M.A. FINAL ECONOMICS

PAPER IV (B)

AGRICULTURAL ECONOMICS

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BLOCK 1

AGRICULTURE AND ECONOMIC DEVELOPMENT
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### BLOCK 1

### AGRICULTURE AND ECONOMIC DEVELOPMENT

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BLOCK 1. AGRICULTURE AND ECONOMIC DEVELOPMENT

The block opens with introduction to agricultural economics in India. It discusses in detail the scope and nature of agriculture in India followed by rural economic development. Role of agriculture in economic development will be dealt in depth and relationship between agriculture and industry will be tackled. Agricultural development and its impact over poverty and environment will finally be taken into consideration.

Second unit highlights the livestock in India. It deals with livestock resources. Livestock system will be discussed and white revolution will be explained. Other areas of consideration in this unit will remain fishery development; poultry; forestry; horticulture; floriculture; rural industrialization and relevance of agro based industries in Indian economy.
UNIT 1

INDIAN AGRICULTURAL ECONOMICS

Objectives

After studying this unit, you should be able to understand and appreciate:

- The scope and nature of agriculture in India
- The concept of rural economic development
- The role of agriculture in economic development
- The relationship between agriculture and industry
- The impact of agricultural development over poverty and environment

Structure

1.1 Introduction
1.2 Scope and nature of agriculture in India
1.3 Rural economic development
1.4 Role of agriculture in economic development
1.5 Agriculture and industry
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1.1 INTRODUCTION

Agriculture in India has a long history dating back to ten thousand years. Today, India ranks second worldwide in farm output. Agriculture and allied sectors like forestry and logging accounted for 16.6% of the GDP in 2007, employed 52% of the total workforce and despite a steady decline of its share in the GDP, is still the largest economic amen and plays a significant role in the overall socio-economic development of India.

India is the largest producer in the world of milk, cashew nuts, coconuts, tea, ginger, turmeric and black pepper. It also has the world's largest cattle population (281 million). It is the second largest producer of wheat, rice, sugar, groundnut and inland fish. It is the third largest producer of tobacco. India accounts for 10% of the world fruit production with first rank in the production of banana and sapota.

India's population is growing faster than its ability to produce rice and wheat.

1.2 SCOPE AND NATURE OF AGRICULTURE IN INDIA
Agriculture in India is the means of livelihood of almost two thirds of the work force in the country. It has always been INDIA'S most important economic sector. The 1970s saw a huge increase in India's wheat production that heralded the Green Revolution in the country. The increase in post -independence agricultural production has been brought about by bringing additional area under cultivation, extension of irrigation facilities, use of better seeds, better techniques, water management, and plant protection. Dependence on India agricultural imports in the early 1960s convinced planners that India's growing population, as well as concerns about national independence, security, and political stability, required self-sufficiency in food production. This perception led to a program of agricultural improvement called the Green Revolution, to a public distribution system, and to price supports for farmers. The growth in food-grain production is a result of concentrated efforts to increase all the Green Revolution inputs needed for higher yields: better seed, more fertilizer, improved irrigation, and education of farmers. Although increased irrigation has helped to lessen year-to-year fluctuations in farm production resulting from the vagaries of the monsoons, it has not eliminated those fluctuations.

Non traditional crops of India, such as summer mung (a variety of lentil, part of the pulse family), soyabeans, peanuts, and sunflowers, were gradually gaining importance. Steps have been taken to ensure an increase in the supply of non-chemical fertilizers at reasonable prices. There are 53 fertilizer quality control laboratories in the country. Realizing the importance of Indian agricultural production for economic development, the central Government of India has played an active role in all aspects of agricultural development. Planning is centralized, and plan priorities, policies, and resource allocations are decided at the central level. Food and price policy also are decided by the central government. Thus, although agriculture in India is constitutionally the responsibility of the states rather than the central government, the latter plays a key role in formulating policy and providing financial resources for agriculture. Expansion in crop production, therefore, has to come almost entirely from increasing yields on lands already in some kind of agricultural use.

The monsoons, however, play a critical role in Indian agriculture in determining whether the harvest will be bountiful, average, or poor in any given year. One of the objectives of government policy in the early 1990s was to find methods of reducing this dependence on the monsoons.

1.2.1 Initiatives

The required level of investment for the development of marketing, storage and cold storage infrastructure is estimated to be huge. The government has not been able to implement various schemes to raise investment in marketing infrastructure. Among these schemes are Construction of Rural Go downs, Market Research and Information Network, and Development / Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization.

The Indian Agricultural Research Institute (IARI), established in 1905, was responsible for the research leading to the "Indian Green Revolution" of the 1970s. The Indian
Council of Agricultural Research (ICAR) is the apex body in agriculture and related allied fields, including research and education. The Union Minister of Agriculture is the President of the ICAR. The Indian Agricultural Statistics Research Institute develops new techniques for the design of agricultural experiments, analyses data in agriculture, and specializes in statistical techniques for animal and plant breeding.

Recently Government of India has set up Farmers Commission to completely evaluate the agriculture program. However the recommendations have had a mixed reception.

1.2.2 Problems

Slow agricultural growth is a concern for policymakers as some two-thirds of India’s people depend on rural employment for a living. Current agricultural practices are neither economically nor environmentally sustainable and India's yields for many agricultural commodities are low. Poorly maintained irrigation systems and almost universal lack of good extension services are among the factors responsible. Farmers’ access to markets is hampered by poor roads, rudimentary market infrastructure, and excessive regulation. —World Bank: "India Country Overview 2008"

The low productivity in India is a result of the following factors:

- According to World Bank's "India: Priorities for Agriculture and Rural Development", India's large agricultural subsidies are hampering productivity-enhancing investment. Overregulation of agriculture has increased costs, price risks and uncertainty. Government intervenes in labor, land, and credit markets. India has inadequate infrastructure and services. World Bank also says that the allocation of water is inefficient, unsustainable and inequitable. The irrigation infrastructure is deteriorating. The overuse of water is currently being covered by over pumping aquifers, but as these are falling by foot of groundwater each year, this is a limited resource.

- Illiteracy, general socio-economic backwardness, slow progress in implementing land reforms and inadequate or inefficient finance and marketing services for farm produce.

- The average size of land holdings is very small (less than 20,000 m²) and is subject to fragmentation, due to land ceiling acts and in some cases, family disputes. Such small holdings are often over-manned, resulting in disguised unemployment and low productivity of labour.

- Adoption of modern agricultural practices and use of technology is inadequate, hampered by ignorance of such practices, high costs and impracticality in the case of small land holdings.

- Irrigation facilities are inadequate, as revealed by the fact that only 52.6% of the land was irrigated in 2003–04, which result in farmers still being dependent on rainfall, specifically the Monsoon season. A good monsoon results in a robust growth for the economy as a whole, while a poor monsoon leads to a sluggish growth. Farm credit is regulated by NABARD, which is the statutory apex agent for rural development in the subcontinent. At the same time overpumping made
possible by subsidized electric power is leading to an alarming drop in aquifer levels.

### 1.3 RURAL ECONOMIC DEVELOPMENT

Nobel Prize winning economist Robert Lucas had remarked that once you start thinking about economic growth, it is hard to think of anything else. What are the causes of economic growth and how can the process be enabled is a question that has obsessively occupied some of the best minds in the world of economics and commerce.

The question takes on an unparalleled urgency and importance when applied to the rural Indian economy because it presents an enormous challenge, and, consequently, presents an equally great opportunity for making a difference in the lives of hundreds of millions of people. India’s economic development is predicated upon India’s rural development because around 700 million Indians live in rural India. An astonishing one out of every ten living humans lives in rural India.

Rapid progress in GDP growth and globalization in the last decade has primarily impacted the urban economy. While software exports, business process outsourcing, etc, have helped urban economic growth, it has done relatively little for the rural economy.

Without rural economic development, India has little chance of achieving growth rates required to become a developed nation. Furthermore, economic development is both a cause and a consequence of urbanization. Clearly, in the Indian context, urbanization through further rural to urban migration is both unsustainable and socially disruptive. Therefore urbanization of the rural population will have to be achieved in the rural areas.

Rural India is caught in what is called a development trap. Because of lack of economic opportunities, incomes are low. Therefore they are unable to pay for goods and services that would enable them to increase their incomes. This leads to low demand for goods and services. Consequently, firms don’t find it profitable to do business in rural India. This leads to the inadequate provision of infrastructure, which in turn leads to lack of economic opportunities, and so on.

It is important to recognize that human capital is the scarce resource globally. Fortunately India is lavishly endowed with immense human capital. However, physical capital is in relatively short supply in India. The challenge therefore is to use the limited capital most efficiently to break out of the poverty trap by integrating the rural economy with the urban Indian economy and indeed the global economy.

Various models for rural economic growth have been proposed and implemented. Experts have proposed a model which harnesses the power of the information and communications technology (ICT) revolution to accelerate rural economic growth. The model called Rural Infrastructure & Services Commons (RISC) has the potential for achieving the multi-faceted goals of sustainable development. It uses limited resources
efficiently by focusing them in specific locations that are accessible to a sufficiently large rural population, such as that of 100 villages.

RISC provides the benefits of urbanization by making available to rural populations the full set of services and amenities that are normally available in urban areas. It brings the benefits of ICT and the increased access to global markets that globalization promises. The model recognizes that rural populations face a number of inter-related gaps, not just the celebrated digital divide. Bridging them simultaneously with a holistic solution is more likely to succeed than any partial intervention can.

The model facilitates the coordination of the investment decisions of the private sector, the public sector, NGOs, and multilateral lending institutions. To achieve its goal, the model strikes a number of balances — between the local and the global, between planned infrastructure investment and market-driven service provision, between specialization and standardization. It does not require government subsidies for its continued operation, although the government does have a role in providing some critical functions such as risk alleviation, loan assistance, and enacting enabling legislation.

A typical RISC installation would provide services for about 100,000 rural people. These services, mostly but not all provided competitively by a large number of for-profit firms, will range from education, health, market making, financial intermediation, entertainment to government services, social services, etc. Since all services themselves require the infrastructural services such as power, telecommunications, water, physical plant, etc., large specialized firms will provide the infrastructure.

RISC obtains urbanization economies, which arise from the agglomeration of populations and infrastructure facilities. By installing RISCs to serve the rural populations of an entire state, economies of scale and scope are also obtained. Scale economies would be significant at each level of the model. At the infrastructure level, there are transaction costs associated with the necessary coordination between the firms providing the core infrastructural services. At the services level, the cost of the services will be inversely proportional to the quantity demanded and supplied.

A RISC provides a complete set of services and functions. Each service provider itself is a customer of other services co-located on the RISC. The banker uses the internet and postal services, and the internet service provider uses the banking and postal services, and so on. They make each other mutually viable and even possible. All these economies essentially lower the cost of service provision and, in a competitive market, makes them more affordable.

At a certain level of abstraction, the proximate causes of poverty can be seen as two gaps: the ideas gap and the objects gap. The objects gap is the lack of physical resources – too little land, too little capital stock, etc – that contribute to persistent poverty. The ideas gap is the lack of knowledge about how to make the best use of the resources available. Fortunately, the cost of knowledge goods has dropped precipitously due to the revolution
in information and communications technologies. Bridging the ideas gap is a much easier task than ever before. RISC uses ICT intensively towards that end.

The transition from the concept to the actual implementation of the RISC model requires co-ordination of investment decision of the government and the large firms that provide the infrastructural elements. It is a non-trivial but surmountable challenge provided the political will and the vision exists among policy makers, private sector leaders, leading investors, and opinion makers.

1.4 ROLE OF AGRICULTURE IN ECONOMIC DEVELOPMENT

In the discussion of the role of agriculture in economic development, a leading question is how agriculture contributes to economic growth, and especially to pro-poor growth. There seems to be a paradox in the role of agriculture in economic development. The share of agriculture contributing to GDP is declining over the years. At the same time, the productivity of for instance cereal yields has been increasing. It seems that as agriculture becomes more successful, its importance declines in the overall economy. Of course, other sectors in the economy can be even more successful, such as the Asian Tigers. Agriculture constitutes the main source of employment of the majority of the world’s poor. In total, the share of agriculture in total employment in developing countries constitutes 53% of the total workforce in 2004. In Sub-Saharan Africa 60% of the economically active population works in the agricultural sector.

Much effort has been put into trying to raise productivity in agriculture, and calls have been made for more investment in agricultural science and technology, especially for Africa. The reasons for this seem evident when one considers the productivity growth in developing countries. In many regions (much) progress has been made in raising land and/or labour productivity measured in output quantity units. When productivity is measured as value added per hectare arable land or labour, Sub-Saharan Africa has not made much progress. East Asia and the Pacific, as well as South Asia experienced productivity growth in terms of value added per unit of land, but not much in terms of value added per unit of labour. Thus although progress has been made in some regions in raising productivity, many other regions have lagged behind.

Agricultural Development in India

That the post-independence period marks a turning point in the history of Indian agriculture is clear from the fact that compared with a rate of growth of less than 0.5 per cent per annum during 1904-5 to 1944-45 the agricultural sector recorded an annual growth rate of 2.7 per cent during 1949-50 to 1983-84. This growth has been achieved as a result of high priority accorded to agriculture. The policy makers adopted a two fold strategy for regenerating agriculture immediately after independence. The first element of this strategy was to implement land reforms in order to remove institutional bottlenecks and the second element was to undertake massive investment in irrigation and other infrastructure in order to update the existing agricultural technology.
The most important event in the social history of India was land reforms enacted and implemented during the mid-fifties. Simultaneously, technological upgradation has also played a crucial role in augmenting agricultural production. It is rather curious that whereas land reforms have been studied in detail, the role of technology and the relations between technology and institutions have, by and large, been ignored by scholars in this country. Since technology does not exist in a vacuum but operates within a given institutional and social context, it is important to study their interaction. It is true that institutional changes by themselves can also lead to increased output by releasing forces of production. For example, the abolition of intermediaries in India did lead to substantial increases in output during the mid-fifties. But without technological innovations, the potential for higher growth is limited and soon gets exhausted.

To maintain a tempo of high growth, huge investments in new technology are essential. It needs to be underlined that without investment in irrigation, roads, electrification and other infrastructure, research and development and extension services, large increments cannot be achieved in agricultural output. It is, therefore, no wonder that the fastest growth has not taken place in states like Kerala and West Bengal where land reforms have been quite radical but in Punjab and Haryana which are not known for any radical land redistribution.

The point to be stressed is that whereas investment in new technology determines the frontiers of growth, the nature of growth and sharing of gains of new technology are determined by the institutional structure, in particular the pattern of land ownership. The latter, in turn is a direct consequence of changes brought about through land reforms. It needs to be underlined that technology and institutions are inextricably linked and cannot be easily separated. It appears that a great deal of confusion has been created by scholars who have classified the Indian agricultural development into two periods 1950-51 and 1966-67 and that between 1967-68 and 1983-84 and have characterised these as the land reform strategy adopted during the mid-fifties and the green revolution strategy adopted since the mid-sixties.

It is further stated that whereas the first strategy led to equitable distribution, the latter has resulted in accentuating inter personal and inter regional inequalities. Obviously, this characterisation is unscientific because a clear cut dichotomy is sought to be created between technology and institutions. It is true that land reforms brought about important changes in most of the states in India during the mid-fifties.

The most important contribution of land reforms was abolition of intermediaries and giving land titles to the actual cultivators. This released productive forces and the owner cultivators put in their best to augment production on their holdings. Whereas land reforms were important in increasing agricultural production during the first period, it also needs to be emphasised that during this period major output increases also took place because of large investments in irrigation infra-structure. In short, one could characterise the first period as having irrigation technology. Thus along with institutional changes, irrigation technology was an important instrument of growth. Further, it is absolutely incorrect to say that this period was characterised by equitable pattern of growth. The
most important limitation of land reforms in various states was its failure in implementation of land ceilings enactments. Consequently land ownership distribution continued to be highly skewed. Because of this even during the first period, the interpersonal inequalities continued to be very large. There is evidence to suggest that the major gainers of irrigation technology were the upper middle, the rich and large farmers. It is no doubt true that the extent to which land reforms resulted in abolishing the intermediaries did release production forces by removing institutional barriers and thereby led to increase in output.

But since large inequalities in land ownership were legitimised, the pattern of growth was such where the main agents of growth were the upper middle and rich farmers. Another point to be noted is that although green revolution technology did make a qualitative difference in augmenting yields, in a sense, it represented a continuation of the earlier irrigation technology. Given assured irrigation much higher yields became possible because of genetic break through in seeds. Highly accelerated output when superimposed on iniquitous institutional framework has had a far reaching impact on agrarian structure and land relations.

For a proper understanding of the changing agrarian structure, the various strategies adopted for augmenting growth should be evaluated bearing in mind the highly skewed distribution of land ownership and land holdings. Soon after independence India found that the domestic production of foodgrains was not adequate to meet the domestic demand. it was justifiably considered humiliating for a country of the size of India to be going around with a begging bowl. Hence increasing foodgrain output and achieving self sufficiency in foodgrains become a matter of high priority for the policy makers.

The Grow More Food campaign, the Community Development Programme and the Intensive Area Development Programmes were all attempts at regenerating Indian agriculture that had stagnated during the British period. Having created an institutional structure, it was but obvious that solutions had to be found within that framework. In this context food output could only be increased through programmes like JADP, through investment in infrastructure in already irrigated areas and through increasing dependence on the main agents of growth namely the upper middle and rich farmers. It was, therefore, inevitable that the growth under such circumstances be concentrated in irrigated regions and in absolute terms a major proportion of incremental income should flow to the rich and very big farmers.

Looked at in this context, to blame green revolution technology for distorted pattern of agricultural development is totally mis-conceived and illogical. It could actually be argued that without the introduction of new technology, India could not have recorded high growth in agriculture and could not have achieved near self-sufficiency in foodgrains:

Major reasons for unequal pattern of development, it may be repeated was the creation of skewed land structure as a result of half-hearted land reforms. The nature of distortions that have taken place in the agrarian structure and their implications for our polity may
briefly be analysed. The following seem to be the major characteristics of agrarian scene in India:

1. Inter-personal inequality
2. Inter-regional inequality
4. Poverty.

1.5 AGRICULTURE AND INDUSTRY

There is no doubt that without agriculture, country cannot exist and without industry, country cannot develop. Agriculture and industry are like two wheels of a bicycle; one cannot survive without other. So it’s necessary for a country to have both- agriculture as well as industry. Like two faces of a coin, agriculture and industries, both are very much important.

What is the difference between our ancestors and us? Our ancestors were fully dependent on agriculture and met their needs from it. Those days, they had very less scope of comfort. This was because of lack of industries. Although there were few small cottage industries, but they cannot be classified as industries. This is the main difference between our ancestors and us. Today we can communicate with anybody, wherever he may be by a push of a little button. Every type of comfort is present before us. This is all because of industries. But, one can also not deny the fact that agriculture is equally important.

After many ups and downs and clashes in Singur, still, they are in the doubt that which is more important. Tata motors’ interest in constructing small car factory on agricultural land angered its opposition and debate continued for months. Industries should be promoted but not by compromising with agriculture. Policies should be made in order to promote both, industries as well as agriculture.

In India, 46 percent land is under cultivation, whereas less than 17 percent is industrial land. This gap between agriculture and industries may seem very high, but more than 70 percent Indian earn their livelihood on agriculture. To feed population of a billion, this percentage may even seem less. So what should be done in order to promote both?

An industry without compromising agriculture and vice-versa is the main policy to maintain balance between them. There are several thousands of acres of barren land present in India. These land are either not suitable for agriculture or due to lack of resources, agriculture is not possible. Such areas can be found in western region of the country, which includes states like Gujarat and Rajasthan. Regions of black soil such as Deccan pleatue and central India are less fertile than river plains and can be used for industries. Areas, which have very less food production, can also be utilized for industries.

To meet the ever-growing need of the people of the country, production must be increased. To increase the production, modern technologies should be used, which can produce good quality goods and at faster rate. During industrial revolution in 17th century, production of goods increased due to use of modern and scientific technologies. Industrial revolution although started in European countries, but its effect was felt all
over the world, especially on the economy.

While food production must also be increased by using scientific method of agriculture, genetically modified seeds, which are resistant to pest and can have high productivity, can increase food production. Modern methods of irrigation can also benefit farmers. Another policy to the maintain balance between agriculture and industry is removal of politics. There is a very common proverb,

“Where there is life, there is politics, and where there is politics, there is corruption.

Political groups try to pull the trigger, which commonly lead to conflict between agriculture and industries. They commonly bring such issues into political criteria and use such issues to win support of the people.

Agriculture is the backbone of industry. But without industry means tea without milk. For a complete comfort, industry as well as agriculture should develop simultaneously. It is not the issue of Industry vs. Agriculture; it is the issue of Industry and Agriculture. Industry in order to fulfill its most of the needs, depends on agriculture. Following points advocate this statement:

1. Industrial sector receives raw materials from the agricultural sector

<table>
<thead>
<tr>
<th>Industry</th>
<th>Raw Materials</th>
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</thead>
<tbody>
<tr>
<td>1. Cotton textile</td>
<td>Raw cotton</td>
</tr>
<tr>
<td>2. Oil</td>
<td>Oilseeds, coconut etc.</td>
</tr>
<tr>
<td>3. Sugar</td>
<td>Sugarcane</td>
</tr>
<tr>
<td>4. Jute products</td>
<td>Jute</td>
</tr>
<tr>
<td>5. Tea</td>
<td>Tea leaves</td>
</tr>
<tr>
<td>6. Coffee</td>
<td>Coffee beans</td>
</tr>
<tr>
<td>7. Tyres and tubes</td>
<td>Natural rubber</td>
</tr>
</tbody>
</table>

2. Population engaged in agriculture is source of demand for industrial goods

3. agriculture sector is a source of labour for the industrial sector

4. agricultural sector provides food to the population engaged in industrial sector

5. Source of funds for the industrial sector

Now let us see how agricultural sector is dependent over industrial sector

Consider following points:
1. Industrial sector provides seeds to agriculture
2. it provides fertilizers
3. Industries produce equipment and instruments needed for irrigation
4. it provides pesticides
5. it provides modern equipments
6. it provides materials for building infrastructure needed for agricultural marketing and storage
7. it supplies manufactured goods to the population engaged in agricultural sector
8. industry is the source of funds to the agricultural sector

Agriculture and Industry both are very important for any country. More so for a country like India with a population of over a billion out of which around a fourth are under the poverty line.

Unfortunately in India the two sectors are engaged in a dog fight due to the ineptitude of our bureaucrats and politicians.

The latest example is Nandigram. The victims as usual are the innocent village folks. The politicians involved did not even have a single scar on their bodies.

It is stupidity to take over fertile lands for Industrial development when there are acres of land available which are not fit for agricultural use. This will not help India. Agriculture is India’s lifeline. We must work towards strengthening it.

We should not come to a conclusion that it cannot provide gainful employment to people. It has been the source of income for millions of people and it will continue to be so for years to come. Rather than having a negative attitude towards this sector the government should plan for the second green revolution. It should aim at 5% year to year growth in agricultural production.

1.6 AGRICULTURAL DEVELOPMENT AND POVERTY

Coming first to interpersonal inequality, almost all studies bring out there exists very large inequalities in the distribution of both income and assets in rural India. Among the cultivator households although income inequalities are generally highly correlated with land ownership/land holding inequalities, the extent of income inequalities are found to be slightly less than that of land holding inequalities. This happens primarily because the smaller farmers are able to put in more family labour on their holdings and are also able to earn relatively higher income from non-agricultural and allied agricultural occupations.
All categories of cultivators seem to have recorded substantial increases in their income as a result of adoption of new technology in areas where new technology has been introduced. It is the middle and small farmers rather than the large farmers, who seem to have derived relatively higher benefits out of the initial thrust of green revolution, mainly because of their ability to augment yields by adopting labour intensive methods by utilising their family labour in an optimum manner. With the intensification of new technology, the capitalist farmers are also tending to become as efficient as the small owners through optimum utilisation of capital assets. The existing studies indicate that the statistical measures do not show unambiguously that increases in income inequality have occurred as a result of the adoption of new technology. In fact if one looks at Gini coefficients or inter-class concentrations one finds a slight decline in inequality after the advent of green revolution.

This notwithstanding, the income inequalities are found to be quite large. I would like to submit that the statistical measures of inequality are quite misleading. For example to suggest that inequalities have not increased is a matter of little consolation and does not capture the real situation. For example, for marginal farmer household more than doubling of income means that the family can now have two square meals a day which probably it could not afford earlier. For a large and rich farming household only doubling of income means that it can not only construct a new house and get children educated, but also that it can now acquire a political clout and purchase patronage. I would submit that this is what has happened. The political clout of middle and rich farmers has increased tremendously whereas the living conditions of smaller and marginal farmers have also improved slightly in the regions where new technology has been introduced. Most of the studies also indicate that in slow growing regions where new technology has not spread, the condition of marginal and small farmers as also of landless labour continues to be quite dismal and many of them continue to live below the poverty line.

The story about landless labour is more complex. In general in regions where new technology has been introduced it has led to increases in labour productivity. This, in turn, initially led to higher bargaining power of the landless labour and increased incomes and wages for them. However, this has gradually been counteracted by increased mechanisation on the one hand and large rural to rural migration of landless labour on the other. These two factors have tended to dampen the increases in wage rates in the prime green revolution regions. For example, the largest data indicate that the wage rates in Punjab have recently tended to stagnate or even decline. The other factors that have influenced the wage rates is the extent of non-agricultural employment, and also the food for work programmes.

Regional inequalities are equally notable. For example it is the north western states of Punjab, Haryana and Uttar Pradesh which have recorded consistently high growth rates since mid-sixties. On the other hand the Eastern region comprising of Orissa, Bihar and West Bengal has had a dismal performance. Except for Andhra Pradesh the recent performance of the southern region has not been very satisfactory. Being primarily dependent on rains the central region has demonstrated a high degree of instability in its growth performance.
A disaggregated districtwise analysis gives very startling results. For example 60 per cent of the incremental output achieved in the country during 1962-65 to 1980-83 was accounted for by only 56 districts (having only a quarter of the total cultivated area). At the other extreme 151 districts which claimed nearly half the cultivated area accounted for only 20 per cent of incremental output. Another 25 districts (with 7 per cent of national area) actually made a negative contribution to total output. The 56 highly productive districts are mainly concentrated in the states of Punjab, Haryana and Uttar Pradesh, although quite a few of these are also located in Andhra Pradesh and Gujarat.

Coming now to rural poverty only a few points needs to be made. Firstly it is established that rural poverty is inversely correlated with agricultural growth. Secondly, notwithstanding the recent data, the extent of rural poverty is extremely high. Thirdly, although anti-poverty programmes have tended to somewhat alleviate poverty in some parts, the vast amount of corruption and leakages and the incapacity to create permanent assets have made these programmes exorbitantly expensive. Nevertheless these programmes continue to be attractive for political reasons. The agrarian scene is not too comforting. Very large inter personal inequalities have given rise to deep discontent resulting in serious conflicts in many parts of India -- notably in Bihar and Andhra Pradesh. The regional discontent is equally disquieting. Assam, Gorkha Hills and Punjab are the clear manifestations. It appears that with all these conflicts we are sitting on a powder keg. The emergence in this scenario of rich peasant leaders with strong regional affiliations has made the scene even murkier.

The important fact to remember is that basically such peasant leadership is bound to be backward looking, non-secular and tyrannical towards the rural poor. Their increasing clout and elevation from the state to national politics is bound to disrupt the national consensus so assiduously built by the national bourgeoisie. But it is the national bourgeoisie that is primarily responsible for the emergence of present situation -- in so far as they failed to build an equitable agrarian structure through radical land reforms during the 'fifties. Now it is too late in the day as the political power fortress of landed interests has become almost impregnable.

The problem could have become manageable had there occurred rapid industrialisation and significant shift of labour force from agriculture to non-agricultural occupations. After all classical capitalist development did result in large rural to urban migration in all the western countries. But in India the pace of industrialisation has been relatively slow and halting. This is because industrialization and modernisation require large amounts of investment. Until recently, the rate of investment has been quite low. The recent increase in investment has been accompanied by sharp increase in capital output ratio. Further, industrialisation in developing countries needs huge investment in research and development for building up their own technologies. Besides capital investment, it requires large outlay on science education.

Another important reason for slow industrial growth has been the deficiency of domestic rural demand which in turn has been constrained due to slow growth of agricultural
incomes in many parts of the country. One would have expected little diversification of labour force with the type of growth rate in manufacturing in India. But the labour absorption has been lower than expected because of increasing capital intensity. Thus the increasing capital intensity of consumer goods industry has hampered rapid growth in manufacturing employment, despite lip service paid to small scale industries. The recent policy of import liberalisation has on the one hand created serious problem for the domestic capital goods industry, it has simultaneously accelerated the process of capital intensification. it is no wonder therefore, that even with eight per cent annual growth in manufacturing output since 1980-81, there has been virtually no increase in manufacturing employment.

Whereas unemployment is a major problem one cannot forget about the problems posed by increasing inequalities not only within the agricultural sector but also between urban and rural India and between organised and unorganised sectors of the economy. In India for example, the average income of workers in the organised sector was four times that of the unorganised workers. Further, among the unorganised workers, the agricultural worker had one third the income earned by the non-agricultural workers. This level of inequality has created the rural-urban divide along with great deal of tensions. It needs to be underlined that equitable distribution cannot be reconciled with the path of capitalist development. It requires a revolution to abolish the feudal inequalities of land ownership. Since these were not abolished, the capitalist development in India has resulted in further aggravating inequalities because of increasing value of land, property, and other assets and because of multiplication of money acquisition opportunities. The extent of inequalities can be gauged from the fact that during 1975-76, whereas the 20 per cent richest households accounted for 48.4 per cent of total consumption, the poorest 20 per cent households accounted for only 7 per cent. Equally serious are the dilemmas posed by the type of urbanisation taking place in the country. Whereas urbanisation is a necessary concomitant of industrialisation, the pattern of urbanisation taking place in India is full of distortions. This is because despite Government intervention the land for housing has by and large been appropriated by the colonisers, the merchants and traders and affluent professionals and the migrant labourers from rural areas are forced to live in burgeoning slums.

In short, the problems of excessive dependence on agriculture, slow process of agricultural and industrial growth and ensuing inequality, unemployment and poverty are much too serious and demand careful thinking by all the enlightened and progressive sections of people in the country.

1.7 ENVIRONMENTAL IMPACT OF AGRICULTURAL DEVELOPMENT

Agriculture imposes external costs upon society through pesticides, nutrient runoff, excessive water usage, and assorted other problems. A 2000 assessment of agriculture in the UK determined total external costs for 1996 of £2,343 million, or £208 per hectare. A 2005 analysis of these costs in the USA concluded that cropland imposes approximately $5 to 16 billion ($30 to $96 per hectare), while livestock production imposes $714
million. Both studies concluded that more should be done to internalize external costs, and neither included subsidies in their analysis, but noted that subsidies also influence the cost of agriculture to society. Both focused on purely fiscal impacts. The 2000 review included reported pesticide poisonings but did not include speculative chronic effects of pesticides, and the 2004 review relied on a 1992 estimate of the total impact of pesticides.

1.7.1 Livestock issues

A senior UN official and co-author of a UN report detailing this problem, Henning Steinfeld, said "Livestock are one of the most significant contributors to today's most serious environmental problems". Livestock production occupies 70% of all land used for agriculture, or 30% of the land surface of the planet. It is one of the largest sources of greenhouse gases, responsible for 18% of the world's greenhouse gas emissions as measured in CO₂ equivalents. By comparison, all transportation emits 13.5% of the CO₂. It produces 65% of human-related nitrous oxide (which has 296 times the global warming potential of CO₂) and 37% of all human-induced methane (which is 23 times as warming as CO₂. It also generates 64% of the ammonia, which contributes to acid rain and acidification of ecosystems. Livestock expansion is cited as a key factor driving deforestation, in the Amazon basin 70% of previously forested area is now occupied by pastures and the remainder used for feedcrops. Through deforestation and land degradation, livestock is also driving reductions in biodiversity.

1.7.2 Land transformation and degradation

Land transformation, the use of land to yield goods and services, is the most substantial way humans alter the Earth's ecosystems, and is considered the driving force in the loss of biodiversity. Estimates of the amount of land transformed by humans vary from 39–50%. Land degradation, the long-term decline in ecosystem function and productivity, is estimated to be occurring on 24% of land worldwide, with cropland overrepresented. The UN-FAO report cites land management as the driving factor behind degradation and reports that 1.5 billion people rely upon the degrading land. Degradation can be deforestation, desertification, soil erosion, mineral depletion, or chemical degradation (acidification and salinization).

1.7.3 Eutrophication

Eutrophication, excessive nutrients in aquatic ecosystems resulting in algal blooms and anoxia, leads to fish kills, loss of biodiversity, and renders water unfit for drinking and other industrial uses. Excessive fertilization and manure application to cropland, as well as high livestock stocking densities cause nutrient (mainly nitrogen and phosphorus) runoff and leaching from agricultural land. These nutrients are major nonpoint pollutants contributing to eutrophication of aquatic ecosystems.
1.7.4 Pesticides

Pesticide use has increased since 1950 to 2.5 million tons annually worldwide, yet crop loss from pests has remained relatively constant. The World Health Organization estimated in 1992 that 3 million pesticide poisonings occur annually, causing 220,000 deaths. Pesticides select for pesticide resistance in the pest population, leading to a condition termed the 'pesticide treadmill' in which pest resistance warrants the development of a new pesticide. An alternative argument is that the way to 'save the environment' and prevent famine is by using pesticides and intensive high yield farming, a view exemplified by a quote heading the Center for Global Food Issues website: 'Growing more per acre leaves more land for nature'. However, critics argue that a trade-off between the environment and a need for food is not inevitable, and that pesticides simply replace good agronomic practices such as crop rotation.

1.7.5 Climate Change

Climate change has the potential to affect agriculture through changes in temperature, rainfall (timing and quantity), CO₂, solar radiation and the interaction of these elements. Agriculture can both mitigate and worsen global warming. Some of the increase in CO₂ in the atmosphere comes from the decomposition of organic matter in the soil, and much of the methane emitted into the atmosphere is caused by the decomposition of organic matter in wet soils such as rice paddies. Further, wet or anaerobic soils also lose nitrogen through denitrification, releasing the greenhouse gas nitric oxide. Changes in management can reduce the release of these greenhouse gases, and soil can further be used to sequester some of the CO₂ in the atmosphere.

Activity 1

1. Discuss the scope and nature of agriculture in India.
2. What do you understand by rural economic development? Throw light on role of agriculture in economic development of India.
3. Discuss how agriculture and industry are linked and dependent on each other.
4. What is the impact of agricultural development of environment?

