Approach to Agriculture: A Holistic Overview

Report of the Committee of Governors constituted during Governors' Conference, 2018

'Approach to Agriculture: A Holistic Overview'

A Report by A Committee of Governors

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Preface

In an informal meeting of Governors held on 3rd June, 2018, prior to Governors' Conference, 2018 held on 4-5 June, 2018, a Group of Governors was constituted for formulation of recommendations of Governors on 'Approach to Agriculture- A Holistic Overview' with the following members:-

1. Shri Ram Naik, Hon'ble Governor, Uttar Pradesh
2. Prof. Kaptan Singh Solanki, Hon'ble Governor, Haryana
3. Shri Vajubhai Vala, Hon'ble Governor, Karnataka
4. Acharya Devvrat, Hon'ble Governor, Himachal Pradesh
5. Smt. Anandiben Patel, Hon'ble Governor, Madhya Pradesh

During the meeting the issue to 'Double the Farmers' Income by 2022', was deliberated from various facets including (i) Food Security, (ii) Health Security, (iii) Energy Security, (iv) Water Security, and (v) Environmental Security, to prevent migration from Rural areas to Urban areas, and also to reduce the rural-urban divide. In response to the letter written by the Hon'ble Governor, Andhra Pradesh & Telangana to the Governors/ Lt. Governors regarding sending their suggestions to the Governor of Uttar Pradesh to finalise the report on identified themes, contributions were received. The names of contributors are included in Annexure-I.

I am highly grateful to the Hon'ble Governors/ Lt. Governors, for extending their cooperation with valuable inputs and precious contributions. On the basis of inputs received from them, a 'Report' is being presented to the Hon'ble President.

Date: 12 September, 2018

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1 Introduction

Agriculture plays a key role in Indian economy as it provides livelihood to nearly 54 percent of our population. The share of primary sectors (including agriculture, livestock, fishery and forestry) is estimated to be 20.4 percent of the Gross Value Added (GVA) during 2016-17 at current prices. India's agriculture sector is likely to grow at 2.1 percent in 2017-18, followed by Industry (4.4 percent) and services (8.3 percent), according to the Economic Survey 2017-18.

All the nations facing problems of poverty, hunger and malnutrition will have to accelerate their agricultural growth for achieving sustainable development goals (SDGs), especially while aiming at elimination of poverty. On the demographic front, India adds annually almost one Australia (about 15-16 million) to its population. Thus, any progress gets nullified by an overall increase in population.

In ancient times, it was said - *'Uttam Kheti, Madhyam Vaniz, Adham Chakri, Bheekh Nidaan*' (best is farming, business is medium and servitude is the least desirable). Today as agriculture is not considered "Uttam Kheti" so, this saying has become contrary because now many persons do not want to be involved in this profession and they are fleeing towards the cities. This has resulted into imbalance in view of increasing necessities in towns/cities.

India is the second most populous country (1,295 millions) in the world next to China. World population has been increasing by leaps and bounds. India's population is expected to reach 1,370 and 1,660 millions in 2030 and 2050, respectively. A food production level of 289 and 349 million tones is needed to satisfy the projected population in 2030 and 2050, respectively to feed our people. Though, India has more arable land after the USA, its irrigated land is only about 35 percent of total agricultural land.

The Green revolution not only led to food self-sufficiency, but, also helped to reduce the poverty and hunger. However, despite fivefold increase in food-grains production, as against a fourfold increase in population, India still has around 250 million people who live in poverty and about 45 million children below five years of age who are malnourished. Moreover, after 50 years of Green Revolution, India is also facing the second generation challenges like decline in the factor productivity growth, poor soil health, loss of soil organic carbon, declining ground water strata, water pollution, increased incidence of pests and diseases, increased cost of inputs, decline in farm profits and the adverse impact of climate change.

The public sector capital investment in agriculture and rural development has declined from 20 percent during Green Revolution period to currently less than 10 percent. In the process, many States

have remained deprived of growth and development. As a result, most farmers, especially, smallholders find agriculture not profitable any more. Further, past strategies of agriculture development in India has focussed on increasing agricultural production which led to food sufficiency, but did not explicitly recognize the need to increase farmer's income. Whereas, increase in farmer's income in real term is necessary to reduce agrarian distress and improve farmers' welfare.

Hon'ble Prime Minister of India has exhorted to "Double the Farmers' Income by 2022." The possible goals of doubling farmers income are: (i) to improve the economic viability of farming by substantially increasing the net income of farmers and to ensure that agricultural progress is measured by advances made in their income; (ii) to provide opportunities in adequate measure for non-farm employment for the farm households; and (iii) to introduce measures which can help to attract and retain youth in farming.

To achieve the set goals, the Government has introduced 7-point action plan viz; i) special focus on irrigation with the aim of realizing more crop per drop; ii) provision for quality seeds and nutrients based on soil health of each field; iii) large investments in warehousing and cold chains to prevent post-harvest losses; iv) promotion of value addition through food processing; v) creation of national farm markets; vi) introduction of new crop insurance

scheme on risk mitigation; and vii) promotion of ancillary activities like poultry farming, piggery, goat raring, bee keeping, mushroom cultivation, fisheries etc. for maximizing the gains from farming.

The net cultivable area is 142.8 million hectares. Though India accounts for only about 2.5 percent of world's geographical area and 4 percent of water resources, it has to support about 17 percent of world human population and 15 percent of the livestock. The per capita availability of land has declined from 0.89 hectare in 1951 to 0.27 hectares in 2011. The per capita availability of agricultural land has also reduced from 0.48 hectares to 0.15 hectares during this period. Indian cultivable land is mainly small holdings (65 percent) and around 86 percent farmers are small and marginal. Moreover, the size of holding is declining. As population is increasing on a faster rate but our land resources are limited. Therefore, efforts need to be made to convert non-fertile land fit for agriculture. Further, vigorous efforts need to be made to increase the productivity with proper land use patterns. The soil health should be protected like that of a man and proper soil health management practices are followed towards attaining this goal.

2 India's Position & Potential in Agriculture

India with 329 million hectares (2.4 percent) of total area of the world (13,479 million hectares) is the seventh biggest country. India ranks third in total cereals production (277 million tones) with

a share of 10.5 percent in world total cereals production (2,819 million tones) next to China and USA, while, in wheat (96 million tones) and paddy (157 million tones) production, it ranks second in the world production of wheat (729 million tones) and rice/paddy (741 million tones) with a share of 13.1 and 21.2 percent, respectively. India's position/rank is first in total pulses with a production of 20 million tones with 25.8 percent share in world total pulses production (78 million tones). In oilseeds production; groundnut (7 million tones) with a 14.9 percent share in world (44 million tones) it ranks second next to China, while in rapeseed and mustard (8 million tones), its share is 10.7 percent in world production (74 million tones) and ranks third next to Canada and China.

