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Agriculture: The Driver of Inclusive Growth

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It is my privilege and pleasure to address the NAAS Fellowship today on the 25th AGM of our Academy. I convey my heartiest congratulations to the newly admitted Fellowship and Associates of the Academy. We are delighted to have amongst us the Foreign and Parvasi Fellows who have travelled from faraway places to participate in the programmes of Academy. A positive development is that number of nominations of young scientists is increasing. The Fellowship of our Academy is being recognised by other scientific fora. Also the rating of Journals in agriculture and allied sciences by the Academy is receiving appreciation. It is our constant endeavour to improve the system of evaluation. Our office bearers have already put before you the activities undertaken by the Academy and I thank you for your constant support, encouragement and cooperation in implementing the programmes of the Academy.

Agricultural scenario

Agriculture is a vital sector of our national economy. About 54.6 per cent of the population is engaged in agriculture and allied activities (Agric. Census, 2011) and it contributed 17.4 per cent to the country's Gross Value Added for the year 2016-17 (at current prices). Hence, advancement in agriculture and allied sectors is a necessary condition for the inclusive economic growth at the national level. Net sown area is 140±2 million hectares (Mha) and the gross cropped area is 198.4 Mha with a cropping intensity of 142 per cent. The net area sown is about 43 per cent of the total geographical area whereas the net irrigated area is 68.4 Mha, less than 50 per cent of the net sown area.

India is among the countries leading in production of several food crops and commodities. In the year 2017-18, it is estimated that our foodgrain production will be about 280 million tons (Mt), the highest ever, even though the area under cultivation and irrigation have not shown any significant increase over the years. It is in this sector that India ranks

second in the world while service and manufacturing sectors rank 11th and 12th, respectively. India's inherent strength in agriculture are: largest area in the world in cultivated crops; abundant sunlight through the year; a wide range of agro-ecological conditions; about 263 million people - many of them work 7 days a week in the farms; largest irrigated area in the world (96 Mha gross irrigated area and over 68 Mha net irrigated area); rich agro- biodiversity-no country grows as many crops as we do; family managed small farms and their crop-livestock mixed farming system and others. India ranks first in milk production (>160 Mt in 2016-17) and contributes to 18% of the world milk production and globally second in fish production with 11.41 Mt in 2016-17. A significant part of Indian Agriculture production has now started coming from horticulture (vegetables, fruits, flowers, etc) and livestock (milk, fish, eggs and meat) and the two sectors together contribute to 60% of India's agriculture GDP. Indian Agriculture remains completely transformed in recent years and is structurally very different today than agriculture of yesterday. I am sure in the years ahead, agriculture will be very different than what it is today. This success has been driven by several factors which include policy support, research and extension, production strategies, higher use of inputs, and public investment in infrastructure.

We should also recall that since mid 1990's while the overall GDP growth rate of 7-9 per cent was recorded, the agriculture growth hovered around 1.5-2.0 per cent per annum. Contribution from agriculture to national GDP has declined from 23 per cent back in 2003-2004 to as low as 14 per cent today. The percentage of working population depending on agriculture was 69.7 as per 1961 and 1971 censuses, it dropped down to 57.0 per cent in 2001 and to 52.0 per cent in 2006-07 of the workforce. In most industrially advanced countries, the percentage varies between 1 and 7. By contrast, it varies between 40 and 70 in most developing countries.

No doubt cultivation remains the major source of income in rural India, still rural households are increasingly participating in non-farm activities. In the recent times, the non-farm employment sector has proved as an engine of rural growth and increasing per household income. The share of non-farm employment was one-sixth (16.6%) in the total rural employment at the end of 1970s which increased to one-fifth (21.7%) within a decade, and to more than one-third of the total rural workforce (35.9%) during 2011-12. To ensure livelihood security of the marginal and small holder farmers, it is necessary to focus on their technological needs as well as infrastructure, including new avenues for gainful employment in the non-farm sector.

