

## Module 5

Land tenure system is the most vital institution which governs the use of land for any agriculture related economically productive pursuit. It relates to two aspects. Firstly, the traditional or legal rights an individual or a group of individuals have on land and secondly the social relationships among the rural population that emerges from such land rights. In simple words, land reforms mean change in land tenure system. Broadly speaking, land reform involves the fluctuations of laws, regulations or customs concerning regulation of ownership, operation, leasing, sales, and inheritance of land. The standard feature of all land reforms, however, is alteration or replacement of current institutional arrangements governing ownership & use of land. In India's context it involves not just replacing the older institutional arrangements (the zamindari system) but also reorganization of land holdings along with reform of ownership or tenurial rights. In the process of abolition of the zamindari system imposition of land ceiling, redistribution of surplus land and redistribution of surplus land and redefining ownership rights are all important constituents.

### Significance of Land Reforms in India

In India, there are both economic & political reasons for land reforms. These include land scarcity reflected in high man-land ratio, prevalence of agriculture in rural India, large mass of rural population living below poverty line and an unequal allocation of land. In this context, it acknowledged main concern on the policy outline after Independence, when India passed a significant body of land reform legislation. Some evidence in this regard from the other countries is presented to highlight the significance of land reforms. Land reform is particularly popular as component of decolonization struggles in Africa & the Arab world, where it was part of the program for African socialism and Arab nationalism. Cuba has witnessed one of the most comprehensive agrarian reforms in LA. Land reform was a significant measure in attaining economic development in many Third World economies in the post-World War II phase, particularly in the East Asian Tigers and "Tiger Cubs" nations such as Taiwan, South Korea, and Malaysia.

### Status of Land Reforms in India

In India, land Reforms may be grouped under four dominant categories.

(a) Abolition of zamindars /intermediaries (erstwhile rent collectors under the pre-Independence land revenue system).

(b) Tenancy regulation (designed to enhance the contractual terms encountered by tenants relating to crop shares & security of tenure).

(c) A ceiling on landholdings (with the objective of redistribution of surplus land to the landless); & lastly,

(d) Steps to combine unequal landholdings Elimination of intermediaries is usually agreed to be one element of land reforms that has been comparatively effective. The achievement in terms of the other components is diverse & varies across states & over time. A list of significant land reforms acts has been provided in Besley and Burgess (2000). Landowners naturally resisted the implementation of these reforms. They directly used their political influence & used several methods of evasion & coercion. They were found to register their own land under names of different relatives in order to bypass the ceiling. They shuffled tenants around different plots of land, so as to prevent them from acquiring incumbency rights stipulated in the tenancy law. It has been claimed that the success of land reform has been determined by the political will of specific state administrations, the notable achievers being the left-wing administrations in Kerala & West Bengal.