For commercial crops, India's production of sugarcane (352 million tones) ranks second next to Brazil with a share of 18.7 percent in world (1,884 million tones) in sugarcane production; for cotton lint production (6.19 million tones) with a share of 23.7 percent in world (26.16 million tones) it ranks second next to China and ranks first in the production of jute and jute like fibres (2.07 million tones) with a share of 56.8 percent in world (3.65 million tones). India's share in tea (1.21 million tones) and coffee (0.30 million tones) was 21.7 and 3.5 percent in world production of (5.56 and 8.7 million tones) ranks second and sixth, respectively.

In fruits and vegetable production, India ranks second next to China with a production of vegetable and melons (127 million tones), fruits excluding melons (88 million tones), potatoes (46 million tones) and onion dry (19 million tones) shares 10.8, 12.8, 12.1 and 21.9 percent in world production of 1,169, 690, 382 and 89 million tones, respectively.

In livestock population, cattle (187 millions head), buffaloes (110 millions head) and camels (0.38 millions head) with a share of 12.7, 56.6 and 1.4 percent share in world livestock population of 1,475, 194 and 28 millions head, respectively, it ranks second, first and twelfth, respectively. Furthermore, in the animal products India's share for total milk (1,46,314), total eggs - primary (3,965) and total meat (6,601) thousand million tones was 18.3, 5.3 and 2.1 percent in world production of 8,01,649, 75,524 and 3,17,855 thousand million tones, respectively. India ranks first, third and sixth of total milk, total eggs and total meat, respectively in world production of animal products.

India's agricultural export constitutes 10 percent of the country’s exports and reached to US $ 28.09 billion during April, 2017–January, 2018 with export of basmati, buffalo meat reaching US $ 6.19 billion and US $ 6.59 billion, respectively. India is also the largest producer and exporter of spices and spices products. India is emerging as the export hub of instant coffee which has led to

exports of coffee increase of 17 percent in year 2017 to reach US $ 958.80 million. Tea exports from India reached a 36 year high of 240.68 million Kgs in year 2017. India also topped the list of shrimp exports globally with exports of US $ 3.8 billion which are expected to double to US $ 7 billion by 2022. India's horticulture output reached 300.64 million tonnes in 2016-17 and is expected to cross over 305 million tonnes in 2017-18. Dairy sector in India is expected to grow at 15 percent Compound Annual Growth Rate (CAGR) to reach 9.4 trillion (US $ 145.7 billion) by 2020.

India has a vast diversity of basic natural resources in terms of land, water, climate, rainfall, flora and fauna. The country is recognized as one of the eight mega-centres of plant biodiversity having about 45,000 species of plants. The country has a vast shoreline, excellent sunshine for about 280 days annually in most parts of the country and has a vast network of natural perennial river systems. The country has second largest area under cultivation with highest irrigated area in the world and third in terms of farm mechanization. The agriculture system is also supported by the huge network of Indian Council of Agricultural Research (ICAR) institutions comprising of State Agricultural Universities (62), Deemed to be universities (5), Central Agricultural Universities (2) and Central Universities (4) with Agriculture Faculty, Institutions (64), Project Directorates(13), National Bureaux (6), National Research Centres (15) and Krishi Vigyan Kendras' (694). It was strength of our

agriculture that we were hardly hit by the global recession a couple of years back that bankrupted many economies of the world.

The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing and cold storage. Furthermore, the growing use of genetically modified crops will also improve the yield for Indian farmers.

In the process of reaping advantages of establishing agro-based industries for achieving increasing employment and livelihood opportunities in rural areas it would be necessary to adopt a comprehensive long term approach towards the development of various food processing activities. Going forward, the adoption of food safety and quality assurance mechanisms such as Total Quality Management (TQM) including ISO 9000, ISO 22000, Hazard Analysis and Critical Control Points (HACCP), Good Manufacturing Practices (GMP) and Good Hygienic Practices (GHP) by the food processing industry will offer several benefits. Such planning exercise should be aimed firstly to examine the overall situation and pattern of existing industrial enterprises and then attempt should be made to identify most niche based product groups of enterprises which possess certain location specific advantages in its sustainable development. This would not only provide a strong base and alternative option for creation of additional employment opportunities and avenues of income for

rural households owning very small size of cultivated land and landless labourers within the rural areas itself but it would help in reduction in the rate of rural-urban migration of population.

3 Challenges before the Agriculture

Today, around 138 million Indian farmers' main concern is about declining farm income on the one hand and increasing cost of various inputs on the other. Accordingly, the distress of small and marginal farmers has drawn specific attention of policy makers lately. It is often argued that Green Revolution mainly helped the country to achieve national level food self-sufficiency, whereas it seemed to have bypassed the majority (almost 86 percent) of smallholder farmers having less than two hectares. Further, besides the second generation problems of Green Revolution, farmers are now faced with twin global challenges; i) global climate change, and ii) globalization of agriculture.

Apart from increase in temperature, altered rainfall trends in terms of intensity and variations across regions pose a new challenge. As during the current monsoon also the total rainfall has met the criteria for 'normality,' although there are wide variations in the patterns of showers, leaving some districts hit by drought as others face floods. Within this phase of the monsoon, some districts of Uttar Pradesh, Uttarakhand, Bihar, Assam, Meghalaya, Arunachal Pradesh, Gujarat, Telangana and Maharashtra experienced deficits

ranging from 20 percent to 59 percent. In the case of Gujarat, it has been a story of both deficiency and heavy rainfall within the State. Water is the key determinant of India's agricultural output and the National Commission on Farmers chaired by the Scientist, Professor M.S. Swaminathan, had several recommendations for its optimal use. Given that 60 percent of the 192 million hectares of gross sown area assessed by the Commission was found to be rainfed, an accelerated programme to harness the monsoon is vital. Therefore, State programmes must take all measures to expand surface water storage, launch more minor irrigation schemes, and improve the recharge of groundwater.

The average land holding is around 1.1 hectares whereas many have much less than even 1.0 hectare which is not economically viable for a farm family. To make farming profitable, these farmers require both; the cost effective technologies for enhancing factor productivity, and the policy support for getting credit at reasonable interest and also higher income by linking them directly with the markets.

Now, it is high time to work for 'Evergreen Revolution' for which positive attitude, self confidence and full commitment is needed to confront various challenges. Scientists must work in close collaboration with farmers and constantly keep in mind the changing field realities. Farming has to be made remunerative and

cost effective with the new technologies. Public research institutions have to be promoted for developing cost effective and area specific technologies suitable to different farm sizes. There is also a need to make adequate budgetary provisions for more institutions to set right problems being faced by farmers.

4 Food Security

As defined by The State of Food Insecurity (Food and Agriculture Organization of the United Nations [FAO] 2002): 'Food security (is) a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life'.

The challenge to food security comes mainly from the slow growth of purchasing power of the farmers in the rainfed eco-systems. Efforts must be made to help farmers by developing drought resistant seeds, cost-effective dry-land farming techniques. In addition, rain water harvesting techniques, moisture conservation, inter-cropping are imperative to stabilize and improve the production in the dry-land areas. India would require 280.6 million tones of food grains comprising about 130 million tones of rice and 110 million tones of wheat by 2020.

