Leveraging Agricultural Markets

Agricultural markets are also witnessing a change with the emergence of new markets such as farmers' markets, contract farming, private wholesale markets, online retailers, etc. These markets contribute to poverty and inequality reduction by helping the farmers in getting a better price for their produce, in other words, higher incomes. They also help in reducing production cost through direct farmer interface and extension (contract farming and direct purchase). It is important to examine how contract farming influences resources and

sustainability, because contracting agencies and state influence the decisions. Punjab was cited as an example, where, during the last phase of diversification (2002–2007), contract farming led to less water consumption on contract farms as compared to non-contract farms; and the water consumption for paddy was 265.7 hours/acre compared to only 183.9 hours for basmati paddy promoted under contract farming. Similarly, maize cultivation under contract farming used less water (18.3 hours/acre).

The other aspect of contract farming was related to sustainability of resources. It was found that reduced water consumption was due to larger area coverage under new crops (basmati paddy and maize) and not due to the adoption of any new agricultural practice/technology. Also, the crop combination of potato and sunflower promoted under contract farming was more water-intensive than wheat, thereby defeating the very purpose of contract farming. For leveraging agri markets to accomplish SDGs, the following needs to be attempted: (1) introduce reforms in Agriculture Produce Marketing Committee (APMC) Act, like free licensing for better competition, exclusion of fruits and vegetables, e-payment of market fee, renotification of commission agents/*arthiyas*, etc., (2) develop more direct linkages with farmers, and (3) integrate farmers into value chains.



VII Climate Action



The impact of climate change on food production, employment generation and farmers' incomes is very well documented across the world, including India. The frequency and intensity of climatic extremes (cyclones, floods, droughts, heavy rains, and heat wave) is increasing. The concentration of carbon dioxide has crossed 410 ppm, and temperatures have increased by about 1°C. This section outlines India's preparedness to achieve the SDG on climate action (SDG13) through technologies, policies and institutions. The information drawn in this section is drawn from the papers presented by Himanshu Pathak and SS Kalamkar.

1. Climate Risks in Achieving SDGs

The rainfall distribution and its pattern is changing. For example, in 2016, even with a normal monsoon at the all-India level, 37 percent of the total area had deficit rainfall while 19 percent had

excess rainfall. With regard to GHG emissions, India's levels are high compared to China and USA. But, in 2015, China topped with a 28 percent share in GHG emissions, followed by USA. Then, India emitted only about 5 percent of global GHGs, and Indian agriculture contributed ~1 percent of global GHG emissions. A look at the historic occupation of atmospheric carbon space revealed that USA occupied 29 percent, China 10 percent and India only 3 percent. About 75 percent of the atmospheric carbon space is occupied by the developed countries. Country-wise per capita GHG emissions are 16.4 ton CO₂ eq by USA, 12.4 ton CO₂ eq by Russia, 7.1 ton CO₂ eq by China and only 1.6 ton CO₂ eq by India.

India is committed to reduce emission intensity by 32-35 percent by 2030 compared to the 2005 levels. It has already submitted its Intended Nationally Determined Contributions (INDC) to the UNFCCC. India has launched eight National Missions on Climate Change and most of the states have submitted their action plans. The country is proposing to lay considerable emphasis on renewable energy sources.

2. India's Preparedness to Mitigate Climate Change

India's preparedness to mitigate the impact of climate change is revealed by the following actions: (1) Launch of the National Mission on Sustainable Agriculture, (2) Launch of the Soil Health Card Program, (3) Initiation of the *Paramparagat Krishi Vikas Yojna*, (4) Launch of the National Agro-forestry Program, (5) Drawing up of the National Policy for Management of Crop Residues, (6) Initiation of the *Pradhan Mantri Krishi Sinchayee Yojna*, (7) Promotion of organic farming, (8) Launch of the National Initiative on Climate Resilient Agriculture (NICRA) Project, (9) Initiation of the *Pradhan Mantri Fasal Bima Yojna*, and (10) Launch of the National Adaptation Fund.