1.8 SUMMARY

Agriculture in India is the means of livelihood of almost two thirds of the work force in the country. This unit highlighted the scenario of Indian agriculture. After a brief introduction unit discusses the scope and nature of agriculture in India. Rural economic development was another important area of concern. The share of agriculture contributing to GDP is declining over the years. At the same time, the productivity of for instance cereal yields has been increasing. It seems that as agriculture becomes more successful, its importance declines in the overall economy. This idea was focused in the section called role of agriculture in economic development. Further it has been discussed that how industry and agriculture are dependent on each other. The next area of discussion
was agriculture and poverty and finally environmental impact of agriculture in India was dealt in depth.

1.9 FURTHER READINGS

- Lester R. Brown World's Rangelands Deteriorating Under Mounting Pressure Earth Policy Institute
- Iqtidar Husain Siddiqui, "Water Works and Irrigation System in India during Pre-Mughal Times", Journal of the Economic and Social History of the Orient, Vol. 29
- Indian agriculture Agribusiness Information Centre, Retrieved on- February 2008
UNIT 2

LIVESTOCK ECONOMICS

Objectives

After studying this unit, you should be able to understand:

- The concept of livestock and its relevance in India
- Livestock resources and systems in India.
- The meaning and relevance of white revolution
- The development of poultry and fisheries in India
- The approaches to horticulture and floriculture in India
- The problems and issues of rural industrialization
- The relevance of agro based industries in India

Structure

2.1 Introduction
2.2 Livestock resources
2.3 Livestock system
2.4 White revolution
2.5 Fishery development
2.6 Poultry
2.7 Forestry
2.8 Horticulture
2.9 Floriculture
2.10 Rural industrialization – problems and issues
2.11 Agro based industries
2.12 Summary
2.13 Further readings

2.1 INTRODUCTION

Livestock production systems are considered to be a subset of farming systems. Livestock (also cattle) refers to one or more domesticated animals raised in an agricultural setting to produce commodities such as food or fibre, or labor. The term "livestock" as used in this article does not include poultry or farmed fish; however the inclusion of these, especially poultry, within the meaning of "livestock" is common.

Livestock generally are raised for subsistence or for profit. Raising animals (animal husbandry) is an important component of modern agriculture. It has been practised in many cultures since the transition to farming from hunter-gather lifestyles.
The livestock sector has been growing rapidly as compared to crop production. This growth can be attributed to the increasing number of animals, thereby leading to high productivity.

In the recent years, the livestock sector has been a significant contributor to the country’s economy. Therefore, it is important that the growth in the livestock sector is in tandem with consumer demand. If there is an increase in the former or decrease in the latter, the economic growth is likely to be affected to a large extent. According to Vijay Mundra, manager of Artic Exporters, a small-sized livestock export company in Chandigarh, “It is heartening to note that despite the global financial slump and rise in commodity prices and outbreak of animal diseases such as swine flu, bird flu and mad cow disease, the livestock sector has remained unaffected due to the growth in the global feed market.”

2.1.1 Significance of the livestock sector

The livestock sector plays a key role in the food processing industry. It fulfils the high demand for proteins in food products, thereby adding to the nutritional value to food products. As a result, there has been a phenomenal growth in the Indian livestock, poultry and aqua feed industry, both in terms of production and consumption.

“Animal feed provides three major groups of substances, which includes carbohydrates, oils and proteins along with vitamins and minerals in a balanced amount. This helps to improve the quality of livestock and in turn leads to higher production. Besides, it protects cattle from various contagious diseases,” says Bimal Guha, manager of Alpha Private Limited, a small-sized export company in Mumbai.

2.1.2 India: A global livestock contributor

The Indian livestock sector accounts for a large share of the livestock resources in the global market. India boasts of having one of the largest livestock populations in the world. With its vast resources, which include livestock as well as poultry, India contributes about 500 million tonnes (mt) of livestock with buffalo, goat and sheep ranking as first, second and third, respectively, to the global market. The country’s milk production in the year 2008 stood at about 104 mt, which was the highest in the world. The sector has also contributed other food products to the global market such as 50 million eggs, 45 million kg of wool and 2.3 mt of meat.

2.1.3 Issues confronting the livestock sector

Although mostly there is abundance of animal feed, there are times when feed availability is low, thereby leading to soaring prices. This particularly affects the supply of protein meals due to low production of oilseeds. It has been observed that the demand for protein meal is more than 40 mt, but the supply is less than half of the demand. Low availability, coupled with hike in prices of animal feed has hampered the quality due to mixing of foreign impurities such as weeds and low quality grass and moisture in the animal feeds. This may consequently bring down the quality of livestock and make them more prone to
diseases. As a result, consumers may also be affected, thereby leading to a decline in demand for food products.

### 2.2 LIVESTOCK RESOURCES

Indian livestock industry makes up for a significant amount of world livestock resources.

Both the national economy as well as the socio-economic growth of the country is backed by the livestock sector. Besides offering great potential and outstanding contribution to the agricultural sector over the past so many years, livestock has proved to be life-savior in many catastrophic situations such as flood or draught. Indian government has come up with programs of reform and economic liberalization to support this sector, which have created numerous market-led opportunities available for the growth of Indian livestock industry.

As per this report "Indian Livestock Industry - An Industry Analysis" it has been found, "inadequate agricultural production has resulted in reduced demand for machinery, feeds, equipments and pharmaceuticals etc in some of the American and European countries. Consequently, the attention of the foreign investors is sure to shift to Asian countries specifically India and China".

As per analysts, "During the years 2003-04, the total worth of livestock output was 1,64,509 crore, which was 25.9% of that of agricultural output. With leather accounting for Rs. 2,660 crore and meat & meat products Rs. 1,720 crore. Also cumulatively, livestock, poultry and other related products brought in total revenue of Rs. 5,120 crore in 2004-05."

Professionally skilled technical, marketing and business manpower and a large number of English speaking people have put India on a strong footing as compared to other countries.

The report also suggests that if the sector is exploited to its potential, can make India the leader in milk and meat products in the near future.

The classification of livestock resources covers the following animal species in India: cattle, buffalo, sheep, goat, pig and chicken.

If we focus on Indian scenario we find that most popular ones are cattle and buffaloes followed by sheep and goats, poultry and pigs.

India livestock resources include the many species of animals that have sustained the lives of its inhabitants for centuries by providing food (e.g. milk, meat, and eggs), draught power, and other animal byproducts. It also includes the feed resources and the management patterns that together shape the characteristic features of the strains and breeds of these animals as seen today.

Major species are cattle, goats, sheep, chicken and pigs. Of these, cattle, sheep and goats are economically most important livestock species for most people in India with chicken serving a subsidiary role. In addition to providing man with milk and meat, cattle, sheep
and goats functions as a form of wealth. People would often convert their liquid money into living heads of cattle, sheep or goats.

2.2.1 Animal rearing

‘Livestock’ are defined, in part, by their end purpose as the production of food or fibre, or labour.

The economic value of livestock includes:

**Meat**
- the production of a useful form of dietary protein and energy

**Dairy products**
- Mammalian livestock can be used as a source of milk, which can in turn easily be processed into other dairy products, such as yogurt, cheese, butter, ice cream, kefir, and kumis. Using livestock for this purpose can often yield several times the food energy of slaughtering the animal outright.

**Fibre**
- Livestock produce a range of fibre/textiles. For example, sheep and goats produce wool and mohair; cows, deer, and sheep skins can be made into leather; and bones, hooves and horns of livestock can be used.

**Fertilizer**
- Manure can be spread on fields to increase crop yields. This is an important reason why historically, plant and animal domestication have been intimately linked. Manure is also used to make plaster for walls and floors, and can be used as a fuel for fires. The blood and bone of animals are also used as fertilizer.

**Labour**
- Animals such as horses, donkey, and yaks can be used for mechanical energy. Prior to steam power, livestock were the only available source of non-human labour. They are still used for this purpose in many places of the world, including ploughing fields, transporting goods, and military functions.

**Land management**
- The grazing of livestock is sometimes used as a way to control weeds and undergrowth. For example, in areas prone to wild fires, goats and sheep are set to graze on dry scrub which removes combustible material and reduces the risk of fires.

During the history of animal husbandry, many secondary products have arisen in an attempt to increase carcass utilization and reduce waste. For example, animal offal and non-edible parts may be transformed into products such as pet food and fertilizer. In the past, such waste products were sometimes also fed to livestock as well. However, intra-species recycling poses a disease risk, threatening animal and even human health (see bovine spongiform encephalopathy (BSE), scrapie and prion). Due primarily to BSE (mad cow disease), feeding animal scraps to animals has been banned in many countries, at least in regards to ruminants and pigs.
2.3 LIVESTOCK SYSTEMS

2.3.1 Landless livestock production systems (LL)

The developed countries dominate the picture of landless intensive production with more than half of total meat production as shown in Figure 3. Asia is already contributing some 20 percent and Eastern Europe 15 percent, with the latter recently in sharp decline.

2.3.2 Landless monogastric production system (LLM)

This system is defined by the use of monogastric species, mainly chickens and pigs, where feed is introduced from outside the farm, thus separating decisions concerning feed use from those of feed production, and particularly of manure utilization on fields to produce feed and/or cash crops. This system is therefore open in terms of nutrient flow.

Landless monogastric systems are found predominantly in OECD member countries with 52 percent of the total landless pork production and 58 percent of the landless poultry production globally. In the case of pig production, Asia is second, with 31 percent of the world total. For poultry, Central and South America follow, with 15 percent. To a large extent, this geographic distribution is determined by markets and consumption patterns in addition to levels of urbanization.

In Southeast and eastern Asia, this system is especially important. As much as 96 percent of the total pig-meat production in Asia occurs in China, Viet Nam and Indonesia. China, Thailand and Malaysia produce 84 percent of poultry meat. This is associated with fast economic growth and urbanization. The demand for monogastric meat is expected to grow from two- to fivefold between 1987 and 2006 from a base of 31 million tonnes, and a three- to tenfold increase is expected in the demand for eggs from 9 million tonnes (Devendra, 1995). The prerequisites for development into large-scale vertically integrated production include the use of appropriate breeds and strains, feed quantity and quality, housing and disease control, as well as assured markets both at home and abroad. Landless poultry and pig production systems account for the majority of the output in developed countries and their share is rapidly increasing in developing countries given their high supply elasticity in the short term.

The system is typically competing with traditional land-based production systems for shares in the urban markets. It must be kept in mind that poultry and pork are close substitutes for beef and mutton, thus also interacting with the ruminant systems. In a broader sense, the demand for cereals created by these systems is also competing for land resources with land-based ruminant systems.

2.3.3 Landless ruminant production system (LLR)

This production system is defined by the use of ruminant species, principally cattle, where feed is mainly introduced from outside the farm system. Landless ruminant
production systems are highly concentrated in only a few regions of the world. In the case of cattle, they are almost exclusively found in eastern Europe and the CIS and in a few OECD member countries. Landless sheep production systems are only found in western Asia and northern Africa.

Typical cases are large-scale feedlots in the United States and in eastern Europe and the CIS, and veal production in parts of the KU. Intensive dairy operations in the same regions are more land-based because of the need to feed palatable fodder, which cannot be transported economically over long distances. In Asia, the intensive ruminant systems are typically found in buffalo and dairy cattle production units/colonies in India and Pakistan.

The LLR system is based almost exclusively on high-producing, specialized breeds and their crosses, which, nevertheless, have not been bred specifically for performance under "landless" conditions. With regard to milk production, the Holstein-Friesian breed is clearly the most important, and for beef production, English breeds predominate in the United States, while the large European dual-purpose breeds provide animals for fattening. The abundance of rangeland in the United States has led to the specialized production of calves from beef breeds for feedlot operations, while under European conditions these animals are a joint product together with milk, mainly from mixed systems.

The LLR system is highly capital-intensive, leading to substantial economies of scale. It is also feed-intensive and labour-extensive. Key efficiency parameters are daily weight gains and feed conversion, basically reflecting the efficient use of capital invested in infrastructure or in the form of lean animals and feeds. Weight gains are usually in the range of 1 to 1.5 kg per day, and feed conversion rates are about 8 to 10 kg of grains per kilogram of weight gain.

This system is closely linked to land-based systems that normally provide the young stock for landless systems. This constitutes an important difference from landless monogastric systems, in which replacement stock is produced within the same vertically integrated system.

Driven by population growth, the landless ruminant system is expected to continue to grow slowly in North America and southern Asia. On the other hand, it is expected to decline in the EU as production becomes more extensive in response to policies reducing agricultural support. In eastern Europe and the CIS, its importance is also declining and ruminant production in that part of the world is shifting to land-based and smaller-scale systems.

A growing market for grain-fed beef exists in Japan and the newly industrialized countries of Asia. The growth rate of this market will depend mainly on the evolution of the international price of cereals and the increased per caput incomes. This market will in part be supplied domestically and through imports from the United States, Canada, Australia and possibly South America.
2.3.4 Grassland-based livestock production systems (LG)

The importance of grassland-based systems in different world regions is shown in Figure 4. Central and South America and the developed countries dominate the picture in terms of meat production, together accounting for more than three-quarters of the world's production.

2.3.5 Temperate zones and tropical highlands grassland-based system (LGT)

In these areas, the grazing system is constrained by low temperatures. In the temperate zones, there is one or two months of mean temperatures, corrected to sea level, to below 5°C, whereas in the tropical highlands daily mean temperatures during the growing period are in the range of 5° to 20°C.

Locations in the tropical highlands comprise parts of the highlands of South America and eastern Africa, and in temperate zones they include southern Australia, New Zealand and parts of the United States, China and Mongolia.

The regions in which the LGT system predominates have a combined human population of 190 million, which represents only 3.5 percent of the world total, and almost half of this population lives in Asia. In OECD member countries, far fewer people (14 million or 1.7 percent) use the LGT system, but they control more land and cattle per inhabitant than in the other regions.

Under the LGT system, product use varies widely, ranging from export-oriented New Zealand farmers, to South American farmers mainly producing for the domestic market, to Asian and African smallholders concerned with local markets and their own subsistence.

Market forces and environmental concerns are curbing the potential for intensification of this system. As a result, their global market share is declining vis-à-vis that of other production systems.

Since the LGT system is found mostly in marginal areas, its production potential in global terms is relatively low. In developing countries it tends to form a subsistence basis for certain groups of the population and its future role is seen more in providing employment for these groups than in making a major contribution to output and economic development. In developed countries, frequently with production surpluses, the production from these systems is declining in relation to other values and uses assigned to these land resources, such as recreational value, value as a wildlife and biological diversity reserve and the contribution to water conservation.

2.3.6 Humid and sub humid tropics and subtropics grassland-based system (LGH)
The LGH system is defined as a grazing system found in regions with more than 180 days of growing period. It tends to be concentrated more in the sub humid zone, particularly in regions where access to markets or, for agronomic reasons, crop production is limited. By definition, only very limited cropping is considered for subsistence.

The LGH system is found mostly in the tropical and subtropical lowlands of South America: in the llanos of Colombia and Venezuela as well as in the cerrados of Brazil. Dual-purpose milk-beef systems in the Mexican lowlands and estancias in Argentina are also typical cases of this system. In the African setting, many of the potentially suitable land resources are not used as a result of trypanosomiasis constraining livestock production. Outside Latin America, this system is important only in Australia because of its ample land resources in relation to its population.

Worldwide, the LGH system comprises about 190 million head of cattle, an important proportion of which are of the zebu breeds. In the subhumid and humid regions, cattle are clearly the dominant species, and in very high rainfall areas, such as the Amazon River delta and some parts of Queensland, Australia, buffaloes are also ranched. African hair sheep and dwarf goats are usually kept for local consumption only. In the subtropics, wool sheep are an important component of the system, for example, in Argentina, Uruguay, South Africa and Australia.

The LGH system produces approximately 6 million tonnes of beef and veal and 11 million tonnes of cow milk worldwide. By far the most important geographic region is Central and South America. The system is predominantly market-oriented.

Globally, 6 percent of the world's population (330 million people) lives in areas where the LGH production system predominates. Its importance in terms of sustaining the livelihood of rural populations is expected to decline as interaction with crop cultivation turns it into a mixed system. In rain-forest regions, efforts are being made to incorporate perennial tree crops, frequently into silvo-pastoral systems. In the savannahs, this system is being converted into a mixed-farming system by including annual crops, such as maize, soybeans and sorghum.

Improvements in road infrastructure and new technologies to allow the establishment of pastures with commercially worthwhile nurse crops are making the ley farming systems, involving rotations of crops and pasture, a potentially attractive pathway into mixed-farming systems (Thomas et al., 1992).

**2.3.7 Arid and semi-arid tropics and subtropics grassland-based system (LGA)**

The LGA system is defined as a land-based system in tropical and subtropical regions with a growing period of less than 180 days, and where grazing ruminants is the dominant form of land use.
This system is found under two contrasting socioeconomic frameworks: in sub-Saharan Africa and the Near East and North Africa regions, where it constitutes a traditional way of subsistence for an important part of the population, and in Australia, parts of western United States and southern Africa, where private enterprises utilize publicly or privately owned range resources for ranching purposes.

While in western Asia, northern Africa and sub-Saharan Africa, the LGA system is important for the livelihood of large sectors of the rural population, in developed countries it is extremely labour-extensive.

In sub-Saharan Africa, agropastoralism is the most important interface between livestock production and other agricultural production. In other regions these systems are interrelated with other livestock production systems that have access to better-quality feed and are closer to markets. In low-income countries without an export market, incentives to produce quality beef are weak. This, in turn, limits the attractiveness of livestock production stratification.

Globally, new roles are emerging for these rangelands, besides that of producing ruminant animal products. In developing countries, the pressure to expand crop production is increasing population pressure on the remaining rangelands. In developed countries, the utilization of these rangelands for animal production has often been subsidized through very low prices for grazing permits and public investments in irrigation.

2.3.8 Rain-fed mixed-farming systems (MR)

The geographic distribution of mixed-farming systems is depicted in Figure 5. Sub-Saharan Africa, West Asia and North Africa, and Central and South America are relatively unimportant in terms of meat production, whereas developed countries and Asia together contribute about 70 percent of the total meat production from mixed-farming systems.

2.3.9 Temperate zones and tropical highlands rain-fed system (MRT)

This system is defined as a combination of rain-fed crop and livestock farming in temperate or tropical highland areas, in which crops contribute at least 10 percent of the value of total farm output.

The MRT system is found in two contrasting agro-ecozones of the world: it is the dominant system in most of North America, Europe and northeastern Asia, basically covering large strips of land north of the 30° northern latitude parallel, and it is found in the tropical highlands of eastern Africa (Ethiopia, Kenya, Uganda, Burundi, Rwanda) and in the Andean region of Latin America (Ecuador, Mexico).
The main common feature of these two regions is that low temperatures during all or part of the year limit and determine vegetation that is quite distinct from that found in tropical environments (e.g. C3 versus C4 grasses).

In the course of the development process, production technology in temperate locations evolved to higher specialization, more use of external inputs and more open systems. This has resulted in increasing negative externalities of these systems for the environment.

In most tropical MRT systems, production is less intensive, with livestock performing a series of functions in mixed systems: a continuous flow of cash income; means to concentrate nutrients for crops through manure; fuel; animal traction; a cash reserve for emergencies; and as a buffer to risks in crop production.

Globally, the MRT system is the most important source of animal products, providing 39 percent of the beef and veal production, 24 percent of the mutton production and 63 percent of the cow milk produced.

In Asia, this system has the potential for increased production and better use of feeds for intensified ruminant production, associated with reallocation of land-use patterns at the farm level.

In the highlands of sub-Saharan Africa and Latin America, production increases must come from a further intensification of crop-livestock land-use systems. The highlands should favour small-scale mechanization because of the high population density, continuous cultivation and relatively heavy soils.

### 2.3.10 Humid and sub humid tropics and subtropics rain-fed system (MRH)

In the humid and sub humid regions of the tropics and subtropics, livestock production is based on mixed-farming systems. Given the range of socioeconomic conditions and soils and climates involved, this livestock system is very heterogeneous in its composition. It is found in all tropical regions of the world, mainly in developing countries. Parts of the southern United States are the only significantly developed regions included in this system. Typical cases are smallholder rice-buffalo systems in Southeast Asia or soybean-maize-pasture large-scale commercial operations in the Brazilian cerrados.

This system includes regions with especially difficult climatic conditions for livestock (high temperatures and high humidity). Adaptation of highly productive temperate breeds to these challenges has been notably poor. In many parts of Africa, trypanosomiasis constitutes an additional constraint to these systems. Particularly in African and Asian smallholder systems the local breeds are still widely used. In Latin America, *Bos taurus* cattle, sheep and goats were introduced some four centuries ago. *Bos indicus* cattle were introduced a few decades ago and have now replaced the earlier introduced cattle breeds in tropical areas.
In the African and Asian MRH system, the multiple roles of livestock have prevailed, particularly animal traction and manure. In Central and South America, this system caters to large domestic markets and, particularly in the case of Brazil, it is also linked to export markets. Under smallholder conditions, milk tends to be a more important output than meat.

The MRH system applies to approximately 14 percent of the global population. This ratio is particularly high in sub-Saharan Africa, where 41 percent of the region's population is associated with the system, and in Central and South America, where it is 35 percent.

The system is replacing grazing systems in Africa and Latin America. In Africa, the process is mainly driven by population growth, and, in Central and South America, by economic development and technological innovations.

The main challenge in sub-Saharan Africa is finding ways to increase productivity. It is generally acknowledged that the biological potentials of mixed systems will be the key to productivity increases, and the expectation is that purchased feed inputs will be replaced by nutrients cycled within the system. In Asia, increased crop production and hence feed availability is an important way of intensifying and maximizing animal productivity, however, the prospects for increasing cultivation area are limited.

In Latin America, low population density, a high degree of urbanization and relatively high per caput incomes have resulted in farming systems that are generally more oriented towards livestock production. In the tropical rain-forest regions, high resource-consuming systems were established, in some cases driven by policies and in other cases by poverty. Many of the policies that promoted wasteful utilization of these resources have been stopped in the process of structural adjustment.

2.3.11 Arid and semi-arid tropics and subtropics rain-fed system (MRA)

The MRA system is a mixed-farming system in tropical and subtropical regions with a vegetation growth period of less than 180 days. The main restriction of this system is the low primary productivity of the land resulting from low rainfall. The more severe the constraint, the less important crops become in the system and the more livestock take over as a primary income and subsistence source.

This system is important in the West Asia and North Africa region in parts of the Sahel (Burkina Faso, Nigeria), in large parts of India and in northeastern Thailand and eastern Indonesia, and less important in Central and South America. Given the low intensity of the system and the multiple purposes of livestock, the introduction of improved breeds has been limited. Globally, 11 percent of cattle and 14 percent of sheep and goats are found in this system. Small ruminants are particularly important in West Asia and North Africa under the MRA system.

As is the case in other largely smallholder systems, livestock have a range of simultaneous roles in this system, including animal traction, production of manure and
use as a cash reserve, in addition to the production of meat and milk. Fuelwood is often scarce as a result of deforestation and range degradation, leading to the ever-increasing role of animals as providers of manure for fuel, in addition to means of transport.

While this system supports larger populations than any other grazing system, only 10 percent of the world's population is related to this system. Fifty-one percent of the population involved is in Asia, mainly India, and 24 percent is in the West Asia and North Africa region.

There is close interaction with the LGA system. With increasing population pressure, the LGA system tends to evolve into mixed systems, mainly MRA, because of the greater caloric efficiency of cropping vis-à-vis ruminant production when land becomes scarce.

The outlook for this system is relatively similar to that for the LGA system. The resource base puts a clear ceiling on agricultural intensification. Low and variable response to inputs makes their use financially risky. Population growth in this setting is contributing to the overexploitation of the natural resource base, as traditional property rights cannot cope with the growing demands. Alternative development strategies and the reduction of population pressure on the resource base are key elements for the sustainable development of these regions.

2.3.12 Irrigated mixed-farming systems

*Temperate zones and tropical highlands mixed system (MIT).* This system belongs to the group of land-based mixed systems of temperate and tropical highland regions. It is found particularly in the Mediterranean region (Portugal, Italy, Greece, Albania, Bulgaria) and in the Far East (the Democratic People's Republic of Korea, the Republic of Korea, Japan and parts of China), where plant growth is limited both by low temperatures in the cold season and reduced moisture availability during the vegetation period. The system's importance in tropical highlands is negligible.

Meat, milk and wool, the main outputs of this system, are mainly produced for the market. Manure is an issue only where animals are stabled, at least for certain periods of the day or the year.

About 10 percent of the global population lives in regions where this system is dominant. A large share belongs to developed countries with relatively high income levels and where agricultural trade is important.

This system is clearly associated with very intensive agriculture in temperate regions with a high population density. With the outcome of the General Agreement on Tariffs and Trade (GATT) negotiations, it can be expected that these systems will be less and less viable, having to compete with more efficient rain-fed systems producing the same commodities.
The expansion of international trade, and particularly the incorporation of southern European countries into the KU, has led to an increase in intensive production systems for off-season vegetables and fruits on the best irrigated land. The integration with livestock has been reduced, with ruminant grazing systems declining in absolute terms and being concentrated on the marginal sites.

**Humid and subhumid tropics and subtropics mixed system (MIH).** This is a mixed system in tropical and subtropical regions with growing seasons of more than 180 days, and in which the irrigation of crops is significant.

The MIH system is particularly important in Asia. High population densities require intensive crop production, and the irrigation of rice makes it possible to obtain more than two crops per year, even under conditions of very seasonal rainfall, substantially reducing yield variability as compared with the yield of upland rice or other rain-fed crops. In the past, animal production has been closely linked to the animal traction issue.

MIH systems throughout the world produce 13 million tonnes of pork (18 percent of global production), more than any other land-based tropical system. Among the tropical and subtropical systems, the MIH system is the one related to the largest population group, 990 million people, 97 percent of which are in Asia. Increasing labour productivity and relative affluence of farmers in this system are reflected in the more frequent use of tractors for cultivation. Manure is recycled on the fields. Ducks do well in this environment, as do pigs and poultry, which thrive on abundant crop residues. In addition, since large ruminants, such as buffaloes and, to a lesser extent, cattle, have little association with draught and transport, their output will be increased milk and meat for the market. Animals and intensive crop production in this ecological zone are an illustration of a successful and sustainable agricultural production system (Devendra, 1995).

Competition for urban markets for livestock products is the main form of interaction with the landless monogastric system, both domestically and globally, through international trade.

**Arid and semi-arid tropics and subtropics mixed system (MIA).** This is a mixed system of arid and semiarid regions, in which irrigation makes year-round intensive crop production feasible. It is found in the Near East, South Asia, North Africa, western United States and Mexico.

Typical cases are alfalfa/maize-based intensive dairy systems in California, Israel and Mexico; small-scale buffalo milk production in Pakistan; and animal traction-based cash-crop production in Egypt and Afghanistan. Cattle and buffaloes for milk and animal traction are the main ruminant resources, although sheep and goats are important where marginal rangelands are available in addition to irrigated land. In the MIA system, pigs are kept only in the Far East; they are virtually non-existent in West Asia and North Africa, largely for cultural reasons (Islamic and Jewish religions). The main introduced breeds are dairy cattle to supply milk to large urban centres. Under good management
conditions, intensive dairy schemes have been quite successful in hot but dry environments. Some of the world's highest lactation yields are achieved in the MIA system in Israel and California. The traditional smallholder MIA system in Asia relies heavily on buffaloes for milk production.

In the traditional MIA system, irrigated crop production is the main source of income, with livestock playing a very secondary role. This is generally reflected in rather extensive management of livestock enterprises. The MIA system is predominant in regions that are home to over 750 million people, two-thirds of them in Asia and one-third in West Asia and North Africa.

The main interaction with other systems occurs through the international market, particularly for milk and dairy products.

The MIA system makes an important contribution to food availability and employment in semi-arid and arid regions. Irrigation allows increased fodder production as a by-product or part of crop rotation, which reduces the feed deficit. The improved feed base and utilization promotes intensification and commercialization of livestock production, especially in areas with good market access.

Globally, mixed-farming systems contribute the largest share (53.9 percent) of total meat production, followed by landless systems (36.8 percent). The small share of grazing systems (less than 10 percent) is certainly surprising (Figure 6). The picture is even more pronounced for milk production, with more than 90 percent of production generated in mixed-farming systems (Figure 7).

Land-based systems still provide a large share of the total livestock output: 88.5 percent of beef and veal, 61 percent of pork and 26 percent of poultry, representing 60 percent of the total of all three meats. Globally, pork is the most important meat source (72 million tonnes), followed by beef and veal (53 million tonnes) and poultry (43 million tonnes). Among land-based systems, specialized grazing systems only contribute 23.5 percent of the ruminant meat output and 7.9 percent of all milk output; the vast majority is provided by mixed systems. It is expected that the importance of mixed systems as suppliers of livestock products will continue to grow in the future.

The relative importance of different production systems and animal species varies markedly across the geographic regions of the world. Grazing systems are more important in Central and South America, with its low population density and relatively high degree of urbanization, and where cattle are the most important livestock species. Africa has vast livestock resources in semi-arid and arid regions, where small ruminants play an important role. More than 90 percent of the world stock of buffaloes is concentrated in Asia, and in the Far East pigs have become a very important source of red meat. Asia's livestock are mainly found in mixed systems.
The MRT system is by far the largest. Globally it represents 41 percent of the arable land, 21 percent of the cattle population, 18 percent of sheep and goat stocks and 37 percent of dairy cattle stocks. In terms of output, its importance is even greater.

In comparing livestock resource availability indices among systems, within systems and across countries, a very wide range becomes evident in terms of resource endowment per inhabitant. Developed countries tend to be substantially better endowed with land and livestock per inhabitant. Similarly, wide differences in production intensity can be observed.

Intensity levels of the world's livestock production systems seem to be converging, though starting from very different levels. On the one hand, the very intensive systems of developed countries are facing a series of environmental problems. Furthermore, intensity levels are frequently linked to price-support policies. Both declining price support and increasing environmental regulations are inducing lower levels of intensity in this part of the world.

2.4 WHITE REVOLUTION

Operation Flood was a rural development programme started by India's National Dairy Development Board (NDDB) in 1970. One of the largest of its kind, the programme objective was to create a nationwide milk grid.

It resulted in making India the largest producer of milk and milk products, and hence is also called the White Revolution of India. It also helped reduce malpractices by milk traders and merchants. This revolution followed the Indian green revolution and helped in alleviating poverty and famine levels from their dangerous proportions in India during the era.

Gujarat-based Amul (Anand Milk Union Limited) was the engine behind the success of Operation Flood and in turn became a mega company based on the cooperative approach. Verghese Kurien (chairman of NDDB at that time), then 33, gave the professional management skills and necessary thrust to the cooperative, and is considered the architect of India's 'White Revolution' (Operation Flood). His work has been recognised by the award of a Padma Bhushan, the Ramon Magsaysay Award for Community Leadership, the Carnegie-Wateler World Peace Prize, and the World Food Prize.

Operation Flood has helped dairy farmers, direct their own development, placing control of the resources they create in their own hands. A 'National Milk Grid', links milk producers throughout India with consumers in over 700 towns and cities, reducing seasonal and regional price variations while ensuring that the producer gets a major share of the price consumers pay.

The bedrock of Operation Flood has been village milk producers' cooperatives, which procure milk and provide inputs and services, making modern management and technology available to members. Operation Flood's objectives included:
- Increase milk production ("a flood of milk")
- Augment rural incomes
- Fair prices for consumers

2.4.1 Programme Implementation

Operation Flood was implemented in three phases.

Phase I

Phase I (1970–1980) was financed by the sale of skimmed milk powder and butter oil donated by the European Union (then the European Economic Community) through the World Food Programme. NDDB planned the programme and negotiated the details of EEC assistance.

During its first phase, Operation Flood linked 18 of India's premier milksheds with consumers in India's major metropolitan cities: Delhi, Mumbai, Kolkata, and Chennai. Thus mother dairies in four metros were established.

Operation flood, also referred to as “White Revolution” is a gigantic project propounded by Government of India for developing dairy industry in the country. The Operation Flood – 1 originally meant to be completed in 1975, actually the period of about nine years from 1970-79, at a total cost of Rs.116 crores.

As start of operation Flood-1 in 1970 certain set of aims were kept in view for the implementation of the programmers. Improvement was done by milk marketing the organized dairy sector in the metropolitan cities Bombay, Calcutta, Madras, and Delhi. The objectives of commanding share of milk market and speed up development of dairy animals respectively hinter lands of rural areas with a view to increase both production and procurement.

Phase II

Operation Flood Phase II (1981–1985) increased the milksheds from 18 to 136; 290 urban markets expanded the outlets for milk. By the end of 1985, a self-sustaining system of 43,000 village cooperatives with 42.5 lakh milk producers were covered. Domestic milk powder production increased from 22,000 tons in the pre-project year to 140,000 tons by 1989, all of the increase coming from dairies set up under Operation Flood. In this way EEC gifts and World Bank loan helped promote self-reliance.

Phase III

Phase III (1985–1996) enabled dairy cooperatives to expand and strengthen the infrastructure required to procure and market increasing volumes of milk. Veterinary first-aid health care services, feed and artificial insemination services for cooperative members were extended, along with intensified member education.
Operation Flood's Phase III consolidated India's dairy cooperative movement, adding 30,000 new dairy cooperatives to the 42,000 existing societies organized during Phase II. Milksheds peaked to 173 in 1988-89 with the numbers of women members and Women's Dairy Cooperative Societies increasing significantly.

Phase III gave increased emphasis to research and development in animal health and animal nutrition. Innovations like vaccine for Theileriosis, bypassing protein feed and urea-molasses mineral blocks, all contributed to the enhanced productivity of milch animals.

### 2.5 FISHERY DEVELOPMENT

With a total fishermen population of about 14.5 million (Livestock census, 2003) and rich marine and inland water resources, fisheries and aquaculture forms an important sector with regard to employment, livelihood and food security. Fish products also form a significant commodity for overseas trade. During the past decades the Indian fisheries and aquaculture has witnessed improvements in craft, tackle and farming methods. Creation of required harvest and post-harvest infrastructure has been receiving due attention of the central and state governments. All this has been inducing a steady growth.

#### 2.5.1 Marine fisheries

India’s estimated marine resources potential is 3.93 million t. as per the latest update of 2000. During 2004, the marine fish catch was 2.81 million t, of which 63% was taken from the west coast and the rest from the east coast. The fishing units consist of 208000 traditional craft, 55000 traditional motorized craft, 1250 mechanized boats and about 100 deep-sea fishing vessels.

There are 3827 fishing villages and 1914 traditional fish landing centers. 79% of the fulltime fishers and 72.3% of the part time fishers are from the coastal states and union territories. A wide range of fishing gears, including trawls, seines, lines, bag nets, stake nets and lift nets are deployed.