4.1 Strategies for Speedy Agricultural Growth

It is quite clear that traditional cropping system based farming will not help in achieving the target of doubling farmers' income. Nor the suggestion by some to take farmers out of farming will help. What would farmers do without the new skills and where would they find employment? Instead, it is better to retain farmers in agriculture by making the profession more attractive and rewarding through diversified options, including post-production management and value addition related activities. Obviously, out of the box thinking with focused efforts on out scaling innovations linked to higher productivity, sustainability and profitability through most appropriate diversified, secondary and specialty agriculture linked to post-harvest management, proper storage facilities at local level, value addition and better access to market would be required to make the farming remunerative and attractive.

4.2 Bridging the Yield Gaps and Improving Productivity

India's cropped area has been stagnant around 141 million hectares (m ha) for over a decade now, whereas net irrigated area is currently 65.3 million hectares and the gross cropped area is 195 million hectares with cropping intensity of 135 percent. Of this, almost 55 percent is still rain-fed. Since there is no scope of horizontal expansion any more, vertical expansion through increased productivity is the only way forward. Some States have

productivity less than National average, whereas some can achieve yet higher productivity in view of rich resources and availability of technological options. A study by Planning Commission outlined these yield gaps between 6 to 300 percent in cereals, 5 to 185 percent in oilseeds and 16 to 167 percent in sugarcane in different states. Yield gap in paddy varied around one-fourth to one third of the benchmark yield. In wheat, the estimates are slightly less. There exist significant differences in the realized and the potential yields in most of the crops. The existing technologies can be judiciously applied to narrow down this yield gap.

There are four existing technologies for harnessing the potential of land and water resources. These include: (i) water harvesting, (ii) micro irrigation, (iii) laser land leveling and (iv) zero or reduced tillage. Under water harvesting, there is ample possibility of harvesting a surplus run-off. Micro-irrigation technologies reduce water losses, enhance input-use efficiency, reduce energy consumption, control soil erosion and reduce biotic stresses. Similarly, laser leveling and zero or reduced tillage is of great value. The existing yield gaps can also be bridged by increasing seed replacement rates/the area under seeds of improved varieties and especially hybrids, by adopting large scale use of biotechnology, including the use of genetically modified (GM) crops and by adopting good agronomic practices. Adoption of newly released high yielding short duration varieties based on agro-

climatic zones will reduce the stress on land and soil rejuvenation for the subsequent crop. Haryana produces some of the finest Basmati rice varieties, but almost all the traditional Basmati rice varieties are sensitive to sodicity stress. A large proportion of Basmati rice growing belt of Haryana is affected by slight to moderate sodicity and poor quality sodic groundwater used for irrigation. Due to these stresses, farmers fail to harvest the potential Basmati yields. Basmati CSR-30, a salt resistant variety with 20 percent higher yields over the traditional Taraori Basmati variety need to be popularized in salt affected areas of Haryana and Uttar Pradesh.

4.3 Increasing Nutrient Use Efficiency (NUE)

One of the reasons of higher productivity in irrigated areas had been the increased use of chemical fertilizers. Today, India uses, on an average, around 105 kg/ha of nutrients and total consumption of chemical fertilizers is around 32 million tones, of which nitrogenous fertilizers are around 25 million tones. Unfortunately, the present nutrient-use efficiency (NUE) is not even more than 30 percent. Thus, increasing the fertilizer-use efficiency is one of the challenges for which there is need to adopt innovative ways like use of seed-cum-fertilizer drill, adopting effective use of soil testing/soil health care and the decision support systems for soil/plant test based use of nutrients, use of Neem Coated Urea for

slow release and better uptake, use of customized fertilizers, fertigation, etc.

4.4 Biotechnological Interventions

Moving from green revolution to gene revolution, biotechnology tools are being deployed for improving breeding precision, efficiency and to widen the genetic base by introgressing the genes across Species/Genera. Initiating and strengthening of biotechnology research is another area involving judicious and pragmatic applications of bio-technological tools which have contributed for various trades including biotic engineering and application of genomic tools.

4.5 Rain-fed Area Development & Reviving Productivity of Sodic Soils

Augmentation of water supplies by conserving rain water in the field, aquifers, water bodies, conjunctive use of brackish and fresh water, treatment of sewage and other poor quality water for their reuse in life saving/supplemental irrigation, desilting of existing water bodies and construction of new small dams/water storage structures and recharge of ground water through available technologies/ subsurface galleries need the highest priorities in the development of rain-fed farming. Over time, twin menaces of water-logging and salinity have attained alarming proportions

especially in canal commands in Uttar Pradesh, Haryana and Rajasthan. Gypsum-based package can be used to reclaim sodic soils, while waterlogged saline soils can be reclaimed by sub-surface drainage (SSD) technology.

4.6 Input Management

Seed replacement, line sowing, seed treatment, soil test based fertilizer application, use of bio-fertilizers, vermi-compost, Farm yard Manure (FYM) in addition to fertilizers, supplementing soil with micro nutrients like Mn, S, Zn and Fe (if deficient), introduction of a legume crop like short duration green gram under Rice-Wheat system will help in enhancing the productivity on sustainable basis.

4.7 Cost Reduction Strategies

The rice-wheat cropping system has also created imbalance in cropping pattern and eliminated the pulses from the system in irrigated agro-ecosystem. The dependence upon wheat-rice systems is showing adverse effect on soil and water resources. Adopt Resource Conservation Technologies (RCTs) like zero tillage to reduce the cost of production to the tune of ₹ 3,400/hectare. Farmers should be encouraged for seed production instead of normal crop production to fetch better price, and also to reduce cost on purchase of seed for their own use. Crops should be grown only

in that area in which they are well adapted agro-climatic zone-wise. Zero Budget Natural Farming and rational use of resources (seeds, fertilizers and water) through diversification and adoption of conservation agriculture should be given top priority. An integrated multi-enterprise model consisting of diverse components (low volume high value field and horticultural crops, pisciculture, dairy, poultry, piggery, apiculture and sericulture) can substantially cut the production costs by synergistic recycling of resources among different components. Solar-energy-based tubewells especially, in shallow water table area be supported to further bring down input cost.

Changes in institutional arrangements to encourage adoption of co-operative/collective/joint farming reduce the production cost as economies of scale can be reaped by increasing the size of holding through farmer collectives. In dairy farming also the group dynamics in input supply, such as use of mobile milking machine in village, bulk preparation of 17ustomized feed, etc. can reduce costs. Establishment of custom hiring centres of agricultural machinery on subsidy is needed to be established at local level.

4.8 Integrated Farming System

It is widely believed that diversification in agriculture can be a game changer and will help in achieving the ambitious objective of

doubling farmer's income in the country besides saving and strengthening the natural resources and enhancement in the productivity, profitability and employment in agriculture. It must be understood well that unless smallholder farmers adopt diversified agriculture in a farming systems' mode, including both secondary and specialty agriculture, the expected doubling of their income will not be possible. Fortunately, India has made great strides in sectors like horticulture (now second largest producer in the world in fruit and vegetable production of more than 304.5 million tones), livestock (White Revolution by achieving the highest milk production in the world of 165.6 million tones), and fisheries (Blue Revolution by achieving 11.0 million tones of total fish production). All these sectors have shown much faster growth (between 5–7 percent) compared to food grains over the last two decades.