ICAR, being the premier organization for agricultural R&D in India, is making efforts to prepare for climate change action. It has developed a GHG emission inventory, quantified the impacts of climate change, assessed vulnerability to climate change, identified the mitigation and adaptation options, developed contingency plans, and developed and released drought-tolerant, submergence-tolerant and salinity-tolerant crop varieties. These crop varieties include high-protein rice varieties 'CR Dhan 310' and 'Mukul (CR Dhan 311)'; drought-tolerant varieties 'Satyabhama', 'Ankit' and 'Sahbhagidhan'; submergence-tolerant varieties 'Swarna' and 'Jalamani'; salinity-tolerant varieties 'Lunishree', 'Luna Sankhi', and 'Luna Suvarna'; and aerobic rice varieties 'CR Dhan 205', 'CR Dhan 201', and 'CR Dhan 202'. The constraints to climate action include non-agreement on climate policy; inaccurate estimates of GHG emissions and mitigation potential; volatility in carbon market; and non-compliance of Green Climate Fund (GCF) commitment.

Some policy actions for climate risk management are: (1) invest in climate-smart technologies, (2) exploit mitigation co-benefits of adaptation and climate change, (3) develop an integrated land-use policy with crop planning; and (4) mainstream climate education and invest in capacity building.

3. Soil Health Cards

Fertilizers constitute an important input for agricultural production but most farmers do not apply fertilizers in appropriate amounts largely due to lack of knowledge about needed quantity. To educate the farmers on judicious application of fertilizers to their individual plots, the Government of India launched the ambitious Soil Health Card Program in 2015.

Gujarat initiated this program as early as 2003-2004. A study was conducted in 16 talukas of 11 districts of Gujarat, with 2013-2014 as the reference year, to determine access, adoption, impact on productivity and constraints in implementation of the Program.

The study revealed that till 2013-2014, about 21.6 percent of the total operated area was covered under the Scheme. A study on the impact of application of recommended doses of fertilizers on crop yield (soil-test farmers) revealed positive results—there was a yield increase of 23.7 percent in cotton, 39.4 percent in groundnut, 23.7 percent in maize, 44.2 percent in paddy, 75 percent in wheat, 15.8 percent in bajra, 27.4 percent in castor, 29.5 percent in banana, and 35.1 percent in cumin.

The study observed that the level of adoption of recommended doses of fertilizers by soil-test farmers was quite low due to constraints like non-availability, non-affordability, difficulty in understanding the recommendations on the Soil Health Card, and unavailability of technical advice on the method and time of application. The inadequate number of Soil Testing Labs and qualified manpower was another major constraint severely affecting the quality of service to farmers.

The program has now been scaled-up at the national level and is a flagship program. There is a need to educate farmers in soil-test based nutrient management so that the program becomes ‘demand-driven’ rather than ‘supply-driven’.



VIII Summary and Recommendations



The Conference discussed India's preparedness to accomplish agriculture-related SDGs by 2030. This section summarizes the deliberations and enumerates the key recommendations.

1. Summary

Poverty, hunger and malnutrition

India has been able to achieve the target of reducing the poverty level (as estimated in terms of the All-India Poverty Head Count Ratio) to half of its 1990-level much before (in 2011-2012) the compliance year 2015. Therefore, if the recent trends continue, India should be able to achieve the SDG on poverty before 2030. Efforts towards increasing small farmers' productivity and income are needed to help achieve this goal.

To achieve the SDG of zero hunger, India will have to meet the food demand of its projected 1.6 billion by 2030, and this, indeed, is a big challenge. But, with the launch of several social safety

net programs like the National Food Security Act, strengthened public distribution system of foodgrains at subsidized rates, and ready-to-eat food offering ventures, India is expected to move forward in achieving the SDG on hunger.