There are two significant empirical issues. One relates to the influence of land reform on productivity and poverty, and the other one relates to the factors that drive success of land reforms. These are inter-related questions. Clearly the factors that affect the success of land reforms are also expected to impact productivity and poverty. For instance, if a left-wing administration comes in authority, as it did in Kerala & West Bengal, it will perform land reforms more keenly & also execute further reforms (e.g., endowing local govts) that may exert a direct effect on productivity & poverty. The task is to segregate the influence of land reforms on productivity & poverty in presence of other factors. Let us start by answering the second question first: What drives the success of land reforms. It is because it is more basic question than the other. After all, cause of a phenomenon must precede its effect. Besley and Burgess (2000) found that political factors had a noteworthy effect on land reforms. Particularly, Congress administrations had an undesirable effect on the passing of land reform legislation, especially tenancy reform. In contrast to it, left-wing administrations had a significant positive effect. Besley and Burgess used these political variables as tools for their land reform measure to acknowledge the apprehension that land reform is endogenous and could be driven by factors that also affect the dependent variables of interest. Conning & Robinson (2005) pursued further the investigation of causes of land reform & observed that, after controlling for other variables together with state & year effects, the probability of reforms increases when land inequality is higher & where peasants have larger political power. Bardhan and Mookherjee (2005) studied village-level data from West Bengal and found that land reform activity is highest where left-wing parties hold a larger number of seats in the state legislature and, interestingly, where they faced greater political competition. Summing up, land reform is distinctly driven by political factors. One important component is the power of left-wing parties in the state. We may think of the support for left-wing parties as “demand” for land reform. The “supply” of land reform appears to depend on the electoral success of left-wing parties, along with how tight the electoral competition is. Now, we look at the literature which analyses the impact of land reforms on productivity and poverty irrespective of political regimes. Besley and Burgess (2000) use state-level data relating to sixteen major states of India from 1958 to 1992 to identify the effect of land reform on productivity and poverty. A cumulative variable aggregating the no. of legislative reforms to date in any specific state was constructed in the study. They controlled for state and year fixed effects, and a number of times fluctuating economic & policy variables and observed that the lagged version of their cumulative land reform variable has exerted a negative & important influence on poverty. According to them, this is due primarily to the tenancy reform component of land reform, which apparently had a negative effect on agricultural productivity. This suggests an equity-efficiency trade-off, not in line with the rationale behind land reforms outlined in an earlier section and contradicts the empirical regularities talked of in an earlier section above. Abolition of intermediaries reduced poverty without any effect on productivity. Imposing a ceiling on landholdings did not appear to have had much effect on either poverty or productivity. Land consolidation had a positive effect on productivity without having any effect on poverty. A significant contribution of the study is that it demonstrated varying impact of different aspects of land reform on poverty and productivity. A major limitation of the previous study relates to the use of land reform legislation as the measure of land reform, and not its implementation, because there exists acknowledged gap between the two. Indeed, a study by Banerjee, Gertler and Ghatak (2002) found that tenancy reforms improved agricultural productivity in West Bengal. West Bengal is one of two states with commendable enactment of land reforms. Within a year of being elected in 1977, the left-wing administration launched Operation Barga, a program intended to apply & impose the long-dormant agricultural tenancy laws that controlled rents & security of tenure of

sharecroppers. Underneath these laws, if tenants registered with the Department of Land Revenue, they would be permitted to permanent & inheritable tenure on the land they sharecropped given that they paid the landlord minimum 25 percent of output as rent. The authors used 2 different approaches to estimate the effect of this reform on agricultural productivity. Their first approach is to compare the growth in productivity in West Bengal districts with that in the districts in the neighbouring country of Bangladesh, which is very similar in terms of agro-climatic conditions, prevalence of tenancy, & agricultural technology. This may lead one to presume technological shocks to agricultural yields to be alike among these 2 regions. The authors find that even though the rate of adoption of HYV rice was faster in Bangladesh than in West Bengal, the rate of growth in rice productivity was greater in West Bengal. They attribute this difference to the implementation of tenancy reform. However, the study is not without its problems. The *ceteris paribus* assumption in the study was questioned on two counts. First, change in the method of data collection relating to agricultural production in West Bengal under the new regime and secondly other policy reforms including decentralization of public works programme in West Bengal. It is possible that impact of the above may have biased the result in favour of West Bengal. The second approach overcomes the above limitation of the study by analysing inter-district variation in agricultural productivity. The result of the study is likely to exclude any likely upward bias in the level of agricultural productivity due to fluctuations in the data collection methods. Since it looks at variation in the intensity of enactment of tenancy reform, it is not possible to pick up the influence of other programs. The study utilizes the fact that this reform was implemented in different districts of West Bengal at different rates due to bureaucratic frictions. The authors capture inter-district variations in the rate of implementation of this program in terms of proportion of sharecroppers who were registered under this program and proceed to use it as exogenous changes in the availability of a new contractual regime. Districts that received the program earlier are the "treatment" districts and the districts that received it later are the "control" districts. The resulting changes in productivity are attributed to the reform, after controlling for a number of other policy and economic variables. This approach provides similar results and suggested that tenancy reform did have a positive effect on agricultural productivity. To recapitulate, it appears that tenancy reform had a direct positive effect on tenants who were directly affected by it, but the indirect effects of this reform on the rural land market as a whole are obscure. The studies discussed above could not distinguish between the direct and indirect effects of land reform, pointing out to the relevance of micro-level studies in this area.