During the ten-year period of 1995-04 marine capture production remained stable around 2.80 million t per year, with a minimum of 2.66 million t in 1995 and a maximum of 2.96 million t in 2002. The marine fish landings consist of about 65 commercially important species/groups. Pelagic and midwater species contributed 51.6% of the total landings. Indian oil sardine (*Sardinella longiceps*), Indian mackerel (*Rastrelliger kanagurta*) and anchovies constituted the main bulk of pelagic species caught followed by Bombay duck (*Harpodon neherrius*), Seer fish (*Scomberomorus spp.*), tunnies and cephalopods. Sciaenids, Carangids, Perches, Elasmobranchs and Marine shrimp forms main bulk of demersal resources harvested. Although contributing only 10% of the total marine landings, commercially shrimp is still the most important variety due to its export potential.
Development of marine fisheries sector is taken up with a focus on sustainability through empowering the traditional sector, enhancement of sea safety, rational exploitation of untapped deep-sea resources etc. for achieving employment generation, social security of fishers, increased food security and augmenting sea food exports. Development of adequate infrastructure for harvest and post-harvest operations with due consideration of the principle of minimizing post-harvest losses and ensuring enhanced food safety has been embarked upon. Under this programme a chain of 6 major and 45 minor fishery harbours and 158 modern Fish Landing Centres have been commissioned and as many as 18 harbours and 46 landing centres are at various stages of construction. In order to improve the domestic marketing of fish in the country, improved fish markets and chilled/refrigerated transport are being provided and low cost technologies for processing are being popularized. With these endeavors the annual per capita consumption of fish has been growing steadily and the national average during 2004 stood at 5 kg, though the consumption pattern along coastal belt stood much high.

2.5.2 Inland fisheries

The country’s fresh water resources consist of 195210 kilometers of rivers and canals, 2.9 million hectares of minor and major reservoirs, 2.4 million hectares of ponds and lakes and about 0.8 million hectares of flood plain lakes and derelict water bodies. During the ten-year period of 1995-2004 inland capture production grew from 600,000 tonnes to 800,000 tonnes and at present contributes to 13% of total fish production of the country.

2.5.3 Freshwater aquaculture

Inland aquaculture (2,352,000 tonnes in 2004) has emerged as a major fish producing system in India, with the governmental initiatives in the past three decades. Fish Farmers Development Agencies (FFDA) were set up in each district for delivering a package of technologies, practices, training and extension besides financial assistance to the beneficiaries. So far 429 FFDA's functioning in the country has brought about 0.65 million ha of water area under fish farming and reached out to 1.1 million beneficiaries and imparted training to about 0.8 million. Currently the average annual yield is around 2.2 t/ha. India produces over nineteen thousand million fry per year. Necessary capacity for feed production also exists. Carp accounts for over 80% of farmed fish. Major species cultured are rohu (Labeo rohita), catla (Catla catla), mrigal carp (Cirrhinus mrigala), grass carp (Ctenopharyngodon idellus), common carp (Cyprinus carpio), silver carp (Hypothalmichthys molitrix), catfish (Clarius batrachus), singi (Heteropneustes fossilis), rainbow trout (Oncorhynchus mykiss). Giant fresh water prawn (Macrobrachium rosenbergii) has emerged as a new species for farming with promising results. The potential for farming in running cold waters and reservoirs is also being developed.

2.5.4 Brackish-water aquaculture
The estimated area of brackish water available for aquaculture is about 1.2-1.4 million ha, of which, about 14% area has been brought under farming. Both traditional and scientific shrimp farming are practiced with yields varying from 300 to 1000 kg/ha/year. Shrimp farming is predominantly a small-scale farming activity, with 91% of the growers holding only water spread area of 2 hectares and below and another 6% holding 2-5 ha. Due to high commercial value, giant tiger prawn (*Penaeus monodon*) is the dominant species cultured followed by Indian white prawn (*Penaeus indicus*). Shrimp production from coastal aquaculture during 2004 stood at approximately 120,000 tonnes. Farmed shrimp accounts for about 60% of shrimp exported from the country.

There are about 260 shrimp hatcheries in the country with an aggregate production capacity of 11 billion, of which 200 are in operation with an output of 7 billion shrimp larvae. There are 33 feed mills with an installed capacity of 150,000 tpa. The sector is providing direct employment to about 0.3 million people and ancillary activities provide employment to 0.6-0.7 million people. Coastal farming of bivalves and seaweeds have made a modest beginning in the country in recent years.

### 2.5.5 Utilization of catches

About 81% of the fish catch is marketed as fresh or chilled and forms staple food along the coastal and inland landing centres. About 6% of the catch goes for drying and curing. Frozen fish production accounts for 5.2%, while 4.7% goes for reduction to fish meal, 0.7% for offal reduction and 0.53% for other miscellaneous purposes. The utilization by fish canning industry is only 0.6% of the total catch. Value added products of different descriptions are slowly becoming popular as ‘convenience food’ in the wake of changing life styles. Though basically aimed at export market, these also have a promising potential in the domestic market. The range of value added products include extruded products, battered and breaded products, surimi and derivatives, pickles and curried products in retortable pouches.

### 2.5.6 State of industry

The fish processing industry is well developed in the country. There are about 625 registered exporters (380 manufacturer-exporters and 240 merchant-exporters). The post-harvest infrastructure includes 215 ice plants, 481 shrimp peeling plants, 371 freezing plants, 495 cold storage units, 7 canning plants, 16 fishmeal plants, 11 surimi plants, and one agar-agar production unit. 95% of the seafood processing units are concentrated in 20 major clusters in 9 states. All processing plants, which are export-oriented, are HACCP certified.

The total installed freezing capacity of 10,700 t/day, is fully utilized only during peak fishing season. The current production is little over 378,000 t/yr. Commercial production is mostly directed towards export. Total exports of fish and fishery products were 163,000 tonnes in 2004 (product weight, about 500,000 tonnes in live weight equivalent).
The country exports twelve major commodity groups to over 40 countries. Shrimp products accounts for 65-70% of the export earnings.

### 2.5.7 Economic role of the fishing industry

Fisheries play an important role in the national economy, providing full-time or part-time employment to 14.66 million people. The contribution of fisheries to GDP at the current prices (2003-04) is 1.07%. There are 11,800 registered primary fisheries societies in India, with a membership of 1,917,300 beneficiaries. It is also a major contributor to foreign exchange earning fetching US$ 1,365 million during 2004.

### 2.5.8 Development prospects

Marine fish production from near shore waters has reached almost a plateau and, at best, only marginal increase is predicted from this zone. Major gap in total fishable potential and present production exists in deep sea and off shore pelagic resources. Good potential exists for coastal aquaculture and Mariculture. Resource enhancement measures in coastal waters also need to be taken up. In contrast, inland fish production has been showing rapid growth of about 6% per annum and has great potential for further development. Area expansion, diversification of farmed species and augmenting productivity from the existing farms in a sustainable manner are possible strategies in this sector. A substantial portion of the future additional demand for fish will have to be met from aquaculture.

Objectives for future fisheries development include enhancing fish production and productivity, generating employment, improving socio-economic conditions of fishers, increasing marine products for export, and increasing per caput availability of fish to about 11 kg/yr. These objectives are sought to be achieved through intensification of aquaculture, qualitative and quantitative improvement in farming, introduction of more economic varieties, improving productivity of reservoirs and lakes and horizontal expansion of farmed area. Combating diseases, popularizing organic farming and implementing sustainable farming practices would be taken up. Developing policy and legal framework with required safeguards for introduction of exotic varieties would receive attention. In the marine sector besides intensifying coastal aquaculture, sea farming, intensification of deep-sea fishing, better management of coastal fisheries with application of principles of sustainability and stock enhancement measures would be practiced for maximizing the returns. Considering the massive processing facilities created and the skilled manpower in hand, import of raw material for processing, value addition and export has good prospects.

### 2.5.9 Fisheries Management
Indian marine fisheries faces frequent fluctuations as cyclic and climatological effects influence the pelagic stocks. All the coastal federal states have enacted their Marine Fishing Regulation Act with jurisdiction over their territorial waters. Management measures such as closed seasons, delimitation of fishing zones for different categories of fishing craft etc. are implemented for ensuring sustainability. Capture of non-targeted species and rejection of by catches are discouraged through awareness programmes involving stakeholders.

The country has been associated with development of several international instruments for management of marine fisheries, so also actively participated in the debates for finalization of the IPOAs. The UN Fish stock Agreement has been accessed and a national level Committee is overseeing the progress of implementation of the Fish Code. The Code has already been translated in to all the regional languages spoken along the coastal belt. Work on improving the legal and institutional framework to enable implementation of the provisions of these international instruments is in progress.

The Central government, which has jurisdiction over the fisheries in the EEZ, has brought out a comprehensive marine fishing policy to achieve harmonious growth of different sectors with least inter-sectoral conflicts and on the principle of stakeholder participation. An inter-ministerial Empowered Committee looks after management and development of fisheries in the EEZ. Instituting an effective monitoring, control and surveillance system (MCS) is in progress. A Vessel Monitoring System (VMS) is being introduced in the deep sea sector. Uniform fishing holidays in the EEZ along east and west coasts are in place. Limiting access for fishing through permits has ensured capacity management in the EEZ. The number of vessels that would be permitted in the EEZ during the next five years in each resource specific category has been worked and notified. The Coast Guard is vested with powers for policing the EEZ.

Conservation of aquatic resources and genetic bio-diversity is another thrust area for the next millennium. The country is party to the Convention on Biological Diversity and Biosafety protocol. Necessary safeguards are put in place for regulating cross-border movement of live aquatic organisms. Attention is paid to protect endangered marine species such as Olive Ridley turtles by declaring marine sanctuaries and no-fishing zones along their nesting sites. Turtle Excluder Devices have been made mandatory for trawlers in the vulnerable areas. Fishing for endangered species of finfishes, crustaceans and molluscs listed under IUCN is banned and studies on the vulnerable species have been taken up. Apart from areas listed under Ramsar sites, other ecological hotspots are identified for abetting pollution and restoration of fishery etc. Fighting land-based pollution and implementation of Integrated Coastal Zone Management has high priority on the country’s agenda. Apart from Environment (Protection) Act, 1986 and Rules framed there under, a landmark Coastal Regulation Zone Notification and a National Coastal Zone Management Authority for regulating the activities in the CRZ are in place.

In the aquaculture front, an aquaculture authority backed by Coastal Aquaculture Authority Act has the mandate to regulate coastal shrimp farming. As such intensive shrimp farming is banned, and only modified, improved traditional and extensive farming are permitted, with a productivity of around 2 to 2.5 t/ha/yr. Farming activity is regulated through permits so as to ensure that the activity is environment friendly.
2.5.10 Future needs

India’s future fisheries development plans are aimed at making substantial contributions to doubling of food production, improving the welfare of fishers, promoting exports and providing food and livelihood security to its rural population. The per capita availability and consumption of fish is to be increased to a level of 11 kg per annum for the fish eating population for which production and distribution has to be scaled up appropriately. All this requires scientific and technological back stopping and capacity building in key areas.

Aquaculture is recognized as an important source for meeting future demands for protein food in the country. A number of schemes have been instituted by state and central sectors to augment production from brackish-water and fresh water aquaculture sectors. The private sector has emerged as a major player in brackish-water aquaculture, particularly in shrimp farming. Responsible aquaculture and prevention and management of aquatic diseases, organic farming, cage farming, induced breeding and fattening of select species are some of the challenges to be addressed in this sector for improving productivity.

Considering the growing global demand for seafood, developing the export production with due care for food safety and product competitiveness has been embarked upon. As a backward linkage for improving hygiene and sanitation in fish handling, centrally sponsored schemes have been launched to upgrade the existing infrastructure at fishing harbours and landing centres and shrimp pealing yards. Quality upgradation in post harvest and domestic marketing sectors requires concerted efforts.

A number of schemes have been initiated by Central Government for the welfare of the fishing community, so as to provide them livelihood security through housing, insurance, and sea safety. Training, micro credit and increased participative management by the stakeholders need to be ensured. Another immediate requirement is to update the national preparedness for handling situations such as the recent tsunami, which has profound impact on the coastal communities and their livelihood. Improvements in database management and development of linkages in all sub sectors are another felt need.

2.6 Poultry

Poultry rearing has always been an integral component of livestock production system in India. The concept of composite farming production system with crop, livestock, fish and poultry production has been practiced for centuries in India. However, poultry production in India has taken a quantum leap in the last four decades, emerging from an entirely unorganized and unscientific farming practice to commercial production system with state-of-the-art technological interventions.

India, with poultry population of 489 million and estimated more than 47 billion eggs production per year, ranks among the top three countries in egg production in the world. The broiler production is growing at the rate of nearly 8-10% every year and India produces about 2.0 million metric tonnes of chicken meat annually at present. The annual
per capita availability of eggs and chicken meat has also increased from a mere 10 eggs and 146 grams in 1970's to more than 41 eggs and 1.6 Kgs respectively presently. India's share of the world trade in poultry and poultry products is very small. However, the country has come a long way during the last decade increasing its value of exports from nearly Rs. 11.00 crore in 1993-94 to around Rs. 316 crore during 2005-06.

Poultry sector, besides providing direct or indirect employment to nearly 3 million people is a potent tool for subsidiary income generation for many landless and marginal farmers and also provides nutritional security especially to the rural poor. Further, landless labourers derive more than 50 per cent of their income from livestock especially from poultry.

The Central Poultry Development Organisations have been playing a pivotal role in the implementation of the policies of the Government with respect to poultry. The mandate of the Central poultry Development Organizations has been reoriented to focus on improved indigenous birds, which lay on an average 180-200 eggs per annum and have a vastly improved Feed Conversion Ratio (FCR) in terms of feed consumption and weight gain. The Central Poultry Development Organizations have been entrusted with the responsibility of producing good quality germplasm in the form of day old chicks and hatching eggs of varieties like Nirbheek, Hitkari, Vanaraja, Shyama Cari, Chabro etc.

Besides, these organizations are imparting training to approximately 1200-1500 farmers every year both at the organizations and at farmers' door steps. These Organizations are also playing a crucial role in analyzing feed samples. Diversification of other avian species like Ducks/Turkeys/Guinea fowl/Japanese Quail etc., is also being taken up to popularise the same. Presently these Organizations are also supporting and handholding the Centrally Sponsored Scheme, 'Assistance to State Poultry Farms'.

The Central Poultry Performance Testing Centre (CPPTC), located at Gurgaon is entrusted with the responsibility of testing the performance of layer and broiler varieties. This Centre conducts one layer test for the period from 0-72 weeks of age wherein the production parameters of the laying birds received from different participants comprising of private and public sector agencies are tested. At the end of the test, data are analyzed and the reports indicating the relative performance of the entrants are published. Accordingly two broiler tests are conducted every year from 0-8 weeks age and the results are published giving full information about growth rate, feed efficiency and margin of profit from each entrant. The report is published for the utilization of the poultry industry in general, and the breeder participants in particular. This Center gives valuable information relating to different genetic stock available in the country.

A centrally sponsored scheme 'Assistance to State Poultry Farms' implemented during the Tenth Plan is being continued in 11th Plan where one time assistance is provided to suitably strengthen the farms in terms of hatching, brooding and rearing of the birds with provision for feed mill and their quality monitoring and in-house disease diagnostic facilities. Since inception, over Rs. 107 crore has been sanctioned for strengthening of 205 farms across the country.
During 11th Five Year Plan, three new programmes have been envisaged to be implemented, wherein component of 'Rural Backyard Poultry Development' will enable the backyard farmers to take up the activity in a more organized and scientific manner and the other two components 'Poultry Estates' and 'Poultry Venture Capital Fund' are aimed towards private entrepreneurs.

2.7 FORESTRY

Forestry is a major government enterprise in India which faces the challenges of dwindling forest cover area due to overpopulation, farming and environmental factors

2.7.1 Distribution

Many forests in the mid-1990s are found in high-rainfall, high-altitude regions, areas to which access is difficult. About 20 percent of total forestland is in Madhya Pradesh; other states with significant forests are Orissa, Maharashtra, and Andhra Pradesh (each with about 9 percent of the national total); Arunachal Pradesh (7 percent); and Uttar Pradesh (6 percent). The variety of forest vegetation is large: there are 600 species of hardwoods, sal (Shorea robusta) and teak being the principal economic species.

2.7.2 Strategy to increase cover

India's long-term strategy for forestry development reflects three major objectives: to reduce soil erosion and flooding; to supply the growing needs of the domestic wood products industries; and to supply the needs of the rural population for fuelwood, fodder, small timber, and miscellaneous forest produce. To achieve these objectives, the National Commission on Agriculture in 1976 recommended the reorganization of state forestry departments and advocated the concept of social forestry. The commission itself worked on the first two objectives, emphasizing traditional forestry and wildlife activities; in pursuit of the third objective, the commission recommended the establishment of a new kind of unit to develop community forests. Following the leads of Gujarat and Uttar Pradesh, a number of other states also established community-based forestry agencies that emphasized programs on farm forestry, timber management, extension forestry, reforestation of degraded forests, and use of forests for recreational purposes.

Such socially responsible forestry was encouraged by state community forestry agencies. They emphasized such projects as planting wood lots on denuded communal cattle-grazing grounds to make villages self-sufficient in fuelwood, to supply timber needed for the construction of village houses, and to provide the wood needed for the repair of farm implements. Both individual farmers and tribal communities were also encouraged to grow trees for profit. For example, in Gujarat, one of the more aggressive states in developing programs of socioeconomic importance, the forestry department distributed 200 million tree seedlings in 1983. The fast-growing eucalyptus is the main species being planted nationwide, followed by pine and poplar.
2.7.3 Conservation

The role of forests in the national economy and in ecology was further emphasized in the 1988 National Forest Policy, which focused on ensuring environmental stability, restoring the ecological balance, and preserving the remaining forests. Other objectives of the policy were meeting the need for fuel wood, fodder, and small timber for rural and tribal people while recognizing the need to actively involve local people in the management of forest resources. Also in 1988, the Forest Conservation Act of 1980 was amended to facilitate stricter conservation measures. A new target was to increase the forest cover to 33 percent of India's land area from the then-official estimate of 23 percent. In June 1990, the central government adopted resolutions that combined forest science with social forestry that is, taking the socio cultural traditions of the local people into consideration.

Conservation has been an avowed goal of government policy since independence. Afforestation increased from a negligible amount in the first plan to nearly 89,000 square kilometres in the seventh plan. The cumulative area afforested during the 1951-91 period was nearly 179,000 square kilometres. However, despite large-scale tree planting programs, forestry is one arena in which India has actually regressed since independence. Annual fellings at about four times the growth rate are a major cause. Widespread pilfering by villagers for firewood and fodder also represents a major decrement. In addition, the forested area has been shrinking as a result of land cleared for farming, inundations for irrigation and hydroelectric power projects, and construction of new urban areas, industrial plants, roads, power lines, and schools.

2.7.4 Chipko Movement

Since the early 1970s, as they realized that deforestation threatened not only the ecology but their livelihood in a variety of ways, people have become more interested and involved in conservation. The best known popular activist movement is the Chipko Movement, in which local women under the leadership of Chandi Prasad Bhatt and Sunderlal Bahuguna, decided to fight the government and the vested interests to save trees. The women of Chamoli District, Uttar Pradesh, declared that they would embrace--literally "to stick to" (chipkna in Hindi)--trees if a sporting goods manufacturer attempted to cut down ash trees in their district. Since initial activism in 1973, the movement has spread and become an ecological movement leading to similar actions in other forest areas. The movement has slowed down the process of deforestation, exposed vested interests, increased ecological awareness, and demonstrated the viability of people power.

2.8 HORTICULTURE

Horticulture is the cultivation of garden plants, fruits, berries, nuts, vegetables, flowers, trees, shrubs and turf. Horticulturists work for plant propagation, crop production, plant breeding, genetic engineering, plant biochemistry, plant physiology, storage, processing and transportation. They work to better crop yield, quality, nutritional value and resistance to insects, diseases, and environmental pollution. Horticulturalists use modern
nurseries for the production of seedlings and mother plants. These plants are propagated through different methods such as seeds, inarching, budding, veneer grafting, patch budding and soft wood grafting.

**Tamil Nadu** - This State is suitable for horticulture because of its rich bio diversity and appropriate climate. A wide variety of tropical fruits, temperate fruits, vegetables, spices, condiments, plantation crops, medicinal herbs, aromatic plants and commercial flowers are grown here.

- **Jammu and Kashmir** - The horticulture industry is the mainstay of the rural economy of Kashmir. Every year, this industry earns revenue of over Rs. 50 crores. Fruits cultivated in Kashmir include a variety of apples, pears, cherries, walnuts, almonds, peaches, saffron, apricots, strawberries and plums.
- **Orissa** - Here horticulture consists of the cultivation of fruits like pineapple, mango and cashew; vegetables like mushroom, drumstick, and onions; and spices like ginger and turmeric. Strategies by the State Government for the promotion of horticulture include supplying better quality planting material at subsidized rates, conducting training programmes; field demonstrations and encouraging cultivation at lift irrigation points.
- **Punjab** - Around 1,82,600 hectares of land were brought under horticulture crops till 2002. This area has grown a lot since then. Currently, fruits like sweet orange, kinnow, guava, peace, litchi and mango are grown in the region.
- **Maharashtra** - Horticulture involves the cultivation of fruits like banana, fig, grapes, custard apple, wood apple, jambul, pomegranate, mandarin orange, guava and sweet orange. Vegetables, medicinal plants and spices are also grown in the State.
- **Tripura** - is land of high hills and hillocks interspersed with rivers and valleys. It has moderately warm and humid climate coupled with well-distributed annual rainfall of 2500 mm. This terrain and climate is ideally suited for rain-fed horticulture. Fruits like pineapple, jackfruit, orange, litchi, cashew nut, coconut; lime and lemon are produced in abundance.
- **Assam** - Some of the popular horticultural crops grown in Assam are carambola, wood apple, jackfruit, ginger, oranges, olives, figs and bamboo shoot. Almost 75 per cent of the population of the state derives their livelihood from agriculture and horticulture.
- **Andhra Pradesh** - This State has a varied climate and is suitable for a wide range of horticultural crops. It leads in the production of citrus, chilies, turmeric and oil palm. Andhra Pradesh is also a major producer of cocoa, cashew, guava, coriander, banana, ginger and coconut.

Horticulture tips to minimize the impact of water stress are:

1. **Popularization of micro irrigation system**: Micro irrigation more popularly known as drip irrigation is an important strategy in reducing the impact of drought. The main feature of micro irrigation is the high level of efficiency in water use coupled with higher yield. If you use the same quantity of water used in
conventional methods of irrigation, nearly two times more land can be irrigated through the drip system.

2. **Use of mulches**: Soil moisture can be conserved through mulching with black polyethylene or locally available mulches, growing cover crops or inter-culturing in the orchards. These methods also check soil erosion and runoff of rainwater. Application of farm yard manure or vermin-compost for improving soil health and water holding capacity of the soil is another way to efficiently use and conserve the water that is available. Sometimes plants are covered with mulches preferably grass mulch (10-12 kg/basin) and black polyethylene mulch (100 micron) throughout the growth period. This helps in conserving soil moisture, saving water for more critical stages and reducing the weed population by 60 per cent with grass mulch and 100 per cent with polyethylene mulch. This reduces the cost of cultivation.

3. **Use drought tolerant rootstocks for Horticultural Crops**: One tool that has played an important role in making India one of the leading producers of fine quality grapes is the use of rootstocks. Rootstocks offer attractive and environmentally sound protection to vine and grapes in conditions of severe shortage of irrigation water and uncertainty of rainfall. Rangpur Lime is one rootstock that is tolerant to drought. It is also capable of bearing Phytophthora and salinity. This rootstock is recommended for areas in which the Rough Lemon rootstock is currently in use because of the large amount of water it saves.

4. **Use of shed-nets in nursery**: Keeping nursery plants under shed-nets and irrigating them through micro-jets facilitates their survival percentage and reduces irrigation needs.

5. **Rain water harvesting**: This method consists of in situ water harvesting through the opening of small trenches and contour bunding. Another technique of rainwater harvesting is the use of micro irrigation systems whereby rainwater is collected in the lower regions of the farm and later recycled to the crops.

India with diverse soil and climate comprising several agro-ecological regions provides ample opportunity to grow a variety of horticulture crops. These crops form a significant part of total agricultural produce in the country comprising of fruits, vegetables, root and tuber crops, flowers, ornamental plants, medicinal and aromatic plants, spices, condiments, plantation crops and mushrooms.

It is estimated that all the horticulture crops put together cover nearly 11-6 million hectares area with an annual production of 91 million tonnes. Though these crops occupy hardly 7% of the cropped area they contribute over 18% to the gross agricultural output in the country.

Horticultural crops play a unique role in India’s economy by improving the income of the rural people. Cultivation of these crops is labour intensive and as such they generate lot of employment opportunities for the rural population. Fruits and vegetables are also rich source of vitamins, minerals, proteins, carbohydrates etc. which are essential in human nutrition. Hence, these are referred to as protective foods and assumed great importance as nutritional security of the people. Thus, cultivation of horticultural crops plays a vital
role in the prosperity of a nation and is directly linked with the health and happiness of the people.

Fruits and vegetables are not only used for domestic consumption and processing into various products

(Pickles, preserves sauces, jam, jelly squashes, etc.) But also substantial quantities are exported in fresh and processed form, bringing much-needed foreign exchange for the country. These groups of crops also provide ample scope for achieving bio-diversity and diversification to maintain ecological balance and to create sustainable agriculture and can make an impact on the national economy in the years to come.

India with more than 28.2 million tonnes of fruits and 66 million tonnes of vegetables is the second largest producer of fruits and vegetables in the world next only to Brazil and China. However, per capita consumption of fruits and vegetables in India is only around 46kg and 130g against a minimum of about 92g and 300g respectively recommended by Indian Council of Medical Research and National Institute of Nutrition, Hyderabad. With the present level of population, the annual requirement of fruits and vegetables will be of the order of 32.58million tonnes and 83million tonnes respectively. To meet this requirement the National Commission on Agriculture has projected an area of 4m.ha. and 8m.ha under fruits and vegetable crops respectively by 2000A.D.

The recent emphasis on horticulture in our country consequent to the recognition of the need for attaining nutrition security and for more profitable land use has brought about a significant change in the outlook of the growers. The need for great utilization of available wastelands against the background of dwindling water and energy resources has focused attention to dry land, to arid and semi-arid tracts and to horticultural; crops which have lesser demands on water and other inputs besides being 3 to 4 times more remunerative than field crops.

It is estimated that India has 240 million acres of cultivable wasteland, which is lying idle, which can be brought under orchard crops without curtailing the area under food crops. The country has abundant sunshine throughout year, surplus labour and widely varied agro-climatic conditions which offer high potential for successful and profitable commercial horticulture

2.9 FLORICULTURE

After liberalization, the Govt. of India identified floriculture as a sunrise industry and accorded it 100 percent export oriented status. Owing to steady increase in demand of flower floriculture has become one of the important Commercial trades in Agriculture. Hence commercial floriculture has emerged as hi-tech activity-taking place under controlled climatic conditions inside greenhouse. Floriculture products mainly consist of cut flowers, pot plants, cut foliage, seeds bulbs, tubers, rooted cuttings and dried flowers or leaves. The important floricultural crops in the international cut flower trade are rose,
carnation, chrysanthemum, gargera, gladious, gypsophila, liastris, nerine, orchids, archilea, anthuriu, tulip, lilies.

Present status and growing trade is still in infancy. Floriculture in India, is being viewed as a high growth Industry. Commercial floriculture is becoming important from the export angle. The liberalization of industrial and trade policies paved the way for development of export oriented production of cut flowers. The new seed policy had already made it feasible to import planting material of international varieties.

The government of India offers tax benefits to new export oriented floriculture companies in the form of income-tax holidays and exemption from certain import duties. Agricultural and Processed Food Products Export Development Authority (APEDA), responsible for export promotion and development of floriculture in India, grants subsidies for establishing cold storage, precooling units, refrigerated vans and green houses, and air freight subsidy to exports. It has been found that commercial floriculture has higher potential per unit area than most of the field crops and is therefore a lucrative business.

According to a report of the APEDA, the total area under flower crops was estimated around 34,000 hectares, which included 24,000 hectares under traditional flowers such as marigold, jasmine, aster, rose, chrysanthemum, tuberose and 10,000 hectares under modern flowers like cornation, rose, gerbera, gladiolous, anthurium.

Returns from floricultural products were estimated at Rs.205 Crores, which included Rs.105 Crores from traditional and Rs. 100 Crores from modern flowers. The data collected by National Horticultural Board (NHB) (1994-95) show that estimated area and production were 53,000 hectares and 4 lakh tonnes. In 1995-96, there were mainly 230 export-oriented units in India. More than 50% of the floriculture units are based in South zone mainly in Karnataka, Andhra Pradesh, and Tamil Nadu. Also West Bengal, Maharashtra, Rajasthan have large areas under floriculture. The domestic flower production goes on increasing annually. Technical collaborations with foreign companies have been approved for India, in order to increase total share in the floriculture world trade.

**2.9.1 Conductive conditions**

India is endowed with diverse agro-climatic conditions like good quality soils, suitable climate, abundant water supply, low labour cost, proximity to market in Japan, Russia, South-East Asia, Middle-East Countries.

Subsidy on airfreight for export of cut flowers and tissue-cultured plants is allowed by the Government. Freight rates are Rs.10 per kg for export to Europe and Rs. 6 per Kg for export to West Asia, Southeast Asia whichever is less.
Import duties have been reduced on cut flowers, flower seeds, tissue-cultured plants, etc. Setting up of walk in type cold storage has been allowed at the International airports for storage of export produce.

Direct subsidy upto 50 percent of the precooling and cold storage units is available, as well as subsidy for using improved packaging material is given by APEDA.

Eleven-model floriculture centre units and two large centres, 20 tissue culture units have been established by Ministry of Agriculture.

Refinance assistance is available from NABARD to a number of hi-tech units at reasonable interest rate.

2.9.2 Export constraints

In spite of an abundant and varied production base, India’s export of floricultural product is not encouraging. The low performance is attributed to many constraints like non-availability of air space in major airlines, since most of the airline operators prefer heavy consignments.

The existing number of flights during the peak seasons is not sufficient for export purpose.

In order to overcome the problems of floriculture, attention must be focused on –

- Reduction in import duty on planting material and equipment
- Airfreight should be reduced to a reasonable level. Sufficient cargo space may be provided in airlines. Establishment of model nurseries far supplying genuine planting material
- Co-operative florist organizations should be established at regional level. Training centres for diploma course on the pattern of ITI for training the personnel in floriculture should be set up.
- Exporters should plan and monitor effective quality control measures right from production to post harvesting, storage, and transportation. An analysis of strengths, weaknesses, opportunities of the floricultural industry shows that India has immense potential for export of floricultural products.

Though the global floriculture industry is growing comparatively at a faster pace than in India, still a scope exists to bridge the demand and supply gap.

Floriculture is the art and knowledge of growing flowers to perfection. Being a branch of horticulture, it deals with the cultivation of flowers and ornamental crops from the time of planting to the time of harvesting. It also includes production of planting materials through seeds, cuttings, budding, grafting and marketing of flowers and flower produce.
In Meghalaya, flower lovers originally practiced floriculture as a hobby. Today, the growing demand has lead to flowers also being grown for commercial reasons. Meghalaya is known for a variety of rich flora and species of orchids that grow wild. The government has come out with a scheme to provide the growers with disease free planting material, organic/inorganic fertilizers, plant protection chemicals, garden tools and implements for a minimum area of 2000 square metres along with a package of practices for commercial production. A few of the recommended ornamental crops are orchids, chrysanthemums, gerberras, carnations, liliums, strelitzia reginae, gladiolus, asters, marigolds, statice, gomphrenas, helichyrsums, zinnias, roses and different kind of house plants.

In Tamil Nadu, flowers such as rose, malligai, chrysanthemum, marigold, jathi mali, marikolundu and carnations are grown. Edward Rose and Andhra Red Rose are two varieties of roses grown in the plains of the State. They need well-drained sandy loam soil.

Consumption of flowers in the southern States is much higher than in the northern States. Flowers are used by florists, flower rentals, perfume industries and as garlands. Centres where modern flowers are in demand are big cities like Mumbai, Pune, Bangalore, Chennai, Hyderabad, Delhi, Chandigarh, Lucknow and Calcutta.

In the Andaman and Nicobar Islands there are around 2000 species of flowering plants, of which nearly 215 are endemic to these islands. These flowering plants include around 110 species of orchids. Here plantation crops like coconut are used as an intercrop for growing orchids. Coconut plants also provide shade to the orchids. Other flowers, ferns, cycads, succulents, bamboo and ornamental medicinal plants also grow naturally in forests.

In Orissa, floriculture involves the growing of flowers like rose, crossandra, jasmine and marigold.

In Punjab floriculture mainly includes the cultivation of different species of gladiolus. Village Majra, near Chandigarh and village Dappar near Patiala are main centres of gladiolus production in Punjab.

Flowers that are cultivated in Andhra Pradesh for floricultural purposes are the rose, jasmine, chrysanthemum and crossandra. The main districts that produce these flowers are Hyderabad, Rangareddy, Guntur, Prakasam, Kurnool, Cuddapah, Ananthapur and Chittoor.

The cool temperate climate of Jammu and Kashmir makes it the ideal place for growing flowers. Some of the flowers cultivated here are wisterias, tulips, carnations, dahlias and lilies.

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**2.10 RURAL INDUSTRIALIZATION – PROBLEMS AND ISSUES**
Village and cottage industries have a popular role in the Indian economy due to scarcity of physical capital, unemployment and under employment, regional imbalances and disparities, inequalities in the distribution of income and wealth, unutilisation or under utilisation of rural resources. The government has accorded utmost importance for the growth of these industries through five year plans and industrial policies because of their high employment intensity. Since employment is a means to achieve growth with social justice, a number of programmes and schemes have been designed and implemented for their development since the dawn of the planning era. It will help in the redistribution of income and wealth. Improving the quality of life for rural people is an enormous and challenging problem.

Solutions to this problem are to be found within the rural areas. In essence, it comes down to generating employment, increasing income, harnessing and utilising the primary and secondary resources that the rural areas are endowed with. Diversification of manpower is required from already saturated agricultural sector to industry and secondary sectors. It has been recognised that in the long run agriculture and other land based activities, even with a high rate of growth, will not be able to provide employment to all the rural workers at adequate levels of income. Over one fifth of the rural workers are engaged in non agricultural activities. This proportion has shown a remarkable increase in

### 2.10.1 Issues and strategies

#### Formulation of Rural Industrial Policy

Rural Industrialisation means encouraging location of large and small scale units away from urban areas or planned shifting of units from urban areas to rural areas. But it is not likely that the existing urban industrial structure can be disturbed. Therefore under rural industrialisation concept, the state should encourage industrialisation in rural areas on a massive scale. It is immaterial whether it is small, village industries or large scale industries. A comprehensive policy should be so evolved that industries are encouraged in rural areas hereafter. A vast reservoir of rural resources should be harnessed. Govt. should create full fledged infrastructural facilities in rural areas before initiating efforts in this direction. Rural industrialization aims at all-round development of an area as well as people living in such areas. This can be realized only through systematic adoption of improved technology.

There should be a harmony among primary sector, secondary sector and tertiary sector in rural industrialization. The focus of rural industrialization should be alleviation of rural poverty by creating wide employment opportunities in rural sphere. At present, there is no policy directive on rural industrialization. A number of Govt sponsored programmes like Khadi and village industries. Hand loom, sericulture, coir, IRDP, DPAP, PMRY, DRIP, DAAP, Artisan employment guarantee programme are in vogue.