India is making sincere efforts to end all forms of malnutrition by 2030, which presents a big challenge. The stunting rate in children under three has declined from 53 percent in 1992-1993 to 38 percent in 2015-2016 due to the launch of programs like NRHM, ICDS, etc. To reduce malnutrition, it is significant to empower women, promote gender equality, enhance women's health, expand female education, etc.

Technologies to accomplish SDGs

India has adopted the following agricultural technologies to help it achieve the SDGs: (1) breeding of self-pollinated crops with a wider gene pool and high through phenotyping; (2) development of high-yielding nutrient-rich hybrids in field and vegetable crops; (3) promotion of biofortified crops; (4) dissemination of good agronomic practices; (5) strengthening of watershed development program; (6) educating on carbon building; (7) promotion of crop diversification towards high-value crops; (8) strengthening of agricultural extension and information systems; and (9) scaling-out programs like *Bhoochetna*, *Rythu Kosam*, *Bhoosamrudhi* for better yield and farm income.

India's attempts on farm mechanization to make agriculture farmer-friendly were presented in terms of development of different equipment for land preparation, seeding, plant protection, and harvesting. For increasing the reach of resource-poor farmers to high-value farm equipment, Custom Hiring Centres are being promoted. The need for precision agriculture to improve input-use efficiency and conservation agriculture for carbon sequestration was highlighted; these programs need to be promoted and undertaken in the mission mode.

Policies to accomplish SDGs

India's initiatives on policy formulations to accomplish the SDGs were reflected through the following measures: enactment of MGNREGA; and National Food Security Act; launch of programs like *Pradhan Mantri Suraksha Bima Yojna*; *Jeevan Jyoti Bima Yojna*, 2015; *Jan Dhan Yojna*, 2014; *Krishi Sinchayee Yojna*; *Fasal Bima Yojna*, *Gramin Avas Yojna*, 2017; Housing for All by 2022; *Gramin Bhandaran Yojna*; *Gram Swarozgar Yojna*; *Gramin Kaushalya Yojna*, 2014; *Swasthya Bima Yojna*, 2008; Disabled Rehabilitation Scheme, 2003; Mid-day Meal Scheme, 1995; Soil Health Card Scheme; National Mission on Sustainable Agriculture; and e-National Agricultural Market.

Presenters suggested that the investment strategy be examined afresh to avoid its bias towards a few states, and, within the states, the urban areas. Also, there is a strong need for location-specific public expenditure policy. Since investment contributes to growth but subsidies incentivize farmers, India must consider carefully whether to focus on rationalization or reduction of input subsidies.

On enhancing farmers' income, the suggestions that emerged included strengthening of livestock and fisheries sectors, promotion of poultry and bee-keeping, development of non-

farm sector, and exploitation of ICTs, particularly the mobile telephone connectivity, for dissemination of agriculture-related knowledge to the farmers.

Institutions for accomplishing SDGs

The following initiatives reveal India's efforts to establish institutions to accomplish the SDGs: Development of the agri-business sector; extension of road network; farmers' willingness to pay for quality and timely availability of inputs; introduction of agricultural land leasing reforms, including framing of Model Agricultural Land Leasing Act; launch of Umbrella Program on Natural Resources Management; promotion of institutions like contract farming, AMUL model of milk production success; custom hiring of costly farm equipment; introduction of reforms in APMC markets; linking farmers to markets; and promotion of retail chains, etc. including online retailing of agricultural commodities.

Climate action

India's preparedness to accomplish the SDG (13) on climate action was established through the launching of different programs, institutions, policies, and adoption of the following measures: (1) voluntary pledge of 33-35 percent reduction in emission intensity by 2030 vis-a-vis the 2005 levels; (2) launch of eight National Missions on Climate Change; (3) preparation of action plans on climate change by most of the states in the country; (4) development of drought-tolerant, submergence-tolerant, salinity-tolerant varieties of different crops; (5) launch of Soil Health Card Scheme for better management of fertilizers; (6) dissemination of better water management technologies, including micro-irrigation technologies; (7) dissemination of zero tillage; (8) awareness generation on crop residue burning impact; (9) initiation of climate smart village concept; and (10) development of integrated farming systems.