Challenges

The major challenge today is to attain a growth rate in agriculture and allied sectors that is 4 per cent plus and with an approach that is based on efficient use of resources and conservation of soil, water and biodiversity; growth with equity i.e. growth that is wide spread across regions and different categories of farmers; growth that is demand driven and caters to domestic market and maximizes benefits from export of agricultural products; and growth that is sustainable technologically, environmentally and economically. The agricultural growth in India has been fluctuating since more than 50 per cent of agriculture in India remains dependent on rainfall. However, the sector has been witnessing a gradual structural change in recent years. The growth rates of agriculture & allied sectors fluctuated between 1.5 per cent in 2012-13, 5.6 per cent in 2013-14, (-) 0.2 per cent in 2014-15, 0.7 per cent in 2015-16 and 4.9 per cent in 2016-17. The variation reflects a high degree of uncertainty in the production environment and as long it persists, sustainable and much desired inclusive growth in agriculture will remain a distant dream. This skewed growth in agriculture has caused marginalization of rural population, widened urban-rural and inter-state divides, and created hot spots of acute distress, indebtedness, deprivation and even farmers suicides.

The two imperatives for India for now and the future are to increase food production to meet the growing demand, and to adopt conservation measures on natural resources that are being degraded as a consequence of human activity, including erroneous and often over-zealous agriculture practices. The paradox of these two objectives is their mutually opposing thrusts, which somehow need to be accommodated with prudent innovation and planning. The obvious primary reason to increase food production is to provide food for the increasing Indian population. Experts have however, determined that the rate of population increase has been decelerating in India, and if the trend continues it will stabilize at 1700 million (1.7 billion) by the year 2060. So, our food production should also be enhanced to match this magnitude of population increase. Presently, farming is a dual-purpose pursuit that has to ensure both food security and income security. Towards this end, farmers should become capable of deciding what to grow and how to grow. For this, they should keep in mind the expected yields as well as production costs, on the one hand, and the resource depletion, on the other. In generating cash incomes, they should be sensitive to the market conditions.

Dilemma in Development and Growth

India is said to be one of the fastest growing economy claiming to reach a two digit growth rate, on the one hand, and on the other, of housing the largest number of poor in the world. In agriculture, the recent estimates indicate a production of 279 plus million tons of food grain, the highest ever, in 2017-18 (3rd Advance Estimates of production of foodgrains, DAC&FW, Min. of Agric. & FW; 16 May, 2018) and also are the largest producer of milk and the second and third largest of fruits and vegetables, but nearly 200 million of our population live below poverty line, 40% suffering from malnutrition, 42% of our children are under weight (Hindu, Jan.11, 2012) and 13 lakh of them die before their first birth day (TOI Jan.17, 2012). Also, growth rate of food grain production has declined from 2.83 per cent per annum in 1961-71 to 1.03 in 2001-11 against the population growth of 2.24 per cent in 1961-71 to 1.65 in 2001-11. Situation more or less remains unchanged even today. It is pertinent to recall the statement of the economist and Nobel laureate Amartya Sen saying "I do not think there's enough clarity on economics here- I do not judge the performance of the Indian economy by growth alone. I am disturbed by the fact that India has the largest ratio of under nourished people in the world and so on. That's why we have to take a broader view. Bangladesh has taken over India in longevity, infant mortality, immunization rate, female literacy and all social criteria and our position in the world has worsened rather than improved in the period of high growth rate, then I think the vulnerability of the political economic strategy of catering primarily to growth and not the human capability expansion would get much more tension. And the fact is that human capability expansion is also very critical for economic growth" (TOI Jan.12, 2012).

When we look at the ground reality in terms of the impact of all these 'so called' developments on the life of 70 per cent rural inhabitants we feel depressed. In fact the rural: urban ratio of income has widened and the suicide rate of farmers has sky-rocketed during this period. This obviously points fingers at the mismatch between resource allocation, management governance, development and our claims. All this tells us to live with ground reality and find measures which can bring real inclusive social growth rather growth. The very policies and priority are questioned and call for a serious review of our mechanism of priority setting and operations. There is need to increase productivity, employment and income of agriculture dependent population based on dual approach to transform the economy through agriculture sector reforms by focusing the technological development on the one hand and the policy reforms to make facilitate the sector on the

other. Recent initiative of GOI for doubling farmer's income in this direction is praiseworthy.