These programmes have different set of objectives, pattern of organization, and system of assistance. The focus of these schemes is either to develop industries or to develop target
group but not to promote rural industrialization. Patel (2004) is of the view that lack of coordination among the various poverty alleviation programmes contributed least to the fight against poverty and unemployment in rural horizon. There is no coordination among these programmes. This has affected concerted action in the implementation of rural industrialization programme. In other words, Central Govt plays a leading role in certain programmes and State Govt act an implementing agency of Central Govt. In certain schemes State Govt. play a leading role while institutional financing agencies dominate in some states? Therefore confusion arises as to who is accountable to whom. Manon (2007) has observed in his article that too many schemes, too many government agencies dual governments, high leakage of financial assistants and role ambiguity made little impact on abject rural poverty and growing rural unemployment. A clear-cut policy for rural .industrialization is to be evolved which should address the likely pitfalls in the road to rural industrialisation.

Reversal of the Trend – Towards Decentralization

Rural industrialization is indubitably a noble idea. While the economic development has gone so far towards capital intensive industrialization, centralization and high degree of unplanned urbanization, very exercise of evolving policies and undertaking efforts towards decentralization and rural industrialization seem to be irrelevant in today’s context of liberalization. It is doubtful whether the present Govt would have political will and pursue rural industrialization and decentralization. In other words, open economy presupposes non-invention of Govt. while successful rural industrialization warrants state intervention. Therefore the issue is how to reconcile these two diametrically opposite view points.

Multiplicity of Technologies and Reservation of Industries

Existence of plurality of technologies in every field is threatening rural industrialization. For example we have hands spinning, as well as power-spinning and hand loom and power loom, weaving. This diversity is found in food processing, building materials, leather goods, soap making carpentry and blacksmithy, paper making, food preservation and processing and so on. Large units that use state-of-the art technology produce goods on a mass scale. This sector is producing goods of necessity to meet the demands of growing population and for satisfying the urge to improve standard of living and quality of life while small scale industries not only produces but also provide employment to a significantly large number of people and create purchasing power in the economy. Ganesan (2006) Small scale units in Cuddalore districts proved to be a boon to rural and village artisans in Cuddalore district and it has created 8978 jobs in 1428 units and contributed rupees 10,282 crores worth export during 2005 and 2006.

This shows the potential of rural and village industries in fighting poverty and unemployment. There is no question of accepting one and rejecting the other. Both have to be supported and conditions are to be created for their sustained development. While small scale industries as well as large scale industries engage in the production of similar items, a conflict arises as to which industry needs to be supported. The large scale
industries contribute to massive production, decrease employment opportunity due to automation and finally lead to unplanned urbanization, ecological and environmental degradation while rural opportunities for the rural masses and brings all its attendant advantages to the rural scenario. So far as India is concerned, rural industrialization cannot be ignored as something irrelevant in today’s context. Thus choice of technology is crucial issue.

**Nature of Employment**

As for nature of employment, it is to be decided as to the type of employment suited for promoting rural industrialization. There are several patterns of generating employment in rural areas. They include self-employment, wage employment in industrial units, wage cum self employment and establishment of rural industrial estates. Each of the above method has its own merits and drawback. Alagappan (2004) who studied employment pattern in rural industries located in Keerapalayam panchayat concluded that wage cum self employment pattern of wage payment proved to be effective. Therefore the pattern of employment generation is to be decided after weighing the relevant factors dominant in each pattern of employment generation.

**Organizational Difficulties**

Rural population being highly scattered and unorganized, organizing and institutionalizing the activities of rural population and proving work on a regular basis are really challenging task. Either work is to be provided by the units to them to be done at their residence or industries are to be started in the rural areas in order to bring them into an organized entity. Some of the efforts undertaken by the Govt. in the past have not made any perceivable impact on the employment generation in rural India. Industrial co-operatives he mission of rural industrialization for different crafts in pursuance of the recommendation of Karve committee 1955. These societies mobilized the scattered rural skill to a certain extent. But it failed in its re-mission.

As these societies could not ensure regular employment and provide fair wages, members were withdrawing from the societies. As a result most of the societies remain currently defunct. Another experiment done was formation of multi purpose block level co-operatives by Govt. of Maharashtra. These societies ended up becoming mere credit societies. Mere provision of credit could not promote rural industrialization. Third experiment was formation of institutions under societies Registration Act 1860. This type of institution was started by Khadi. This entity is currently thriving due to Govt. patronage. Management and workers assume significance in these institutions. Since the societies can not afford to pay good pay scales, it can not get a team of talented, experienced and capable administrative staff. Therefore it suffers on administrative front.

Paying higher pay scale would result in increasing the final cost of the product and the consequently, the State would have to come forward to support them. Besides there is a need to evolve a separate labour code for unorganized rural labour since the present
labour laws are oriented towards organized sector. Maran (2007) has suggested evolution of labour code for unorganized rural workers for improving the living standard of working masses in rural areas. In this background, it is suggested that the unorganized rural work force may be converted into organized force through self - help group. These groups may be financed either directly by banks and institutions or through voluntary agencies or through Non-Govt. organizations. The State has to put in place a marketing structure for marketing the produce of self help group on a massive scale. Thus organization of unorganised work force through self help group mechanism appears to be a viable solution.

**Technology Gap**

While organized industry is fast upgrading its technology, there is no technology up gradation in rural industries. Around 60 per cent of artisans are still carrying on their traditional occupation in a primitive way. National Research and technical institutes have done little for the village industries. Infect there is more urgent need for R & D in rural industrial sector. Other wise, it is likely to be irrelevant and obsolete. The fact that still large number of artisans carry on the work in most antiquated methods highlight the failure of transfer of technology. This discourages new persons entering into this occupation cutting across the caste barrier. Therefore mechanical and engineering talents have to develop suitable technology which would be modern and efficient and which would absorb greater number of people in work.

In this context Sushil Kumar (2005), it is pertinent to mention the efforts undertaken by IIT Delhi and Mumbai recently. The former developed looms, hand tools washing and drying plants, embossing machines trimming and moisture measuring devices for use by the weavers in the carpet industry and organized awareness programme to promote new technologies among them. So far 500 weavers were trained in the various carpet belts. Training cum awareness programme is still in progress.

Further about 500 looms and 1000 tool kits were distributed to weavers at subsidized price. IIT Mumbai developed tools and technologies for processing of bamboo and cane. About 400 sets of improved tool kits have been fabricated which were distributed to artisans at the subsidised rate in North - East and Kerala. Indian Institute of carpet technology has been training the carpet designers in Computer-Aided-Design application, colour matching and testing equipments.

The efforts of similar nature should be undertaken by Technical Universities Specialised Institutes for different crafts and other Industrial Technical Training Institute and the like. This would help the artisans shed antiquated production practices and embrace modern production practices. Planning commission ought to earmark adequate funds for promoting research endeavour in rural industrialization. A mechanism ought to be put in place to fund directly the research endeavours directed towards technical up-gradation of rural and village industries.

**Credit Gap**
It is observed that most of the rural industries are starved of financial resources. Ranga Rao (2007) empirically proved the apathy of commercial banks towards rural credits ever since our country followed globalization path. He further stated that the loan waiver is the price paid by the Govt for the neglect of the rural sectors. The public sector outlays are hardly one per cent and institutional credit is negligible. Therefore it is necessary to continue to provide concessional credit to encourage rural industrialisation. As suggested earlier, Govt. has to redefine small scale and village industries for concessional financing and other privileges from financing agencies.

2.11 AGRO BASED INDUSTRIES

Agro processing could be defined as set of techno economic activities carried out for conservation and handling of agricultural produce and to make it usable as food, feed, fibre, fuel or industrial raw material. Hence, the scope of the agro-processing industry encompasses all operations from the stage of harvest till the material reaches the end users in the desired form, packaging, quantity, quality and price. Ancient Indian scriptures contain vivid account of the post harvest and processing practices for preservation and processing of agricultural produce for food and medicinal uses. Inadequate attention to the agro-processing sector in the past put both the producer and the consumer at a disadvantage and it also hurt the economy of the Country.

Agro-processing is now regarded as the sunrise sector of the Indian economy in view of its large potential for growth and likely socio economic impact specifically on employment and income generation. Some estimates suggest that in developed countries, up to 14 per cent of the total work force is engaged in agro-processing sector directly or indirectly. However, in India, only about 3 per cent of the work force finds employment in this sector revealing its underdeveloped state and vast untapped potential for employment. Properly developed, agro-processing sector can make India a major player at the global level for marketing and supply of processed food, feed and a wide range of other plant and animal products.

2.11.1 Growth of Agro Processing sector

Starting with a small number of processing facilities in 1950-51, a fairly well spread network of processing facilities has developed in the Country. Various estimates suggest the number of processing units in 2000-2001 as: atta chakkis and small hammer mills - 2,70,000, rice hullers - 90,000, rice shellers - 11,000, huller-cumshellers - 12,000, modern rice mills - 30,000, bullock/electricity operated oil ghannis - 2,00,000, oil expellers - 55,000, dhal mills - 12,000, roller flour mills - 700, rice flaking and puffing units - 2,000, bakery units - 54,000, solvent extraction plants - 700, vanaspati plants - 100, fruits and vegetables processing plants - 5,000, dairy plants - 450, cold storage units - 3,000, licensed units in organized sector for meat processing - 165, pork processing units – 144, fish processing units - 18 and so on. Major problems faced by these units have been:
(a) low capacity utilization, (b) poor recovery of the finished product from the raw materials, (c) problems of arranging adequate working capital and its management, (d) low product quality and (e) unreliable assured power supply. Strong R&D support will have to be continued to overcome these and many other problems to ensure that our agro-processing technology becomes competitive at the global level. As stated earlier, in spite of the problems, agro-processing technology in India has continued to make steady progress towards modernization. Table below gives information of the latest development trends in respect of major crops/crop groups.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Crop/ Item</th>
<th>Recent products, processes, trends and technologies</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rice</td>
<td>Fully automatic modern rice mills</td>
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<tr>
<td></td>
<td></td>
<td>Partially cooked/quick cooking rice</td>
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<td></td>
<td></td>
<td>Breakfast cereals and value-added products</td>
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<td></td>
<td></td>
<td>Attractive packaging and branding</td>
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<tr>
<td>2.</td>
<td>Wheat</td>
<td>Fully automatic roller flour mills</td>
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<td></td>
<td></td>
<td>Whole bran wheat flour</td>
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<td></td>
<td></td>
<td>Fortified wheat flour</td>
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<tr>
<td></td>
<td></td>
<td>Attractive packaging and branding</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Large number of baked products</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Automatic chapati making machines</td>
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<tr>
<td>3.</td>
<td>Maize</td>
<td>Corn flour-packaged and branded</td>
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<tr>
<td></td>
<td></td>
<td>Corn flakes and value-added products including ready-to-eat snacks (salted &amp; sweetened)</td>
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<tr>
<td></td>
<td></td>
<td>Starch material, corn oil with specific consumer desired attributes</td>
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<td></td>
<td></td>
<td>Cattle feed</td>
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<td></td>
<td></td>
<td>Baby corn</td>
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<tr>
<td>4.</td>
<td>Coarse Cereals</td>
<td>Large, automatic corn processing plants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Value-added products including breakfast foods &amp; extruded fortified tasty products</td>
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<td></td>
<td></td>
<td>Industrial raw materials</td>
</tr>
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<td>5.</td>
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**2.11.2 Crop and commodity wise status of Agro-Processing industries and problems**

The commodity-wise growth of agro-processing industries in the country during the years 1950 to 2000 has been as given below.

**Rice Processing Industry**

Starting with 20.6 Mt of rice production during 1950-51, the country has come a long way to produce about 89.48 Mt of rice in the year 1999-2000. Similarly, in processing sector, the technology has undergone significant changes. Earlier, hand pounding, pedal Table 3. Recent trends in agro processing technologies S.No. Crop/ Item Recent products, processes, trends and technologies

1. Rice Fully automatic modern rice mills Partially cooked/quick cooking rice Breakfast cereals and value-added products Attractive packaging and branding
2. Wheat Fully automatic roller flour mills Whole bran wheat flour Fortified wheat flour
Attractive packaging and branding

2. Large number of baked products

3. Maize Corn flour-packaged and branded Corn flakes and value-added products including ready-to-eat snacks (salted & sweetened) Starch material, corn oil with specific consumer desired attributes, Cattle feed, Baby corn, Large, automatic corn processing plants

4. Coarse Cereals Value-added products including breakfast foods & extruded fortified tasty products Industrial raw materials

5. Pulses Automatic processing units for pulses with driers, colour sorters and packaging unit, Attractive consumer packaging with branding, cold storing of processed pulses, Snack foods and other value added products

6. Soybean Production of full fat soy flour/enzyme active soy flour for bakery and fortified foods Ready-to-eat snack foods operated system and Engleberg huller units were common for milling of paddy. By the year 1998-99, there were nearly 30,000 modern rice mills using rubber rolls for paddy dehusking. Of these, more than 5,000 are large rice mills with parboiling facility and nearly 100 have colour sorters for removal of discoloured rice for export market. Innovations in rice processing include improved process of parboiling developed at IIT, Kharagpur; CFTRI, Mysore; PPRC, Thanjavur and other R&D centres. Starting from sun drying, the technology for drying of paddy now includes use of a variety of driers, specifically for parboiled paddy. Continuous flow LSU type driers have been most commonly used units followed by tray driers (batch type).

Thermic fluids are used as medium of heat transfer for heating the air used for drying in a large number of rice mills. Though efforts have been made to improve the rice hullers, limited success was achieved in improving their performance with respect to reduction in broken percentage. Rubber roll technology for dehusking has now been well established. Efforts are ongoing to find use of Teflon to replace rubber rolls for economy.

**Wheat Processing Industry**

Wheat is a major crop of India. In the year 1950-51, the country produced 6.5 Mt of wheat that has increased to 76 Mt by the year 2000-2001. India has emerged as the second largest producer of this cereal in the world. Wheat contains 12% bran, 3% embryo and 85% flour. It is mainly processed for flour (atta), maida, suji and dalia. In last 50 years, harvest and post harvest technology of wheat has advanced substantially. The most significant development has been the use of self propelled harvester combines used for harvesting and threshing of wheat. From a small figure of about 20-30 combines during 1950-51 imported from USSR by the State Farm Corporation of India, the number has now grown to nearly 6,000 combines. In the year 1998-99, there were about 27 lakh atta chakkis (7.5-10 kW rating) and 700 roller flour mills in the country. This number has risen from 53,000 atta chakkis and 200 roller flour mills in 1971-72. The figures were much lower 50 years back.

The industry could grow on account of R&D inputs starting from the design and development of a variety of threshing machines. Mud bins, wooden plank and mud
plastered bins, gunny bags and metal bins have been in use by the farmers for storage of wheat for food and for seed purposes. The traders and government agencies use gunny bags and godown type structures for storage of wheat. For transit level storage, CAP structures have been in use. Metal bins have gained popularity among farmers in the capacity range of 0.2-1.0 tonne of grain storage. As wheat is usually harvested at low moisture content, drying has not been a major problem except for untimely rains.

A number of commercial organizations have been offering processing units for handling, cleaning, grading, drying, storage, treatment and bagging of wheat for seed and food applications. Wheat is now increasingly being used in the form of bread, biscuits, suji and atta. Wheat flakes and puffed wheat as breakfast cereals has been gradually picking up. In the area of wheat milling, Central Food Technology Research Institute, Mysore; Central Institute of Agricultural Engineering, Bhopal and a number of other R&D institutions have developed mini flour mills for higher efficiency in small scale. Traditionally used smaller size atta chakkis may face problems of declining clientele. Better mechanized chakkis (with lower pollution level and better energy efficiency) are likely to increase in number. The number of roller flour mills is also likely to increase steadily; however, majority of the mills may continue facing the problems of low capacity utilization and working capital constraints. These units would need to function through vertical integration of operations for sustaining profitability and achieve cost reduction through appropriate automation and computerization. Increase in demand is also expected in grain handling machinery, silo systems in grain markets and seed processing machinery.

**Processing of Coarse Cereals**

Production of coarse cereals has risen from 15.4 to 32.0 Mt between 1950-51 and 2000-2001. The growth has not been as rapid as in case of wheat and rice. It is because of low profitability of these crops for farmers. Till 1950s, we were dependent on manual methods of harvesting of these crops, bullock treading, storage in mud bins and gunny bags and milling by manual chakkis or water mills. By the year 1998-99, power operated equipment were available for all operations including threshing, pearling and milling. For storage of coarse cereals, metal bins have been designed at IGI, Hapur; CIAE, Bhopal; CFTRI, Mysore; PAU, Ludhiana and several of the other R&D Centres. For drying of freshly harvested HYV sorghum or maize, hot air driers using agriculture residue as a source of fuel are now in use.

Technology has also been developed for production of value-added products from coarse cereals such as extruded snacks developed from ragi at CFTRI, Mysore; ragi based snacks at UAS, Bangalore and IIT, Kharagpur; corn products at GNDU, Amritsar; ready to-eat traditional foods with storage life of 6-9 months at DFRL, Mysore and sorghum-soybean fortified foods at IIT Kharagpur. The trends indicate that coarse cereals are now increasingly used as cattle feed, speciality/occasional foods, and industrial products such as starches. Efforts are required to develop high yielding varieties of coarse with desired characteristics for different uses and to explore new food uses. Safe storage of the flour
produced from most of the coarse cereals has been a problem due to its high degree of perishability. This problem needs to be solved.

**Processing of Pulses**

India produced 8.4 Mt of pulses in the year 1950-51. The production grew to a level of about 14 Mt by the year 2000-2001. Starting with nearly 500 dhal mills in the country in 1950-51, there were about 15,000 dhal mills of 100-500 TPD capacity in the year 2000-2001. Pulses were generally stored in gunny bags or in small tin containers under straw cover during 1950s. By the year 2000-2001, metal bins and gunny bags (with profilactic treatment by insecticides) were in use. Research at CIAE, Bhopal; CFTRI, Mysore; JNKVV, Jabalpur and GBPUA&T, Pantnagar has revealed that pulse grains need to be stored at 20-22 degree Celsius in partially airtight containers at 8-10 per cent moisture content for long duration storage. A number of plant based mild insecticides and insect repellents (such as, neem seed powder) have been developed for safe storage of seeds. In the area of milling of pulses, CFTRI developed a dhal mill that has the advantage of not being dependent on natural sun shine. It involves subjecting the pulse grain to high temperature (120 degree Celsius) for short time and the dehusking by carborundum rollers resulting in higher dhal recovery. For small entrepreneurs in rural areas, dhal mills have been designed at CIAE, Bhopal; PDKV, Akola; IIPR, Kanpur, TNAU, Coimbatore; GBPUA&T, Pantnagar and CFTRI, Mysore.

These units in specific regions have gained popularity as these are low investment machines which can be owned and operated with low risk. In a number of dhal mills, improved machinery including cleaners, graders, magnetic separators, washers, driers, polishers, colour sorters and packaging systems are being used. With complete phasing out of hand operated dhal chakkis, commonly used during 1950s, the technology has turned fully mechanized and more-and-more urban based. There is a need to evolve more efficient machines and processes for pre-treatment of the grain, dehusking, sorting, polishing and packaging in order to improve dhal recovery and consume less energy. Also, there is a need for product diversification and development of technology for quick cooking and ready-to-eat dal.

**Oilseeds Processing**

Besides, animal based fat specifically obtained from milk and milk products, edible plant oils have been the major source of oils and fats for most of the population in the country. In the year 1950-51, the country produced 5.2 Mt of oilseeds. Production by the year 2000-2001 had increased to 24.5 Mt. In the year 1950-51, most of the oilseeds were crushed in either bullock operated oil ghanies or a few mechanical oil expellers. Both of these resulted in high volume of edible oil left in the cake. By the year 2000-2001, there were nearly 2.5 lakh oil ghanies, 60,000 oil expellers and 700 solvent extraction plants. Besides, there were 200 oil refining units in the country and 100 units for production of hydrogenated oil (Vanaspati). Per capita availability of edible oils is still very low at 8.0 kg per capita per year in the country. Out of this, 2 kg/capita is imported oil.
Processing of Fruits and Vegetables

Joint effort of R&D institutions, farmers, government agencies and the trade has resulted in India emerging as a major producer of fruits and vegetables in the world. In the year 2000-2001, the country produced about 45 millions tonnes of fruits and 80 millions tonnes of vegetables. It was next to China in production of vegetables and topped in production of fruits. However, the growth in post harvest sector has not kept pace with the production. Even during the year 2000-2001, there were only 6,000 fruits and vegetable units in the country that had grown from a figure of about 1,000 during 1950-51. Less than one per cent of the total produce was processed, though the installed capacity of the processing industry has grown steadily from 0.27 Mt in 1980 to about 3 Mt in 2000-2001. Significant developments in technology include better understanding of the process of ripening of fruits, optimum harvesting time, pre-cooling of freshly harvested produce, cold storing of the raw fruits and vegetables, sorting, cleaning, waxing, packaging technology for fruits. At CFTRI, DFRL, IIHR, Bangalore; IARI, New Delhi; GBPUA&T, Pantnagar; IIVR, Varanasi and HPKV, Palampur; a number of technologies have been developed. Most significant work has been recorded in the technology for ripening of the fruits under controlled conditions. Production of juices and value-added products including jams, jellies, pickles, canned products etc. has become a commercial success. The industry using indigenous technology includes units engaged in juice extraction, concentration of juices, canning and production of several of the products like jams, jellies, canned fruits, dried vegetables etc. Technology is still being imported for establishment of large scale exported oriented units for production of items like banana paste, concentrates of various fruit juices, sorting, cleaning, washing, waxing and packaging of raw fruits and vegetables.

Sugarcane Processing Industry

Sugarcane production was 310 Mt in the year 2000-2001. About 80% of the cane produced is milled, about half for the production of refined white sugar in the organized sector with the sugar mills located in the production catchments in public, private and cooperative sectors and about 42% for the production of Jaggery and Khandsari. Based on sugar recovery, minimum price scheme has been introduced. Mills have loose tie-up with the growers; some of them provide critical input support to the growers. Apparently, it is working well. But there have been cases where farmers burnt their crops in the absence of remunerative prices.

For Jaggery, canes are crushed, clarified and concentrated. Gur as sweetener has better nutritional profile than white sugar. It is possible to refine the process and the product for greater competitiveness and realize export potential specially where people of Indian origin are located. Energy efficient furnaces, concentration pans, clarificants, moulds and storage are needed for Gur. Khandsari units used open pan in place of vacuum pans for concentration and the sugar obtained is of lower quality compared to white sugar from mills. Sugar recovery in Khandsari is much lower. These units depend on grid supply or diesel generators for mechanical/electrical power or both when grid power or both when grid power supply is erratic and diesel gensets are kept as standby power sources. This
increases the cost of production of Khandsari. Bagasse, tops, dry leaves and molasses are by-products. Modern sugar mills with co-generation meet their entire energy needs, both thermal and electro mechanical from these bagasse fired boilers – steam turbine units. They feed extra power to grid or save 15-20% bagasse for the use as feedstock or paper making. Jaggery promotional and regulatory measures have been taken by the Government to improve quality and production. Large number of sugar mills is using outdated processes and equipment; some of them not only use entire bagasse but also use wood.

**Cotton Processing Technology**

Cotton is a natural textile fibre. Traditional cotton textile industry could not face onslaught of modern high speed spinning, weaving and surface finish technologies. Small scale textile industry supported by Swadeshi and Khadi and Village Industries Commission face serious labour problems also. Cotton seeds are valued as feed and oilseed and the stalks are used as fuel. However, stalks yield excellent paper and pulp, particle boards and microcrystalline cellulose (MCC). Cotton hulls also yield good particle board and furfural. Cotton willow dust can be used for production of bio-gas. Cotton wastes can be used for mushroom production. There is scope for income and employment generation if cotton stalks are utilized for pulp and paper making.

**Processing of Jute**

Jute has the distinction of having ushered India into industrialization era. Both jute production and manufacture of jute-based products are highly labour intensive, concentrated mostly in Eastern India. Mini jute carding and spinning mills have now been developed which allow decentralized production of utility items from jute but these are not popular yet. For each tonne of jute, 2-3 tonnes of jute sticks are produced. Chemically these resemble hardwood. Sticks are traditionally used as fuel wood and low cost structural material. Jute sticks yield excellent particle boards and the technologies are now fully commercial. Jute sticks are a good feedstock for paper pulp. The sticks can also be used as fuel for steam and power generation.

**Processing of Animal Produce**

Meat and poultry production in India has been about 4.6 Mt per year with goats and sheep contributing 54%, buffalo and cattle 26%, poultry 13% and pig 7%. It is mostly used fresh. Efforts are on to develop infrastructure for export of both fresh and processed meat and poultry. Production is essentially decentralized and rural based. Poultry has done well remaining in rural sector and developing network of marketing in distant remunerative markets. Hygiene in slaughter houses and use of blood, viscera and other wastes is not satisfactory. The meat from culled birds, goats and buffaloes is tough textured, better suited for processed meat products. However, there is no tradition of using processed meat products in India, yet.

**Fish & Fish Products Processing**


India, with its 7,500 km long coastline and an exclusive economic zone of 2.02 million square km; 191,024 km of rivers & canals and 4.4 million hectares of reservoirs and fresh water lakes has an enormous potential for fisheries. In 1999, the country had an estimated 1,81,284 traditional fishing crafts; 44,578 motorized traditional crafts, 53,684 mechanized fishing boats and about 200 deep-sea vessels in operation. Fish processing in India is done almost entirely for export. Open sun dried fish and fish meal are the only major exceptions. At present India has – freezing units, - cold stores, - ice plants, - canning units and – fish meal plants. Capacity of most of these is processing and storage units in small when compared to the facilities in fish processing industry in technologically advanced countries. The total fish processing and storage facility in India grossly is inadequate compared to the potential for fish production and processing. Inland fisheries need low cost palletized feeds and special containers to transport fingerlings and fish. More rearing ponds are needed. Techniques to reduce seepage loss of water have to be introduced. Obsolete fishing gear needs replacement with better gear. Extensive network of refrigerated handling, transport, storage and retailing has to be put in place. Also, we have to make better use of fish waste and by-products.

**Processing of Commercial Crops**

The commercial crops include spices, condiments and crops such as gorgon nut (*makhana*), water chestnut, bettle leaves, tobacco etc. Post harvest operations of these crops are highly energy intensive and there is a scope for reducing energy consumption and improvement of quality through proper cleaning, grading, drying/dehydration, milling, grinding and other operations. India has been a leading producer, consumer and exporter of spices like black pepper, cardamom, chilies, spice oils and oleoresins. It produces about 3.0 Mt of spices valued at over Rs. 60,000 million. About 7% of the total production is exported. Contribution of R&D to PHT of spices includes equipment and processes for cleaning, grading and packaging of whole spices and production of value-added products such as oleoresins and spice oils. Institutions like CFTRI, DFRL, Indian Institute of Spices Research and some of the SAUs including TNAU, Coimbatore have contributed significantly to this development. Projected world trade in spices in 2001 AD was estimated to about 6.25 lakh tonnes, valued at US$ 3 billion and projected export from India at that time was about 10% of the world trade.

To achieve and maintain India’s share in the trade, the quality of spices and their products will have to be improved. New products like dehydrated pepper freeze dried green pepper, ginger candy, ginger beer/in-brine/ squash, ginger flakes have to be developed. Development of internationally accepted quality products, packed under hygienic conditions need attention in this context. Similarly, in the area of PHT of other crops, contribution of R&D basically has been on raw materials refinement, product quality enhancement and diversification.

**Activity 2**

1. Write an essay on livestock resources and systems in India.
2. What do you understand by white revolution? Discuss its relevance in boosting up the livestock system in our country.
3. Discuss the problems of rural industrialization in India.
4. Write short notes on the following in Indian context:
   - Fisheries
   - Poultry
   - Horticulture
   - Floriculture
   - Forestry

2.12 SUMMARY

This unit focuses on livestock in India. Livestock generally are raised for subsistence or for profit. Raising animals (animal husbandry) is an important component of modern agriculture. It has been practiced in many cultures since the transition to farming from hunter-gather lifestyles. After a brief introduction livestock resources were discussed followed by livestock systems in India. White revolution in India has been discussed with relevance of it in flourishing the Indian livestock setup. Fisheries development in India was the next area of discussion which took into account various approaches to fish farming and rearing. Poultry development was discussed in detail in the later section. Horticulture works for plant propagation, crop production, plant breeding, genetic engineering, plant biochemistry, plant physiology, storage, processing and transportation. The next topic was floriculture which is associated with production and farming of various kinds of flowers. Problems and issues of rural industrialization were explained and relevance of agro based industries was dealt in detail in last sections.

2.13 FURTHER READINGS

- Marcus Colchester and Christian Erni, "Indigenous Peoples and Protected Areas in South and Southeast Asia: From Principles to Practice", IWGIA, 1999
M.A. FINANCIAL ECONOMICS

PAPER IV (B)

AGRICULTURAL ECONOMICS

BLOCK 2

ECONOMICS OF RURAL INFRASTRUCTURE
AND RURAL LABOUR MARKET
PAPER IV (B)

AGRICULTURAL ECONOMICS

BLOCK 2

ECONOMICS OF RURAL INFRASTRUCTURE AND RURAL LABOUR MARKET

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This block comprises of two units. Unit 1 deals with the rural infrastructure of India. An overview to rural infrastructure in India was discussed followed by use of resources – land, water and energy. Rural transportation and communication will remain the other important area of concern. Rural banking in India; Rural electrification; Rural social infrastructure; Land tenures and farming systems; Land reforms in India and status of marginal and small farmers in India are some other areas of discussion of this unit.

Unit 2 highlights the rural labor market in India. An overview to rural labor in India will be given and labour supply in India will be discussed in detail. Agricultural wages and gender differences will be revealed and non agricultural rural employment will finally be discussed with the help of suitable examples.
UNIT 1

RURAL INFRASTRUCTURE OF INDIA

Objectives

After studying this unit you should be able to:

- Know the rural infrastructure of India
- Understand the use of resources in rural areas
- Analyze the rural transportation, communication, rural electrification and rural banking systems and initiatives
- Have the knowledge social infrastructure in rural areas
- Discuss the land tenures and farming systems in India
- Explain the land reforms and status of marginal and small farmers in India

Structure

1.1 Introduction
1.2 Rural infrastructure in India – an overview
1.3 Use of resources – land, water and energy
1.4 Rural transportation and communication
1.5 Rural banking in India
1.6 Rural electrification
1.7 Rural social infrastructure
1.8 Land tenures and farming systems
1.9 Land reforms in India
1.10 Status of marginal and small farmers in India
1.11 Summary
1.12 Further readings

1.1 INTRODUCTION

Unlike in urban areas, the rural scene is characterized by scattered populations, making conventional networks too expensive and inefficient to be practical. In addition, the slower growth of the agricultural sector in recent times is in part due to inadequate infrastructure. Rising income of rural and urban areas would result in diversified diet patterns and hence a diversified agricultural production pattern as well. This diversification would generate demand for ancillary activities and for completing the supply chain from farm to markets. This natural progression leading to acceleration in economic growth is bound to be constrained unless there is adequate investment in rural infrastructure.

It is however a matter of great concern that despite the critical role of rural infrastructure in development and poverty reduction, the progress in the provision of rural
infrastructure in the country has been generally tardy, although in certain sectors some significant progress has been observed. Also considerable rural-urban differentials in the levels of infrastructure are indicated with rural infrastructure way behind the urban. Some idea about it can be gained from the Census data, which provides details about access to water supply and sanitation, electricity, and roads in rural and urban areas. It may however be pointed out that data for various Censuses are not always comparable. Sometimes the unit is a household at another time it is village/habitation.

### 1.2 RURAL INFRASTRUCTURE IN INDIA – AN OVERVIEW

According to the 2001 Census, while nearly 69 percent of urban households had access to tap water, this percentage for the rural households was a trivial 24 percent. The 1991 Census data reveals that only 18 percent of the villages had access to tap water. As far as access to sanitation facilities is concerned, while over the period 1991-2001, access to some kind of toilet to rural households improved from around 10 percent to nearly 20 percent, the rural-urban differentials remained large. Almost 75 percent of the urban households had some access to toilets in 2001 compared to 21 percent for the rural. In regard to drainage facilities, while nearly 66 percent of urban households had either open or closed drainage in 2001, this percentage for the rural households was only 22 percent. As far as road connectivity is concerned, as per 2001 Census 39.2 percent of the habitations had remained unconnected compared to nearly 37 percent villages having an approach road in 1991. Also, as many as 62.5 percent of the smaller villages with population less than 1000 were unconnected by approach roads, indicating size bias.

The situation is no better even today and we must also point out that the mere access does not reveal the quality of infrastructure or services emanating from such infrastructure. This is true even for such services as drinking water supply, where quality of water that is supplied is often not taken into account when we review access to drinking water. Almost nine-tenths of households are without their own telephones, although 85 per cent of villages have at least one village public telephone. A good half do not have domestic power connections, and even the connected households are without power because of outages for almost 17 hours a day in monsoon and 13 hours a day in other months. Half of all people living in habitations away from a main village do not have access to all-weather roads.

The quality and quantity of drinking water actually available is often low because of poor maintenance. It is this point about operation and maintenance of rural infrastructure that needs to be stressed in the context of developing sustainable infrastructure. This dismal state of rural infrastructure has hardly shown any improvement despite economic reforms initiated in 1991, thus depriving the rural communities of opportunities that a well-developed infrastructure could offer. Most efforts to extend rural infrastructure have been severely restricted by a shortage of funds. According to the estimates made in the Rural Infrastructure Report of NCAER, it would require a total investment of over Rs 158,313 crore (at 2002-03 prices) for new asset creation which, in fact, represents a small proportion of the total investment needed. In the telecom and power sectors, the investments required for full coverage are estimated at Rs 92,690 crore and Rs 55,243
crore, respectively. The corresponding expected investment requirements for roads and transport, and water and sanitation sectors are Rs 5,892 crore and Rs 4,488 crore. The Union government provides capital for the initial investment, and the States are responsible for operations and maintenance of these assets.

There is need for finding new methods, attracting new players to provide services, and adopting new policies to support privatization and decentralisation of infrastructure services. There is also a case for local financing of both investment and maintenance of rural infrastructure. Specifically, the private sector needs to play a larger role - a premise repeatedly endorsed in recent policy documents. However, it would be more appropriate to achieve a limited and gradual entry of private players to begin with. There is also a need to strengthen local governments, institutionally as well as financially. In this context attracting multiple service providers in rural infrastructure could widen the revenue base of local government institutions and strengthen them financially.