Average productivity of High Value Crops (HVCs) after adjusting cropping intensity provided an estimated income of ₹ 1,42,777 per hectare as compared to ₹ 41,169 per hectare for the staple crop. Thus, shifting one hectare area from staple crops to commercial crops has the potential to increase gross return upto ₹ 1,01,608 per hectare. Furthermore, the productivity of HVCs is 3.5 times more than the productivity of other crops and area under these crops increased from 15 million hectares to 20 million hectares which is only about 10 percent of gross cropped area (GCA) till now. If the

expansion in area is increased from 10 to 13.5 percent, it has the potential to increase farmers' income by 35 percent.

Horticulture development on cluster approach basis should be encouraged for doubling farmer's income. Formation of baagwani villages and crop clusters with a provision of market and post harvest management facilities with adequate amount of funds is to be promoted in the country. Moreover, setting up of Centres of Excellences for crops in each state be encouraged to boost the horticultural output. In hilly and inaccessible terrains, low volume high value crops, apiculture and sericulture need to be promoted.

There are commodities like minor millets, medicinal and aromatic plants, bio-diesel crops, such as, Jatropha, Neem, Madhuca etc. which are highly under-utilized. Increasing the potential of these underutilized crops can increase the income of the farmers substantially. Also, considerable scope exists to increase the income of farmers by adopting dairy, poultry, goat rearing, piggery, pisciculture, apiculture, sericulture, agro-forestry, rural based low cost primary processing for value addition, cold chain and by adopting secondary and specialty agriculture such as: protected cultivation, mushroom production, growing low volume high value crops like nuts, spices, aromatic & medicinal plants, nutria-crops, etc., seed production of vegetable hybrids, nursery raising to provide disease free saplings, fish seed production, growing of flowers, vegetable seedlings to promote peri-urban agriculture, use

of plastic culture, post-harvest processing, rural based low cost value addition, cool chain, etc.

To enhance the livestock productivity, there is need of timely and quality input supply services, including animal breeding, feeding, animal health, credit and insurance services. The mechanisms for support and service delivery need to be targeted to the needs of the different sub-sectors of livestock and different user communities. Livestock championships, yield competitions and mini dairies may be encouraged through better incentives. Farmers may be encouraged to import high quality germ-plasm of livestock. Efforts must be made to reduce the calving time to 1½ years at the puberty level and for buffaloes they should be made ready for next calving within two months after their lactation period. Since no single vaccine is available for all the major diseases thus there is a need to develop combined vaccine for better adoption of health practices. Quality of prepared feed is the most important parameter that has far reaching implications not only for the productivity of the animals but also for human and livestock health. Poor quality of feed ingredients of low nutritive value and/or various types of adulterants such as, groundnut husk, ground rice husk, non-edible oil cakes, maize cobs, saw dust, marble powder, sand, limestone, etc. are used in the cattle feed because of which the benefits to the farmers are not realized and it shakes their confidence in more intense adoption of the product. Additionally, the improper storage and hot and humid weather conditions may lead to contamination of

feedstuffs with myco-toxins. Hence, there is a need for undertaking policy interventions for quality assurance and feed safety. To augment income from dairy along with returns from milk, economic utilization of dung, urine and male animals, large scale compost and vermin-compost manure plant be established on a cooperative basis for a cluster of three to four villages, depending upon the population of animals.

Farmers should be encouraged to adopt fisheries component as it can be practiced even under salty water and waste land/barren lands. Hence, fish based integrated farming system approach should be taken up in a holistic manner, moving from mono cropping to multiple enterprises adoption. Lease amount on reservoirs/ponds/waste land for fisheries be reduced and infrastructure should be improved to raise fish production. Further, clustering/group/cooperatives be promoted to reduce cost of production and transportation.

4.9 Post Harvest Management and Value Addition

Even after holding position in the production of many agricultural commodities like fruits, vegetables, dairy products; India still lags in food processing behind many other agriculturally important nations. Out of the total production of fruits and vegetables, wastage and losses account for 20 to 22 percent; only 2 percent of vegetables and 4 percent of fruits produced are being processed.

Whereas, in some countries the extent of fruit processing is very high as 70 percent in Brazil, 83 percent in Malaysia and 78 percent in Philippines.

Agricultural products should be prepared according to necessity of market and for this the process should be started at National level. Focus should be on scaling up the use of innovations. Agro-processing centres in the production catchment itself to facilitate backward linkage should be set up for value addition.

All grains and cash crops need processing infrastructure. The demand of processed products, such as dried onion & garlic powder, ginger & garlic paste; jam, jelly, juice is increasing. Country has some good agro industries mostly in and around cities, rural based small scale industries are required for processing of surplus produce. This will not only help in reducing post-harvest losses but also benefit farmers considerably. Further processing of spices, such as chillies, coriander, fennel, fenugreek, garlic, ginger, turmeric, etc. has great potential. The value added products from flowers are dry-flower & pot-pouring, essential oils, flavours and fragrance, pharmaceutical & neutra-ceutical products, pigments and natural dye, gulkand, rose water, vanilla products. It offers excellent opportunities for marketing, establishment of processing industries and export of flowers.

Value addition in dairy sector is very important for better price realization. In this context, there is a need for improving functioning of organized milk marketing network; establishment of small processing units at village level for value added dairy products, etc. Cooperative Federation should be developed on the line of AMUL in Gujarat in each state.

There is need to inculcate entrepreneurial skills in the farm households to process regionally important products, which have greater demand outside the region. Women self-help groups need to be provided with marketing support. Emphasis be given on post-harvest management so that no waste is discharged from the farm as industry to operate like 'Zero Discharge Factories'. Food processing units for women including cold chains, drying centers/chilling centres must be made available to them for their self-employment.

Food products testing labs with trained staff for agricultural & dairy products, organic products, etc. must be established at district level in the country for protection from adulteration and maintaining the safety standards of food products to compete in international market. Agro-processing units in the form of hubs of vegetables, fruits, flowers, milk, honey etc. may be promoted in the villages with direct access to farmers for procurement. Smaller processing units and plantations, squashes & juice, jam, jelly like aloevera

juice and nurseries, etc. through diversified agriculture must be established and encouraged for providing 20-25 percent of income from different enterprises on regular basis. During Mid-Day meals in schools value added processed products should be served e.g. Milk pouch, bajra biscuits/products, corn flakes and soya products, etc.

5 Health Security

With nearly 195 million undernourished people, India shares a quarter of the global hunger burden. Nearly 47 million or 4 out of 10 children in India are not meeting their full human potential because of chronic under-nutrition or stunting. Stunting has consequences such as diminished learning capacity, poor school performance, reduced earnings and increased risks of chronic diseases.

Global Nutrition Report-2016 clearly indicates how India still lags behind in tackling malnutrition effectively. Malnutrition manifests in the form of stunting, wasting, micronutrient deficiencies and overweight/obesity. In terms of stunting, India ranks 114th out of 132 nations (incidence: 38.7 percent) while, for wasting, it is 120th among 130 countries (incidence: 15.1 percent). Regarding anemia prevalence among women of reproductive ages, India ranks 170th out of 185 countries (incidence: 48.1 percent) and hence, this is a matter of grave concern.