The production linked infrastructure creation in rural settings namely, electricity, irrigation resources, processing and marketing network, storage facilities, training facilities for breeding rural entrepreneur credit facilities on easy accessible terms will perhaps lead to employment based sustainable growth. A highly governed system based on rural infrastructure and employment creation with strong human capability development is perhaps the answer. For all this to happen, we need to have a very clean, transparent and efficient governance and administrative system and adopt all these improvement oriented programs and be answerable to the people. If this kind of environment is created, it will give promotion to industrialization and export promotion of the product. All this needs a strong political will which is difficult but not impossible. To ensure states' growth all these have to happen and there is no shortcut.

Operational landholdings pose limitations. The agriculture census 2010-11 revealed that the total number of operational holdings in the country was 138 million in 2010-11, with a total area of 159.6 Mha and an average size holding of 1.15 ha thus, declining from 1.23 ha in 2005-06 with increasing fragmentation. This has led to smaller size of land holdings and more clusters per holding. The percentage share of female operational holders is only 12.79. Small and marginal holdings taken together (below 2.0 ha) constitute 84.97 per cent of the total holdings (70% in 1953-54); forming 44.31 per cent of the total operated area. Semi-medium and medium operational holdings (2.0 ha–10.0 ha) constitute 14.30 per cent of the total holdings with 44.77 per cent of the total operated area; whereas the large holdings (10.0 ha and above) constitute 0.73 per cent of total number of holdings with a share of 10.92 per cent in the total operated area. (Table 1).

Thus, it can be seen that 85 per cent of the farmers cultivate about 44 per cent, and 15 per cent cultivate 56 per cent of the operated area. Although small and marginal farmers are found to have higher productivity compared to large sized holdings, but they invariably have low marketable surplus and profit. There has been significant fragmentation of operational holdings in India; medium holdings are getting reduced to small and marginal holdings with no sign of reversal in the foreseeable future.

This trend obviously makes a strong case for much needed land reforms, especially for land consolidation, as well as reforms in tenancy laws.

Table 1: Number and area of operational holdings by size group

Category of Holdings	Number of Holdings (000 number)			Area Operated (000 ha)			Average Size of Holding (ha)		
	2000-01*	2005-06*	2010-11	2000-01*	2005-06*	2010-11	2001-01*	2005-06*	2010-11 (P)
1	2	3	4	5	6	7	8	9	10
Marginal (Less than 1 hectare)	75408 (62.3)	83694 (64.8)	92826 (67.1)	29814 (18.7)	32026 (20.2)	35908 (22.2)	0.40	0.38	0.39
Small (1.0 to 2.0 hectares)	22695 (19.0)	23930 (18.5)	24779 (17.9)	32139 (20.2)	33101 (20.9)	35244 (22.1)	1.42	1.38	1.42
Semi-Medium (2.0 to 4.0 hectares)	14021 (11.8)	14127 (10.9)	13896 (10.1)	38193 (24.0)	37898 (23.9)	37705 (23.6)	2.72	2.68	2.71
Medium (4.0 to 10.0 hectares)	6577 (5.5)	6375 (4.5)	5856 (4.3)	38217 (24.0)	36583 (23.1)	33709 (21.2)	5.81	5.74	5.76
Large (10.0 hectares and above)	(1.0)	(0.8)	(0.7)	(13.2)	(11.8)	(10.9)	17.12	17.08	17.38
All Holdings	**119931 (100.0)**	**129222 (100.0)**	**138348 (100.0)**	**159436 (100.0)**	**158323 (100.0)**	**159592 (100.0)**	**1.33**	**1.23**	**1.16**

*(**Source:** Department of Agriculture Cooperation and Farmers Welfare (Agriculture Census 2010-11) *Excluding Jharkhand; ( ) indicate percentage share out of total holdings.*