On the regulatory front, there is a need for light-handed regulation of rural infrastructure: namely, promote regulation that is in close proximity to users as well as service providers. A single multi-utility regulator at the district level is a preferred option for dispute resolution through the legal system. A scrutiny of the type of entry barriers facing the small infrastructure service providers is necessary. Price regulation in practice has been found to benefit only users of services from regulated providers. And when the prices are set below the cost of supply to remote locations, incentive to service providers is destroyed. It is logical to permit service providers to recover costs through user fees not only from the Power and Telecommunication sectors as at present, but also from the other infrastructure sectors — except perhaps where a strong case is made for some infrastructure services to be treated as a public good. In this context, a new approach would be to limit access to the infrastructure sector to only those (largely the non-poor) who are willing to pay for such services, the user fees clearly needs to be determined on the basis of costs. As far as the subsidies are concerned, targeting of subsidies would be necessary to meet the needs of the poorest. The supply of infrastructure services by small, private informal providers is more advantageous in rural areas.

In the context of rural infrastructure, the issue of use of appropriate technology is critical. New technologies should be used to produce various infrastructure services economically on a decentralized basis. Poor maintenance, not only caused by the shortage of funds, but also because of the poor quality of human resource locally available for the purpose, results in speedy depletion of newly created assets. The case of hand pumps is just one example. Most hand-pumps are lying dysfunctional largely because of lack of funds and adequate, trained staff for maintenance and repair. The report, on the basis of detailed analysis, suggests building adequate local capacities for not only taking care of O&M related activities, but also for identifying and preparing the right kind of infrastructure projects. The other area that needs to be highlighted in the context of infrastructure in rural areas is the dearth of contractors to take up small works.

With regard to public-private partnership (PPP), traditional models in infrastructure are difficult to apply to rural areas where services are largely financed and delivered by the
government, and where, as indicated, technology needs are different. Unlike urban infrastructure, where private sector sees robust financial returns, funding remains a major challenge as far as provisioning of rural infrastructure is concerned. It is here that some kind of synergy between the private and public sector is needed. While the private sector would seek decent financial returns; the public sector will be concerned with the robustness of economic returns. It is difficult to perceive large private players to participate in the provisioning of rural infrastructure services given low tariffs except in select rural infrastructure projects where financial returns are adequate.

However, if an acceptable risk sharing arrangement between the public and private sectors can be worked out, it may be possible to evolve a more viable PPP model for the provision of infrastructure in rural areas. The other factors that would need attention in the context of promoting a PPP initiative for rural infrastructure are intimately related to political commitment, commercial viability, and capacity of line organisations.

1.3 USE OF RESOURCES – LAND, WATER AND ENERGY

India's economy is growing presently at the rate of 10 per cent per annum. This means that we will double up all the inputs in seven years. Thus, by 2011, we will double the consumption of petroleum products, electricity, food and other commodities to keep this growth rate. Last year we imported about Rs 85,000 crore worth of petroleum products. India will also require about 140,000 mw of installed electricity capacity by 2010 at an estimated outlay of Rs 5.5 trillion. Thus, financial outlay needed for the energy sector alone is staggering and to maintain "India shining" it is necessary that we produce as much as possible, energy and liquid fuels internally. There are about 60 per cent of rural households, which do not have electricity, and without the basic amenities in rural India the progress of the country will be hampered. A sustainable energy development programme can create all-round development. One of the possible ways to do it is the increased use of land based renewable energy resource like biomass. This will help rural development and create tremendous wealth in these areas.

1.3.1 Land-based renewables

There are three ways in which energy production from land-based renewables can be effected:
* Production of electricity from biomass and agricultural residues.
* Liquid fuel production from biomass which can be grown in arid regions and on wastelands and saline soils. Besides producing liquid fuels, this will also help in land reclamation.
* Creation of synergy between corporate sector, national government labs and institutions and NGOs so that energy technologies can be developed and disseminated in rural areas. A study done by the Nimbkar Agricultural Research Institute (NARI) in Maharashtra showed that existing agricultural residues can produce all the electricity demands for a taluka. The study done for Phaltan taluka in western Maharashtra showed that these residues could produce about 10-15 mw of power from biomass based power plants. Besides, it was also shown that with a capital input of Rs 300 crore in power production
technologies, each taluka could produce wealth of Rs 200-250 crore per year besides giving employment to 30,000 people year round. With about 3,340 talukas in India, there is a possibility of creating about Rs 7,00,000 crore per year of wealth and employment for about 100 million people per year. The implications of this strategy for rural development are staggering and can create a quantum jump in the quality of life for rural population. With availability of assured electricity supply the growth in rural industrialisation can be exponential. With the new Electricity Act 2003 and Prime Minister's Rural Electricity Supply Technology (REST) Mission this strategy can become a reality and it is quite possible that in the coming years the whole face of rural India can change. Availability of assured electricity for lighting will make rural India shine! India is following the world trend of increasing reliance on liquid fuels. Last year 75 per cent of all liquid fuels consumed was imported. By 2010, this figure might jump to 85-90 per cent. Increasing reliance on imported fuel will compromise our security and thus there is a need to develop an indigenous liquid fuel production policy based on renewable. The liquid fuel policy should, therefore, be centered on the production of ethanol and biodiesels. Presently, ethanol production in the country is mostly molasses based. However, with expanded use of ethanol, both for transportation and as cooking and lighting fuel, there is a need for its production to have a broader biomass base. Thus, the use of alternative feedstock like sweet sorghum, sugar beet, cassava etc., can help in its increased production. Besides, these crops require less water than sugarcane and some of them can be grown on saline soils. Thus, a national technology mission on alternative crops for alcohol production should be set up by the Government of India. It is estimated that ethanol production itself can bring in about Rs 40,000-50,000 crore wealth to rural India.

1.3.2 Technology mission

Similarly, the technology mission for new crops for producing biodiesel also needs to be set up. Some of the crops like Jatropha and tree borne non-edible oilseeds like Neem and Karanja can be grown on waste and degraded lands. This will also help the country in land reclamation. With very little processing required for biodiesel, the farmers can get substantial remunerations by growing them. However, for the technology missions to succeed, it is necessary that very intensive R&D is carried out in agriculture, materials and renewable energy technologies. The Government of India should substantially increase the level of R&D funding in renewable energy and agricultural crops for liquid fuel production. Research done at NARI has shown that the emerging areas of nanotechnology and biotechnology can play a vital role in creating novel renewable energy technologies. Thus, new materials for storing biogas in small cylinders, increasing the efficiency of photovoltaic solar cells and producing new thermoelectric materials, which can efficiently convert heat directly into electricity, are being researched and developed via nanotechnology all over the world. Similarly, biotechnology can be used for increasing the efficiency of crops for liquid fuel and biomass production. It can also help develop organisms, which can increase the efficiency of ethanol fermentation and biogas production from their respective biomass. For the fruits of extensive R&D to reach the rural areas, it is necessary that a strong synergy is developed between the corporate sector, the Central government R&D
establishments and non-governmental organisations. Both the corporate sector and national labs can work together to research, produce and commercialise renewable energy technologies, which can be disseminated through NGOs in rural areas. Finally, the development of rural India should be taluka based for it provides the critical mass for rural development.

1.3.3 Land and Water Resources

The total geographical area of land in India is 329 (exactly 328.762) m.ha. which is 2.45% of the global land area? The total arable land (as per Food and Agriculture Organization estimate) is 165.3 m.ha., which is about 50.2% of total geographical area against the corresponding global figure of 10.2%. India possesses 4% of the total average annual runoff in the rivers of the world. The per capita water availability of natural runoff is at least 1,100 cu.m. per year (year 2000 estimates).

The utilizable surface water potential of the country has been estimated to be 1869 cubic km. But the amount of water that can be actually put to beneficial use is much less due to severe limitations imposed by physiographic, topography, inter-state issues and the present state of technology to harness water resources economically. The recent estimates made by the Central Water Commission indicate that the water resources utilisable through surface structures are about 690 cubic km. only (about 36% of the total). Ground water is another important source of water. Quantum of water which can be extracted economically from the ground water aquifers every year is generally reckoned as ground water potential. The preliminary estimates made by the Central Ground Water Board indicate that the utilisable ground water is about 432 cubic km. Thus, total utilisable water resource is estimated to be 1122 cubic km.

Of the total 329 m.ha. of land, it is estimated that only 266 m.ha. possesses potential for production. Of this, 143 m.ha. is agricultural land. It is estimated that 85 m.ha. suffers from varying degrees of soil degradation. Of the remaining 123 m.ha., 40 m.ha. are completely unproductive. The balance 83 m.ha. is classified as forest lands, of which over half is denuded to various degrees.

India has a large cattle population. The 419 million heads of livestock (as per 1982 census report) have to be supported on 13 m.ha. i.e. less than 4% of the land which is classified as pastures lands, most of which is overgrazed. Thus, out of 266 m.ha., about 175 m.ha. (66%) is degraded to varying degrees. Water and wind erosion account for the degradation of almost 150 m.ha. out of this. Soil erosion has increased from 6,000 million tonnes in 1972 to 1,2000 million tonnes in 1985. Per capita availability of land is half of what it used to be some 35 years ago. The challenge of prevention of erosion and indeed of restoration of India's land resources is therefore intimately related to strategies for the management of land, water and vegetative cover. At present 141 m.ha. are used for cultivation purposes. Between 1970-71 and 1987-88 the average net sown area has been 140.4 m.ha. with a maximum of 143.21 m.ha. in 1983-84 and a minimum of 136.18 m.ha. in 1987-88. The need for production of food, fodder, fibre, fuel and urbanisation will put
severe competing claims on the land. Moreover, water logging, salinity, alkalinity of soils on account of inadequate planning and inefficient management of water resource projects in conjunction with over adverse physical factors, will severely constrain the growth of net sown area in the future.

1.3.4 National Water Policy

The National Water Policy deals with establishing standardised national information system, data collection, establishment of basinwise organisations with multi-disciplinary approach to the planning, formulation, clearance and implementation of projects, rehabilitation, ground water development, water zoning, flood and drought management, research and development including training. The National Water Policy provides a framework for coordinated water development across States and alternative uses of water, and it emphasises the need for river basin planning. However, the National Water Policy has had little operational impact due to lack of institutional mechanism to plan, coordinate and implement water development across State boundaries and among users. Another problem is limited data and mechanisms for sharing data between States and between users within the States. Each State has to reaffirm that National Water Policy fitting within the framework of that policy and river basin plans built so far. Madhya Pradesh has prepared a draft State Water Policy. Bihar has taken initiative in setting up of a Second Irrigation Commission and Water Resources Commission. Apart from these, no other State has taken any initiative to draft a State Water Policy. The National Water Policy may require some updating on certain issues in near future.

The National Water Policy in its present form appears to be a statement of intentions as it is not supported by any legislation and does not have an action plan. It does not provide any authority or makes anybody responsible for its implementation. The Policy does not provide the economic cost of water and investment scenarios. The constitutional provisions and legal issues have also not been addressed in the Policy.

Hence there is a need for evolving and operating the Policy according to a feasible action plan.

1.4 RURAL TRANSPORTATION AND COMMUNICATION

The importance of rural transport to economic and social development is obvious. Three fourths of India’s population of 960 million, i.e. 720 million, lives in six lakh villages, which vary in population between 800 and 5000 (ref. 1). Though migration to towns is reducing the percentage of rural population, in absolute numbers the rural population is increasing. For instance, during the decade 1981–91, rural population has increased by 100 million. Bulk of the 300 million people below the poverty line and the 30 million handicapped are in rural areas. 50% of the rural population is illiterate. At least 50% does not have access to clean drinking water, schools and primary health care facilities. Adequate rural road transport will improve these conditions.
Such a dismal state of affairs continues even after massive governmental investment for rural development, poverty alleviation and employment generation. Only 15% of Rs 20,000 crores of annual subsidies and grants, under various schemes, has reached the beneficiaries. Increasing allocation for rural development in successive Five Year Plans has not improved the situation. Only an efficient Rural Transport (RT) system can allow people to take advantage of massive investment envisaged for rural development.

Rural roads are an important sector in rural development, which deals in all aspects of development including agriculture, health, education, forestry, fisheries, small-scale industries, trade, commerce etc. that depends on good communication. Rural transportation network will give shape to the living environment of villagers; rather roads of rural transportation are the connectivity elements in our society. Appropriate combination of various links both technically and economically can generate rural traffic infrastructure, which should be prepared for the measure of land development. Rural road connectivity is not only the key component of Rural Development in India, it is also recognized as an effective poverty reduction programme. An improved accessibility to all quarters of a village is an indispensable prerequisite for the provision of adequate living conditions in rural areas. The interdependency in change of land use and transportation is not promoted in rural areas and this keeps the economic system inactive in these areas. The absence of roads in rural areas leads to stagnation of socio-economic conditions of the villagers.

The network planning should promote the objectives like accessibility and connectivity to most of the places in the region. There is a wide difference in the development of land use system in rural and urban areas. The settlements in urban sprawl will place, irrespective of local road network, whereas in rural areas, the resources are to be connected to the marketing centers for promoting transitional changes in socio economic status of people. A proper skeleton of road network will create a promotional impact of land use activity.

The present scenario in India warrants a serious thought on planning rural road network in a scientific way. The existing research work in the area of planning is limited to modification and upgradation of the existing planning approaches already developed. Attempts are being made to incorporate the socio-economic parameters, local transport system and transportation cost aspects. The existing regional rural road planning practices are mainly based on adhoc criteria and lack of scientific research, which are not giving any insight on pattern of connectivity. The current planning practice in India considers the connectivity based on the population of the villages and the small sized villages tend to get neglected in this method. The planning of rural road is not made in a comprehensive and co-ordinated manner.

Another imbalance is the rural urban dichotomy. In developing countries, though the percentage of population living in rural areas is high, still 50 - 75% of the villages are yet to be connected. At this juncture, there is an urgent need to develop a scientific methodology for the assessment of rural travel demand, which can promote a road network of hierarchical importance and wider range of connectivity basically from user,
Computers have been applied in planning almost since their inception, but only recently with the development of graphics, distributed processing, and network communications has software emerged which can now be used routinely and effectively. At the basis of these developments are Geographic Information Systems (GIS) but gradually, these are being adapted to the kind of decision and management functions that lie at the heart of the planning process. Using GIS to support a wide range of planning and management operations will make an enormous impact towards guiding the development and growth of rural areas. Rather than aiming at optimal solutions, pragmatic approaches must rely on the usage of heuristic problems capable of supporting the dynamic requirements of the domain. Hence the spatial entity when associated with the non-spatial attributes will be useful to achieve most rational infrastructure strategy. This is a key factor for applying GIS technology as a tool in supporting road network planning.

1.4.1 Rural Transportation scenario in India

In the hierarchy of road system in India, rural roads include Other district roads (ODR) and Village roads (VR). There are about six lakh villages spread over 3.28 million square kilometers area. There were road development programmes like Minimum Needs Programme (MNP) and Basic Minimum Services programme (BMS) which envisaged provisions of connectivity to all villages and habitations by the end of 2002 AD. According to the recent study by Planning Commission only three-fifths of the nearly 6 lakh villages are known to be connected by all weather roads. In 2000, a Centrally Sponsored Scheme called the Pradhan Mantri Gram Sadak Yojana was announced with the objective of connecting every village that has population more than 500 persons by the year 2007.

Elements of successful rural road network:

- Identification of demand potential
- Wider coverage and Demand dominated connectivity
- Potential service centres
- Uniform coverage of village nodes
- Hierarchical linkage pattern
- Minimisation of gap between direct and indirect cost

Objectives

The existing practices in rural road developments have to be tackled with scientific inputs for effective reorientation of network elements and also to subdue the inconsistent growth of land use activity in regional areas. In order to achieve a desired network to road user and system owner and to overcome the limitations in the current practices, following are considered as objectives of this study.
1. To develop a simpler method of demand potential of nodes, this can serve as a proxy to the actual travel behavior of users.

2. To develop a methodology which can identify uniform road connectivity for the compatible development of the area with GIS as a supporting tool?

3. Coordination of existing road network and the proposed road network and develop the missing links.

4. To assess and generate the road network configuration on the basis of demographic and socio-economic characteristics thus assessing the socio-economic impacts on the roads

5. To develop a user, system owner based and cross composition based network for wider coverage of the given area

1.4.2 A wave of telecommunication

Telecom and network connectivity have widely been seen as enablers of a nation’s socio-economic growth; a McKinsey study cites that a 10% increase in teledensity contributes to 0.6% of GDP growth. Though urban India is reaping the benefits of the telecom revolution, rural teledensity is still low, at only 8%.

The scenario for Internet and broadband penetration is much bleaker - a Just Consult report pegs India's rural Internet usage at just 5 million. The constantly evolving ICT landscape has not been unable to include the vast rural majority, simply because these areas have no access to the internet. The industry could do more to think differently on how rural India can participate and benefit from the ICT revolution.

The Internet is without a doubt the superhighway on which economies surge ahead, and apart from the apparent benefits to the economy and a modern workforce, there is also immense opportunity for agriculture as well as other traditional industries.

Imagine if rural communities had access to information that could improve their livelihoods. Initiatives such as e-Choupal have successfully been able to leverage the Internet to empower small and marginal farmers. The program provides farmers with know-how, services, timely and relevant weather information, transparent price discovery and access to wider markets - all through a mobile device that feeds off a wider network. This has helped roughly 4 million farmers to better manage risk. India would be well on its way to minimizing the digital divide if similar models were replicated across other sectors in rural areas - cottage industries, fisheries, and others.

The true benefits of technology are in its application, and if an effective deployment of a network that enables academic information to flow to rural areas brought millions of children access to better education, we should be able to improve our scores on literacy and employability. A recent effort towards this has been made by several IT majors who have come together for a District Learning Centre initiative at Chhindwara, Madhya Pradesh, to provide learning opportunities and IT training to the youth of the district.
Access to high-speed internet services could make rural BPOs a viable option, offering attractive employment opportunities to village youth. This in turn would decrease the current migration rates of rural population to urban areas, reduce rural India's dependency on agriculture, and contribute towards inclusive growth.

The government has also been advocating the use of technology to enable efficient delivery of public services. State Govt. endeavours to use technology include forays into wide area networks, setting up systems for processing information and delivering services to enable the citizen-state interface for various services like electronic file handling, public grievance systems, and routine transactions such as payment of bills and tax dues.

But all is not hunky dory - for rural areas to truly benefit, PC penetration will have to increase and affordable PCs or suitable alternatives will have to be made available to the masses. Additionally, if inclusive growth is our goal, India needs to treat the Internet and telecom connectivity as critical infrastructure, just like roads, airports and power.

The winds of change are blowing in that direction - the Indian government has recently announced its 3G policy which will make available 3G, HSPA and WiMAX technologies that are expected to bridge the last mile and drive mobile broadband in rural areas. Moreover, the Telecom Regulatory Authority of India's (TRAI) recent Internet telephony decision, permitting ISPs to terminate local, STD and ISD calls from computers to mobiles and landlines or vice versa, is likely to reduce both local and long distance call rates and boost rural connectivity in a relatively price-sensitive market like India. Once differences over policy issues and spectrum allocation are resolved the country could see 3G HSPA and Net telephony rollouts, throwing open a world of possibilities. In addition to all the benefits cited earlier on in this article, other potential applications could include introduction of customised services in regional languages via Live TV, webcasts and streaming audio/video applications, e-healthcare and infotainment, to mention a few. India can then look to adopt models that have been tried and tested in other markets or even export some of our learning to other markets, and are likely to delay services.

Rural India is expected to account for 40% of the 250 million new wireless users as per a recent study conducted by FICCI and Ernst and Young. If these subscribers had access to broadband and high-speed Internet, every citizen would truly be able to participate in - and benefit from - the global information revolution and contribute to a balanced growth of the nation.

1.5 RURAL BANKING IN INDIA

State Bank of India, the country's largest bank, recently announced that it would shift its focus to Rural India to boost the retail portfolio. According to its Chairman, there is business opportunity in rural India. Similarly, ICICI Lombard plans to market weather insurance in the rural areas.

Urban-oriented banks and financial institutions see business prospects in shifting focus to the rural sector. They had not given this market much attention hitherto. A large pool of
high net worth individuals, traders, entrepreneurs, processing industries, marketing and warehousing agencies, market intermediaries, professionals, educational institutions, plantations and so on provides a wide range of business avenues and market for these institutions to diversify the risks and also seeks growth.

The development of the telecom infrastructure in the rural areas has made doing business easy. Marketing intermediaries and loan recovery agents have brought down the cost of operations. Recent studies indicate that the actual level of non-performing assets (NPAs) in the rural sector is less than elsewhere, and this coupled with the low cost of operations, less expensive labour, infrastructure, cost of living, and so on make Rural India an attractive market.

Success, however, depends on using the right strategies and the ability to foresee the growth of this sector. Many economists and policy-makers increasingly believe that future growth of the domestic economy to a large extent will depend on the robust performance of the agriculture and rural sector. The manufacturing and service sectors cannot sustain the economy's growth if the rural sector underperforms.

Despite decades of effort and experimentation in banking, the organised financial sector is still not able to meet the credit gap in the rural sector. It took time for banks to realise the potential of the rural markets. Lack of infrastructure in the rural areas and the focus in the urban sector were the reasons. Directed and subsidised lending, cumbersome procedures, delay in sanctioning loans and lack of statutory backing for recoveries were major impediments to the growth of banking in the rural sector.

The focus in the past has always been to make available cheaper credit. When banks are forced to lend cheap, there has been a tendency for a scramble for credit by the non-target group of beneficiaries. Empirical data indicate that various measures to make available cheaper source of credit have failed to achieve the desired results and led to willful defaulting because such loans gets written off for reasons mainly political. This has really damaged the credit culture and structure in the rural sector.

The rural sector needs timely credit. Due to the failure of the organised sector to make an impact in bridging the credit gap, the informal credit sector has been thriving and is able to lend as high as 24-36 per cent per annum depending on the borrowers' risk profile.

The concepts of lending based on credit history and risk perception being implemented in the organised sector now have been in vogue in Rural India's informal credit sector for long. It is time to find out why the informal credit sector thrives despite efforts to reduce the credit gap.

Banks need to make loan procedures simple and accessible if they want to make inroads into the rural sector. If banks can offer housing and car loans through simple procedures in urban markets, it is ridiculous to have cumbersome and complicated procedures in the rural sector. Simplification of loan procedures and credit accessibility will attract quality and high net worth borrowers.
Recent Budget announcements on the availability of agriculture credit at soft rates are welcome, but better credit delivery systems are required for Rural India.

The success of the informal credit sector proves this point. To boost credit growth, banks should be permitted to lend at different rates depending on the borrower's risk profile. This will help develop a superior credit culture.

Recent measures to strengthen the loan recovery mechanism through the SARBESI Act will help develop the credit culture. Healthy competition and market forces will achieve free flow of credit at lower cost.

The Government should play a supportive and regulatory role in developing the investment climate. It should facilitate private and public sector investments for developing infrastructure in Rural India. Greater acceleration in development can be achieved through such direct incentives as exemption of tax on all private sector employment generation activities in the rural sector. As banking is the engine of growth, it would be worthwhile to exempt rural earnings from tax.

Maybe the Government, apart from its own involvement, ought also to work on schemes to attract corporate investment in infrastructure, education and health. Infrastructure is a key factor in the development of the rural sector and even the President, Dr A. P. J. Abdul Kalam, has been advocating this aspect through PURA (providing urban infrastructure in the rural areas).

The Government and trade bodies should forge partnerships to attract domestic and foreign investment, because investments here will generate huge direct and indirect employment opportunities. Banks with their presence and exposure in the rural sector can play a creative role in such road shows.

Such projects as the Golden Quadrilateral and the proposed interlinking of rivers can boost Rural India's economy. Major economic activity should be set up along the project corridors to gainfully utilise the investments.

Domestic economic growth depends on the rural sector. Therefore, the corporate sector should focus on this sector. The external sector is attractive and offers exceptional opportunities, but in case of global economic slump, it is the rural sector than can sustain domestic growth. Advantages offered by the rural sector, such as cheap labour, need to be fully exploited by the domestic companies.

Banks should harness the rural savings, though smaller because of the lower income, and direct them towards productive sectors. Investment avenues for the urban population, such as government debt, mutual funds and capital market instruments, as also insurance products should be made available to the rural sector too. Information and communication technology can help banks convert rural networks into financial marts. Banks today have surplus liquidity and those that succeed in directing the surplus funds
to productive sectors will gain. Banking is becoming increasingly complex and those that fail to tap the potential of the rural sector will stand to lose.

The overhead cost of operations for banks in Rural India will be more because of low business per employee and the large number of small clients. However, mechanisation and centralisation of accounting as also decentralisation, cheaper office premises, engagement of external agents for recovery of loans and marketing of products will make up for the other drawbacks. Taking the cue from a few banks and financial intermediaries that have big plans to make a foray into the rural sector, other banks also need to re-draw their strategies at the earliest.

However, numbers do not tell the truth. Fifty-eight per cent of the rural households do not have a bank account and only 21 per cent have access to credit from a formal source. Over 70 per cent of marginal farmers have no deposit account and 87 per cent have no formal credit.

Only a little over 1 per cent of rural households can rely on a loan from a financial intermediary to finance unforeseen expenses. Approval for such loans takes between 24 and 33 weeks. Often, consumers need to bribe officials to get loans, with the bribe varying between 10 and 20 per cent of the loan amount.

In 2002, the number of rural deposits was 30.2 per cent of the total deposits in the banking system (Rs 13.30 crore out of Rs 43.99 crore). However, the amount of deposits mopped up in rural India is only 14 per cent of the total deposit liability of the system (Rs 1,59,423 crore of Rs 11,23,393 crore).

Similarly, there are 2.51 crore rural advance accounts, which is 44.5 per cent of the total number of advance accounts. However, the share of rural pockets in the total credit kitty is only 14 per cent (Rs 92,789 crore of Rs 6,55,993 crore). Overall, 18 per cent of the rural population has bank accounts. The comparative figure in urban India is 103 per cent.

It is clear that the supply of formal finance is biased against the rural population. The per capita deposit in rural areas stood at Rs 2,150 or around 10 per cent of the national per capita income in 2001.

In contrast, in urban India, it is Rs 33,780 or around 160 per cent of per capita GDP. Credit per person in rural India is Rs 900 or around 4 per cent of national per capita GDP compared to Rs 20,600 for urban centres, which is 100 per cent of national per capita GDP.

The number of credit accounts in rural areas relative to the total rural population is only 3.4 per cent against around 10 per cent in urban areas.

Modelled on ITC's e-choupal initiative, the Internet kiosk run by Deepa can play an important role in bringing banking to the rural population. E-choupal -- equipped with a computer and Internet connectivity -- was conceived to tackle the challenges posed by the agriculture sector, such as fragmented farms, a weak infrastructure and the presence of numerous intermediaries.
Although the objective of e-choupal is to bring efficiency to ITC's procurement process, an important byproduct is the increased empowerment of rural farmers.

ICICI Bank's Internet kiosk scheme can mean financial empowerment for rural people. In a way, it can be described as a backdoor entry into banking.

But, given the circumstances, this is a welcome initiative, if we want to reduce rural India's dependence on non-formal financial sources like local money lenders, chit funds, bishis and so on. A 1997 PricewaterhouseCoopers study said that the dependence of low-income households on informal sources is as high as 78 per cent.

Branch banking in rural India is a loss-making proposition and existing regulations prevent the entry of agents mobilising deposits or selling loans.

In this context, the combination of the Internet kiosk and a local language ATM can revolutionise the landscape of rural banking without violating the letter of the law. They can do what 196 regional rural banks and four local area banks have been unable to achieve.

At a parallel level, the rural population can be reached out to through non-government organisations and micro-finance institutions. ICICI Bank is using this route by developing two products -- buying out existing portfolios of the MFIs and offering loans through a partnership model.

The bank has securitised two asset pools of small loans worth Rs 20 crore in Andhra Pradesh. Crisil will undertake a rating exercise for the pool of assets. It hopes to score a triple-A for these pools as the non-performing asset level is extremely low in such loans - about half a percentage point.

Demonstrating its seriousness about the entire exercise, ICICI Bank has initiated talks with the Grameen Bank of Bangladesh, a pioneer in micro-financing, to float a company for giving credit guarantee to such papers. Grameen USA, a trust of the Grameen Bank, is slated to hold a majority stake in the proposed non-banking finance company.

Under the arrangement, ICICI Bank has replaced the MFIs' existing high cost loans (bearing an interest rate of 14 per cent) to over-60,000 borrowers, by low cost (around 8 per cent) new loans. To ensure repayment, ICICI Bank has opened an escrow account where all repayments by the small borrowers will flow. So far, the bank has tied up with 10 MFIs and several more are on the cards.

It's a win-win situation for all parties involved. The MFIs are drastically bringing down the cost of their resources that are on lent to small borrowers. The small borrowers are assured of flow of funds and ICICI Bank is building rural assets without compromising on its quality. Even at 8 per cent, the bank is able to make money because full repayment is assured.

Moreover, this exposure also helps the bank achieve the Reserve Bank of India's norm of priority sector lendings that stipulates that 40 per cent of loans should be lent to priority sector and 18 per cent of this to the agricultural sector.
ICICI Bank Executive Director Nachiket Mor, who also heads the bank's social initiative group, is passionate about the project. "This is just the beginning. We have rolled out only two products in four states -- Tamil Nadu, Andhra Pradesh, Orissa and Uttar Pradesh.

In four months, between December 2003 and March 2004, we plan to reach out to five lakh beneficiaries. By fiscal year 2005, we will build an asset base of at least Rs 500 crore (Rs 5 billion)," he says.

It may sound optimistic but the target is achievable as the second product, based on a partnership model, is working well. The estimated demand for micro financing in India varies between Rs 15,000 crore (Rs 150 billion) and Rs 45,000 crore (Rs 450 billion).

The partnership model has been designed to leverage the comparative advantages of the bank on the one hand, and the MFI on the other. Under this model, the MFI sources loans directly in the books of ICICI Bank and continues to monitor and recover loans thus disbursed.

This releases the capital constraint for the MFIs and permits rapid increases in reach. The MFI then becomes an originator and service of micro loans on an ongoing basis.

What makes ICICI Bank's attempt unique in introducing financial products to the rural poor is its packaging. Small loans of Rs 20,000 for buying buffaloes or for setting up a tea shop are offered with life, non-life and even weather insurance.

The last one, a relatively new product in India, can eventually replace the government's age-old crop insurance policy, which takes long to settle claims and is expensive both for the government as well as the beneficiaries.

Weather insurance products provide cover against deviation from the normal expected rainfall, wind speed or other weather phenomenon, and not just against drought and flood.

The pilot programme of India's first rainfall insurance programme was conducted in July 2003, in Mahabubnagar, Andhra Pradesh, when a local area bank bought a bulk insurance policy from ICICI Lombard, the bank's general insurance arm, and sold around 200 individual policies for groundnut and castor farmers. Since then, the cover has been extended to 50 soya farmers in Madhya Pradesh and 600 acres of paddy crop in Aligarh in Uttar Pradesh.

The message is quite clear. An innovative approach to rural lending can do what the government's continuous pressure on the banking system for expanding the base of kisan credit cards and good old guidelines for agricultural lending cannot.

1.6 RURAL ELECTRIFICATION

Rural electrification is the process of bringing electrical power to rural and remote areas. Electricity is used not only for lighting and household purposes, but it also allows for mechanization of many farming operations, such as threshing, milking, and hoisting grain
for storage; in areas facing labor shortages, this allows for greater productivity at reduced cost.

It is a matter of shame for all of us that even 56 years after independence, 63% of all rural households in India do not have electricity and use kerosene for lighting. Even for those rural areas, which are electrified, there is a tremendous shortage of power supply. Thus it is not uncommon for these areas to have 10-15 hours of blackouts and brownouts every day. There is a shortfall of about 15-20,000 MW of electricity in the country and we require about 140,000 MW of additional capacity by 2010 with an estimated outlay of Rs. 5,50,000 crores. Because of tremendous shortage of electricity, industrial growth and general life in the country is seriously affected. Moreover with any problems in the national grid, rural areas are affected the most, since the State Electricity Boards (SEB) provide urban areas with electricity on priority basis.

However the recently enacted Electricity Act 2003, which allows for the first time in India a private utility to produce and distribute power, provides a glimmer of hope not only for the country but more so for the rural areas. Hence small rural private and cooperative power utilities can be empowered to quickly and efficiently supply electricity.

Work done at the Nimbkar Agricultural Research Institute in Phaltan, Maharashtra has shown that each Taluka in the country produces enough agricultural residues so that all its electricity demands can be met by using them in 10-20 MW biomass-based power plants. The NARI study also showed that besides providing power, the Taluka energy self-sufficiency plan could also create 30,000 jobs/year. With the new Electricity Act, Taluka energy self-sufficiency can become a reality since the utility can produce and supply power to its customers without the need to go through SEBs. The Taluka utility company can also lease the existing transmission and distribution infrastructure of SEBs so that it need not invest in developing its own. This will also help the SEBs to get regular income from their infrastructure. NARI study also showed that Taluka energy program can produce Rs. 100-crores/year wealth for its inhabitants in terms of biomass production and setting up of new electricity-based industries. With about 3500 talukas in the country it is therefore possible to produce about Rs. 3,50,000 crores/year extra wealth through the Taluka program.

Recently the Prime Minister has set up the Rural Electricity Supply Technology (REST) mission in the Ministry of Power (MOP). It is hoped through this mission to electrify all villages by 2010. According to MOP officials funds of about Rs. 10-15,000 crores will be made available to the rural power utilities at 2-2.5% p.a. interest rate. With the new Electricity Act and this type of funding it becomes very attractive for microunitities to come up in rural areas. Thus it is envisaged that a small rural power cooperative can be set up to produce 200-500 KW of power and supply all the electricity demands of one or two villages. Again this utility can lease the existing SEB power line infrastructure for its purposes. The state government can also explore the possibility of allowing SEBs to lease these lines and provide standby power to rural microunity at substantially lower rates so that the state's social obligations to rural areas is also met. NARI has recently suggested
this concept to Maharashtra Electricity Regulatory Commission (MERC). It is also envisaged that electric cooperatives may function on the lines of TV cable operators in rural areas.

However for small power packs of 500 KW and less to function smoothly in rural areas it is necessary that they be powered by fuel from locally available resources. This will make these microultilities green and will create wealth in rural areas in producing value-added item. Thus there is a need to do sophisticated R & D in producing biofuels from renewable energy sources like agriculture residues and crops specifically grown for them. These biofuels can easily power the existing diesel gensets. Development of liquid fuels like ethanol and biodiesel from multipurpose crops should be done so that the issue of food and fuel from the same piece of land is taken care of. NARI has done pioneering work in developing sweet sorghum for ethanol production. Sweet sorghum can provide food, fuel and fodder from the same piece of land and requires much less water than sugarcane. Thus the Government of India should extensively fund the R & D program on biofuels.

Finally for the rural electricity supply mission to succeed it is necessary that a very close cooperation between corporate sector, government and NGOs is needed. The corporate sector can provide the necessary technological and managerial support, NGOs can create the necessary trust in such utilities and Government of India can help provide soft financing through its many rural development programs. An energy self sufficient and hence prosperous rural India will be the first step in making us a developed nation.