Nutrition Security implies physical, economic and social access to balanced diet, clean drinking water, safe environment and health care (preventive and curative) for every individual. India is at the top in vegetable and fruit production in the world, but vegetable intake of Indians remains low; consequently prevalence of anemia and vitamin A deficiency continue to be high. India's Horticultural Mission expected to focus on production, processing and marketing of low cost, nutrient rich vegetables so that these are available throughout the year at an affordable cost to urban and rural population. Non-dietary factors also influence nutrition status. Under-nutrition reduces immunity and infections reduce appetite, impair absorption and lead to catabolic losses of precious nutrients. India has made rapid strides in improving malnutrition. Between 2006 and 2016, stunting in children below five years declined from 48 percent to 38 percent. Yet, India continues to have one of the world's highest children under-nutrition rates, impacting the child's health and development, performance in school and productivity in adult life.

The two concepts are interlinked, but nutrition security has a much wider connotation than food security. It encompasses a biological approach, that is, adequate and safe intake of protein, energy, vitamin and minerals along with proper health and social environment. The nutritional aspect of the quantity of grain to be

distributed to each person under the Public Distribution System (PDS) is somewhat less researched.

Organic farming treats the soil as a living entity to support the plants in an eco-friendly manner and maintains soil biological diversity and productivity on sustainable basis. This is a production system in which all agricultural products involving grains, vegetables, meat, dairy, eggs and fibers such as cotton, flowers and processed food are produced organically. Organic farming excludes the use of synthetic/chemical fertilizers, pesticides, growth regulators and livestock feed additives. This system of farming involves the use of organic sources for plant nutrition *i.e.* farm yard manure (FYM), vermin-compost, rice straw compost, green manuring, crop residues incorporation and need based applications of natural minerals like rock phosphate and gypsum as soil amendments etc. So, this is a method of farming that works at grass root level preserving the reproductive and regenerative capacity of the soil, good plant nutrition and sound soil management, produce nutritious food rich in vitality which has resistance to diseases.

Across the world, people are becoming conscious about healthy nutrition for general health and overall well-being. Conventional food products, processed and junk foods contain high enough content of saturated fats, sugar and sodium, other carcinogenic substances and low in essential nutrients. These have also been

reported as the major contributors to a number of health related problems including diabetes, high blood pressure, allergic and heart disease. Besides above, many other artificial preservatives, flavor enhancers, growth promoters, agro-chemicals and a number of other chemicals with the reflection of harmful effects on health pave the way to seek the alternative farming method. Keeping in view the above mentioned problems, there is a safer and healthier alternative like organic food for long term maintenance of human health in a eco-friendly manner. In addition to direct health benefits, organic food offers a number of indirect advantages such as important favourable effects on both human health and the environment. Since, organic food production strictly inhibits the application of hazardous chemicals, so there is no chance of soil and water contamination. Therefore organic farming/organic food production is considered as the best alternative for safe and nutritious food production to avoid health hazards without impairing the environmental health on sustainable basis.

6 Energy Security

The International Energy Agency (IEA) defines energy security as “the uninterrupted availability of energy sources at an affordable price”. Lack of energy security is thus linked to the negative economic and social impacts of either physical unavailability of energy, or prices that are not competitive or are too volatile. The reliable supply of energy is one of many important requirements for

attaining desired growth in agricultural productivity. Modern agriculture requires an energy input at all stages of agricultural production such as direct use of energy in farm machinery, water management, irrigation, cultivation and harvesting. Post-harvest energy use includes energy for food processing, storage and transport to markets. In addition, there are many indirect or sequestered energy inputs used in agriculture in the form of mineral fertilizers and chemical pesticides, insecticides and herbicides.

India is not well endowed with energy resources in comparison with its large population. While it supports 17 percent of the world's population, it only has 0.6, 0.4 and 7 percent of the world's oil, gas and coal reserves, respectively. India's renewable energy potential is vast and holds a great promise. It is evident that an integrated approach towards developing domestic energy resources, and giving special attention to the ones in which India may have higher potentials, has been engaging the attention of India's economic planners.

Agriculture being the most important human activity in terms of basic requirements of life, technological advancement in this area is imperative. This is also the area in which human work is hard and strenuous. As such the working conditions of the farmers and the sheer human energy required to do farming further necessitate the introduction of technology in the agricultural and allied activities.

This would require the type of technology that can make it possible to render farm work more skill human and less tedious. From that point of view, agriculture is far behind than other sectors in technology. Introduction of farm machinery assists the farmer for the liberation of labourers' from hard, exhausting, degenerating and dehumanizing type of farm work carried out in the most adverse climatic conditions. Therefore the human liberation of poor farming classes from the dehumanizing raw manual labour has to be a major objective of introducing appropriate technology in agriculture.

Compared to traditional practices of farming the advanced farm machinery reduces the repetition of farm operation and time consumed for different operations in farming. These systems can also offer benefits such as increased crop yields, soil moisture conservation and reduced time in the field operation. By introducing this technology the initial moisture of the field can be utilized for the crop and thus reduction in irrigation which results in saving of energy. The need of the hour is climate-smart agriculture practices and technologies that save on scarce resources like water and energy but increase yields and incomes. The technique like laser land leveler helps to save 25-30 percent of water. It also helps increase yields by 10-15 percent due to even crop stands and full land utilisation. The study shows that laser land levelling saves electricity amounting to about 755 Kwh per hectare for rice-wheat systems.

Water use and energy demands for irrigated agriculture are closely related. Agriculture production is faced with an era in which both are scarce. Electricity as used for irrigation pumping is an important component of total electrical energy consumption in Indian agriculture. However, the existing pump sets, due to lower efficiency under variable conditions, consume more than required power. Several possibilities exist which have the potential to reduce energy consumption in the pumping systems. Some of the measures include proper selection of pumping systems, retrofitting of existing pumping systems; community based pumping, adoption of efficient methods of irrigation, partial change in cropping patterns and groundwater recharge in water table declining areas.

The long term energy security for agriculture would require liberal support for large scale installation of bio, solar and wind based energy generation units coupled with energy conservation measures. The deployment of renewable technologies usually increases the diversity of electricity sources and, through local generation, contributes to the flexibility of the system. Shifting to renewable energy can help to meet the dual goals of reducing greenhouse gas emissions, thereby limiting future extreme weather and climate impacts, and ensuring reliable, timely and cost-efficient delivery of energy. More effort is required to develop and commercialize second generation bio-fuel technologies, such as bio-refineries and cellulosic ethanol, enabling the flexible

production of bio-fuels and related products from non-edible parts of the plants. The current trends in Indian agriculture reveal that its energy requirement will increase further. Therefore, there is a need for introducing technological change involving energy-efficient farm machinery and irrigation system.