Consolidation of land holdings in Punjab, Haryana and Uttar Pradesh has helped in accelerating agricultural growth. In India, the contribution of small farmers to total farm output exceeded 50 per cent, although they cultivated only 44 per cent of the land. Small farmers are characterized by smaller applications of capital but higher use of labour and other family-owned inputs, and a generally higher index of cropping intensity and agricultural diversification. To ensure livelihood security of the marginal and small holder farmers, it is necessary to focus on their technological needs as well as infrastructure, including new avenues for gainful employment in the non-farm sector. With current trend, the projections are that small and marginal farmers may account for more than 90 per cent of farm holdings by 2030.

Role of Agriculture in Growth of other Non-Agriculture Sectors

Agriculture, being the largest private enterprise (sustaining around 138 million farm families), can survive only if it grows consistently. And, growth is incumbent upon savings and investment, both of which are a function of positive net returns from the enterprise. The net returns determine the level of income of an entrepreneur, farmer in this case. Agriculture is also important for another reason. If it fails to develop at a suitable pace, it could prove to be a major constraint on the growth of industrial and other sectors. It is not only the supplier of food, but also of raw materials to industry. Moreover, agriculture could provide the motive for industrial expansion by being a major market for industrial goods, thus agriculture sector is the backbone of an economy which provides the basic ingredients to mankind and now raw material for industrialisation.

Agriculture has an important role in growth of trade, transport and other industries. It has all along played a very important role in India's external trade. Three major items of India's traditional exports *viz*. tea, jute and cotton textiles, are agro-based. Other items include sugar, oilseeds, tobacco, and spices. According to an estimate, farm exports constituted about 50 per cent of India's total exports in 1960- 61. However, net exports of food-grains exceed net import of food-grains. In recent times, exports of non-traditional items like vegetables, flowers, milk products, animal meat, marine products, and food processing goods have seen a significant increase. This diversification of exports augurs well. Our agricultural exports had share of 12.55% in the total national exports during 2015-16.

India has one of the largest surface transport systems consisting of railways and roads. Agriculture seems to provide the main support to the country's

transport system. Railways and roads secure the major portion of their business from the movement of agricultural commodities from producing to distant consuming centres. In fact, India's internal trade largely consists of purchase and sale of agricultural commodities.

Agriculture is the main provider of raw materials not only for the food industry but also for large industries such as food processing, sugar and molasses, textile and rubber. Food Processing Industry is one of the major employment intensive segments constituting 11.69 per cent of employment generated in all registered factory sectors in 2013-14. A well-developed food processing sector with higher level of processing helps in the reduction of wastage, improves value addition, promotes crop diversification, ensures better return to the farmers, promotes employment as well as increases export earnings. This sector is also capable of addressing critical issues of food security, food inflation and providing wholesome, nutritious food to the masses. Annual growth rate of food processing industries sector during 2015-16 was 7 per cent. The sector constitutes as much as 8.8 per cent of GVA in manufacturing and adds 8.39 per cent to the GVA of agriculture sector.

In Social sector, food security and improved household nutrition have contributed towards improving the national social parameters. The life expectancy that was 32.1 years in 1950-51 is now 67.9 years. It is an irony that the very same farmer is now caught in the vortex of more serious challenges. The average income of an agricultural household during July 2012 to June 2013 was as low as Rs.6426, as against its average monthly consumption expenditure of Rs.6223. As many as 22.5 per cent of the farmers live below official poverty line. Nevertheless, there is a distinct change in the rural canvas with more number of children getting enrolled in schools, at least till primary and middle levels. No nation can afford to compromise with its farming and farmers. The welfare of this large size of India's population is predicated upon a robust agricultural growth strategy that is guided by an income enhancement approach.

Problems and Resolves

The agriculture sector is currently facing a dilemma. While it has made large strides in achieving the agricultural development goals of food security, availability and accessibility, it is still being challenged by a formidable agrarian crisis. This situation has recently led to fresh thinking on the developmental approach in the agriculture sector. The farmer welfare-centric approach to agricultural development can empower

the rural masses with higher income and employment and make balanced development a reality. Hence, in policies of poverty alleviation and enhancing sustainable development, agriculture has enormous potential.