### 1.7 RURAL SOCIAL INFRASTRUCTURE

Development of social infrastructure comprising education, health and medical care, nutrition, housing and water supply which is instrumental in contributing to substantial improvements in human resources development which, in turn, initiate and accelerate economic development with increased telesis. Physical quality of life and human well being are pivotal on the enhanced availability of these social services. These services are key to overall increased productivity. Investment in human development programmes, enable the poor to help themselves and try to give a fair chance of getting those rewards. On social front Government adopts a three-pronged approach during the successive Five Year Plan periods - augmenting increased resources on social sector, implementing anti-poverty programmes in an effective way and accelerating economic growth.

#### 1.7.1 Rural housing schemes

Several schemes have been started by the government to solve the problem of rural housing. Under the minimum needs programme house sites are allotted and construction assistance provided to rural landless workers, artisans and weaker sections. This scheme was initiated in 1971

The Indira awas yojna was introduced in 1985-86 for the poorest of the poor belonging to scheduled castes and scheduled tribes and freed bonded labourers in the rural areas.
Houses under this scheme are built in clusters so that common facilities can be provided for the clusters.

Housing and urban development corporation has been financing several rural housing schemes by allocating 15% of its resources to such schemes.

1.7.2 Medical health facilities in rural areas

The rural health system is a three tier structure of sub centers, primary health centers and community health centers. There are at present approximately 22,000 primary health centers, 1.5 lakh sub centers and 2400 community health centers and at village level 6.5 lakh trained dais and 4.2 lakh village health guides besides a large number of rural dispensaries.

It is proposed to expand these facilities further in a phased manner so as to have one primary health centre for every 30,000 population, one sub centre for every 5,000 population and one community health centre for about one lakh population.

1.7.3 Education in rural areas

At the turn of the millennium, the Indian government launched a universal education program known as the Sarva Shiksha Abhiyan (SSA). The initiative aims to achieve relevant elementary education for all Indian children by 2010.

The Indian government also introduced the Mid-Day Meal program in 1995, whereby children are given a meal in school. The objective is to increase enrolment, attendance and retention at government-run primary schools.

Like midday meals, computers are also helping to draw more children to schools.

A plethora of government initiatives to provide access to primary education may be underway, but issues of equity, quality and access remain areas of concern — particularly in rural schools. Children in rural areas continue to be deprived of quality education owing to factors like lack of competent and committed teachers, lack of textbooks or teaching-learning materials, and so on.

In view of such concerns, the recently constituted Rural Education Cell, department of educational surveys and data processing, NCERT, organised a national seminar on ‘school education in rural India’ at its Delhi headquarters. The seminar provided a platform to policy analysts, administrators, researchers and practitioners to analyse the current scenario in rural education, identify problems and come up with recommendations to improve the situation.

EMPOWERING THE GIRL CHILD
Talking about the philosophy and success of Kasturba Gandhi Balika Vidyalaya KGBVs) — a scheme for girls from rural and disadvantaged groups from educationally backward blocks (EBBs) — Gouri Srivastava, a professor with Department of Women’s Studies, NCERT, says: “The scheme is aimed at realising the constitutional commitment of providing free and compulsory education to all children in the age group of 6-14 years. The programme also aims to bridge gender and social gaps in education, which is an important objective of SSA.”

Currently, the scheme is operational in over 3,000 EBBs in 24 states, where rural female literacy is below the national average and the gender gap in literacy is more than the national average. At present, there are 2,578 KGBVs, of which 2,383 are operational and the total number of girls enrolled is 1,76,713, according to Srivastava.

Similarly, the Mahila Samakhya Programme (MSP), working in the field of women empowerment through education, aims to promote ‘skill-development’ and ‘entrepreneurial skills’ to make women self-reliant. Rashmi Sinha, programme director, MSP, says: “We are not into imparting skills like sewing or tailoring. Instead, we impart skills like plumbing, repairing and so on to break gender stereotypes and empower girls. So, when flooring has to be done in classrooms or taps are not working, our students are in a position to handle the situation.”

Likewise, the ‘Pehchaan’ project is a model that attempts to ensure that out-of-school girls (9-14 years) are provided with educational opportunities and brought on par with the other children of their age in schools. The project is a collaboration between Unicef, NGOs Digantar and Culp and the community.

COMMUNITY PARTICIPATION

Recognising community participation as one of the effective strategies to improve access and quality in education, Kashyapi Awasthi, lecturer from M S University of Baroda, Gujarat, cites an example: “A rural school of Surat owns an LCD projector through community funding and children of 9-10 years of age can use it effectively for teaching-learning processes.”

Similarly, she adds, “There is a government school in Gujarat with 70 herbal plants that involves students in activity-based learning like planting seeds, encouraging concept learning like the germination process, and so on. It turned out to be such a successful venture that four private schools in the vicinity had to close down, with students from the private schools moving to the government school.” It is the devotion of individuals, innovative practices employed, the joint efforts of the school and community that works wonders, she added.

INNOVATIVE PRACTICES

Participatory videos can best be used to empower underprivileged students from rural areas, feels Vedavati Ravindra Jogi, an educational professional from Pune. Breaking
away from producing educational videos for children, she believes that innovation and creativity of children should instead be tapped to enable maximum learning. Thus, she conducted a study on class VIII and IX students where students were imparted lessons in script writing, video-shooting and editing, using various formats. Today, her students are creative individuals producing video clips on concepts like force, pressure, covalent bonds, and so on.

"Computer education in rural areas has definitely helped in lowering the school dropout rate," L. Balasubramanian, president of school learning solutions at NIIT Technologies, told ZDNet Asia in a phone interview. As per government statistics, over 7 million children aged 6 to 14 years had dropped out of school as of end-2006.

NIIT has worked with the state governments of Andhra Pradesh, Assam, Chhattisgarh, Himachal Pradesh, Karnataka, Madhya Pradesh, Meghalaya, Tamil Nadu, Tripura and West Bengal, to offer computer-assisted education in schools. Over the last 10 years, it has provided computer-based learning tools to over 7,700 government and private schools, reaching out to over 2.3 million school students.

1.8 LAND TENURES AND FARMING SYSTEMS

Land tenure refers to the way in which land is held by an individual from the Government. It shows the relationships between the land holder and the State. The absolute ownership of land rests with the Government. Government gives proprietary rights to individuals or communities. Thus, whom we call a land owner, is in that sense is the proprietor of that land and he has to pay land renew for that.

1.8.1 History of Land Tenures in India

In ancient times, the State of India claimed a share of the produce of the land from the cultivator. The laws of Manu mention one sixth of the gross produce at the legitimate share of the King. During the war and other emergencies, it was increased to one fourth.

The institute set up by Timur represented the first systematic attempt in the direction of converting the State’s share of the produce into money. Sher-shah made some improvement. However, it remained incomplete due to his short reign.

The most famous settlement was made under Akbar by his able Finance Minister, Todarmal. While fixing the revenue, scientific and detailed investigation was made to assess the taxable capacity of different soils. Land was carefully measured and divided into four classes representing different grades of fertility. The Government’s share was fixed as one-third of the gross produce. Thus, Mughals did not introduce any fundamental changes in the ancient revenue system but put a coherant system in place of customary and unwritten usages of the Hindu administration.

Malik Amber of Ahmednager made similar improvements in the Deccan. He fixed one-third of the gross value of produce as the revenue. Maratha rulers continued the system.
They fixed 'Kamal' or the maximum rates for the best lands. The assessment was not permanent in majority of the cases. However, 'Miras' tenure was subject to the payment of fixed assessment.

In the declining days of Mughal Empire, the control over the revenue officials became weak. The flow of income started declining. So, the system called 'revenue farming' was introduced in Bengal in the reign of Farukhsiyer (1713-19). Under this system, the revenue farmer paid the Government nine-tenth of the whole collection and kept the rest as his collection charges. However, in the later period, the right of collecting land revenue for a pargana or a district was sold by public auction to the highest bidders. Due to this, the exploitation of the cultivators started. The revenue farmers became more dominant. This revenue farming system which started during the Mughal rule in Bengal was soon extended to other parts of the country.

In Deccan, Nana Fadanis, in the later part of the 18th Century, had introduced a revenue system which was very efficient and equitable. It was universally recognised.

The revenue farming system even came to the Deccan. In Konkan, the Khots who were earlier revenue farmers acquired landlord rights. In United Provinces and in Punjab revenue farmers succeeded in acquiring certain overlord rights.

The disorders in the revenue administration resulted in many complexities of land tenures and rights.

Land Tenures under British Rule:

Under British Rule, there were three main types of land tenure systems in India. They were Zamindari, Mahalwari and Rayatwari.

i. Zamindari: This system was introduced by Lord Cornwallis in Bengal in 1773. Under this system, the lands of a village or few villages were held by one person or few joint owners who were responsible for payment of land revenue to the Government. There used to be number of intermediaries between the Zamindars and the actual tillers of the soil. The system took were various forms such as Zamindari, Jagirdari, Inamdari, etc. In many cases revenue collectors were raised to the status of land owners. This system was introduced in many parts of the country. In this system, tillers of the soil were exploited by way of exorbitant rents. There were no incentives for them to improve the land or to use better cultivation practices. There were many other social evils of the system. It is said that the British introduced Zamindari system to achieve two objectives. First, it helped in regular collection of land revenue from a few persons i.e. Zamindars. Secondly, it created a class of people who would remain loyal to the British ruler in the country.

ii. Mahalwari: Under this system, the village lands were held jointly by the village communities, the members of which were jointly and severally responsible for the payment of land revenue. Land revenue was fixed for the whole village and the
village headman (Lumberdar) collected it for which he received ‘Panchatra’ i.e. 5 per cent as commission.

iii. Rayatwari: It was introduced by Sir Thomas Munro first in Madras state and then in Bombay State. In this system, there was a direct relationship between Government and the tenant or Rayat i.e. individual land holder. Every registered holder was recognised as its proprietor and he could sell or transfer the land. He was assured of permanent tenure as long as he paid the land revenue. The land holder was also allowed to sublet his land. It was a better system as compared to Zamindari or Mahalwari and similar other forms of tenure.

Though we have discussed the above three main systems of land tenure, there was lot of intermixing of characteristics of these systems. It is said that these three systems gravitated towards the tendencies of the Zamindari system. The Mahalwari system in states like Madhya Pradesh and Uttar Pradesh subletting and rock renting became common. It became common even in the Rayatwari areas. There was no proper revenue record. This was the situation which prevailed at the time of independence.

Post-independence Period:

Our leaders had thought about the need for land reforms even prior to independence. For instance, the Agrarian Reforms Committee under Shri J.C.Kumarappa had given the guidelines for the formulation of land reform policies in the independent India. The committee recommended that

i. all intermediary interest should be abolished and land should belong to the tiller;
ii. leasing of land should be prohibited except in case of widows, minors and other disabled persons.
iii. All the tenants who had been cultivating land for a period of 6 years should be granted occupancy rights
iv. The tenants should have the right to purchase the holdings at reasonable price to be determined by the land tribunal;
v. The agrarian economy should provide an opportunity for the development of the farmers.

Abolition of Zaminari and Intermediaries Acts;

India’s First Five year plan has clearly mentioned the land policy and the specific land reform measures to be undertaken. Most of the states passed the legislations for abolition of zamindari and similar exploitative land tenure systems. The first act in this respect was passed in Madras in 1948. The other states followed it. Now land tenure systems like Zamindari, Mahalwari, Jagir, Inam, etc. are abolished in all the states in the country.

It has been said that in implementation of land reforms, this first and the important step of abolition of zamindari was completed peacefully.
As a result of abolition of Zamindari and intermediaries, about 26 lakh intermediaries and 20 lakh tenants got proprietary rights of lands i.e. they became the land owners. This has resulted in improving their economic and social conditions. The land revenue income of the states also increased.

1.8.2 Tenancy reforms

Tenancy refers to the relation between the land holder (owner) and the actual tiller of the soil. Many of the land owners did not cultivate their lands personally but gave it to some tiller and took rent for that. They were absentee landlords. The tenancy prevailed in all forms of land tenure systems including Rayatwari system. The main reason was the increase in the population of landless labourers. In 1951, of the total families dependent on agriculture, as many as 23.6 per cent families belonged to the tenant class. The National Sample Survey (8th round) indicated that the lands leased out varied from 11 per cent to 26 per cent of the total, in different states. The tenants were exploited by the land owners by way of heavy rents (50 per cent or even 2/3rd of the produce). There was no protection of tenure (evictions on minor pretexts). Thus, there were no incentives for tenants to make land improvements or to increase production. This necessitated enacting the legislation for tenancy reforms. Tenancy Acts were passed in most of the States, they provided for

i. regulation of rents
ii. security of tenure, and
iii. conferment of ownership on tenants.

Bombay State promptly enacted the legislation as early as in 1950. As regards the regulation of rents, different states fixed different rates. For instance, in Bombay (Maharashtra), Gujarat and Rajasthan, one-sixth of the grass produce has been fixed as the maximum rent; while in Punjab rent fixed is one-third of the produce.

It was found that there were large scale evictions of tenants on the plea of resumption for personal cultivation.

As reported in the draft fourth five year plan, as a result of tenancy legislations in India, 3 million tenants or share croppers became the land owners. Uttar Pradesh was in the forefront in this respect. The next state in order is Maharashtra where 13.56 lakh tenants got the ownership rights of about 32 lakh hectares of land by September, 1992.

Protection of tenants and regulation of rent is the first step in the tenancy reforms. The ultimate object of the reform is "land to the tiller". The Tenancy Acts have been moved in that direction.

It could be said that the land reform measures adopted by the States soon after independence, provided a sound basis for agricultural developments that took place in the country in the later period.
1.8.3 Farming system

The Community Development Programme in India was inaugurated in 1952 to implement a systematic, integrated approach to rural development. The nation was divided into development blocks, each consisting of about 100 villages having populations of 60,000 to 70,000 people. By 1962 the entire country was covered by more than 5,000 such blocks. The key person in the program was the village-level worker, who was responsible for transmitting to about ten villages not only farming technology, but also village uplift programs such as cooperation, adult literacy, health, and sanitation. Although each block was staffed with extension workers, the villagers themselves were expected to provide the initiative and much of the needed financial and labor resources, which they were not in a position to do or inclined to do. Although progress had been made by the early 1960s, it was apparent that the program was spread too thin to bring about the hoped-for increase in agricultural production. Criticism of the program led to more specialized development projects, and some of the functions were taken up by local village bodies. There was only a negligible allocation for community development in the sixth plan, however, and the program was phased out in the early 1980s.

The Intensive Agricultural District Programme, launched in five districts in 1960 by the central government in cooperation with the United States-based Ford Foundation, used a distinctly different approach to boosting farm yields. The program operated under the premise that concentrating scarce inputs in the potentially most productive districts would increase farm-crop yield faster than would a wider but less concentrated distribution of resources in less productive districts. Among these inputs were technical staff, fertilizers, improved seeds, and credit. Under the technical guidance of American cooperative specialists, the program placed unusual emphasis on organizational structures and administrative arrangements. For the first time, modern technology was systematically introduced to Indian farmers. Within a decade, the program covered fifteen districts, 28,000 villages, and 1 million inhabitants. The Intensive Agricultural District Programme was thus a significant influence on the forthcoming Green Revolution.

Irrigation in India

Except in southeastern India, which receives most of its rain from the northeast monsoon in October and November, dryland cultivators place their hopes for a harvest on the southwest monsoon, which usually reaches India in early June and by mid-July has extended to the entire country. There are great variations in the average amount of rainfall received by the various regions--from too much for most crops in the eastern Himalayas to never enough in Rajasthan. Season-to-season variations in rainfall are also great. The consequence is bumper harvests in some seasons, crop-searing drought in others. Therefore, the importance of irrigation in India cannot be overemphasized.

Irrigation in India has been a high priority in economic development since 1951; more than 50 percent of all public expenditures on agriculture have been spent on irrigation alone. The land area under irrigation expanded from 22.6 million hectares in FY 1950 to 59 million hectares in FY 1990, an increase of 161 percent in four decades (see table 28,
This increase was about 33 percent of the estimated potential. The overall strategy has been to concentrate public investments in surface systems, such as large dams, long canals, and other large-scale works requiring huge outlays of capital over a period of years, and in deep-well projects that also involve large capital outlays. Shallow-well schemes and small surface-water projects, mainly ponds (called tanks in India), have been supported by government credit but were otherwise installed and operated by private entrepreneurs. Roughly 42 percent of the net irrigated area in FY 1990 was from surface water sources. Tanks, step wells, and tube wells provided another 51 percent; the rest came from other sources.

Between 1951 and 1990, nearly 1,350 large- and medium-sized irrigation works were started, and about 850 were completed. The most ambitious of these projects was the Indira Gandhi Canal, with an anticipated completion date of close to 1999. When completed, the Indira Gandhi Canal will be the world's longest irrigation canal. Beginning at the Hairke Barrage, a few kilometers below the confluence of the Sutlej and Beas rivers in western Punjab, it will run south-southwest for 650 kilometers, terminating deep in Rajasthan near Jaisalmer, close to the border with Pakistan. A dramatic change already had taken place in this hot and inhospitable wasteland by the late 1980s. As a result, desert dwellers switched from raising goats and sheep to raising wheat, and outsiders flocked in to purchase six-hectare plots for the equivalent of US$3,000.

Progress in irrigation has not been without problems. In India, large dams and long canals are costly and also highly visible indicators of progress; the political pressure to launch such projects was frequently irresistible. But because funds and technical expertise were in short supply, many projects moved forward at a slow pace. The Indira Gandhi Canal project is a leading example. And the central government's transfer of huge amounts of water from Punjab to Haryana and Rajasthan, frequently cited as a source of grievance by Sikhs in Punjab, contributed to the civil unrest in Punjab during the 1980s and early 1990s.

Problems also have arisen as ground water supplies used for irrigation face depletion. Drawing water off from one area to irrigate another often leads to increased salinity in the supply area with resultant effects on crop production there. Some areas receiving water through irrigation are poorly managed or inadequately designed; the result often is too much water and water-logged fields incapable of production. To alleviate this problem, more emphasis is being placed on using irrigation water to spray fields rather than allowing it to flow through ditches. Furthermore, charges of corruption and mismanagement have been levied against government-operated facilities. Cases of bribery, maldistribution of water, and carelessness are frequently raised in the media.

Another major problem has been the displacement of thousands of people, usually poor people, by large hydroelectric projects. Critics also claim that the projects are damaging to the ecology. Smaller projects and such traditional methods for irrigation as tanks and wells are seen as having less serious impact. In the late 1980s and early 1990s, the debate between large-scale versus small-scale projects came to the fore because of the US$3 billion Sardar Sarovar project on the Narmada River. Sardar Sarovar, as conceived, was
one of the world’s largest hydroelectric and irrigation projects. Some 37,000 hectares of land in Madhya Pradesh, Gujarat, and Maharashtra were slated to be submerged following the construction of some 3,000 dams, 75,000 kilometers of canals, and an electric power generating capacity of 1,450 megawatts of power per year. Included among the 3,000 dams was the proposed 160-meter-high Sardar Sarovar Dam. In 1985 the World Bank agreed to loan US$450 million for the project. Environmentalists in India and abroad, however, argued that the project was ecologically undesirable. In the face of this strong protest, the World Bank appointed a two-member team in 1991 to review the project. Despite a negative review of the environmental impact by the team, World Bank funding and the project continued. By 1993, however, in the face of continued international protest as well as opposition and a call for a satyagraha (passive resistance—see Glossary) by villages in the affected areas, the central government cancelled the dam project loan. Work on the Sardar Sarovar project continues, however, with funds provided by the central government and the governments of the three states involved.

Although India had the second largest irrigated area in the world, the area under assured irrigation or with at least minimal drainage is inadequate. The irrigation potential estimated to have been created by the early 1990s was about 82.8 million hectares. This amount includes the gross irrigated area plus the potential for double cropping provided by irrigation. There was a cumulative gap in irrigated land use of about 8.6 million hectares until FY 1990, by which time the gap had decreased through improved land management.

1.9 LAND REFORMS IN INDIA

As the basis of all economic activity, land can either serve as an essential asset for the country to achieve economic growth and social equity, or it could be used as a tool in the hands of a few to hijack a country’s economic independence and subvert its social processes. During the two centuries of British colonization, India had experienced the latter reality. During colonialism, India’s traditional land ownership and land use patterns were changed to ease acquisition of land at low prices by British entrepreneurs for mines, plantations etc. The introduction of the institution of private property de-legitimized community ownership systems of tribal societies. Moreover, with the introduction of the land tax under the Permanent Settlement Act 1793, the British popularized the zamindari system at the cost of the jajmani relationship that the landless shared with the land owning class. By no means a just system, the latter at least ensured the material security of those without land.

Owing to these developments, at independence, India inherited a semi-feudal agrarian system. The ownership and control of land was highly concentrated in a few landlords and intermediaries whose main intention was to extract maximum rent, either in cash or kind, from tenants. Under this arrangement, the sharecropper or the tenant farmer had little economic motivation to develop farmland for increased production. Naturally, a cultivator who did not have security of tenure, and was required to pay a high proportion of output in rents, was less likely to invest in land improvements, or use high yielding varieties or other expensive inputs likely to yield higher returns. At the same time, neither
was the landlord particularly concerned about improving the economic condition of the cultivators. As a result, agricultural productivity suffered and oppression of tenants resulted in a progressive deterioration of their plight.

In the years immediately following India's independence, a conscious process of nation building looked upon problems of land with a pressing urgency. In fact, the national objective of poverty abolition envisaged simultaneous progress on two fronts, high productivity and equitable distribution. Accordingly, reforms of the land were visualized as an important pillar for a strong and prosperous country. The first few five-year plans allocated substantial budgetary amounts for the implementation of land reforms. A degree of success was even registered in certain regions and states, and especially in areas like the abolition of intermediaries, protection to tenants, rationalization of different tenure systems and the imposition of ceiling on land holdings. Fifty-four years down the line, however, a number of problems are still far from satisfactorily resolved.

Most studies indicate that inequalities have increased, rather than decreased. The number of landless labor has gone up and the top ten percent monopolizes more land now than in 1951. Meanwhile, the issue of land reforms has over the years, either unconsciously faded from public mind or deliberately been glossed over. Vested interests of the landed elite and their powerful nexus with the political-bureaucratic system have blocked meaningful land reforms and/or their earnest implementation. The oppressed have either been co-opted with some benefits, or further subjugated as the new focus on LPG has altered government priorities and public perceptions. As a result, we are today at a juncture where land, mostly for the urban, educated elite, and who also happens to be the powerful decision-maker, has become more a matter for housing, investment and infrastructure building. In the bargain, the existence of land as a basis of livelihood – for subsistence, survival, social justice and human dignity has largely been lost.

Objectives

It is against this background that the specific objectives of the Project in India have been articulated as:

- To raise popular and elite awareness on issues related to land, particularly in the present context of the LPG thrust of the government since the 1990s
- To monitor specific projects and programmes being aided by international financial institutions in some states of India in order to assess their true impact on the rural community directly affected.
- To monitor and scrutinize national and transnational economic trends that have a specific bearing on issues related to land and agriculture.
- To explore the efficacy of the current developmental model that perceives land only as a factor of production, and not as a means of survival, equity and dignity.
- To examine possible strategies for facilitating reconciliation between the claims of the market over land and land reforms to ensure social change based on justice and equity.
To document historical strategies of land reforms and place them in the socio-economic-political context in which they were effective or not and accordingly cull out lessons for the future.

To recommend alternative policies and approaches to contemporary land challenges.

To provide research and analytical support to the existing land movements, and facilitate better networking among them.

To awaken the weakening social consciousness of an increasingly consumerist society by drawing linkages between the economic policies of globalization at the macro level and its impact on human livelihoods at the micro level.

**IFIs and Issues Related to Land in India**

The task of the articulation of objectives is several times easier compared to the challenges that lie ahead in realizing these goals. Any reform is as difficult an economic exercise as a political undertaking since it involves a realignment of economic and political power. The groups that are likely to be the losers naturally resist reallocation of power, property and status. Obviously, the landholding class is unlikely to willingly vote itself out of possession. Neither should it be expected that it would be uniformly inflamed by altruistic passions to voluntarily undertake the exercise. Hence, one cannot underestimate the complexity of the task at hand.

Loopholes in legislation have facilitated the evasion of some of the provisions, for instance in ceiling reforms, by those who wanted to maintain the status quo. At the same time, tardy implementation at the bureaucratic level and a political hijacking of the land reforms agenda have traditionally posed impediments in the path of effective land reforms. Even in states that have attempted reforms, the process has often halted mid-way with the cooption of the beneficiaries by the status quoits to resist any further reforms. For instance, with the abolition of intermediary interests, the erstwhile superior tenants belonging mostly to the upper and middle classes have acquired a higher social status. Rise in agricultural productivity, rising land values and higher incomes from cultivation have added to their economic strength. These classes have since become opposed to any erosion in their newly acquired financial or social status.

Hence, problems related to land such as concentration, tenancy rights, access to the landless etc still continue to challenge India. The criticality of the issue, in fact, may be gauged from the fact that notwithstanding the decline in the share of agriculture to the GDP, nearly 58% of India's population is still dependant on agriculture for livelihood. More than half of this percentage (nearly 63%), however, owns smallholdings of less than 1 hectare while the large parcels of 10 hectares of land or more are in the hands of less than 2%. The absolute landless and the near landless (those owning up to .2 ha of land) account for as much as 43% of the total peasant households.

This reality, however, had come to worry the governments little during the late 1970s and 80s. It was only in the 1990s, with the initiation of the economic restructuring process that the issue of land reforms resurfaced, albeit in a different garb and with a different
objective and motivation. If the government-led land reforms had been imbued with a degree, though the extent is debatable, of desire for attaining equity, social justice and dignity, the new land reforms agenda is market-driven, as everything else in this phase of economic globalization, and has at its heart certain other kinds of objectives. Being promoted and guided by various IFIs, contemporary emphasis on land reforms reflects and seeks to fulfill the macro-economic objectives of these multilateral economic institutions.

While the return of land reforms to the government's list of priorities is a welcome development, the manner in which it is being undertaken, its objectives, and consequently the impact on people, especially those that are already marginalized and are being further deprived of a stake in the system, raises a number of questions and prompts one to look for alternatives. The Project, therefore, shall devote its energies to identifying and monitoring the implementation of certain specific IFI-sponsored programmes in particular states with a view to examining their short-term and long-term impact on the lives and livelihoods of local residents. This shall enable an informed critique of the IFI-led land reforms programmes and serve as a lesson for peoples else where in India and in other regions of the globe as well.

**Market- Led Land Reforms** -- The Current Emphasis on Land Administration, Titling and registration In their analyses of India's land reforms programme, most IFIs have highlighted that one of the basic problem that the rural poor face is access to land and security of tenure. Consequently, they advocate redemption of this situation through structural reforms of property rights to create land markets as part of a broader strategy of fostering economic growth and reducing rural poverty.

A large emphasis has, therefore, been placed on the need to establish the basic legal and institutional framework that would improve secure property rights as a means to protect environmental and cultural resources, to facilitate productivity-enhancing exchanges of land in rental and sales markets, to link land to financial markets, to use land as a sustainable source of revenue for local governments, and to improve land access by the poor and traditionally disenfranchised.

*The package the IFIs offer includes comprehensive reforms of land tenure, including titling, cadastral surveys and settlement operations, land registries, improvements in land revenue systems, land legislation, land administration, land sale-purchase transactions, and removal of restrictions on land leasing. In fact, it may be recalled that even in 1975, a Land Reforms Policy Paper brought out by the WB had described land registration and titling as the main instruments for increasing individual's tenure security, the main facilitators for the establishment of flourishing land markets and the major tools to enable the use of land as collateral for credit. However, the emphasis on these issues then was much less. But today, these ingredients constitute the mainstay of IFI-led land reforms across the world.*
Through this approach, land reforms are envisaged in two phases:

1. **Phase One – Dismantling Distortionary Policies.**
   - This would involve the removal of all restrictions on the sale and purchase of land, including those related to minimum and maximum size, and revision of procedures for sale of public lands.
   - It would envisage the complete elimination of rent controls so as to increase investments and efficiency in agriculture.
   - Zoning would also be eliminated, except in the case of safeguarding certain environmental concerns. Restrictions on land use, if necessary in specific areas, would be achieved through instruments other than government legislations, such as creation of a market for development rights.

2. **Phase Two - Institutional and Legal Reforms**
   - Constraints in the operations of the land markets to be removed through reforms that aim at reducing costs of land adjudication, issuing of correct titles, and easy availability of crucial market information to interested parties.
   - Creation of land laws that remove uncertainty facilitates easy and transparent access to the land administration system, establish dispute settlement institutions and institutionalize property rights.

As is evident, the bottom line of all these measures is the facilitation of land markets wherein land is available for sale-purchase from *less to more productive users*. It is believed that with proper title deeds being available for property, it would become easier and less risky to buy and sell land. As a private commodity, the owner will have a stake in putting the land to best use, which in WB terminology implies use that can generate maximum profits.

The manner in which this exercise would generate access to land for the rural poor is through the provision of credit to them for purchase of land, making available to them technical assistance to enable them to plough the land in keeping with the needs of commercial farming, and providing them with marketing support. Of course, everything would come for a price with the farmer being gradually pushed into a process of indebtedness. Credit would be easily available to have access to land and other expensive agricultural inputs such as seeds, fertilizers, pesticides, irrigation, market mechanisms etc. The market forces at every step would encourage the farmer to take easily available loans, but vagaries of nature as much as those of the market could easily bring him to ruin. Bankrupt, he may be forced to sell the land and either move out of the land market completely, leaving the fields for the richer and more able farmers/corporations, or get into the process once again to try his luck.

It is in this context that the market-driven land reforms that are being encouraged by the IFIs need to be looked into. None can deny the need for reform in land administration agencies, for updating of land records through surveys and settlement of rights,
computerization of land records etc. In fact, one can recall that in the first two decades of government land reforms after independence, the reformers demanded these measures. At that time, however, the issues were largely ignored or neglected owing to lack of institutional support such as trained staff, equipment, capital etc. The IFIs have rightly discovered this lacuna and are now offering the financial help and technical expertise in carrying out the exercise. However, the purpose for which these reforms are being undertaken in the present context raises several issues since the motives may not measure up to those of social justice and dignity for the individual:

1. The IFIs proclaim increasing access to land for the rural poor by offering credit. However, how does this help if they simultaneously encourage macroeconomic and trade policies that negate the benefits of such an exercise? Policies such as trade liberalization, cutbacks in price supports and subsidies for food producers, privatization of credit, commercialization of agriculture, excessive export promotion and promotion of research in expensive technologies such as genetic engineering etc undercut the economic viability of the smaller and poorer farmers. The onslaught of these policies adversely affects the small farmers leading to high failure rates, mass sell-offs, increased landlessness, land concentration, even intensified land degradation, and rural-urban migration. What then are the efficacy of such land reforms?

2. The emergence of land markets and the consequent commodification of land raise several issues for the status of the common property resources because by codifying social and property relations that were hitherto implicit, land titling could reduce the asset-endowment of vulnerable groups with inadequate access to political power. Therefore, their privatization would spell severe consequences for those who have survived on it for generations but have no legal documents to show for the same. Does this not lead to situations, where common lands may be acquired by powerful individuals/corporations in violation of long-established rights of indigenous communities?

3. What impact would the process of titling and land registration have on the status of women and indigenous people who often tend to be left out of these processes?

4. The market-driven economy emphasizes short-term profit motives with little regard for the people or environment. Rather, the primacy of commercial interests in a market society encourages the view that stretches of densely vegetated forests or other open lands that may have an intangible ecological value but are not being utilized to carry out activities that can fetch tangible foreign exchange are ‘non-optimally used resources.’ With such perceptions becoming prevalent, would not the environment, too, become victim to a thoughtless extraction of maximum profits with little consideration for the actual ecological value of land? For instance, the conversion of non-agricultural land to agricultural, or vice versa, may not be the most judicious use of the land but may be resorted to for the sake of maximizing profits.
5. The benefits of secure titles to land may be nullified by market distortions caused when land is used as a commodity for investment and speculation. This then inflates land value, making access to land even more difficult. Therefore, how can land speculation, an inevitable accompaniment of land market development, help in providing secure tenure for all -- the major World Bank motivation for market-led land reforms?

While data is not yet available, most observers feel that the net result of the predominance of land markets in regions where they have become operative has been a deterioration in the access of the poor to land as they are forced/tempted to sell off land they own, or lose it by defaulting on credit. None can argue against the need for straightening land records and the provision of secure land titles and registration, the motivation for the exercise must delve deeper than the mere creation of land markets for private profit. The Project proposes to undertake a study of this issue and its actual impact on the rural poor by studying the implementation of the activity in the state of Maharashtra. It also proposes to study alternative schemes in this regard, such as the one undertaken by the Maharashtra government in Pune. The simultaneous analysis of two different methods of undertaking regularization of land records would reveal lessons for others. It shall also weigh the benefits costs of these measures against those of land redistribution as a means of poverty alleviation and for promotion of ecological sustainability.

Commercialization / Industrialization of Agriculture

An economic model based on widespread industrialization has signified profound changes in the manner in which agriculture is conducted and for what purpose. From a family, or at the most a community affair, agriculture has been "professionalised" into an industry where a farmer produces for a global market. Indeed, modern techniques of arming such as increased mechanization, development and widespread use of artificial fertilizers, pesticides and herbicides, emphasis on economies of scale through larger field and farm size, continuous cropping, developments in livestock, plant breeding and biotechnology have transformed agriculture.

This phenomenon has been promoted by decision-makers who perceive agriculture more as an industry that must be conducted to maximize profits and less as a way of life that has social and ecological ramifications. The trend has been justified by the substantial increases in agricultural output, which, it is argued, has substantially eased national food security concerns. Undoubtedly, national granaries are today overflowing. And yet, the individual in the village is starving to death or a failed farmer is resorting to suicide. Surely, this calls for a closer examination of the issues involved.
Commercialization of agriculture first struck its root in India in the 1960s with the Green Revolution in Punjab when the World Bank, along with the U.S. Agency for International Development (USAID), promoted agricultural productivity through import of fertilizers, seeds, pesticides and farm machinery. The Bank provided the credit that was needed to replace the low-cost, low-input agriculture in existence with an agricultural system that was both capital- and chemical-intensive. The Indian government decided that the potential of the new technology far outweighed the risks and accordingly, the foreign exchange component of the Green Revolution strategy for the five-year plan period (1966-1971) was raised to about $2.8 billion, a jump of more than six times the total amount allocated to agriculture during the preceding third plan. Most of the foreign exchange was spent on imports of fertilizer, seeds, pesticides and farm machinery.