It is estimated that percentage of agricultural workers in total work force would drop to 25.7 percent by 2050 from 58.2 percent in 2001. Thus, there is a need to enhance the level of farm mechanization in the country. Due to intensive involvement of labour in different farm operations, the cost of production of many crops is quite high. The power availability in agriculture has also increased from about 0.043 KW/ha in 1960-61 to about 0.077 KW/ha in 2014-15. However, as compared to tractor growth, increase in human power in agriculture is quite low. A paradigm shift in agricultural mechanization is required to realize the goal of eco-friendly sustainable agriculture with reduced cost of production and high quality of produce. This is necessary to make the farmers globally competitive and to check further damage to natural resources of soil, water and ecology. Hence there are ample opportunities pertaining to agricultural mechanization. These include: introduction of new state-of-art farm tools and machines for new crops and ventures especially for horticulture, floriculture, rain-fed and organic farming. Equipment such as sugarcane

harvesting, cotton picking and potato harvesting need to be introduced.

7 Water Security

Water security can be defined as the ability to access sufficient quantities of clean water to maintain adequate standards of food and goods production, proper sanitation, and sustainable health care. Population becomes “water stressed” when water levels fall to 1,700 cubic metres per capita, and “water scarce” when water levels fall to less than 1,000 cubic metres per capita. Water once considered abundant, is becoming increasingly scare. In India, water availability per capita was over 5,000 cubic metres per annum in 1950, has come down to 2,000 cubic metres and is projected to decline to 1,500 cubic metres by 2025.

Niti Aayog has come out with a Composite Water Management Index to assess and improve performance in efficient management of water resources. According to the Report, 600 million Indians face high to extreme water stress and India ranks 120th among 122 countries in the water quality index. In India, there is competition for water resources of inter-state rivers among the riparian states of India and also with neighbouring countries viz; Nepal, China, Pakistan, Bhutan, Bangladesh. Though the overall water resources are adequate to meet all the requirements of the subcontinent, the water supply gaps due to temporal and spatial distribution of water

resources among the states and countries in the subcontinent are to be bridged.

There is intense competition for the water available in the inter-state rivers such as Kavery, Krishna, Godavari, Ravi-Beas Sutlez, Narmada, Tapti, Mahanadi, etc. among the riparian states of India in the absence of water augmentation from the water surplus rivers such as Brahmaputra, Himalayan tributaries of Ganga and west flowing coastal rivers of western ghats. About 70 percent of small rivers in India have died and all river basins are facing severe water shortage even for drinking needs of people, cattle and wild life during the intense summer season when the rainfall is negligible. If current trends continue, India is set to become a water scarce country in the not too distant future. A rapidly increasing population and the expanding middle class have driven up demand, while years of pollution, inefficient farming, decentralized governance, groundwater exploitation and poor infrastructure have depleted the water supply. Thus, all these water security concerns need to be tackled on priority basis providing solutions to all water conflicts in the country.

It is necessary to ensure that rural areas get enough water. In absence of water, massive migration to cities will increase and because of water scarcity socio-economic dynamics will change drastically. For achieving drinking water security in a holistic

manner, a four-pronged approach of: 1) Measures for source sustainability through convergence with Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS), The Integrated Watershed Management Programme (IWMP) and other Watershed programmes and National Rural Drinking Water Programme (NRDWP). 2) Participatory integrated water resources management led by Gram Panchayats. 3) Preparation of drinking water security plans by villages. 4) Making the selected villages open defecation free and ensuring proper solid and liquid waste management on pilot basis. Apart from these, household based piped water supply schemes from alternate safe surface/ground water source could also be taken up on priority basis as the long term sustainable solution.

Water scarcity is caused by agriculture as about 80 percent of all water consumed in India is used by the agricultural sector. It is projected that availability of water for agricultural use in India may be reduced by 21 percent by 2020 due to increasing demand of other sectors, resulting pressure on agricultural production. Due to lack of adequate regulations or legislation, groundwater is being extracted at faster rates than the resource can replenish itself and approximately half of all groundwater blocks are now no longer 'safe'. Water is the lifeblood of the agricultural industry in India; without it, farming cannot function. A struggling agricultural industry means the threat of unemployment for approximately 50 percent of India’s workforce, as well as severe implications for

food security and human health security, which pave the way for a potentially disastrous downward spiral.

There are some major innovations that currently need to be out scaled as matter of priority, keeping in view of the expected impacts on production and productivity. They are: i) hybrid rice – the current area coverage (over the last two decades) is only around 2.0 million hectares, whereas scope exists for covering at least 10.0 million hectares in next one decade; ii) single cross maize hybrids – the area covered under these hybrids presently is less than 60 percent, whereas scope exists to double the maize production in next decade provided more than 90 percent of maize area is brought under promising single cross hybrids; iii) the area under conservation agriculture (CA) in rice-wheat cropping system in the Indo-Gangetic plains, is about 3.5 million hectares only, whereas scope exists for almost 10.0 million hectares. The CA innovation also has vast scope under rain-fed farming covering around 55 percent of the total 141.0 million hectares cultivable area in India; iv) protected cultivation – the current area under protected cultivation in India is only around 50,000 hectares, compared to more than 2.0 million hectares in China; v) micro irrigation – out of total irrigated area of 64.7 million hectares, the area so far covered under micro-irrigation is around 8.6 million hectares only, which can certainly be doubled by 2022 provided direct subsidy support to the farmers is enhanced for adopting practices such as: drip,

sprinkler, laser leveling, plastic mulching, raised-bed planting, direct seeding of the rice, System of Rice Intensification (SRI) etc. As per one estimate, drip irrigation can save water (54 percent), energy (30.5 percent), fertilizer (28.5 percent), labour (20 percent), irrigation cost (31.9 percent), yield increase (42.4-57.7 percent), water productivity (50-90 percent) and farmers income (42 percent). Also, the current initiatives by the Government to augment and complete irrigation schemes may add additional 2.0 million hectares area under irrigation. However, for more efficient water use, both free supply of water and flood irrigation practice will have to be stopped in the larger national interest.

Promotion of water saving technologies, use of micro-nutrients and popularisation of cost effective farm machinery like rice transplanter, sugarcane trash harvester/chopper, etc. need high attention to reduce the cost of cultivation. Farmers will have to be trained for effective adoption of these technologies.

8 Environmental Security

Farmers need to be paid remunerative prices for their waste materials to discourage them from straw burning. In this connection, for example the government of Haryana has taken a policy initiative of purchasing residual waste/paddy straw from farmer and will spend ₹ 12 crore to manage stubble burning.

Agricultural Waste/Crop residues like paddy hull/husk, paddy and wheat straw, cotton-stalk, agro forestry waste like leaves, small timber/stalk etc. are produced in huge amounts. Hence, converting this agricultural waste into useful products, bio-energy, bio-fuels, bio-fertilizer/compost, animal fodder and briquetting into agricultural wealth can improve the farmers' income.