The structural changes that are being witnessed by the agriculture sector in India necessitates re-orientation in policies towards this sector in terms of strengthening the agricultural value chain by focusing on allied activities like dairying and livestock development along with gender-specific interventions. To improve productivity in agriculture the focus has been on the critical inputs like irrigation, seeds, fertilisers and mechanization. The dynamics of agricultural growth reflect a reduction in the share of crop sector and an increase in the share of agricultural sub-sectors. As agriculture entails risks related to production, weather, prices and policy, capitalizing the structural changes in the agriculture sector by diversifying income generating activities can mitigate the risks and sustain growth of the economy.

Large tracts of arable land (66%) have transformed into problem soils, becoming acidic, alkaline and saline physico-chemically. Soils are generally shallow, low in plant available water capacity, very low sub-soil saturated hydraulic conductivity, sub-soil hard pans, imperfect drainage, sub-soil gravelliness, calcareousness, low soil organic carbon and have a multiple nutrient deficiencies. Land degradation has been an area of major concern in the past few decades. Nearly 120.7 Mha (36.6% of total land area) is suffering from land degradation of some sort, whether wind and soil erosion, water logging, soil alkalinity/ acidity, seepage of mining and industrial waste, along with excessive use of fertilizers, intensive cropping and depletion of organic matter.

Another primary factor of production, namely, water is also under stress. Emphasis needs to be given not only to sustainable development of potential resources of water but also to augment, conserve and manage available water through improvement in water storage, conveyance application, and crop water use efficiencies without detriment to environment and other natural resources of land, soil, plants and bio diversity.

Enhancing water productivity in rain fed regions with rainfall ranging from 300-1500 mm, the imbalance between the rainwater input and the water withdrawals from surface and ground, water needs to be balanced. Future projection of rainfall and temperature is likely to affect evapo-transpiration and irrigation demand, which is to be answered by suitable

technologies including crops and genotypes and policies on water use in such areas.

The rain fed agriculture accounts to 55% per cent of total net sown area and is crucial to country's economy and food security since it contributes to about 40 per cent of the total food grains production, supports two-third of livestock and 40 per cent of human population. Further, it influences the livelihood of 80 per cent of small and marginal farmers and is most vulnerable to monsoon failures. Even if full irrigation potential is created, 40 per cent of the area will continue to be rain dependent. The major challenge, therefore is sustaining by addressing the issues of rain fed agriculture from technical, social and policy point of view.

Evolving rain fed integrated farming system models by strengthening predominant traditional rain fed farming systems that enhances resource use efficiency and livelihood by providing risk resilience, food and nutritional security, staggered employment and income has a great promise for such situations. Promotion of agro-forestry and silvi-pasture systems, fodder trees, multiple tree based systems have great opportunities in such lands. Promotion of dry land horticulture and animal husbandry especially sheep rearing, fisheries in water harvesting ponds, protected agriculture, fodder production, use of proper farm machinery for different operation, food processing and value addition are some potential areas for rain fed lands.

The livestock sector has emerged as an important sector for ensuring a more inclusive and sustainable agriculture system. The livestock segment supplements farm income (almost 30-40%) by providing employment, draught animals, milk, manure etc. There is evidence to show that farming households with some cattle head are better able to withstand distress due to extreme weather conditions. Fishery is one of the most promising sectors of agriculture and allied activities in India, with a projected overall growth rate of 6 per cent for the 12th Five Year Plan. Fisheries sector supports the livelihood of almost 1.5 million people in the country.