Draft National Land Reforms Policy was put in public domain on 24th July, 2013. It is a draft of a bill that the Congress government intended to introduce in Parliament. The draft needs to be debated widely. It ignores the fact that many states are sitting on land which has been appropriated from those with more than the ceiling, and which has not been distributed to the landless, due to vested interests seeking to preserve the political and economic status quo. The other reality it ignores is that it is very difficult for any government to identify who owns how much land. So, it is hard to enforce ceilings, or identify the genuinely landless. The fundamental reason is the sorry state of land records. Registration of tenants is fraught with the same difficulties. Identifying who is leasing to whom is very difficult for the government, or any outsider to the village. Attempts to enforce tenancy registration end up driving most tenancy underground. It is resisted vigorously by owners who tend to be politically more powerful. There exist a number of other areas where lack of profound thinking is noticed in the draft. To deal with distress sales, it is suggested that a credit facility for poor landowners in distress be developed, without any further details. The other big issue is land acquisition. Setting the compensation amount at four times the market price avoids the question of how 'market price' will be assessed based on land records that are based on British-time surveys. The ceiling limit on exemptions for religious, education, charitable institutions to a single plot of 15 acres does not seem

to be appropriate. It will lead to a proliferation of institutions opened under different names to circumvent this regulation. While genuine charitable and educational institutions will be stymied. The important issue of consolidation of land holdings has missed attention in the draft. There is a huge demand from landowners for consolidation, as the fragmentation of properties is now widespread, with individual parcels too small to be economically viable. Government can promote consolidation of land by helping owners with fragmented plots to exchange holdings. This is one area where there will be little or no political resistance, as it ends up in a win-win for everyone.

### **Farm Size and Productivity**

Agricultural output depends on both, the area under cultivation and the productivity of factors employed in agriculture, both labour and capital. There are limitations to increase in acreage. Labour productivity, due to disguised unemployment, is close to zero. In this context, in order to ensure availability of food grains and non-food grains, to keep inflationary pressures at bay and to conserve the scarce foreign exchange by reducing India's dependence on imports of food grains and non-food grains, what is needed is a secular increase in land productivity. In sum, output is a function of both acreage and yield per acre. Increases in the former are not possible. Therefore, any increase in output can be obtained largely if productivity improves. Increase in agricultural output and improvements in productivity are crucial for food security of the large mass of population in both agricultural and non-agricultural sectors. Food security is defined as increased availability of food, access to food by ensuring entitlements and nutritional adequacy of the food consumed rather than mere calorie count. Availability is made up of two components - production and imports. Growth in production is intrinsically linked to growth in productivity as possibilities of increasing acreage are limited. An important part of food security comprises increases in production which can be increased via productivity improvements.

In the post-independence period Indian policymakers concentrated more on heavy and capital goods industry in the Second Five Year Plan with the assumption that agriculture would continue to perform well and provide food to the large industrial workforce. However, food crisis and the wage goods constraint of the mid-1960s led to the introduction of modern technology in agriculture. This comprised the use of divisible inputs like the high yield variety of seeds (HYVS), provision of irrigation and availability of fertilizers. However, these were not the inputs which were available on the farm. Rather these had to be purchased for cash. This neutral-to-scale technology in agriculture was expected to help the country tide over the food-crisis and promote agricultural growth at an accelerated pace. However empirical studies have shown that the benefits of this technology were confined to some regions, to large farmers and to some food crops like wheat and to some extent rice. The benefits of modern technology spread to maize only in the 1980s while benefits to oilseeds and pulses have been largely negligible. Trends in production and land use: Agricultural output can be divided into food grain production and non-food grain production. Food grains comprise cereals and pulses. Cereals include rice, wheat, jowar, bajra, maize, etc and pulses include moong, gram, masoor, arhar, etc. Non-food grains are made up of cash crops like oilseeds (sunflower, groundnut, rapeseed, mustard, sesame, etc), sugarcane, tobacco, jute, tea, coffee, cashew, coconut, vegetables and fruits. In India food grains are produced on almost three-fourths of the gross cropped area. Total food grain production in India increased from 82 million tonnes in 1960-61 to 108.4 million tonnes in 1970-71. By 1990-91 this rose to 176.4 million tonnes and in the next ten years to 200 million tonnes. By 2008-09 the figure stood at 229.9 million tonnes. Food grain production for the period 2013-14 is 265.6 million tonnes and the advance estimate for 2014-15 is 257.07 million tonnes.. The output of pulses has