World Bank credit subsidized these imports while also exerting pressure on the government to obtain favorable conditions for foreign investment in India's fertilizer industry, import liberalization and the elimination of most domestic controls. The Bank advocated the replacement of diverse varieties of food crops with monocultures of imported varieties of seeds. In 1969, the Terai Seed Corporation was started with a $13 million World Bank loan. This was followed by two National Seeds Project (NSP) loans. This program led to the homogenization and corporatization of India's agricultural system. The Bank provided NSP $41 million between 1974 and 1978. The projects were intended to develop state institutions and to create a new infrastructure for increasing the production of Green Revolution seed varieties. In 1988, the World Bank gave India's seed sector a fourth loan to make it more "market responsive." The $150 million loan aimed to privatize the seed industry and open India to multinational seed corporations. After the loan, India announced a New Seed Policy that allowed multinational corporations to penetrate fully a market that previously was not as directly accessible. Sandoz, Continental, Cargill, Pioneer, Hoechst and Ciba Geigy now are among the multinational corporations that have major interests in India's seed sector.

While the Revolution did ease India's food grain situation, transforming the country from a food importer to an exporter, it also provided space to the rich farming community to politicize subsidies, facilitate concentration of inputs increase dependence on greater use of external inputs such as credit, technology, seeds, fertilizers etc.

Moreover, a study by the World Resources Institute, published in 1994, showed that the Green Revolution only increased Indian food production by 5.4% while the agricultural practices that were followed have resulted in nearly 8.5 million hectares or six percent of the crop base being lost to water logging, salinity or excess alkalinity. Furthermore, although the amount of wheat production has doubled over a period of 20 years, and rice production has gone up by 50%, greater emphasis has been placed on production of commercial crops like sugarcane and cotton etc at the expense of crops like chickpeas and millet that were traditionally grown by the poor for themselves. This has steadily eroded the self-sufficiency of the small farmer in food grains.
Yet, governments remain stuck on the same model of agrarian reforms and are being generously encouraged by the IFIs. Agriculture is the World Bank's largest portfolio in any country. 130 agricultural projects have received $10.2 billion Bank financing in India since the 1950s. These projects have taken the form of providing support for the fertilizer industry, ground water exploitation through pump-sets, introduction of high yielding variety of seeds, setting up of banking institutions to finance capitalist agriculture etc.

Women and Land

With farms linked to the wider market economy, the condition of women's participation in farming has undergone a change, and not for the better. Traditionally, rural women have been responsible for half of the world's food production. They remain the main producers of the world's staple crops - rice, wheat, and maize - which provide up to 90% of the rural poor's food intake.

Their contribution to secondary crop production, such as legumes and vegetables, is even greater. Grown mainly in home gardens, these crops provide essential nutrients and are often the only food available during the lean seasons or if the main harvest fails. Women's specialized knowledge about genetic resources for food and agriculture makes them essential custodians of agro-biodiversity. In the livestock sector, women feed and milk the larger animals, while raising poultry and small animals such as sheep, goats, rabbits and guinea pigs. Also, once the harvest is in, rural women provide most of the labor for post-harvest activities, taking responsibility for storage, handling, stocking, processing and marketing.

However, in the market-driven agriculture, a conceptual division of labor between the productive tasks of farming and the unproductive tasks of household and reproduction recasts women's role as "mere 'supporters' of the 'producers.'"

This tendency, however, tends to overlook the reality of rural-urban migration of men in search of paid employment and rising mortalities attributed to health problems such as, due to excessive drinking, HIV/AIDS etc. which has led to a rise in the numbers of female-headed households in the developing world. This 'feminization of agriculture' places a considerable burden on a woman's capacity to participate in agriculture in view of the difficulty in their gaining access, control and recognition of their ownership to valuable resources such as land, credit and agricultural inputs, technology, extension, training and services.

The status of women in all societies is directly linked to their right to access, ownership and control of land. In fact, this link has been well recognized by the government as is evident in the fact that the Eighth Five Year Plan (1992-1997) lays down that one of the basic requirements for improving the status of women is:
a) change inheritance laws so that women get an equal share in parental property, inherited or self-acquired. (Unfortunately, there are no government directives to ensure that this is followed through.)

b) state governments be asked to allot 40% of surplus land (i.e. land acquired by the government from households owning land more than the specified ceiling) to women alone, and to allot the rest jointly in the names of the husband and wife. (Unfortunately, the land available for this purpose is a meager 1.04 million hectares.)

However, despite the noble intentions, the truth is that the process of understanding the relationship between land and woman and its incorporation into public policy in India has been extremely slow. In fact, today it remains an issue of marginal concern. There has been a neglect of women's land-related concerns by both governmental and non-governmental institutions and this also mirrors a gap within academic scholarship, where the relationship between women and property has remained virtually unattended.

In order to understand the criticality of the link between property and women, one may well begin with the question as to why do women need independent rights to land? Perhaps, the answer to this can be little different from why do men need independent rights to land? The answers in both cases remain the same: for their welfare, for equality and for empowerment. Just as ownership of land imbues the man with a certain confidence and sense of self worth, so does this apply to the woman. In fact, having been subjugated as the weaker sex for generations, right to property not only enhances her social status but also has an impact on the relations of power between women and men which are revealed in a range of practices, ideas, and representations, including the division of labor, roles, and other resources between men and women. Her relations within the household and family, outside the household and family as in the market, community or the state are all affected.

Certain communities in India (especially in the Northeast and the South) have practiced the tradition of customarily recognizing women's property rights. Their inheritance laws and marriage practices were so tailored to provide and protect these rights and enough studies have been devoted to studying these practices. Several matrilineal and bilateral systems of land inheritance also advantaged women in many respects, especially in granting them economic and social security, and considerable autonomy and equality in marital relations. These systems, however, have eroded over time. Interventions by the colonial and post-colonial government policies, particularly in the legal and economic spheres, and the complex processes of social and cultural change which these set in motion, have degraded customary practices. The large joint family estates have fallen into disuse, formerly egalitarian tribal societies have grown economically differentiated; there has been an increasing penetration of market forces; and, notable shifts in the techniques of production, the social division of labor, and land relations; sexual mores have altered; and patriarchal ideologies have spread their influence. Women, in particular, have been profoundly affected by these changes and their customary exclusion from major authority
in public bodies has meant that they are not the ones directing the change or even in a position to effectively protect their interests.

Their interests in the present context are deemed to be protected under laws, but unfortunately, even where the laws have the interests of women at heart, there is a wide gap between law and practice in traditionally patrilineal communities. Moreover, there are social barriers to women inheriting land in such communities and cases of "voluntary" renunciation of claims by women, the necessity of male mediation, hostility from male kin, village bodies and government officials etc.

Another problem presents itself in the existence in the gap between ownership and control. In fact, the issue of control has several dimensions. The three principal ones in the context of individual ownership being --

- women's ability to retain title to the land they inherit or otherwise acquire;
- their ability to take decisions regarding the disposal of the land through sale, mortgage, bequest or gift;
- and their ability to take decisions regarding the use of land, including leasing it out or self-managing it and disposing of its produce.

In a bid to rectify the skewed bias in favor of property rights for men, women have in some cases resorted to struggles. Women's struggles have to be waged over both resources and meanings and it could be conducted in several different arenas -- the family, the community and the State -- and across the lines drawn by class, caste, religion, and ethnicity and so on. Indeed the task is not easy and government intervention in the form of honest land reforms could go a long way in assuring social justice and equity for women.

The women grow dryland crops such as groundnut, red gram and the local cereal ragi -- most of it for home consumption. But they also earn a small amount of money by making plates from sal leaves collected from the nearby forests and selling them at the local market. While the women work, the men travel to look for work.

The village is part of a nationwide trend in agriculture, which over the last few years has seen huge changes. While more and more men are migrating to urban areas and large industrialised farms looking for paid work, women stay in the village and are increasingly taking over cultivating the land.

According to estimates by Bina Agarwal, an academic researching and writing about women and land rights, almost half of the land in India is now farmed by women. The changes mean that in the rural areas the vast majority of women -- around 85% -- are now farmers. Agarwal points out that although what she calls the ‘feminisation of agriculture' is taking place at a rapid pace, there has been less of a shift in cultural attitudes towards women.
According to her research, India's inherently patriarchal mindset has not adjusted rapidly enough or questioned whether the women have rights to own the title deeds to the lands they farm.

Although the women of Narsenahalli may be typical of this pattern, what is extraordinary is that they are also one of the first groups of women to challenge the status quo and demand the right to own the title deeds to the land they cultivate.

Today the women are organised and form an all-women village unit to deal with land issues as part of a larger organisation, the Karnataka People's Forum for Land Rights (KPFLR), which was formed in 2001 to campaign for land reform.

"We want our pattas. It is our right," say the majority of women on the school veranda, as though rehearsed, referring to the title deeds to their plots of land.

"We need our land," says 40-year-old Chondamma. "Tell her about our struggle," she asks Chitravathy, a convenor working with KPFLR who explains that they've been working with the women to raise their awareness about land rights and to push Karnataka to speed up the process of reform.

Karnataka, along with West Bengal, has been at the forefront of land reform in India. In the 1970s, the Indian government initiated a progressive land reform process, known as regularisation, which aimed to allocate gomal lands to socio-economically weaker, landless communities.

Progress over 30 years has been extremely slow, but recently the government has established Land Grant Committees to reinvigorate the reform process. Although the committees have been criticised for failing to consult with local communities, Chitravarthy feels that they still offer the best chance of change.

"NGOs or donors cannot make a big impact on obtaining land for the landless. This is a very political issue and working through the government is the only way out," he says.

So far, land for the landless, regardless of gender, has been a greater priority than land rights for women. However, given that the majority of KPFLR's members are now women, the gender dimension to land rights is becoming a higher priority.

Where land is owned and managed by women, there are signs that they use it as collateral to borrow money to start up micro-businesses which generate a steady income. The women also grow in confidence and demand services from the government for themselves and their children.

Progress on land rights for women has also slipped down the agenda of development organisations working with women. A 2002 survey of women and land issues in Karnataka, conducted by the US-based Rural Development Institute, says interventions by non-governmental organisations have succeeded in empowering women in areas such
as literacy, access to credit, job skills and health, but have not significantly increased claims for land ownership rights.

In India, the debate about women's land rights and the impact they can have on rural wealth creation and security is minimal. Even in places where policy has been changing, such as in Karnataka and West Bengal, implementation is slow, and patriarchal attitudes are proving more powerful than the law.

A few radical women's collectives have obtained land, such as in northern Karnataka where tribal women are working collectively. But these cases are few and far between and are mostly isolated projects supported by aid organizations.

**Status of marginal and small farmers in India**

Due to the unprecedented expansion of rural population from 298 million in 1951 to 629 million in 1991, the per capita land availability has shrunk. The predominant feature of structural change in agriculture is the increase in number of marginal holdings of below one hectare, without proportionate increase in the area operated by them. The only redeeming and commendable feature of agrarian change is that land is not getting concentrated in the hands of a few land owners. These also are reflections of inadequate absorption of labour in non-agricultural rural and urban sectors. The organised sector has limited capacity to absorb the rural labour, even if it provides double the employment by year 2000 to its 266 million employment in 1987-88. The major part of the rural labour force will have to be absorbed within rural areas in agricultural and non-agricultural activities induced by agricultural growth and incomes.

Several innovative approaches have been suggested to overcome the twin problems of poverty and unemployment in rural areas. One of these approaches is to provide small and marginal farmers adequate support to make them vibrant and instrument of growth through value addition and diversification. The available literatures reveal that small farmers were more productive than their larger counterpart in the pre-green revolution period. This inverse farm size-productivity relationship weakened in the post-green revolution period (Walker, et al, 1990). More recent evidences at least in some areas, suggest that the inverse farm size-productivity relationship reestablishes over a period of time (Reddy, 1993). Given efficiency and viability of small farms, it is puzzling that the economic status of small farmers does not differ much from that of agricultural labourers. That is, even when small farmers achieve increase in production efficiency, they are unable to improve their economic condition. The value addition and diversification are sought to bring out these economic changes to small farmers. To achieve these goals, the Small Farmers Agri-business Consortium (SFAC) has been created. The primary objective of SFAC is to extend the benefits of modern agribusiness to small farmers and create employment and income generating opportunities in rural areas through diversification and commercial orientation.

An important aspect to note about Indian agricultural production (in most parts of the country) is its relationship (even dependency) on skilful and wise water-management
practices. One of the unique features of the Indian Subcontinent is how almost its entire rainfall is concentrated in the few monsoon months. During the monsoons, the Indian Subcontinent is usually gifted with bountiful rains, although not infrequently, this bountiful monsoon can turn into a terror, causing uncontrollable floods in parts of the country. Conversely, every few years, the monsoon can be erratic and deficient, leading to drought and the possibility of famine.

Thus, all through history the development of Indian agriculture has been inextricably linked with effective water-management practices that have either been taken up by the state, or by local village communities. Water management has necessitated a certain degree of cooperation and collective spirit in the Indian countryside, and until the imposition of colonial rule, it precluded any widespread development of private property in India.

Regional rulers, or local representatives of the state were generally obliged to allocate a certain percentage of the agricultural taxes on building and managing water-storage, water-harvesting and/or water-diverting structures which facilitated a second crop, and provided water for drinking and other purposes in the long dry season.

Only a small percentage of Indian farmers have enjoyed the luxury of natural irrigation, although there are reports that in certain parts of the country, the soil used to retain enough moisture well beyond the monsoon months. However, it is equally true that the drying up of wells led to mass migrations, and sudden depopulation of old towns and villages.

In Assam, Bengal and Bihar - all flood-prone states, there is evidence of a massive network of canals that allowed both effective drainage to prevent flooding during the heavy monsoon months, and also provide for fishing, transportation and irrigation arteries in the dry seasons.

Intelligent water-management thus allowed for the growth of a healthy agricultural surplus, that in turn facilitated steady urbanization (albeit at a much slower pace than seen in the industrial era), and the development of a variety of pre-industrial manufacturing in areas such as textiles, jewelry, wood/metal-working etc.

Because of the immense importance of effective water-management, the entire revenue system of the state was structured so as to take into account both the necessity of water-management and the inherent dependency that existed between Indian agriculture and the availability of water. Most Indian states attempted to collect revenues in a manner that did not entirely destroy the village solidarity that was essential in proper sharing and management of common water-resources. At the same time, urban tax collectors had to deal with mediating entities from the villages, so that they did not tax at a rate that might lead to the destruction of water-management facilities so essential for life and sustainable agriculture.
By and large, taxes were imposed on villages collectively (not on individual farmers directly), and the village elites (whether Brahmins or others) were obliged to ensure that the burden of taxes did not destroy the complete viability of agriculture. Taxes were also adjusted keeping in mind whether the land was well-irrigated or not.

When ruling dynasties became utterly corrupt and decadent, and failed to tax within limits, or neglected the construction and maintenance of collective water-management facilities, they were confronted with revolts and rebellions, and even risked being overthrown.

There is evidence that whenever the tax collectors of a certain regime became too greedy (such as what happened in certain villages/districts during the reigns of some of Northern India's more rapacious invading conquerors), entire villages would be abandoned to escape the burden of heavy taxes. As long as India was not very densely populated and there was the potential of new lands to cultivate, (and the reach of the armed state was not absolute and all-encompassing), this was one of the means by which Indian villagers - both artisans and peasants were able to escape the burden of back-breaking taxes.

But as the population grew and states became more powerful, this escape route was gradually sealed off, and this then led to regional peasant rebellions - most significant of which were the Sikh and the Maratha revolts against the Mughals.

Thus, the British arrived in India at a time when peasant rebellions were beginning to eat away at the invincibility of the might of the Mughal empire. However, even as the decentralization that resulted from the break-up of the widely resented Mughal empire eased slightly the burden on the peasantry in most instances, it also provided an opportunity for the increasingly cunning and shrewd Britishers in India to seize the opportunity, and exploit the widening cleavages in Indian society for their own nefarious ends.

**Colonial Aspects of Exploitation in the Indian Countryside**

The imposition of Colonial Rule in India led to a drastic break with the past, in that not only did the scale and intensity of the exploitation of the village communities greatly increase, it also led to the introduction of new, and almost entirely parasitic intermediaries between the state and the tax paying masses - intermediaries who were typically induced (or pressurized) to abandon traditional restraint, and discard the old formulae that helped mediate the burden on the typical village peasant or artisan.

Not only were these intermediaries under no pressure to build or maintain traditional water-management structures, the manner in which they were chosen by the British to collect the taxes actually discouraged any diversion of the taxes towards any capital upkeep. Over time, this not only led to the destruction of century-old water management structures, but also to the virtual destruction of the knowledge systems and cultural traditions that had helped build and preserve these water-management techniques over the centuries in states such as Bihar, Bengal, Karnataka, Tamil Nadu and others.
In addition, the British obliged these intermediaries to collect the taxes not in kind, but in cash. Since the peasant had little experience or understanding of a cash economy (or any control on the price of grain and agro-inputs), this put a further burden on the peasant, who now also had to face the thuggery of unscrupulous grain traders and usurious money-lenders - who took full advantage of the highly diminished status of the Indian peasant in the colonial dispensation.

As a result, not only was the typical Indian peasant reduced to a state of utter degradation, social relations within the village also became highly distorted. The traditional solidarity that had existed between villagers was now subject to the divisive and ruinous tactics of the parasitic intermediaries who had the protection and support of the colonial state.

As colonial rule progressed, the typical Indian peasant (and village artisan) faced a dual burden. Not only did the traditional feudal form of exploitation greatly intensify (in comparison to traditional Indian practices), the typical Indian villager was now also subject to the merciless forces of mercantile capitalism, who attempted to extract every ounce of savings or assets that any villager might still possess. Eventually, the typical Indian villager was stripped of all savings, and driven to mortgaging a considerable portion of any assets - whether personal jewelry, land and livestock, or tools and equipment.

But even as the Indian money-lenders and grain traders fleeced the village artisans and peasants, their accumulated wealth was not especially significant in comparison to the British mercantile capitalists of the East Indian Company who kept a lion's share of the loot.

It is especially important to note that whereas a share of the village surplus went to a few Indian intermediaries (who served as a buffer between the British colonial overlords and the Indian masses, and generally acted to quash the class struggle), it was the British who expropriated the bulk of the peasant's assets and annual agro-produce, and transferred most of this looted wealth to the British homeland where it was turned into industrial capital and urban development.

This point is of special significance in understanding the unique nature of class contradictions in the Indian countryside (as compared to elsewhere in the non-colonized world.) For instance, almost throughout Europe, the peasantry was also subject to exploitation by the feudal landlords, but the expropriated surplus from the countryside eventually found its way into the urban banking system, and ultimately facilitated in the growth of industrial capitalism. Sections of the impoverished peasantry then had the chance to gradually move into industrial occupations.

But India was subject to an especially tragic plight. Its masses were thoroughly impoverished, but their immediate exploiters were able to keep only a very small share of what had been extracted from the peasantry. This meant that even when a transformation into industrial capitalism became possible (after freedom from British colonial rule) -
there was simply not enough accumulated savings to fund the rapid expansion of industry that could eventually transform the countryside.

When the British left, they left India with extremely limited material means to industrialize, but a sizeable class of parasitic intermediaries who would serve as a constant drag on future development. Unlike India's pre-colonial mercantile classes and the more nationalist sections of India's traditional feudal nobles and intermediaries (who were mostly neutralized or exterminated in 1857) this new colonial era mercantile class was extremely backward in cultural terms and was generally lacking in nationalist spirit.

In comparison, the mercantile classes in Europe of the late 18th and 19th centuries were not only wealthier, but also more urbane, and displayed a much higher level of cultural, scientific and technological openness and curiosity. This was also generally true of Japan, and to a somewhat lesser degree, of mercantile classes in other parts of Asia that escaped direct European colonial rule (such as in Korea, Thailand and even China).

It should also be noted that whereas the mercantile classes in Europe, Japan, Korea and China were moving in a broadly secular direction, the Indian mercantile classes were excessively weighed down by sentiments favoring religious revivalism or extreme sectarianism (a trend that was especially strong amongst Muslims, but also posed a serious problem amongst Sikhs and Hindus).

It is thus important to understand that not only was the Indian countryside weighed down by a new and more intensified feudal oppression in the colonial era (such as through the Zamindari or Mahalwari systems), it was also oppressed by a highly reactionary and socially conservative intermediary class of petty mercantile capitalists who would pose as the biggest obstacle to any radical or revolutionary developments in the Indian countryside.

Finally, it should be noted that colonial rule exacerbated the problems of the Indian countryside in yet another way. Prior to colonization, India was steadily becoming more urbanized, with some estimates suggesting that as much as a third of the Indian population may have been living in large or small towns. In addition, even in the villages, a considerable proportion of the population comprised of skilled artisans - weavers, potters, carpenters, metal-workers, painters etc. The proportion of the population that was exclusively engaged in agricultural production was steadily decreasing.

But in the colonial regime, several laws were passed that led to a catastrophic de-urbanization and de-industrialization of India. Trade tariffs and excise duties were set so as to destroy Indian industries, and squeeze domestic trade. In states like Bihar and Bengal, severe restrictions were placed on the use of inland water-ways - causing fishing and inland shipping and transportation to suffer. This led to even greater pressures on agriculture since large categories of highly skilled artisans and non-agricultural workers were thrown out of work.

Effects of Partition
The problem for India was compounded further by the demands for partition, and the insistence of the Muslim League in splitting the country on communal lines. It is important to note that prior to partition, the best naturally irrigated and most productive lands in Northern India were in North Western Punjab (now Pakistan). Fed by a network of all-weather rivers, no other part of the Indian sub-continent was capable of producing more grain with relatively little capital investment. Similarly, Bangladesh was a much better irrigated land than West Bengal (although it faced far greater risks of flooding than Pakistan Punjab).

But in any case, it is worth pointing out that the bulk of pre-partition India's wheat, cotton and jute were grown in what are now Pakistan and Bangladesh. Not only did partition provide India with a smaller share of the land (relative to the ratios of the Hindu, Sikh and Muslim populations), it also left India without the means to feed itself, and without some of the essential raw materials for industry.

It should also be noted that partition disrupted what had been a somewhat natural distribution of labor between what became Pakistan and India. Since West Punjab and Sindh were better suited to agriculture, the relatively arid states of Rajasthan and Gujarat specialized in all manner of cottage industries and manufacturing that needed the raw materials and markets of West Punjab and Sindh to flourish.

In the same way, there was considerable co-dependencies not only between Western and Eastern Bengal, but also between undivided Bengal and its neighboring states such as Assam, Orissa and Bihar. The artificial vivisection of Bengal virtually destroyed the potential of regenerating the traditional trade linkages that had been so vital to the prosperity of the Eastern half of India. Geographically, it should be evident that the management of water and other natural resources cannot be efficiently undertaken without the effective coordination and active involvement of all the states in the Ganga-Brahmaputra region.

But the vitiated atmosphere under which partition took place meant that the possibilities of mutually beneficial cooperation in matters of resource-sharing, trade, transportation and agriculture were practically foreclosed. (To this day, communal forces in Bangladesh have resisted attempts by India to expand cooperation since they would rather see India suffer more rather than see both India and Bangladesh make more rapid progress.)

Thus, when the British left, India had become a much more village-based agricultural economy than it had been earlier - it is likely that the British had pushed India back by several centuries in this respect. Yet, its prospects for rapid industrialization were also quite bleak.

India had inherited one of the most depressing scenarios in Asia - a fairly densely populated nation with a pitiful urban base, a rural infrastructure in wrecks, a huge mass of population forced to survive exclusively on agricultural production - yet cynically oppressed by petty mercantile capitalists and feudal intermediaries. Moreover, it had also been left artificially divided on communal lines that meant that important historical linkages might never be revived (or revived only with great difficulty).
No civilized nation could have faced a worse set of circumstances.

Why have the farmers to commit suicide?

What is happening to our farmers? The international price has fallen. Here, there has been an increase in the input price and a fall in the output price. Take even the production cost. The farmers have to sell their product at below the production cost. The indebtedness has increased. When the farmers in certain States decided to switch over from foodgrains cultivation to cash crops, from paddy and wheat to cotton, at that time the international price was much higher than our domestic price. When they started producing cotton, the international price has fallen and it is reduced.

For switching over from traditional cultivation to cash crops, they had to borrow money. The institutional lending, the institutional credit during the last five to six years has been reduced abnormally.

Farmers were to depend on moneylenders and because of the indebtedness of the farmers, they were not getting the price as they had to sell their products below even production cost. So, they were not in a position to repay the loan. As a result of that, farmers started committing suicides.

What we are seeing from the Sixth Five-Year Plan is that the capital formation in agriculture has been gradually reducing. The deterioration started from the Fifth Five-Year Plan, and during the Ninth Five-Year Plan, there has been total stagnation.

There has not been any increase in the irrigated area. There has been total stagnation. Percentage of agriculture in GDP has also gone down year after year. Up to 1995-96 it was 1.6 per cent. It came down gradually and today it is only 1.3 per cent. Similarly, in capital formation also, plan after plan there has been deceleration or reduction.

Investment in agriculture reduced over the successive five-year plans. From 6.1 per cent in the Sixth Plan it has come down to 5.2 per cent in the Eight Plan and then to only 3.2 per cent today. Reduction in the capital formation or capital investment in agriculture has its impact on the rural employment. Out of the 37.5 crores of people engaged in the unorganised sector, 22 crore are engaged in agricultural labour. If there is a deceleration, if there is a reduction in capital formation or investment, it impacts the employment of agricultural labourers and also their wages. Unemployment in the rural sector is increasing today. A Bill was introduced yesterday in the Lok Sabha for providing at least 100 days employment to one member of each family in rural areas. This will definitely, not fully but partially, help if it is sincerely implemented in the rural areas. It will depend on the Panchayati Raj system or the State Government and there is a need for improvement also. There are some provisions which will be deterrent in implementing some of the provisions like unemployment allowance. Because this is a Central legislation, the entire responsibility is of the Central Government. Because this is in the National Common Minimum Programme and the National Common Minimum Programme is a programme of the United Progressive Alliance (UPA) which we the Left
parties are supporting from outside. As this is a programme of the UPA Government, the entire responsibility for providing employment, and if they are not provided with employment then paying unemployment allowance will be the responsibility of the Central Government. It should not be entrusted to the State Government. Where will the State Governments find the money from to provide the unemployment allowance?

All this is because of the policy of liberalisation, globalisation and the WTO conditionalities.

There has been an attempt to reverse the Land Ceiling Act also in a number of States. The small and marginal farmers are being forced to give up their land for the purpose of industrialization. What we have seen is that the tribals who are living for years together in wasteland or degraded forest land were uprooted. They were uprooted because of the direction from the Supreme Court and no protection was given to the thousands and thousands of tribal farmers. It has been suggested that in order to protect the farmers of our country, the Government should come out with a new agricultural policy, not the policy which was announced by the earlier Government three years ago in the year 2000. That policy was not in the interest of small and marginal farmers. The Government should bring an alternate agricultural policy so that the farmers of our country can be protected. They should be able to sell their produce not at a cheaper price than the production cost but at a remunerative price. We are for remunerative price.

Lifting of quantitative restrictions should also be reviewed. We will have to see whether by lifting the quantitative restrictions, it has benefited our farmers or not. Our experience has been that it has not benefited our farmers. It has benefited multinational companies. The Food Corporation of India should come to the market before the harvesting starts so that the small farmers are not forced to sell their produce at a price much lower than the minimum support price. Investment in agriculture sector should be enhanced. The subsidy given for irrigation is about Rs.27,000 crore. How much subsidy America is providing for a farmer for one hectare of land? It is 550 US dollars for one hectare of land.

How can we compete with them? In order to protect the farmers, the subsidy, which is being provided, should be increased so that the production cost of the farmers becomes cost effective.

Similarly, cross subsidy in case of electricity tariff should continue in the interest of the farmers.

Low literacy, lack of organization and poor connectivity lead to low levels of awareness among farmers regarding technology usage, institutional credit schemes and sources and the government’s support initiatives. There is enough evidence to suggest that the size of farmer’s holding and level of formal education are positively correlated. Since small farmers are far behind in terms of formal education, they are inherently at a greater disadvantage.
Last but most importantly, there is a need for land reforms. Today also, seven per cent of the population of our country is having 30 per cent of our land. Land reforms have been mentioned in various Five-Year Plans in the objects. But during the last 57 years after Independence, land reforms have not been implemented in letter and spirit. Today, there is a huge number of landless agricultural labors in our country. But there is an experience of West Bengal of showing how a deficit State has become a surplus State today. We are not depending on the rice from Punjab or Haryana. Today, we can produce, we can feed our people and even we can supply to the other States. We are now a surplus State. It is because, in West Bengal, land reforms have been implemented. There is not a single land owner having land more than the ceiling.

Whatever is distributed in our country, 25 per cent of it is being distributed through West Bengal alone. Therefore, other States should also follow this so that economy can be generated and employment potentiality can be increased in the rural areas. Thereby, we will be able to solve the problem of landless labors, which are depending on agriculture.

Government should bring out an alternate Agriculture Policy in consultation with various organizations of farmers, kisaans and agricultural workers. We will have to plead for the farmers who have made this country self-sufficient, although there has been a deceleration in the production in the last two years. If farmers are to commit suicide, we will all have to ponder it and we will all have to find a solution as to how we can save millions and millions of farmers of our country from poverty, from starvation and from exploitation.

Activity 1

1. Write an essay on rural infrastructure in India.
2. What is the contribution of rural transportation in rural development?
3. Discuss land reforms in India. What is the role of women in land reforms?
4. Write short notes on the following:
   - Rural electrification
   - Social infrastructure
   - Land tenures

1.11 SUMMARY

The unit highlights the rural infrastructure in India. After a detailed overview it discusses the use of various resources like land, water and energy in rural areas of the country. It further discusses the concepts of rural transportation, rural electrification in detail. Another important area of discussion was rural banking. It has been emphasized that banks should harness the rural savings, though smaller because of the lower income, and directs them towards productive sectors. The next area of consideration was rural social infrastructure including the aspects of rural housing, rural education and rural health. Land tenures and farming systems in India then discussed in a detailed manner. Land reforms and their causes were dealt in detail and role of women in land reforms was
revealed. Finally the status and problems of small and marginal farmers in India were discussed.

### 1.12 FURTHER READINGS

UNIT 2

RURAL LABOR MARKET IN INDIA

Objectives

After studying this unit you should be able to:

- Understand the relevance and overview to labor market in India
- Know the trends of labour supply in India
- Be aware about the agricultural wages and gender differences in India
- Discuss the non agricultural employment in India

Structure

2.1 Introduction
2.2 Labour in India – An overview
2.3 Labour supply in India
2.4 Agricultural wages and gender differences
2.5 Non agricultural rural employment
2.6 Summary
2.7 Further readings

2.1 INTRODUCTION

India's labour force exhibits extremes ranging from large numbers of illiterate workers unaccustomed to machinery or routine, to a sizable pool of highly educated scientists, technicians, and engineers, capable of working anywhere in the world. A substantial number of skilled people have left India to work abroad; the country has suffered a brain drain since independence. Nonetheless, many remain in India working alongside a trained industrial and commercial work force. Apart from this there is a huge amount of labor working in rural areas often called as rural labor. This unit discusses various aspects of rural labor in India.

2.2 LABOR IN INDIA – AN OVERVIEW

The Indian labor market can be categorized into three sectors:

- Rural workers, who constitute about 60% of the workforce
- Organized of the formal sector, that constitutes about 8% of the workforce; and
- Urban unorganized or informal structure which represents the 32% of the workforce.
The chart below describes the estimated increase in the number of labors from 1977-78 to 2004-05. The labor force has grown from 276.3 million to 385.5 million between 1977-78 and 1993-94 showing an annual growth rate of 2.1%. During the year 1999-2000, the workforce was estimated to be 407 million. In 2004-05 the labor market consisted of 430 million workers and has grown up to 500 million in 2006.

Two-third of India’s workforce is employed in agriculture and rural industries. One-third of rural households are agricultural labor households, subsisting on wage employment. Only about 9 percent of the total workforce is in the organized sector; the remaining 91 percent are in the unorganized sector, self-employed, or employed as casual wage laborers. The labor force in year 2006 has grown up to 509.3 million out of which 60% are in agriculture, 12% are employed in industries and the residual 28% are in services.

Labor force can be divided into four categories: self employed workers, wage and salary earners, casual workers and unemployed. Of these, self-employed are most loosely connected to labor market because of the possibilities of work-sharing and work spreading in a self-employed enterprise. Non-contractual casual laborers have the closest connection to labor market on almost day-to day basis. Same is the case with those unemployed who are actively seeking work. Contractual and hence stable hired employment (with the same employer and/or in the same job) on a regular basis is covered in the description wage and salary workers.
Persons who are engaged in their own farm or non-farm enterprises are defined as self-employed. The employees in an enterprise can be either regular salaried/wage employees or casual wage employees who are normally engaged on a day-to-day basis. The casual wage workers both in public work and other types of work don’t have any job security or social security. These workers, either in formal or informal sector or in private households, are informal workers. The regular salaried/wage employees are those working in others farm or non-farm enterprises and getting in return salary or wages on a regular basis and not on the basis of daily or periodic renewal of work contract. This category includes those getting time wage as well as those receiving piece wage or salary and paid apprentices, both full time and part time. This category of persons may, therefore, include persons engaged regularly on an hourly basis, temporary workers, out-workers, etc. The table given below classifies labor force across male-female and rural-urban dimensions. It is clear that

- Self-employment and casual labor statuses are more prevalent among rural than urban labor force and among female than male workers.

- The incidence of unemployment is higher in the urban than in the rural labor force with nearly 48 per cent of the total unemployed persons coming from aggregate urban labor force whose share in total (rural plus urban) work force is 22 per cent.

- Those reporting wage and salary earning dominate in the urban labor force, their share being around 62 per cent.
2.3 LABOR SUPPLY IN INDIA

Based on the 1991 census, the government estimated that the labor force had grown by more than 65 million since 1981 and that the total number of "main workers"--the "economically active population"--had reached 285.9 million people. This total did not include Jammu and Kashmir, which was not enumerated in the 1991 census. Labor force statistics for 1991 covered nine main-worker "industrial" categories: cultivators (39 percent of the main-worker force); agricultural laborers (26 percent); livestock, forestry, fishing, hunting, plantations, orchards, and allied activities (2 percent); mining and quarrying (1 percent); manufacturing (household 2 percent, other than household 7 percent); construction (2 percent); trade and commerce (8 percent); transportation, storage, and communications (3 percent); and "other services" (10 percent). Another 28.2 million "marginal workers" were also counted in the census but not tabulated among the nine categories even though unpaid farm and family enterprise workers were counted among the nine categories. Of the total work force--both main and marginal workers--29 percent were women, and nearly 78 percent worked in rural areas.

Included in the labor force are some 55 million children, other than those working directly for their parents. The Ministry of Labour and nongovernmental organizations estimate that there are 25 million children employed in the agricultural sector, 20 million in service jobs (hotels, shops, and as servants in homes), and 5 million in the handloom, carpet-making, gem-cutting, and match-making industries. With mixed success, nongovernmental organizations monitor the child labor market for abuse and conformity to child labor laws.