Crop diversification needs to be encouraged to improve soil health, productivity and thereby, profitability of cultivation. There is a need to diversify into high value crops and horticulture crops for which Government has taken several measures. Crops Diversification Programme is being implemented by the Government in original green revolution states viz. Punjab, Haryana and in Western UP to diversify paddy area towards less water requiring crops like oilseeds, pulses, coarse cereal, agro-forestry

and shifting of tobacco farmers to alternative crops/cropping system in tobacco growing States

Climate change has become a serious global negative externality with its multiple, far-reaching and persistent effects. Its adverse impact on food production systems, due to rising temperatures and extreme weather events, is at the centre stage of discussion worldwide. Developing countries, in particular, with their large agrarian base, are more prone to threats due to climate change. With India's large size, its numerous agro-ecological zones, preponderance of small, fragmented holdings and persistent dependence on the vagaries of the monsoon, the issue of climate change becomes even more challenging. Recently acknowledged by the world community that the Climate change caused by excessive emission of Green House Gases (GHGs) is one of the greatest challenges facing our planet today. The atmosphere carries out critical function of maintaining life sustaining conditions on earth. GHGs (for example carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), water vapour) re-emit some of the heat to the earth surface. If they did not perform this useful function, most of the heat energy would escape, leaving the earth cold (about -17^oC) and unfit to support life. Increase in the level of GHGs could lead to greater warming, which, in turn could have an impact on the world climate-the phenomenon known as "Climate Change". Ever since industrial revolution began 150 years ago, manmade activities have added significant quantities of GHGs to the atmosphere. A portfolio of measures on various sectors of economy like energy, agriculture, urban and rural habitat and all measures related to environmental protection and ecological sustenance are needed to combat this grave problem.

Slow infusion of new technologies, lack of timely availability of information and communication, lack of marketing facilities and cold chain and food processing and product development systems are issues of concern today. Extension services need to be strengthened by scaling-up investment levels and by improving their quality. The government spending on agricultural extension has been fluctuating, though has moved on a rising trend. The share of agricultural GDP spent on agricultural extension has not shown any specific trend. In recent years, the government has spent about 0.14% of agricultural GDP on extension services (NIAP Policy paper: 25).

Biggest challenge remains in terms of increasing access to credit, particularly for the poor farmers. The structural changes that are being witnessed by the agriculture sector in India necessitate re-orientation

in policies towards this sector in terms of strengthening the agricultural value chain by focusing on allied activities like dairying and livestock development along with gender-specific interventions

There is predominance of small operational holdings in Indian agriculture. It is, therefore, needed to consolidate the land holdings to reap the benefits of agricultural mechanization. There is a need to innovate custom service or a rental model by institutionalization for high cost farm machinery such as combine harvester, sugarcane harvester, potato combine, paddy transplanter, laser guided land leveller, rotavator etc. to reduce the cost of operation and it can be adopted by private players or state or central organizations in major production hubs.

Investment in the agriculture sector as a whole and research, extension and education in particular need to be enhanced.

Investments and technology development are two major drivers of growth. A major cause of present agrarian crisis is inadequate investment in agriculture. Of the total Plan outlay the share of agriculture as 4.90% in 9th Plan; 3.90% in 10th Plan and further reduced to 3.70% in the 11th plan. In the 12th Plan (2012-17) the annual share of agriculture that was 5.40% in 2012-13 reduced to 1.88% in 2015-16. These include the infrastructure development as irrigation facilities, roads, markets, cold storage, rapid transportation especially for perishables etc. and simultaneously development of new technologies to improve the resource use efficiency. Unfortunately, the investment in agriculture R&D has never gone more than 0.7 per cent of total agriculture GDP (**Table:2**). Considering that there is a resource crunch and it will continue to be so, we need to make serious prioritization efforts to ensure optimum allocation and use of resources.

According to ICAR-NIAP study (Policy paper:25) returns to investment on research have been found to be a highly paying proposition. The overall internal rates of return to public investment in agricultural research during the period 1975 to 2005 turned out to be 29% for rice, 38% for wheat , 28% for maize, 39% for jowar, 1% for bajra, 34% for gram, 57% for arhar, 18% for groundnut, 20% for rapeseed & mustard, and 39% for cotton. The study has suggested that further investments on research will generate significant returns. The internal rate of return to investments in agricultural research has been estimated quite high (42%). There is ample evidence in form of several studies to conclusively prove that the return on investment in agricultural R& D is much higher than any other sector, then what prevents us from investing more in this sector. And simultaneously