Environmentally Balanced Rural Waste Complexes (EBRWE) has to be developed in every village by combining all the waste generated in rural areas in one complex to produce valuable products with zero pollution. These rural waste complexes by utilizing agricultural waste through briquetting as renewable energy source; using anaerobic digestion (biogas) and to produce energy, bio-fertilizer, composting for soil conditioner, animal fodder and other recycled products from solid waste using several compatible technique can generate agri-wealth in rural economy. This agricultural biomass waste will not only generate various valuable products, but also nullify negative environmental impacts like pollution, greenhouse gases, combustion residues, degraded sediments, special waste sludge, etc. can be used for manufacturing concrete blocks, bricks, tiles, clay for cement, bitumen etc. for building materials also.

Agro-forestry and social forestry is the most economical, sustainable and stable alternative for ecological security of land

production system. Further, there is a scope to raise farmers' income by diversifying towards other allied enterprises like agro-forestry on private lands. India meets 40 percent of its non-fuel timber requirement from the import of wood and wood products. India imports wood and wood products worth more than 33 thousand crores, whereas, thousands of hectares of private land remain barren. Various legal restrictions on felling of trees and setting of timber industry and transit permit for marketing of timber are the major deterrent to raise trees on private lands. Therefore,if the problems associated with species suitability, marketing, policy and industrialization are resolved, both; environmental and financial conditions will improve. Liberal support for large scale installation of bio, solar and wind based energy generation units is also required to reduce the environmental pollution and cost of cultivation.

9 Attracting Youth to Agriculture to prevent migration from rural to urban areas

Empowering youth both, men and women through vocational training and building a cadre of 'Technology Agents' to provide technical back support as well as custom-hire services to the smallholder farmers would go a long way in linking research with extension, and thereby accelerating agricultural growth. There is also a need to link now the 'land with lab,' the 'village with institute' and the 'scientists with society' to ensure faster adoption

of efficient resource utilization technologies which would benefit both the producers and consumers. In the suggested transformation process, the Agriculture Technology Agents will need to become 'job-creators' and not 'job-seekers' and provide best technologies as well as quality inputs on farmers’ door steps. The per capita income in Haryana state is more as compared to other states and hence, the migration is less to other cities/urban centres. The migration can be arrested as in case of Haryana, only when the work to every hand is provided by creating the livelihood options at village level.

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

10 Rural - Urban Divide

Migration from rural areas to urban areas has been a disturbing factor and is to be viewed seriously. If left unchecked, it would further widen the rural-urban divide. The plight of the agricultural sector and inefficacy of the rural social safety net programs are the chief factors responsible for widening of the urban-rural divide. Poor state of rural infrastructure such as power, roads, health, education, transport, market, communication network and internet

access etc., have restricted rural income growth. Besides under performance of social safety net programmes like rural employment, income and public distribution systems have aggravated further the rural-urban divide, thereby threatening the rural household livelihood security.

Lack of interest in agriculture has resulted in large scale migration to the cities. We cannot avoid migration if we don't invest in rural development. The only solution for stopping migration of rural people towards cities is to provide proper basic facilities in villages and create earning opportunities. This can happen only through promoting agriculture. In villages, particularly youths feel that there is nothing left in village for them to stay back, so they have to go to cities for earning. We must promote agriculture in various ways like creating awareness, printing agricultural literature, distributing good quality seeds, constructing cold storage and warehouses and encouraging achiever farmers by felicitating them.

To enhance income and livelihood security of the rural poor, we should give major impetus to various activities related to rural development. Our efforts should be to ensure that the benefits of economic reforms percolate to all the villagers across the length and breadth of our country. Measures for the development of rural areas should encompass aid for investment into farms, processing of agricultural products, environmental protection measures in

agricultural and forestry areas, land improvement measures. Further, rural and agricultural development should also be made an important part of various corporate social responsibility (CSR) initiatives.

Government strategies and investments should be directed towards making villages economically attractive. Small scale industries that can be linked with agricultural operations spread over rural areas and smaller towns nearby may be the answer.

Economic opportunities must be provided to the rural masses throughout the year even through non-agricultural occupations to overcome poverty and make a decent living without migrating to big cities.

It is to be ensured that villagers have easy accessibility to finance through strengthened rural banking. The Reserve Bank of India and the National Bank for Agriculture & Rural Development (NABARD), in close coordination with regional rural banks and district cooperative banks have to play a key role in providing credit and micro-lending facilities to small and marginal farmers.

11 Conclusions

The agriculture sector is facing many challenges such as climate change, degradation of natural resources, saline and water logged

soils, decreasing size of land holdings, declining factor productivity, lack of adequate storage and processing facilities, dominance of marketing intermediaries in the marketing system which need to be tackled on priority basis for doubling the income of the farmers by 2022.

In India, while farmers are the major producers, they also constitute the largest proportion of consumers. Hence, improving small farm production and productivity, as a major development strategy, can make significant contribution towards elimination of hunger and poverty, provided farming is made efficient and remunerative. Experience of countries those have succeeded in reducing hunger and malnutrition shows that growth originating in agriculture, through smallholder farmers is at least twice as effective in benefiting the poorest as growth from non-agriculture sectors. Earlier, the focus was on enhancing productivity of crops, but, now it needs to be shifted towards maintaining the sustainability of natural resource endowments, growth oriented innovations, shifting of crop rotation towards high value crops, diversification of agricultural enterprises and enhancing income of the farmers, especially the small and marginal farmers.

The agriculture sector in India is expected to generate better momentum in the next few years due to increased investments in agricultural infrastructure such as irrigation facilities, warehousing

and cold storage. However, higher productivity on sustainable basis will further require higher investment in agriculture and 1.0 percent of agricultural GDP should be invested on agriculture research, as against present level of just 0.4 percent. Modern agriculture will be developed in the villages by providing water, electricity, road and establishing optical fiber network. For doubling farmers income, the focus should be on reducing input cost, integrated farming, diversification towards high value crops, strengthening livestock, fisheries and dairy, value addition, packaging, branding and direct marketing to make agriculture more remunerative and to mitigate the physical, financial and psychological distress of farm house holds and landless labourers.

12 Suggestions & Recommendations :

1. The challenge of climate change is real and there is a howling need to develop a climate resilient agriculture. Development of climate resilient and input efficient improved varieties/ hybrids need to be developed.
2. For holistic development of area, Government of India should consider to extend one time incentive Grant for establishing 'Special Agricultural Zone' under Mission for Integrated Development of Horticulture (MIDH) or Rashtriya Krishi Vikas Yojana (RKVY).
3. Regional hubs for specialized region specific crops, livestock, etc. should be established. Cropping plans should be prepared

in light of suitability of crops, feasibility and availability of natural resources. In hilly and inaccessible terrains, emphasis should be more on low volume high value crops, off-season vegetables, apiculture and sericulture.

4. Regulatory reforms in the existing Acts especially pertaining to land, water, seed, fertilizers, energy and market, etc. must be brought by the Government of India for the judicious use of various resources.
5. Integrated planning of water resources sector with components such as drainage, flood management, water conservation techniques and adequate provisions for recycling of used water should be made mandatory. Promotion of micro irrigation systems like drip and sprinklers, laser leveling, irrigation scheduling techniques is required,
6. Effective power supply is vital for rural economy; rural power grid be strengthened. To supplement and substitute commercial energies, renewable sources such as solar, wind, biogas, biodiesel need to be encouraged and added to the grid power.
7. Under Pradhan Mantri Fasal Bima Yojana (PMFBY), premium rate of 5 percent is too high and needs to be lowered to 2.5 percent of sum insured as some of the states like Kerala have large area under plantation crops.