been marked by an erratic performance. Pulses output increased from around 8 million tonnes in 1950-51 to 12.7 million tonnes but declined to 10.63 million tonnes in 1980-81. Subsequently it rose to 14 million tonnes in 1990-91 but declined to 11 million tonnes in 2000-01. By 2012-13 it rose to 18 million tonnes. Oilseed production increased from 5 million tonnes to 9 million tonnes in 1980-81 and jumped to 18.6 million tonnes in 1990-91 and 31 million tonnes in 2012-13. Cotton and sugarcane have registered sharp increases from 3 million tonnes of cotton and 57 million tonnes of sugarcane in 1950-51 to 34 million tonnes and 339 million tonnes respectively in 2012-13. For cotton major increases were registered in the period after 2000. Between 1950-51 and 2010-11, the percentage share of cultivable area under coarse cereals has declined. Area under pulses fell between 1950 and 1990 after which there has been only a marginal gain in 2010-11. Percentage area under wheat has continually increased from 4 percent in 1950-51 to 8 percent in 1990-91 and more than 10 percent in 2011-12. Percentage area under oilseeds has increased from 5 percent to 9 percent in 2011-12 and area under cotton and sugarcane has doubled to 2 percent and 4 percent respectively in 2011-12. In 2012-13, West Bengal, Uttar Pradesh and Punjab produced almost 40 percent of rice whereas 65 percent of wheat was grown in Punjab, UP and Madhya Pradesh. Fifty-three percent of pulses come from Madhya Pradesh, Uttar Pradesh and Maharashtra whereas 67 percent of oilseeds are grown in Maharashtra, Madhya Pradesh and Rajasthan. Forty percent of sugarcane comes from UP while 70 percent cotton comes from Gujarat, Andhra Pradesh and Maharashtra. In terms of constant 1999-2000 prices agricultural production grew at the rate of 2.5 percent in the period before the green revolution. From the late-1960s to 1980-81 real growth was 2.4 percent. Over the 1980s and the 1990s real growth averaged at 3.5 percent but for 1997-98 to 2006-07 the rate decelerated to 2.5 percent. The target growth rate for the Twelfth Plan was 4 percent at 2011-12 constant prices. The sector registered real growth of 1.2 percent in 2012-13, 3.7 percent in 2013-14 and 1.1 percent in 2014-15. Share of agriculture and allied sectors in total gross capital formation (GCF) shows a decline from 8.6 percent in 2011-12 to 7.9 percent in 2013-14. Regarding land use in agriculture, net sown area is defined as area which is actually available for cultivation. Even if the area is sown twice, it is counted only once. Gross cropped area is the total area sown either once or more than once in a year. Hence area sown more than once is the difference between gross cropped area and net sown area. Agricultural land use data show that India has managed to increase the net sown area from 118.75 million hectares in 1950-51 to 143 million hectares in 1990-91. By 2009-10 this figure declined to 139.18 million hectares. Gross cropped area increased from 131.89 million hectares in 1950-51 to 185.74 million hectares in 1990-91. By 2010-11 this increased to 198.97 million hectares. The area sown more than once increased from 13 million hectares in 1950-51 to 42.74 million hectares in 1990-91 and to 57.39 million hectares in 2010-11. Of the total agricultural land available in 1950-51, 34 percent was not available for cultivation while gross cropped area was 42 percent. By 2010-11 these figures were 23 percent and 46 percent respectively. Trends in productivity: For food-grains, the largest increases in productivity have been registered for wheat for which the yield per hectare has gone up from 650 kgs in 1950-51 to 1307 kgs in 1970-71, 2281 kgs in 1990-91, 2800 kgs in 2007-08 and 3140 kgs in 2011-12. For rice the increase in productivity has not been this dramatic. The yield per hectare rose from 668 kgs in 1950-51 to 1123 kgs in 1970-71, 1740 kgs in 1990-91 and 2202 kgs in 2007-08 to 2372 kgs in 2011-12. For coarse cereals, yield increased from 408 kgs in 1950-51 to 1593 kgs in 2011-12. The weakest performer has been the pulses in which the productivity has increased from 441 kg per hectare in 1950-51 to 524 kgs in 1970-71 to 625 kgs in 2007-08. By 2011-12 it increased to 694 kgs. Within this group productivity of Gram has doubled from 482 kgs to 912 kgs between 1950-51 to 2011-12 but for Tur / Arhar there has been a decline in productivity from 788 kgs to 656 kgs between 1950-51 and 2011-12. In sum, overall productivity of food grains has increased from 522 kgs to 2059 kgs between 1950-51 and 2011-12. Within non-food grains, yield per hectare figures for oilseeds show a rise in productivity from 481 kgs in 1950-51 to 771 kgs in 1990-91, 810 kgs

in 2000-01 and 1135 kgs in 2011-12. For groundnut the increase is from 775 kgs to 1305 kgs between 1950-51 and 2011-12, rapeseed and mustard from 368 kgs to 1145 kgs, soybean from 426 kgs to 1207 kgs and sunflower from 653 kgs to 692 kgs.