2. Key Action Points

To achieve the SDGs in India, the following recommendations were made:

Higher investments in agricultural R&D

- Advance frontiers for nutrition-driven technologies.
 - Breed high-yielding, high-nutrient crop varieties/hybrids.
 - Develop and disseminate biofortified crops.
- Support technologies that promote diversification of agriculture.
- Invest in human capital and skill development.
- Ensure investment of at least one percent of the agricultural GDP in agriculture research for development (AR4D).

Improve land management systems

- Legalize land leasing and disseminate NITI Aayog's Model Agricultural Land Leasing Act, 2016.
- Develop situation- and site-specific land-use plans for different agro-ecological regions/sub-regions/zones/sub-zones.

- Focus on irrigation management with the aim of ‘per drop more crop’.
- Strengthen the Soil Health Card Scheme for applying soil-test based nutrients.
- Develop geo-portal and mobile Apps for national and international connectivity.

Accelerate climate action

- Invest in development of climate smart agriculture.
- Develop and disseminate drought-tolerant, submergence-tolerant, salinity-tolerant and aerobic stress-tolerant varieties of crops.
- Promote conservation agriculture technologies; for instance, develop institutional arrangement for custom hiring services to especially promote small-farm mechanization.
- Mainstream climate and agriculture related education.
- Develop a long-term weather forecasting system.
- Ban crop residue burning completely.

Reform policies and interventions

- Revisit investments strategies that have favored a few better-off states and regions.
- The paradox of investment vs subsidy need deeper analysis, because it is believed that investments contribute to growth but subsidies incentivize only farmers. Whether India should focus on rationalization or reduction of input subsidies should be thoroughly examined.
- Ensure effective implementation of various social safety net programs.
- Develop the non-farm sector to de-stress the agricultural sector, enabling income enhancement of rural households, and checking rural-urban migration.
- Promote the bee-keeping, livestock, poultry, and fisheries subsectors of agriculture.
- Popularize the ‘Umbrella Program on Natural Resource Management’ initiated by NABARD.
- Replicate collective initiatives like *Bhoochetana*, *Rythu Kosam* (of Andhra Pradesh) and *Bhoosamrudhi* (of Karnataka) that have provided better crop yield, and higher income.
- Evolve farmer-friendly crop insurance products.
- Initiate dialogue and have clear policy on GM crops.

Strengthen agri-marketing systems

- Focus on agri-marketing and pricing issues. Undertake price monitoring and forecasting of major food commodities frequently for timely trade decisions.
- Develop warehousing, cold chains, and food processing (preferably at the production sites).

India must substantially increase its capital investments in agriculture for creating the much needed infrastructure. This must be done by involving both the public and private sectors, especially in the eastern and north-eastern regions, to capitalize on the rich natural resources that will enable faster agricultural growth.

SDGs have several interconnected goals and, thus, require an effective coordination and convergence mechanism at all levels through an inter-disciplinary and inter-institutional/departmental approach to draw collective strength for the desired impact. Such a coordination mechanism needs to be top down for effective monitoring and evaluation.

Widening the policy space with much-needed faith in agricultural science and new technology, is necessary to accelerate agricultural growth. There is need for an aggressive approach on policy advocacy and reforms to scale up innovations for achieving the SDGs before 2030.

**TAAS– ICAR– IFPRI National Conference on
Sustainable Development Goals:
India’s Preparedness and the Role of Agriculture**