8. The bank loan interest rates for dairy entrepreneurs should also be same as applicable for agricultural loan i.e. 4-5 percent instead of 12-14 percent.
9. The pattern of assistance under centrally sponsored schemes like Rashtriya Krishi Vikas Yojana (RKVY), Pradhan Mantri Krishi Sinchayee Yojna (PMKSY), Mission for Integrated Development of Horticulture (MIDH) of 60:40 may be reverted to the old pattern of 90:10 assistance to make agriculture sector more lucrative in the states having tiny and fragmented holdings e.g. Kerala, Uttar Pradesh, West Bengal, Tripura etc.
10. Indian Council of Agricultural Research (ICAR) and State Agricultural Universities (SAUs) should develop models of farming system for different types of socio-economic and bio physical settings combining all their technologies in a package with focus on farm income.
11. There is a pressing need for reorientation of agricultural price policy as the existing price policy has distorted cropping pattern. 'Price Deficiency System' should be adopted to mitigate price fluctuations. Under the system, subsidy should be provided to targeted producers in case the price falls below a pre-specified assured threshold and also to prevent unwanted stocks hoarding.
12. Remunerative Minimum Support Price (MSP) for most of the commodities needs to be fixed and announced well in advance

of planting season by the Ministry of Agriculture & Farmers Welfare (MOA&FW) with assurance for either procurement or compensation directly to the producers for prevailing price difference in the market so that farmer is not a looser. Crops like Guar, Castor, spices (garlic, ginger, turmeric etc.), aromatic & medicinal crops also need to be brought under the ambit of MSP.

13. Higher price for farmers should be assured through integrated supply chain. 'Contract Farming' needs to be encouraged to reduce the role of middlemen and enhance the income of farmers. Further, to make the agriculture from production oriented to farm business oriented, Farmers Producer Organizations (FPOs) for all input purchase and selling of their produce/output should be formulated and be linked with the government departments like agriculture, dairy and animal husbandry, fisheries, forestry, food processing, etc.
14. Comprehensive efforts should be made to create unique products and branding of such products (with registered trademark and logo) including organic products, bio-tech products, rice, baby corn, mushrooms, bio-fertilizers, honey, vegetables, fruits, dairy products like A-2 Milk, ghee, curd, butter, etc. to attract stakeholders from inside and outside the country. Further, marketing facilities in cluster of villages should be created to realize better prices of their produce/products at nearby places.

15. To combat with malnutrition, 'Anganwadis' should be modernised through the use of Corporate Social Responsibility Fund.
16. The Government should create basic infrastructure to encourage other allied sectors to enhance job creation in the villages through high value agriculture like floriculture, sericulture, apiculture etc. and in hilly areas special emphasis be given on Eco-tourism.
17. The State Governments should introduce policies for providing subsidised financial incentives in the form of capital subsidy cum loan to establish industrial units, especially in industrially backward districts. Supply of raw materials in required quantities be ensured through establishing raw material banks in specific to particular product group of industries in areas where they are largely concentrated.
18. Farmers' grievances redressal cells at district level should be formed for resolving farmers' grievances and proper co-ordination with line departments viz. agriculture, dairy, fisheries, animal husbandry, forestry etc.
19. At present technological innovations in agriculture are gender biased in favour of males. As feminization of agriculture is on rise due to migration of men out of villages and also considering involvement of women in major crop and livestock related activities including the post harvest

management, training and technologies should also be developed favouring women.

20. MNREGA must be linked with productive agricultural activities as it is adversely affecting the availability of labour for agricultural activities especially during the harvesting seasons.
21. There is a need for a law that formally recognizes tenancy. This is essential for the implementation of Government programmes and reforms that require identification of actual cultivator. The actual cultivator gets bypassed in the payment of disaster relief and various other subsidies as the actual cultivator does not figure in revenue records.

Annexure 1

List of contributing Governors

1. Shri E.S.L. Narasimhan, Hon'ble Governor, Andhra Pradesh & Telangana, Raj Bhavan, Hyderabad - 500041.
2. Admiral Shri D. K. Joshi, Hon'ble Lieutenant Governor, Andaman & Nicobar Islands and Vice Chairman, Islands Development Agency, Raj Niwas, Port Blair - 744101
3. Brig. (Dr.) B.D. Mishra (Retd.), Hon'ble Governor, Arunachal Pradesh, Raj Bhavan, Itanagar - 791111.
4. Shri Jagdish Mukhi, Hon'ble Governor, Assam, Raj Bhavan, Guwahati- 781001.
5. Shri Satya Pal Malik, Hon'ble Governor, Bihar, Raj Bhavan, Patna - 800022.
6. Shri Balramji Dass Tandon, Hon'ble Governor, Chhattisgarh, Raj Bhavan, Raipur - 492001.
7. Prof. O.P. Kohli, Hon'ble Governor, Gujarat, Raj Bhavan, Gandhinagar - 382020.
8. Prof. Kaptan Singh Solanki, Hon'ble Governor, Haryana, Haryana Raj Bhavan, Chandigarh - 160019.
9. Shri Acharya Devvrat, Hon'ble Governor, Himachal Pradesh, Raj Bhavan, Shimla - 171002.
10. Shri N.N. Vohra, Hon'ble Governor, Jammu and Kashmir, Raj Bhavan, Srinagar - 180001.
11. Shri Vajubhai Vala, Hon'ble Governor, Karnataka, Raj Bhavan, Bengaluru - 560001.
12. Justice (Retd.) P. Sathasivam, Hon'ble Governor, Kerala, Raj Bhavan, Thiruvananthapuram - 695099.
13. Smt. Anandiben Patel, Hon'ble Governor, Madhya Pradesh, Raj Bhavan, Bhopal - 462052.
14. Dr. Najma Heptulla, Hon'ble Governor, Manipur, Raj Bhavan, Imphal - 795001.

15. Shri Kummanam Rajasekharan, Hon'ble Governor, Mizoram, Aizawl - 796001.
16. Shri P.B. Acharya, Hon'ble Governor, Nagaland, Raj Bhavan, Kohima - 977001.
17. Prof. Ganeshi Lal, Hon'ble Governor, Odisha, Raj Bhavan, Bhubaneswar - 751008.
18. Smt. Kiran Bedi, Hon'ble Lt. Governor, Puducherry, Raj Bhavan, Raj Nivas, Puducherry - 605001.
19. Shri V.P. Singh Badnore, Hon'ble Governor, Punjab, Raj Bhavan, Punjab, Chandigarh - 160019
20. Shri Kalyan Singh, Hon'ble Governor, Rajasthan, Raj Bhavan, Jaipur - 302006.
21. Dr K.K. Paul, Hon'ble Governor, Uttarakhand, Raj Bhavan, Dehradun - 248003.
22. Shri Keshari Nath Tripathi, Hon'ble Governor, West Bengal, Raj Bhavan, Kolkata - 700062.