From the above data on trends in production and productivity one may conclude that overtime both production and productivity have increased in India. The increases in the aggregate food grains and non-food grains are made of component crops with varied trends and the gains in one crop are offset by decline in other crops. Moreover, growth in productivity also has been slow. In the international context, for the year 2011, India has the second highest proportion of arable land in the world. It produces 12.3 percent of world's wheat output which is the third largest after China and USA, 21.7 percent of world's rice output which is the second largest after China and has the highest share of pulses at 25.9 percent. India is the second largest producer of groundnut and the third largest producer of rapeseed with their respective shares of 18.2 percent and 13.7 percent respectively in 2011. India has the distinction of being the largest producer of fruits and vegetables especially potatoes and onions. It produces 19 percent of total world output of sugarcane, 20.6 percent of tea and 3.6 percent of coffee. It is the largest producer of jute and has a share of 54.6 percent. It is the second largest producer of cotton after China with a share of 32.5 percent. However, notwithstanding these impressive figures, Indian performance on the productivity front is dismal in comparison to other countries especially China. We find that, compared to a sample of countries, India has one of the lowest productivities in most crops. In 2002 for rice, India had lower productivity vis a vis China, Egypt, USA, Japan, Bangladesh and the world average. It was marginally better than Pakistan. UK had yield above 8000 kgs per hectare in 2002 compared to India's 2770 kgs which was lower than China, France and slightly better than Pakistan and Bangladesh. For maize, India had the lowest productivity (1705 kgs) in a sample of seven countries with the highest figure for Italy (9560 kgs) and the world average of more than 4000 kgs. Even for groundnut, China had a yield of 2986 kgs per hectare, USA was 2986 kgs and Brazil had 2043 kgs in 2002 compared to India's 794 kgs and the world average of 1381 kgs. In 2012, India's productivity in wheat and rice production was lower than China. For maize it continued to be the lower than USA, China, Brazil, Indonesia and Mexico. For sugarcane it was more than China but lower than Brazil and Thailand. For groundnut it was lower than the world average and the averages for China, USA, Nigeria and Myanmar.

### **Causes of Productivity**

The main causes of low productivity in agriculture in India are:

1. **Incomplete land reforms:** Despite the initial efforts on part of the government to undertake land reforms in India comprising abolition of the zamindari system, improvement in the land tenure system and consolidation of fragmented holdings, the land reforms in India were only a partial success whereby land holdings continue to be of sub-optimal size which does not allow increase in yields.
2. **Labour quality and productivity:** With large dependence on agriculture disguised unemployment results in low productivity. Generally, a large mass of the rural population is not literate and lacks training to use the right mix of inputs which is optimal for their farm size. This also results in waste of resources and lower yields.
3. **Small size of the holdings:** The average size of the holdings for small and marginal farmers is less than two hectares which limits the use of better and modern inputs and machines and allows production only for subsistence. As result there is little surplus for the market thus limiting the ability to generate cash incomes. Rise in indebtedness further limits their prospects of breaking this impasse.

4. Inadequate credit facilities: Institutional credit is not forthcoming despite agriculture being a priority sector. Rural poverty and lack of collateral force farmers to borrow from the local money-lender who charges usurious rates of interest and perpetuate indebtedness over generations. This limits the possibility of investment and improvement in agriculture on part of the individual farmer. 5. Lack of public investment: The share of public investment has also been low which affects productivity in agriculture. Lack of provision of adequate infrastructure, transport, storage and marketing and extension services keeps yields low.

6. Non-availability of modern inputs and use of backward technology: Modern inputs like high yield variety of seeds, irrigation facilities, electricity, fertilisers and farm tools are purchased inputs which required adequate cash. Indian farmers are cash strapped whereby they are unable to procure these inputs in the right quantities at the appropriate time which affects the yields adversely. This leads to insecurity regarding the future availability of these inputs and so whenever they can access these inputs they tend to over-use them especially water, fertiliser and pesticides which has negative consequences for land quality and hence output. More recently use of genetically modified seeds imposes a constraint on the farmer in that he has to buy the seed every year which is again a major limitation of modern technology. More often farmers continue to use their older inputs which are available on farm but at the cost of production of productivity.