May 11-12, 2017

**A P Shinde Auditorium, NASC, Pusa
New Delhi, India**

Program

Day 1

Thursday, May 11, 2017

08:30–09:30 hrs: **Registration and Tea/Coffee**

09:30–11:00 hrs: Session 1: Inaugural Session

09:30–09:45 hrs: **Welcome and Conference Background**

Dr. P K Joshi, IFPRI

09:45–10:00 hrs: **Special Remarks**

Dr. Trilochan Mohapatra, DARE and ICAR

Launch of Global Food Policy Report

10:00–10:25 hrs: **Keynote Address**

Dr. Shenggen Fan, IFPRI

10:25–10:35 hrs: **Comments on Global Food Policy Report**

Prof. S Mahendra Dev, IGIDR

10:35–10:50 hrs: **Chairperson’s Remarks**

Dr. R S Paroda, TAAS

10:50–11:00 hrs: **Vote of Thanks**

Dr. J L Karihaloo, TAAS

11:00–11:30 hrs: **Tea/ Coffee Break**

Poster Session

11:30–13:00 hrs: Session 2: Status of Indicators of SDGs

Co-Chairs: Dr. Rita Sharma, Ex-Secretary, Ministry of Rural Development
and Dr. D K Marothia, NIE

11:30–11:45 hrs: **Poverty and Hunger**

Prof. S Mahendra Dev, IGIDR

11:45–12:00 hrs: **Land Degradation**

Dr. S K Singh, ICAR- NBSS&LUP

12:00–12:15 hrs: **Climate Risks**

Dr. C H Srinivas Rao, NAARM

- 12:15–12:30 hrs: **Discussant's Remarks**
 Dr. J C Katyal, ex-ICAR
 Dr. Parthasarthy Rao, ex- ICRISAT
- 12:30–12:45 hrs: **Open Discussion**
- 12:45–13:00 hrs: **Remarks by Co-Chairs**
Rapporteurs: Akshay Bhatnagar and Avinash Kishore, IFPRI
- 13:00–14:00 hrs: Lunch**
Poster Session
- 14:00–15:30 hrs: Session 3: Technologies to Accomplish SDGs**
Co-Chairs: Dr. R S Paroda, TAAS and
 Dr. David Bergvinson, ICRISAT
- 14:00–14:15 hrs: **Genetic Enhancement**
 Dr. H S Gupta, ex- IARI and BISA
- 14:15–14:30 hrs: **Natural Resource Management**
 Dr. S P Wani, ICRISAT
- 14:30–14:45 hrs: **Farm Mechanization**
 Dr. C R Mehta, CIAE
- 14:45–15:00 hrs: **Discussant's Remarks**
 Dr. N K Tyagi, ex-ASRB
 Dr. Indra Mani, IARI
- 15:00–15:15 hrs: **Open Discussion**
- 15:15–15:30 hrs: **Remarks by Co-Chairs**
Rapporteurs: Barun Deb and Vinay Kumar, IFPRI
- 15:30–16:00 hrs: Tea/ Coffee Break**
 Poster Session
- 16:00–17:30 hrs: Session 4: Concurrent Sessions on Scaling Innovations to Accomplish SDGs**
- 16:00–17:30 hrs: **Crop Sector**
Co-Chairs: Dr. H S Gupta, ex-ICAR and Malvika Dadlani, ex-ICAR
 Crop-based ICAR institutes, Agricultural Universities & CG system??
- 16:00–17:30 hrs: **Horticulture Sector**
Chair: Dr. Krishna Kumar, Bioersivity International
 Horticulture-based ICAR institutes Horticultural Universities
- 16:00–17:30 hrs: **Natural Resource Management**
Chair: Dr. J C Katyal, ex-ICAR
 NRM-based ICAR institutes, Agricultural Universities & CG system
- 16:00–17:30 hrs: **Livestock Sector**
Chair: Dr. V K Taneja, ex-ICAR
 Livestock-based ICAR institutes, Veterinary Universities & CG system
- 16:00–17:30 hrs: **Farm Machinery and Processing**
Chairperson: Dr. K Alagusundaram, ICAR and Gajendra Singh, ex-ICAR
 Agri engineering-based ICAR institutes, and Agricultural Universities