Table 2 : Expenditure on Agricultural Research and Education (Rs. Crore at 2006-07 prices)

		Tenth Plan	2007-08	2008-09	2009-10	2010-11	2011-12	Eleventh Plan
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
State	Plan	4151	694	965	1070	1289	1382	5401
	Non Plan	6477	1464	1315	1497	1755	1599	7629
	Total	10629	2158	2279	2567	3044	2981	13030
Centre	Plan	4977	1210	14181	402	1909	1998	7938
	Non-Plan	4125	852	1040	1235	2168	1512	6808
	Total	9102	2063	2458	2636	4077	3510	14745
RKVY	Plan		55	197	63	100	160	576
Centre and States	Plan	9128	1961	2580	2534	3298	3540	13914
	Non-Plan	10603	2316	2355	2732	3923	3111	14437
	Total	19732	4277	4935	5266	7221	6652	28351
GDP Agriculture and Allied (2006-07 prices)		3340648	764890	765601	773565	827969	850812	3982837
Research/Education as % GDP Agriculture		0.59%	0.55%	0.61%	0.67%	0.86%	0.76%	0.70%

Source: 12th Plan Document, Planning Commission.

new technologies improve the resource use efficiency. Investment in the agriculture sector as a whole and research, extension and education in particular need to be enhanced. The gap in the financial commitments made at the beginning of the Plan and now annually, is widening that leaves the sector with thin spread of resources ultimately resulting in constraining the implementation of programmes.

Priority areas for Investments in Agriculture Research and Development (AR&D)

- A distinct focus on conservation of natural resources:
    - Rain water management wherein every drop of water has to be saved. It is now not uncommon to see that the areas that witness floods also are faced with drought like situations soon after the receding of floods. Water will be the most limiting factor in agriculture. Therefore, water storage and conservation, ground water recharge, reviving water bodies have to be given top priority.
    - Soil health management will be crucial and it will be major challenge to sustain the fertility and production potential of the soils
    - Biodiversity conservation and utilization- in all forms, floral, faunal and microbial.
- Promotion of rain fed and dry land agriculture through technological interventions on more than 50 per cent of the rain dependent agricultural lands. Integrated farming with emphasis on livestock component has a great promise.
- Climate change will have far reaching consequences for agriculture and therefore, our efforts through adaption and mitigation approach to combat the problem need our emphasis.
- Diversification involving crop, horticultural, livestock and fisheries for sustainable growth and also minimising the risk arising out of climate change effect.
- Processing and value addition to produce for enhancing farmer's income and reducing post-harvest losses at farm level.

- Research on modern tools and technologies viz. precision farming, biotechnology, nano-technology, novel fertilizers, microbe-based interventions, mobile-based apps (ICT), weather forecast at sub-block level etc need to be used in promoting agriculture.
- Enhancing use of Drones, Robotics, Space technology, ICTs and Artificial Intelligence (AI) applications in agriculture
- Improving advisory services and forecast and forewarning systems especially to regulate farm production and avoid distress sales.
- Pricing mechanism for farm produce and prior price announcement and sale of produce through network of e-markets and other village level markets.
- Higher investment in agriculture R&D to generate advanced technologies and meet the food challenges of the growing population.

Conclusion

It is a paradoxical situation, we have enough food production, food availability, accessibility, markets and consumption, while the producer of food is in distress. There is no other industry where the production units run into losses when the market environment is favourable. I think we need to seriously think and analyse the situation and suggest remedial steps to make farming more remunerative. Knee jerk reactions will not take us anywhere**.** There is a need for a holistic approach to the problem and all issues from production till consumption involving all stakeholders need to be dealt simultaneously and not one after the other. We should also realise that Indian agriculture is characterized by a very vast agro-ecological diversity in terms of natural endowments, rainfall, land forms, soils, climate, biodiversity, socio-economic levels of farming communities, etc and therefore, **"one size fits all"** approach cannot work and each situation has to be dealt with separately and comprehensively.