### **Agricultural Inputs**

Agricultural inputs comprise consumable and capital inputs - seeds, fertilisers, irrigation, pesticide, tractors and other agricultural equipment and tools. Credit and infrastructure. Marketing and storage, agricultural labour and crop insurance. Inputs in traditional and modern agriculture - traditionally agricultural production was for subsistence or for barter but with the rise in non-agricultural population need to increase farm output and make it available in the market became imperative. Need to improve production and productivity implies movement away from traditional to modern technology. The main characteristic of modern technology is the use of divisible inputs purchased from the market. This raises the demand for cash. Use of divisible, marketed and modern inputs has slowly evolved to include the use of machines. However, the latter are not scale-neutral and require a particular threshold of farm-size.

1. SEEDS: Adoption of modern technology in agriculture comprised the use of high yield variety of seeds (HYVS), assured water supply and the fertiliser to improve land productivity. Seeds account for 20-25% of productivity. The seed industry in India is worth Rs. 9,000 crores compared to Rs. 2,20,000 crores of world market with the private sector providing 70% of the seeds. The private sector spends 10-12 percent of their turnover on R&D and have a technological financial partner. More than 500 companies exist in seed production and trade. Some of the well-known names are Monsanto and Unilever. Indian seed exports comprise 1% of the global market. Production of 'foundation' and 'breeder' seeds in India has increased from 38.65 thousand quintals to 136.73 thousand quintals. The distribution of seeds (or consumption) increased from 57.5 to 277.3 thousand quintals. There has been a rise in the surplus of seeds available over the amount required between 2006 to 2011. In 1988 - policy on seed development to increase production and productivity was adopted. Import of seeds was to be followed by testing and indigenous development. In 2001 - act to protect plant varieties and farmers' rights to develop new varieties and promote investment. India participated in OECD seed scheme (2008) for five seeds - grasses and legumes, cereals, crucifers and oil and fibre seeds, maize and sorghum and vegetables. National Seeds Policy of 2002 aims at increasing production and seed replacement rate. Seed Replacement Rate is the percentage of area sown out of total area of crop

planted in the season by using certified/quality seeds other than the farm-saved seed. Areas for further development include protection of different varieties of plants and seeds and seed development. Seed bill of 2004 has been designed to curb the use of bad seeds and promote seed testing. Some of the problems in the use of seeds arises due to a mismatch between breeder to foundation seeds and foundation to certified seed. There is a need to follow seed chain and quality norms, provide farmers with timely and easy access to better plant seeds and develop seeds as quality of seed is important and must be available on time. What is required is greater development of improved varieties, timely delivery, availability of skilled practitioners to encourage breeding and increased public investment and participation in seed development.

2. FERTILISERS - Fertilisers comprise six macro and eight micro nutrients. Global consumption in 2010 was worth US \$130 billion and volume of consumption was 163 million tonne consumption. In India, in 2010, US \$ 24 billion in value and 28 million tonne in volume of fertilisers were consumed. India and China form 40 percent of global consumption. The world market for NPK has a combined share of 170 million tonnes. There is global excess supply. Total production of NPK in India increased from 127 to 288 million tonne between 1991 and 2010. India is the second largest producer of Nitrogen and third largest of Phosphate fertilisers. Potash is fully imported. Consumption increased from 77 to 144 kg/hectare. However, efficiency in the use of Nitrogen has declined in India at the rate of 1.7% per annum between 1970-2004. Fertiliser Control Order adopted in 1985 includes customised, fortified, bio and organic fertiliser. It also covers fixation of MRP of fertiliser for fair price and easy access to farmers. It is especially important for urea. However, due to excessive subsidy there has been imbalanced use of fertilisers. Farmers lack the knowledge to ensure balanced use and plant nutrition which leads to poor crop management and fall in yields. Low farm gate prices encourage over-use which is counterproductive as it leads to lower productivity, distorts cropping pattern, leads to wastage of fertilisers and contaminates and pollutes soil. The fertiliser industry is not innovative and there is no government policy to encourage R&D. There is greater emphasis on subsidy than efficiency. In April 2010 a Nutrient Based Subsidy (NBS) was announced which allows industry to obtain subsidy on the basis of nutrient content of fertilisers than on the product but it is not applicable on urea. The selling price of fertiliser except urea is to be determined by the importer/manufacturer. Import of all fertiliser is under OGL except urea. NBS allows companies to compete on the basis of cost, brand, distribution networks, etc. What is required is R&D incentive to develop new products, reduced subsidy and working capital and timely availability of micro nutrients. NBS promotes competition on the basis of nutrients.