- 16:00–17:30 hrs: **Human Resource Development**
Chair: Dr. U S Sharma
 ICAR institutes, Agriculture Universities and CG system
- 16:00–17:30 hrs: **Knowledge and Technology Delivery**
Chairperson: Dr. V V Sadamate and Suresh Babu, IFPRI
 ICAR institutes, AUs, KVKs, ATMA & CG system
- 17:40–18:50 hrs: **Scaling Innovations to Accomplish SDGs: Key Recommendations**
Chair: Dr. Gurbachan Singh, ASRB
- 17:40–18:20 hrs: Presentations by the Chairpersons of Concurrent Sessions
- 18:20–18:40 hrs: General Discussion
- 18:40–18:50 hrs: Remarks by Co-Chairs
Rapporteurs: Sunil Saroj and Anjani Kumar, IFPRI

19:00 hrs onwards: Reception Dinner

Day 2

Friday, May 12, 2017

09:30–11:00 hrs: Session 5 A: Role of Policies in Achieving SDGs

Chair: Dr. Vijay P Sharma, CACP

09:30–09:45 hrs: **Social Safety Net Programs**

Dr. RS Deshpande, Former ISEC

09:45–10:00 hrs: **Investment and Subsidies**

Dr. Seema Bathla, JNU

10:00–10:15 hrs: **Enhancing Farmers' Incomes**

Dr. Pratap S Birthal, NIAP

10:15–10:30 hrs: **Discussant's Remarks**

Dr. Andreas Bauer, IMF-India

Dr. BG Mukhopadhyay, NABARD

Dr. Hameed Nuru, WFP

10:30–10:45 hrs: **Open Discussion**

10:45–11:00 hrs: **Remarks by Co-Chairs**

Rapporteurs: Manmeet Singh and Devesh Roy, IFPRI

09:30–11:10 hrs: Session 5 B: Achieving 'No Poverty' and 'No Hunger'

Chair: Dr. P Kumar, AERA

09:30–09:40hrs: **Pathways from Agriculture to Nutrition in India: Disconnects & Burden**

Dr. Mousami Das, NCAER

09:40–09:50 hrs: **How South Asia Performed in Food and Nutrition Security?**

Dr. A Amarender Reddy, MANAGE

09:50–10:00 hrs: **Dietary Diversity, Gender Parity and Women's BMI in Rural Farm Households**

Dr. D Suganthi, IGIDR

10:00–10:10 hrs: **Examining the Link Between Protein Consumption and Nutritional Status**

Dr. Priya Rampal, MSSRF

- 10:10–10:20 hrs: Analysis of the Prevalence of Undernourishment Among the Selected South Asian Countries
Dr. Neela Madhaba Sheekha, JNU
- 10:20–10:40 hrs: **An Enquiry into Development Trajectories of Smallholder Farmers in Semi-arid India as Influenced by Choices and their Drivers**
Dr. Shalander Kumar, ICRISAT
- 10:40–10:50 hrs: **Impact of Institutional Innovation on Welfare and Food Safety: A Case of Dairy Contract Farming in Bangladesh**
Dr. Abu Hayat Md. Saiful Islam, BAU
- 10:50–11:00 hrs: Role of Policy Process in Achieving SDGs in South Asia: # The Food Security Act in India
Dr. Suresh Babu, IFPRI
- 11:00–11:10 hrs: Remarks by Co-Chairs
Rapporteurs: Deepa J and Anjani Kumar, IFPRI
- 11:00–11:30 hrs: Tea/Coffee Break**
Poster Session
- 11:30–13:15 hrs: Session 6A: Role of Institutions in Achieving SDGs**
Chair: Dr. S S Acharya, ex-CACP
- 11:30–11:45 hrs: **Agriculture R & D**
Dr. Suresh Pal, NIAP
- 11:45–12:00 hrs: **Land Reform**
Dr. Avinash Kishore, IFPRI
- 12:00–12:15 hrs: **Institutional Financing**
Dr. M V Ashok, NABAR
- 12:15–12:30 hrs: **Agriculture Market Reforms**
Dr. Sukhpal Singh, CRRID
- 12:30–12:45 hrs: **Discussant's Remarks**
Dr. Mruthyunjaya, ex-ICAR
Dr. P G Chengappa, ex-ISEC
- 12:45–13:00 hrs: **Open Discussions**
- 13:00–13:15 hrs: **Remarks by Co-Chairs**
Rapporteurs: Jaspreet A and Avinash Kishore, IFPRI
- 11:30–13:00 hrs: Session 6B: Policies and Institutions for Climate Action**
Chair: Dr. N H Rao, ex-NAARM
- 11:30–11:40 hrs: **Climate Risks**
Dr. Himanshu Pathak, ICAR-NRRI
- 11:40–11:50 hrs: **Adoption of Soil Health Card for Sustainable Agriculture in Gujarat**
Dr. S S Kalamkar, Sardar Patel University
- 11:50–12:00 hrs: **Coping with Drought, Agriculture and Food Insecurity in India: An Analysis of Household Surveys in Odisha & Gujarat**
Dr. Basanta K Sahu, IIFT