3. AGRO-CHEMICALS: These comprise insecticides, herbicides, fungicides, veterinary medicines and pesticides. With a rise in the demand for food and a decline in average yield there is pressure to protect the meagre crop. In India per hectare consumption of chemicals is 381 gm compared with the world average of 500 grams. There are 9 major companies producing pesticides with a combined market share of 80%. Increased use of GM seeds especially Monsanto seeds the use of crop protection by using pesticides is also effective if the Monsanto pest control chemicals are used. Expensive seeds which have to be purchased than used from previous year's output induces farmers to depend heavily on pesticides as they cannot afford a crop failure because it means no income to pay off loans and buy next year's seed and fulfil other consumption needs. Overuse of pesticides also has negative externalities in contamination of ground water, genetic disorders and health hazards. The largest share in pest control is that of insecticides followed by herbicides and fungicides. In 2009 the largest consumption of pesticides was for paddy (28%) followed by cotton (20%) and then vegetables (14%). Some states have introduced intensive pest surveillance mechanisms to control pests. National Institute for Plant Health Management came up in 2008 for human resource development in bio-security. Plant quarantine services are available for exporters to obtain their phytosanitary

certificates. The 5 major plant quarantine centres are at Amritsar, Kolkata, Mumbai, Delhi and Chennai with the ISO 9000 certification.

4. **MACHINES, FUELS AND LUBRICANTS:** Mechanisation of farm activities involving the use of tractors, threshers, harvesters and irrigation pumps along with simple mechanical tools has increased. Although not part of the 'neutral to scale' modern technology used in agriculture, mechanisation has increased especially on large farms owned by big farmers. One of the reasons is the rise in the cost of labour. For land development, the traditional practice of using the plough and blade for tilling and preparing the seed-beds here has been replaced by the use of tractors, mould board ploughs and power tillers. Seed drill and seed cum fertiliser drill are used for sowing and planting, the power weeder for weeding, blower for plant protection and harvesters and threshers for harvesting and threshing. The advantages of mechanisation of agriculture include a rise in productivity, crop-intensity, no shortage of labour, shifting of land from fodder to grain production, increased employment and farmer's income. It also leads to a conservation in the use of seeds and fertilisers. However increased mechanisation poses some challenges and issues which also need to be addressed. The most important is the specificity of equipment to farm-size and soil type. Use of machines renders cattle redundant and safe use of equipment requires imparting training and knowledge. High cost of equipment and scattered and small farms do not deter small farmers from using this equipment as they can hire these machines. Of all the equipment used small tractors are the fastest growing segment compared to the overall growth of 4-5% for all tractors. India is the largest producer of tractors in the world. Other machines used include electrical and mechanical power operated tools, pump sets, sprayers, ploughs, drills, threshers and combines. The government's report on agricultural implements and machinery notes that mechanisation leads to a rise in productivity, saving of seeds and fertilisers and an increase in the cropping-intensity resulting in farmers' incomes.

5. **WATER:** Another important input is water. Traditional agriculture depends on rains but due to uncertainty of monsoons it is important for farmers to have access to some form of irrigation facilities. Total irrigation potential in India is 140 million hectares of which 58.4 million hectares comprises major/medium irrigation works and the rest are the minor works with 70% of irrigation dependent on ground water sources. However there exists a large gap between actual and potential irrigation. The biggest challenge is the over-use of irrigation water with environmental consequences especially waste of ground water and increased salinity of soil. Ways have to be evolved to encourage drip and sprinkler systems and development of micro-irrigation works.

6. **LABOUR:** Agricultural activity in a country like India is generally labour-intensive. Moreover, employment opportunities outside rural and agricultural area are limited. Most often labour productivity is low due to excessive dependence on land which hides high disguised unemployment and is reflected in low wages. Low levels of income due to large dependence on agriculture and inter-sectoral inequalities have resulted in a high incidence of rural poverty. The government has tried to address these issues by introducing various poverty alleviation programmes in rural areas in an attempt to either create assets for sustained income generation or wage employment opportunities. Of these the most recent is the MNREGA enacted in 2005. The explicit objective is to generate at least 100 days of employment and reduce distress migration and encourage women empowerment. However, some critics of the scheme hold MNREGA responsible for rise in rural wages due to lack of availability of sufficient labour for agricultural operations. Of the rural work force the largest component is that of casual labour especially the landless. With large unemployment or limited employment potential in manufacturing in recent times dependence on agriculture for wage employment is still large. Hence the index of wages of agricultural labour in rural areas is an important indicator of the well-being of the rural landless and overall rural population.

7. **CREDIT:** Lack of institutional credit is one of the most significant binding constraints on Indian agriculture, notwithstanding the priority given to agricultural credit in government policy. Alternatively, peasants and small and marginal farmers resort to private loans at usurious rates of interest from the local landlords and money lenders. The reasons for the lack of willingness on part of formal banking sector to provide loans is the low incomes of the farmers, inability to furnish collateral, small farm size and the associated uncertain output and income and administrative delays. The role of cooperatives in providing bank loans has also been limited because a substantial proportion of the loans disbursed are appropriated by large farmers who also have a high rate of default. The share of commercial banks has increased over the period between 2000 and 2010 to almost 74% while the share of regional rural banks has remained almost the same around 10% with the share of cooperative banks declining to 16% from 39%. The apex bank dealing with agricultural credit and development is the NABARD which provides refinance facility to the RRBs and the cooperative banks and facilitates implementation of the self-help-group-bank linkage programmes. The loan waivers which are provided by the government in the event of a default are misdirected as they benefit large farmer who initially had access to institutional credit. Schemes like the Kisan Credit Card (1991) are attempts to provide short-term loans to farmers for crops.

8. **CROPINSURANCE:** This involves providing insurance or protection to farmers in the event of a natural disaster or destruction of crops due to pests or disease which either prevents the sowing or else destroys the crop standing in the field. Risks arise due to loss of crop, lower than expected yields and lower prices. Crop insurance helps farmers overcome these risks and stabilise their incomes. This way it prevents farmers from distress sale of land and other family assets. The origins of crop insurance in India go back to 1972 with experiments with hybrid 4 cotton. In 1979 Pilot Crop Insurance Scheme introduced in 1979 to 1984. Comprehensive Crop Insurance Scheme was introduced 1985 which was replaced by National Agricultural Insurance Scheme (NAIS) in 1999 and Modified NAIS (MNAIS) thereafter. It covers all food crops and oilseeds, commercial crops and horticultural crops. A Pilot Scheme on Seed Crop Insurance introduced in 1999 for better quality seeds. From 2007 weather insurance index was introduced protects yields from vagaries of weather based on average rainfall over 5-10 years. The government set up the Agriculture Insurance Company of India in 2002 with the aim of providing yield and weather-based crop insurance covering 500 districts and 20 million farmers. At present Weather Based Crop Insurance Scheme (WBCIS) is also operative to cover for losses due to poor weather conditions. It operates on an area approach as opposed to the individual approach. A 'reference unit area' is linked to a 'reference weather station' and all the farmers are eligible for insurance claims in the area if actual weather conditions deviate from the reference table. Premium rates vary with each crop and each reference area. However, crop insurance is still in its experimental stages in India. Effective implementation requires measurement of yields, sharing of information by agencies and less reliance on rural finance institutions. However weak institutional structure, difference in area and individual yields and categorisation of farmers on the basis of loan sanctioned are some of the other problems faced in providing crop insurance. There is a need to increase the coverage in terms of area, farmers and value of output.

9. **PACKAGING AND MARKETING/WAREHOUSING:** This involves grading, packaging, transport and storage of agricultural output. In India the infrastructure is extremely ill designed to support farmers in marketing their produce for profit. Lack of storage and transport facilities force the marginal farmers to sell at harvest prices which are low and fail to even cover their costs of production. Important agencies are the Commission for Agricultural Cost and Prices and the Food Corporation of India. There are also separate bodies or boards for cotton, tea, coffee, rubber, spices and vegetables and agricultural market committees.