- 12:00–12:10 hrs: **Policy Options and Development Priorities To Cope with Climate Change Impacts in Agriculture Sector of Odisha State, India**
Dr. A K Padhee, ICRISAT
- 12:10–12:20 hrs: **Can Adoption of Micro-Irrigation Technologies Reduce Groundwater Extraction?**
Dr. Chandra Sekhar Bahinipati, GIDR
- 12:20–12:40 hrs: **Exploitation of Irrigation Water: Role of Sugarcane Cultivation**
Dr. Kingsly Immanuelraj, NIAP
- 12:40–12:50 hrs: **Information Enabling Agriculture Growth: Case Study of Karnataka**
Dr. Parmod Kumar, ISEC
- 12:50–13:00 hrs: **Remarks by Co-Chairs**
Rapporteurs: Gaurav Tripathi and Sunil Saroj, IFPRI
- 13:15–14:00 hrs: Lunch**
Poster Session
- 14:00–15:00 hrs Session 7: Panel Discussion on Role of Private Sector in Achieving SDGs**
Co-Chairs: Dr. K L Chadha, HIS and Dr. Gajendra Singh, ex-ICAR
Dr. Vijay Sardana, UPL Group
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Rapporteurs: Deepa J and Jaspreet A, IFPRI
- 15:00–16:00hrs Session 8: Panel Discussion on Strategies to Accomplish SDGs**
Chair: Dr. R B Singh, CAU
Dr. Sachin Chaturvedi, RIS
Dr. Mohammad Jalal Uddin, BARC
Dr. Akhter Ahmed, IFPRI
Rapporteur: Avinash Kishore, IFPRI
- 16:00–16:30 hrs: Session 9: Concluding Session**
Chair: Dr. Ramesh Chand, NITI Aayog
Key Recommendations
Dr. Avinash Kishore and Dr. Devesh Roy, IFPRI
Special Remarks: Dr. Shenggen Fan, IFPRI
Special Remarks: Dr. Raj Paroda, TAAS
Special Remarks: Chairperson: Dr Ramesh Chand, NITI Aayog:
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TAAS is an outcome of the 88th session of Indian Science Congress which was held on the campus of the Indian Agricultural Research Institute, New Delhi in January 2001 under the President ship of Dr. R.S. Paroda. The theme of the Congress was "Food, Nutrition and Environmental Security". The vision statement concluded stating "Hunger-free India is an idea whose time has come. Let us launch a science-based crusade for elimination of hidden hunger and malnutrition". TAAS is a partner in leading this crusade.



The Indian Council of Agricultural Research (ICAR) is an autonomous organisation under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. The Council is the apex body for co-ordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 101 ICAR institutes and 71 agricultural universities spread across the country this is one of the largest national agricultural systems in the world.



The International Food Policy Research Institute (IFPRI) provides research-based policy solutions to sustainably reduce poverty and end hunger and malnutrition in developing countries. Established in 1975, IFPRI currently has more than 600 employees working in over 50 countries. It is a research center of CGIAR, a worldwide partnership engaged in agricultural research for development.