In government organizations throughout the nation and in nonagricultural enterprises with twenty-five persons or more in 1991, the public sector employed nearly 19 million people compared with about 8 million people employed in the private sector. Most of the growth in the organized work force between 1970 and 1990 was in the public sector. Observers expected that this trend might be reversed if the government's policy of
economic liberalization continued. Labor law makes it very difficult for companies to lay off workers. Some observers feel that this restriction deters companies from hiring because they fear carrying a bloated workforce in case of an economic turndown.

A new source of employment appeared after OPEC sharply increased crude oil prices in 1974. The Middle East oil-exporting countries quickly undertook massive development programs based on their large oil revenues. Most of these countries required the importation of labor, both skilled and unskilled, and India became one of many nations supplying the labor. Because some labor agents and employers took advantage of expatriate workers, especially those with little education or few skills, in 1983 India enacted a law governing workers going abroad. In general, the new legislation provided more protection and required fairer treatment of Indians employed outside the country. By 1983 some 900,000 Indian workers were registered as temporary residents in the Middle East. In the mid-1980s, there was a shift in the kinds of skills needed. Fewer laborers, metalworkers, and engineers, for example, were required for construction projects, but the need for maintenance workers and operating staff in power plants, hospitals, and offices increased. In 1990 it was estimated that more than 1 million Indians were resident in the Middle East. India benefited not only from the opening of job opportunities but also from the remittances the workers sent back, which amounted to around US$4.3 billion of foreign exchange in FY 1988. Both employment and remittances suffered as a result of the 1991 Persian Gulf War, when about 180,000 Indian workers were displaced. In the mid-1990s, the outlook for Indian employment in the Middle East was only fair.

India's labor force exhibits extremes ranging from large numbers of illiterate workers unaccustomed to machinery or routine, to a sizable pool of highly educated scientists, technicians, and engineers, capable of working anywhere in the world. A substantial number of skilled people have left India to work abroad; the country has suffered a brain drain since independence. Nonetheless, many remain in India working alongside a trained industrial and commercial work force. Administrative skills, particularly necessary in large projects or programs, are in short supply, however. In the mid-1990s, salaries for top administrators and technical staff rose sharply, partly in response to the arrival of foreign companies in India.

### 2.3.1 Labor Relations

The Trade Unions Act of 1926 provided recognition and protection for a nascent Indian labor union movement. The number of unions grew considerably after independence, but most unions are small and usually active in only one firm. Union membership is concentrated in the organized sector, and in the early 1990s total membership was about 9 million. Many unions are affiliated with regional or national federations, the most important of which are the Indian National Trade Union Congress, the All-India Trade Union Congress, the Centre of Indian Trade Unions, the Indian Workers’ Association, and the United Trade Union Congress. Politicians have often been union leaders, and some analysts believe that strikes and other labor protests are called primarily to further the interests of political parties rather than to promote the interests of the work force.
The government recorded 1,825 strikes and lockouts in 1990. As a result, 24.1 million workdays were lost, 10.6 million to strikes and 13.5 million to lockouts. More than 1.3 million workers were involved in these labor disputes. The number and seriousness of strikes and lockouts have varied from year to year. However, the figures for 1990 and preliminary data from 1991 indicate declines from levels reached in the 1980s, when in some years as many as 35 million workdays were lost because of labor disputes.

The isolated, insecure, and exploited laborers in rural areas and in the urban unorganized sectors present a stark contrast to the position of unionized workers in many modern enterprises. In the early 1990s, there were estimates that between 10 percent and 20 percent of agricultural workers were bonded laborers. The International Commission of Jurists, studying India's bonded labor, defines such a person as one who works for a creditor or someone in the creditor's family against nominal wages in cash or kind until the creditor, who keeps the books and sets the prices, declares the loan repaid, often with usurious rates of interest. The system sometimes extends to a debtor's wife and children, who are employed in appalling working conditions and exposed to sexual abuse. The constitution, as interpreted by India's Supreme Court, and a 1976 law prohibit bonded labor. Implementation of the prohibition, however, has been inconsistent in many rural areas.

Many in the urban unorganized sector are self-employed laborers, street vendors, petty traders, and other services providers who receive little income. Along with the unemployed, they have no unemployment insurance or other benefits.

Unemployment and rural India

The Planning Commission has estimated that 27.5% of the population was living below the poverty line in 2004–2005, down from 51.3% in 1977–1978, and 36% in 1993-1994. The source for this was the 61st round of the National Sample Survey (NSS) and the criterion used was monthly per capita consumption expenditure below Rs. 356.35 for rural areas and Rs. 538.60 for urban areas. 75% of the poor are in rural areas, most of them are daily wagers, self-employed householders and landless labourers. Although Indian economy has grown steadily over the last two decades, its growth has been uneven when comparing different social groups, economic groups, geographic regions, and rural and urban areas.

Wealth distribution in India is fairly uneven, with the top 10% of income groups earning 33% of the income. Despite significant economic progress, 1/4 of the nation's population earns less than the government-specified poverty threshold of $0.40/day. Official figures estimate that 27.5% of Indians lived below the national poverty line in 2004-2005. A 2007 report by the state-run National Commission for Enterprises in the Unorganised Sector (NCEUS) found that 77% of Indians, or 836 million people, lived on less than 20 rupees per day with most working in "informal labour sector with no job or social security, living in abject poverty."

Income inequality in India (Gini coefficient: 32.5 in year 1999- 2000) is increasing. In
addition, India has a higher rate of malnutrition among children under the age of three (46% in year 2007) than any other country in the world.

2.3.2 National Rural Employment Guarantee Act

The SKMS members based their claim on the National Rural Employment Guarantee Act (NREGA) of 2005, which determines that the state must provide people with at least 100 days of employment at minimum wage, or else pay out the stipulated unemployment benefit. A myriad of officials that include village pradhans, Block Development Officers and Chief Development Officers benefit from the projects intended to provide employment under NREGA, and are therefore inclined to resist the payment of benefits, according to Richa Nagar of the University of Minnesota. This was only the fifth time that such a pay-out was made since the passing of the act in 2005.

On a visit to South Africa Professor Nagar explained that although this victory will not end rural poverty in India, it is nevertheless meaningful to the families involved, as the daily minimum wage is about 2 US dollars. "This victory also disturbs the oppressive relations imposed by the caste system, as more than 90% of Sangtins belong to the so-called untouchable dalit caste, who now will insist on and get respect from the state officials," she said to Suite101 in an interview on 3 February 2009.

According to the official website of the government of Uttar Pradesh, there were about 8 million women living in the state in 2001 of whom more than 57% were illiterate. These more than 4 million women, who struggle to find jobs, are all potential beneficiaries of the success of the SKMS.

2.3.3 Movement of Women Farmers and Rural Workers

Professor Nagar was also able to share background information about the SKMS that points to a much wider potential significance. As the name indicates the Sangtin Kisan Mazdoor Sanghatan is a movement of women farmers and rural workers. Sangtin actually means a woman who is a close friend and comrade in a difficult struggle.

The movement started in 2004 out of a process where 9 women co-authored the book Playing With Fire: Feminist Thought and Activism Through Seven Lives in India. Through the writing process the “sangtins” came to terms with their experiences of the sexism, capitalism and hierarchy that rip apart the lives of especially rural women. The problem, they began to understand, was not only the greed of capital and the authoritarianism of the state, it was also the reproduction of these kinds of relationships and behaviour within the Non-government Organisations (NGOs) formed to “empower” women.
2.3.4 Sangtins Against Hierarchy and Oppression

The sangtins began to imagine creating relationships that exclude hierarchy, oppression and greed in favour of equality, freedom and solidarity. Out of imaginings they began working for a new society by taking up struggles such as the dharna for the unemployed. The movement has grown to include 5000 members of whom 45% are men.

2.3.5 Revolutionary Shift

Instead of waiting on members of elites to take action, the Sangtins have made a revolutionary shift of attitude by not only showing a possible way to alleviate the shock of job losses, but by becoming active in shaping the kind of society they live in.

2.4 AGRICULTURAL WAGES AND GENDER DIFFERENCES

The Technical Working Group on Rural Retail Prices set up by the NSSO in 1974, suggested to collect and compile the wage rate data for rural workers on a continuous monthly basis. In pursuance of these recommendations, the wage rate data in respect of 11 agricultural and 7 non-agricultural occupations are being collected every month along with rural retail prices in Schedule 3.01(R) from a fixed set of 600 sample villages spread over 66 N.S.S. regions of 20 States (Andhra Pradesh, Assam, Bihar, Gujarat, Haryana, Himachal Pradesh, Jammu & Kashmir, Karnataka, Kerala, Madhya Pradesh, Meghalaya, Maharashtra, Manipur, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Uttar Pradesh and West Bengal) since July, 1986. These data are being compiled and published w.e.f. the agricultural year 1995-96. In this booklet, daily wage rates for 20 States and All-India have been presented, occupation-wise and sex-wise, for the agricultural year 2003-04 (July to June). Some of the highlights of the data are summarised below:

a) Agricultural occupations:

1. All-India annual average daily wage rates in different agricultural occupations during the year 2003-04 varied widely from Rs.40.46 for male herds-keepers to Rs.88.61 for male labour engaged in ‘well-digging’; from Rs.30.29 for female herds-keepers to Rs.49.69 for the female engaged in ‘harvesting’ activities; and from Rs.26.00 for child ploughers to Rs.36.57 for those employed in ‘sowing’ occupations.

2. Amongst agricultural occupations, ‘well digging’ was observed to be the highest paid activity for men followed by ‘ploughing’ and ‘sowing’ occupations. During the year 2003-04, the all-India average daily wage rates in ‘well digging’ varied from Rs.86.12 in May, 2004 to Rs.92.34 in October, 2003. It was noticed that the average wage rates for men in ‘well digging’ was the highest in the state of Kerala and the lowest in the state of Madhya Pradesh throughout the year.

3. ‘Harvesting’ occupation fetched maximum wages for women followed by ‘transplanting’ and ‘threshing’ occupations. The all-India average daily wage rates for
women in ‘harvesting’ occupation ranged between Rs.47.75 in November, 2003 to Rs.51.73 in August, 2003.

4. Children got highest wages in ‘sowing’ occupation in the range of Rs.34.31 in September, 2003 to Rs.39.08 in March, 2004 followed by ‘transplanting’ and ‘cane crushing’ occupations.

5. ‘Herds-keeping’ was observed to be the least remunerative occupation for men and women workers as the annual average daily wage rates were as low as Rs.40.46 and Rs.30.29 respectively, whereas for children ‘ploughing’ occupation fetched the lowest wages of Rs.26.00 during the year 2003-04.

b) Non-agricultural occupations:

6. The all-India annual average daily wage rates in non-agricultural occupations also varied widely from Rs.50.81 for male ‘sweepers’ to Rs.119.38 for male ‘masons’; from Rs.44.48 for female ‘unskilled labourers’ to Rs.49.87 for female ‘sweepers’; and Rs.29.41 for ‘unskilled child labour’.

7. Amongst non-agricultural occupations, ‘masonry’ was observed to be the highest paid occupation for men followed by ‘carpentry’ and ‘blacksmithy’ occupations. During the year 2003-04, the all-India average daily wages for male ‘masons’ ranged between Rs.118.12 in July, 2003 to Rs.121.14 in June, 2004.

8. ‘Sweeping’ was the highest paid occupation for women as their all-India average daily wages in that occupation varied from Rs.48.52 in December, 2003 & March, 2004 to Rs.51.37 in August, 2003.

9. During the year 2003-04, the all-India average daily wages of children engaged as ‘unskilled labourers’ ranged between Rs.28.97 in April, 2004 to Rs.29.72 in January, 2004.

10. ‘Sweeping’ was found to be the lowest paid occupation for men during the year under reference with an all-India average daily wage rate of Rs.50.81. For women, ‘Unskilled labourers’ was observed to be the lowest paid occupation with an average daily wage rate of Rs.44.48.

11. The average daily wage rates for women were found to be generally lower than those for men in most of the occupations. These can largely be attributed to variations in the number of quotations as the wage differential based on sex was not that significant at sample village level.

12. None of the female workers were found employed either as ‘carpenters’, or ‘blacksmiths’, or ‘cobbler’s’ or as ‘tractor drivers’ as no wage rate was reported for these occupations during the year 2003-04.
2.4.1 Gender Wage differentials

The employment situation in India, as revealed by the study of available data, suggests the presence of discrimination against women at all levels. Labour Force Participation Rates (LFPRs) are lower for women than for men, the disparity being particularly high in urban areas. In Mumbai, LFPR for women was 10.7%, as against 53.7% for men in 1991 (Deshpande and Deshpande 1992). This disparity is a source of some concern, for high labour participation rates for women have been shown to raise nutrition levels for their children, lower mortality rates and raise sex ratios by combating traditional male biases (Agnihotri 1997). Many have argued that the labour participation of women is one of the most important indicators of women’s empowerment, access to resources, and decision-making ability and thus must be made a central focus of policy.

The distribution of men and women across economic sectors and the nature of their work have already been discussed above. John (1995) has effectively shown LFPRs are additionally affected by caste and communal differences that interact with gender to influence employment status. Dalit males and females are more likely to be concentrated in casual employment. Dalit women are less likely than other groups to be involved exclusively in domestic work, and thus actually have a higher LFPR than other groups of women, though their employment, as is stated above, is concentrated in low-paying casual labour. The gap between the LFPRs of Muslim women and men was also found to be much higher than average, as was the case with upper caste Hindu families. Such variation across groups indicates that the relationship between LFPRs and income must not be assumed, for no easy categorisation of this relationship exists. Intervention measures to aid any of these groups must take into account the particular characteristics of their employment—such as heavy involvement of the dalit community in casual labour—to most effectively meet their needs.

A greater detail of group-differentiated data is, thus, critically needed. Wage differentials have been extensively documented in all sectors of the Indian economy. Within the workforce, two kinds of wage differentials have been found to exist. In the informal sector—where most women are employed—there is evidence of women directly being paid lower wages than men, especially in the agricultural labour sector and the urban informal labour sectors where little effective legislation exists as a disincentive for this practice. In the organised sector, where equal renumeration laws are more directly enforceable, pure wage discrimination (differential pay for the same job) has not been found to exist. However, differential levels of education and differential returns to that education implies that women are usually less skilled than men and thus can attain only lower level jobs even within the organised sector, leading to a high wage differential.

In the agricultural sector, it appears that a trend of rising wages for women has ceased. Male-female wage differentials had declined steadily to fall to 1.3 in 1987-88 from 1.7 in 1965. After 1996, however, the differential stagnated in most states, and even rose in a few others (Unni 1998). Less favourable conditions of employment for female agricultural workers in recent years, attributed by many to the effect of the SAPs, is thought to be primarily responsible for this trend.
Education has been found to greatly influence wage differentials. Studies found that the female-male wage ratio in urban India was 0.59 for female illiterates and 0.82 for literates (Deshpande and Depshpande 1992). Another study by Kingdom et al., however, found that even after controlling for gender, only 22% of the gap in wages could be explained by the lack of female education—78% of the wage gap, thus, is due to differential returns to education. Barriers to education and employment of women must be studied, given that differential rates of return on education brings the level of direct economic return of female education into question. It must also be kept in mind that different caste, religious and income groups will have widely varying incentives to either educate, or conversely not educate, their daughters as opposed to their sons.

2.5 NON AGRICULTURAL RURAL EMPLOYMENT

The Indian economy grew at an impressive rate in the last decade and demographic pressure also slowed. yet, the incidence of unemployment (CDS) towards the end of the 1990s were more than seven percent. The situation is especially disconcerting in the rural sector. Employment in rural sector, which is associated mostly with agriculture, has stagnated during the 90s (Jha 2006). Considering the increased pressure on land there exists limited scope for increasing employment in agriculture so that employment in the non-farm sector becomes an important option.

Studies also suggest that with the process of development, the share of non-farm income and employment in the total income and employment of the rural household increases in the developing countries. A combination of farm and non-farm income at the household level provides resilience against adverse situations in either of the sectors, though agriculture is known for more frequent adversity. There are also evidences to show that productivity and profitability in the non-farm sector is generally higher than in the farm sector; as are the average wages and working conditions that obtain in the non-farm sector (Fisher et al. 1998). A greater reliance on the non-farm sector would therefore provide a demand-pull to rural economy and also ensure welfare for rural workers.

In India, economic opportunities in the non-farm sector have also increased.3 A comparative account of the non-farm sector in the rural vis-à-vis the urban sector however, shows significant disparity in terms of its size and growth.4 The lopsided nature of growth of the non-farm sector is causing a problem of rural - urban migration. The small base of the rural non-farm sector located within a large rural population is in fact indicative of the employment potential in the rural non-farm sector (RNFS). Achievement of employment growth as per its potential may require a more favourable policy environment; and the present study attempts to search for these policy options. The study of rural diversification with the objective of ensuring a proper policy match requires first an understanding of the pattern of farm and non-farm employment in the rural sector; Section II of this paper discusses macro-trends in rural employment.
The rural non-farm sector (RNFS) encompasses all non-agricultural activities: mining and quarrying, household and non-household manufacturing, processing, repair, construction, trade and commerce, transport and other services in villages and rural towns undertaken by enterprises varying in size from household own-account enterprises to factories. The RNFS thus comprises diverse activities while sustained growth in the RNFS depends on a varied set of factors, depending on the kind of impetus, positive or negative, that these factors provides to the rural economy RNFS will experience development- and distress- related rural diversification. Section III of this paper discusses rural diversification, its determinants and implications for the rural people. For a better understanding of rural diversification it is necessary to study the participation of rural households in particular non-farm activities; the motivation behind the decisions as well as the ability of the households to participate in these. Section IV attempts to illustrate these points, from the evidence of the survey of Agro-Economic Research Centres (AERCs) spread across the country.

The state plays an important role in encouraging positive rural diversification. The rural economy includes several heterogeneous rural activities having different demand and

### Table: 1999-00: Rural

<table>
<thead>
<tr>
<th>State</th>
<th>Non-agricultural workers as a % of total workers¹</th>
<th>Usual status unemployment rate²</th>
<th>Current daily tatus unemployment rate³</th>
<th>Non-agricultural wage rate as a % agricultural wage rate⁴</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male 100%</td>
<td>Female 100%</td>
<td>Male 100%</td>
<td>Female 100%</td>
</tr>
<tr>
<td>ap</td>
<td>25.6</td>
<td>15.8</td>
<td>12</td>
<td>7</td>
</tr>
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<td>47</td>
<td>119</td>
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<td>15.7</td>
<td>24</td>
<td>6</td>
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<td>9.8</td>
<td>8</td>
<td>3</td>
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<td>40.8</td>
<td>28.8</td>
<td>13</td>
<td>5</td>
</tr>
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<td>k'natka</td>
<td>21.5</td>
<td>12.2</td>
<td>10</td>
<td>3</td>
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<td>kerala</td>
<td>58.7</td>
<td>54.8</td>
<td>76</td>
<td>197</td>
</tr>
<tr>
<td>mp</td>
<td>15.8</td>
<td>8.1</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>m'tra</td>
<td>26.1</td>
<td>5.9</td>
<td>24</td>
<td>11</td>
</tr>
<tr>
<td>orissa</td>
<td>22.8</td>
<td>19.7</td>
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<td>punjab</td>
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<td>51.0</td>
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<td>9.9</td>
<td>8</td>
<td>2</td>
</tr>
<tr>
<td>tn</td>
<td>37.9</td>
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<tr>
<td>up</td>
<td>28.7</td>
<td>16.4</td>
<td>13</td>
<td>6</td>
</tr>
<tr>
<td>wb</td>
<td>33.7</td>
<td>42.8</td>
<td>34</td>
<td>38</td>
</tr>
</tbody>
</table>

supply conditions in their input and output markets. Government policies therefore, in most of the cases are industry specific. In a labour surplus country like India, the government also has a role to play in regulating and mediating in the rural labour market. The present study in Section V reviews some of the government policies that have a direct bearing on the intensity and quality of employment in the rural sector.

A Comparative Account of Growth in Employment and Income for selected Industries / Industry-groups during 1980s and 90s

<table>
<thead>
<tr>
<th>Industries</th>
<th>ACGR in Employment</th>
<th>ACGR in Income</th>
<th>Employment Elasticity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture &amp; allied</td>
<td>1.13 2.33</td>
<td>0.06 -1.58</td>
<td>1.22 1.24</td>
</tr>
<tr>
<td>Mining &amp; quarrying</td>
<td>1.47 1.47</td>
<td>0.27 -1.56</td>
<td>2.61 2.21</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.89 0.85</td>
<td>0.84 1.32</td>
<td>2.52 3.10</td>
</tr>
<tr>
<td>Utilities</td>
<td>0.41 0.67</td>
<td>-0.08 -1.22</td>
<td>3.51 2.92</td>
</tr>
<tr>
<td>Construction</td>
<td>1.03 3.11</td>
<td>2.28 2.61</td>
<td>2.1 2.67</td>
</tr>
<tr>
<td>Trade+Hotels &amp; Restr.</td>
<td>1.67 1.88</td>
<td>1.22 4.31</td>
<td>2.36 3.81</td>
</tr>
<tr>
<td>Transport+storage+com.</td>
<td>1.16 1.01</td>
<td>2.93 1.92</td>
<td>2.57 3.89</td>
</tr>
<tr>
<td>Fin+Insur+RE+B. services</td>
<td>1.18 1.62</td>
<td>1.90 2.72</td>
<td>4.18 3.48</td>
</tr>
<tr>
<td>Com+Social+Pers. servi</td>
<td>0.66 1.93</td>
<td>-0.63 -2.40</td>
<td>2.40 3.37</td>
</tr>
<tr>
<td>Non-agriculture</td>
<td>1.03 1.57</td>
<td>0.91 1.24</td>
<td>2.7 3.39</td>
</tr>
<tr>
<td>Total</td>
<td>1.11 1.64</td>
<td>0.26 0.99</td>
<td>2.19 2.79</td>
</tr>
</tbody>
</table>

Note: These estimates have been worked out with the Current Daily Status (CDS) figures of employment from the NSSO and income figures from the CSO, New Delhi.

In manufacturing, employment growth during the 80s was similar in both the rural and urban sectors; disparity in the rate of growth between these sectors has surfaced in the 90s. The possible reasons for disparity in the rural and urban rate of growth of employment in manufacturing during the 90s are as follow: (a) burgeoning gap in rural and urban infrastructure facilities with regard to assured power and telecommunications; (b) increasing focus on cost-competitiveness with trade liberalization which discourages rural manufacturing that is generally small scale in either the organized or unorganized categories; (c) uncertain policy environment for small-scale industry has also discouraged some village resource-based manufacturing activities in the rural sector; and (d) with trade liberalization and growing consumerism the relative importance of goods produced in the urban sector has increased even for the rural masses.

2.5.1 Rural Employment Trends in States

The above discussion gives a comparative account of employment for major industries at the aggregate level. Certain trends, which were evident at the aggregate level, may emerge robust with the help of state-level information. Table 2 presents the share of different industries in rural employment across states during the reference period (1983 and 1999-2000). Table 2 shows that over a span of 17 years, the share of agriculture in rural employment has declined by only 2 per cent at the aggregate level. There are mixed
trends from the states; the percent share of agriculture has not declined in the states of Andhra Pradesh, Bihar, Karnataka, Madhya Pradesh, Maharashtra and Orissa. The reasons for non-decline of rural employment in agriculture could be different for these states. In certain states like Bihar and Orissa, a dearth of opportunity in the non-agricultural sector could have pushed rural workers towards agriculture whereas in states like Maharashtra the pull factor could have attracted the rural workforce in agriculture. These issues need further probing.

In the non-agriculture employment categories, manufacturing is the most important, accounting for more than 7 per cent of rural employment in the country. With economic development, one would expect manufacturing to become more important in the rural sector; however there is only a marginal increase in its share during the reference period. The share of manufacturing in rural employment has in fact declined in some states like Andhra Pradesh, Bihar, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa and Punjab; whereas, in Assam, Delhi, Gujarat, Haryana, Tamilnadu and West Bengal, the share of manufacturing has increased during the reference period.

Though the reasons responsible for these trends may be different for different states; changes in infrastructures to a large extent explain these trends. In the latter group of states, rural infrastructure has increased significantly during the reference period. This does not necessarily mean that the rural infrastructure in the earlier group of states is poor. A significant increase of rural infrastructure in these states might not have taken place during the reference period. There is evidence at least from Punjab to suggest that even with relatively better rural infrastructure, manufacturing activities have shifted away from the rural sector. It may be noted that the rural sector here is defined on the basis of census classification rather than the revenue records. Urbanization and better infrastructure facilities like assured power could also have lead to this situation.

The state of Delhi presents a different pattern of growth in which rural manufacturing has increased significantly. The developed world arguments to justify manufacturing in the rural sector as for example, low cost of living, etc, in the rural sector probably hold good for Delhi. While the difference in rural and urban infrastructure from the view-point of manufacturing is not there in Delhi; nevertheless, manufacturing activities in the rural sector of Delhi has certain advantages; these units escape some regulations imposed by municipal corporations.

The utilities (consisting of electricity, water), mining and quarrying are the employment categories not very important from the rural employment perspective. Both these categories registered negative growth during 90s at the aggregate level. The share of mining in rural employment has however increased at the aggregate level, whereas the share of utilities in rural employment like its share at the aggregate level has declined. Construction has provided an important impetus for the growth of rural employment; its share in most of the states barring Karnataka, Madhya Pradesh and Maharashtra has increased. The states of Bihar and Orissa, which have not performed well otherwise have done well in construction. It appears that population pressure in these states accompanied by a favourable policy environment for building construction material during the
reference period has encouraged construction activity. There can be other reasons such as increase in per capita income for improved construction activity in the country. Trade is another industry group, in which evidence of rural employment increase is apparent for most of the states. The states of Andhra Pradesh, Orissa and Tamil Nadu were exceptions. The share of transport in rural employment has increased for all the reference states. The creation of basic infrastructure like roads is obviously increasing in recent years in the rural sector; subsequently rural employment in transport has also increased.

Services in rural employment are grouped into two categories namely; community social and personal (CSP) services, which largely fall under the domain of the public sector; while finance insurance real estate and business (FIREB) services are subsumed under the private sector. The share of CSP services in rural employment has also declined in the country, though Assam was an exception. It may be noted that in the recent decade there has been a greater focus on the North-Eastern states including Assam, which may have led to an increase in the share of CSP services. The share of CSP services in rural employment also might have declined on account of a rural-urban classification in the census as well. There is a possibility that with an increase of rural employment in the community social and personal services of a place, the population around that place increases and with an increase of population beyond 5000, the village (rural) gets reclassified as town (urban) sector.

The share of FIREB services in rural employment has increased marginally at the aggregate level; though this has emerged as important for some states such as Andhra Pradesh, Bihar, Gujarat, Haryana, Kerala, Maharashtra, Rajasthan. The share of FIREB services has also declined in many states like Delhi, Goa, Karnataka, Orissa and West Bengal. There could be a variety of reasons that vary across states for this decline in the share of FIREB services. Increase of employment in FIREB services requires slightly different kinds of skill and infrastructure, for example, better literacy, more communication-related infrastructures. Basic infrastructure like roads is almost a precondition for the growth trajectory of the non-agriculture sector to take-off.

The nature and pattern of rural employment across states, shows that various independent factors influence employment in the non-agricultural sectors. Demography or population pressure for instance, influences construction activity, while rural literacy in general promotes FIREB services.

The expansion of rural roads appears to both increase rural employment in trade and transport, while there is also evidence that availability of roads encourages employment of skilled rural work-force in urban centers in selected industries like manufacturing and business services. Infrastructure as such is important for employment in most of the industrial categories. The kind of infrastructure however, varies across industries; for instance, employment in manufacturing requires more of assured power/electricity; while employment in transport and trade requires basic infrastructure like roads; employment in finance-insurance-real estate-business services require more of communication-related infrastructure.
<table>
<thead>
<tr>
<th>State</th>
<th>Agriculture</th>
<th>Mining &amp; Q'rying</th>
<th>Manufacture</th>
<th>Utilities</th>
<th>Construction</th>
<th>Trade &amp; hotels</th>
<th>Transport etc</th>
<th>FIREB services</th>
<th>CSP services</th>
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<td>77.24</td>
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<td>6.45</td>
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<td>14.42</td>
<td>0.36</td>
<td>0.23</td>
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<td>Uttar Pradesh</td>
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<td>0.12</td>
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<td>0.19</td>
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<td>75.89</td>
<td>0.62</td>
<td>0.67</td>
<td>7.17</td>
<td>7.37</td>
<td>0.22</td>
<td>0.18</td>
<td>2.63</td>
</tr>
</tbody>
</table>

Source: Per cent figures calculated from employment (CDS) data published by NSSO
Activity 2

1. Give an overview of labour in India.
2. Discuss agricultural wages in India. What is the standard wage rate of men in India?
3. What do you understand by gender differences? Give your views in context of Indian economy.
4. Explain with the help of suitable examples, non agricultural rural employment in India.

2.6 SUMMARY

The unit discusses the rural labour market in India. India’s labour force exhibits extremes ranging from large numbers of illiterate workers unaccustomed to machinery or routine, to a sizable pool of highly educated scientists, technicians, and engineers, capable of working anywhere in the world. A substantial number of skilled people have left India to work abroad; the country has suffered a brain drain since independence. Nonetheless, many remain in India working alongside a trained industrial and commercial work force. After the detailed introduction, with an overview to labour in India, the supply of labour in India was discussed in detail. Agricultural wages were discussed with gender differences in India. Finally non agricultural rural employment was explained with the help of suitable examples.

2.7 FURTHER READINGS

M.A. FINAL ECONOMICS

PAPER IV (B)

AGRICULTURAL ECONOMICS

BLOCK 3

AGRICULTURE PRODUCTION, PRODUCTIVITY AND RURAL CAPITAL
## AGRICULTURAL ECONOMICS

### BLOCK 3

**AGRICULTURE PRODUCTION, PRODUCTIVITY AND RURAL CAPITAL**

### CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Title</th>
<th>Page number</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Agricultural production and productivity</td>
<td>4</td>
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<tr>
<td>2</td>
<td>Rural capital and credit in India</td>
<td>65</td>
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</table>
In this unit we will throw light on agricultural production, productivity and rural capital in context of Indian economy.

Unit 1 is about the agricultural production and productivity. It deals in agricultural production; production function analysis; resource use efficiency; factor combination and resource substitution; laws of return and variable proportions; size of farms; cost and supply curves; farm budgeting and cost concepts; supply response and aggregate supply; traditional agriculture and resource use efficiency; technical change in agriculture; labour absorption and gender issues in agriculture.

Unit 2 focuses on rural capital and credit in India. Organised and unorganised capital markets will be discussed followed by rural savings and capital formation. Further the rural credit will be discussed with various credit agencies in rural financing. Cooperative banks; societies and rural financing and their role in rural capital formation will be discussed and NABARD refinancing will be dealt in detailed manner.
UNIT 1

AGRICULTURAL PRODUCTION AND PRODUCTIVITY

Objectives

After completing this unit, you should be able to:

- Understand the basic concepts of agricultural production and productivity
- Become aware of the production function analysis
- Know the resource use efficiency, factor combination and resource substitution
- Describe the laws of return and variable proportion and size of farms
- Explain the cost and supply curves, farm budgeting and cost concepts and supply response and aggregate supply
- Discuss the traditional agriculture and resource use efficiency
- Reveal the technological change in agriculture and labor absorption
- Share the gender issues in agriculture

Structure

1.1 Introduction
1.2 Agricultural production
1.3 Production function analysis
1.4 Resource use efficiency
1.5 Factor combination and resource substitution
1.6 Laws of return and variable proportions
1.7 Size of farms
1.8 Cost and supply curves
1.9 Farm budgeting and cost concepts
1.10 Supply response and aggregate supply
1.11 Traditional agriculture and resource use efficiency
1.12 Technical change in agriculture
1.13 Labour absorption
1.14 Gender issues in agriculture
1.15 Summary
1.16 Further readings

1.1 INTRODUCTION

Agriculture is the production of food and goods through farming. Agriculture was the key development that led to the rise of human civilization, with the husbandry of domesticated animals and plants (i.e. crops) creating food surpluses that enabled the
development of more densely populated and stratified societies. The study of agriculture is known as agricultural science. Central to human society, agriculture is also observed in certain species of ant and termite.

Agriculture encompasses a wide variety of specialties and techniques, including ways to expand the lands suitable for plant rising, by digging water-channels and other forms of irrigation. Cultivation of crops on arable land and the pastoral herding of livestock on rangeland remain at the foundation of agriculture. In the past century there has been increasing concern to identify and quantify various forms of agriculture. In the developed world the range usually extends between sustainable agriculture (e.g. permaculture or organic agriculture) and intensive farming (e.g. industrial agriculture).

Modern agronomy, plant breeding, pesticides and fertilizers, and technological improvements have sharply increased yields from cultivation, and at the same time have caused widespread ecological damage and negative human health effects. Selective breeding and modern practices in animal husbandry such as intensive pig farming (and similar practices applied to the chicken) have similarly increased the output of meat, but have raised concerns about animal cruelty and the health effects of the antibiotics, growth hormones, and other chemicals commonly used in industrial meat production.

The major agricultural products can be broadly grouped into foods, fibers, fuels, and raw materials. In the 2000s, plants have been used to grow biofuels, biopharmaceuticals, bioplastics, and pharmaceuticals. Specific foods include cereals, vegetables, fruits, and meat. Fibers include cotton, wool, hemp, silk and flax. Raw materials include lumber and bamboo. Other useful materials are produced by plants, such as resins. Biofuels include methane from biomass, ethanol, and biodiesel. Cut flowers, nursery plants, tropical fish and birds for the pet trade are some of the ornamental products.

In 2007, about one third of the world's workers were employed in agriculture. The services sector has overtaken agriculture as the economic sector employing the most people worldwide. Despite the size of its workforce, agricultural production accounts for less than five percent of the gross world product (an aggregate of all gross domestic products).

1.2 AGRICULTURAL PRODUCTION

Programmes of agricultural production lie at the base of the comprehensive approach to the reconstruction of the rural economy which is embodied in the Third Five Year Plan. Development of irrigation, from large as well as small works, soil conservation programmes and supplies of fertilisers, improved seed and credit, along with the provision of extension services reaching down to the village level, are measures undertaken directly to increase production. In support of these programmes, through the community development movement, the energies of each village community as a whole are sought to be harnessed and its manpower and other resources effectively mobilised. Land reform policies aim at removing impediments to greater production due to the agrarian structure inherited from the past and to prepare the way for the development of a
progressive agriculture organised on a cooperative basis. The various programmes of cooperative development which have been undertaken and will be given still greater emphasis in the Third Plan are intended to build up the necessary institutional framework for rapid economic development in rural areas such as will be of special benefit to the weaker sections of the rural population. Schemes for increasing agricultural production are closely bound up with the success of animal husbandry and dairying and the development of fisheries and of rural industry. From the aspect of long-term development, care of forest wealth, conservation of soil and moisture and the growing of village fuel plantations are of great importance. In some parts of the country rural electrification is already beginning to make a significant impact on rural life through extension of irrigation and speeding up of technological change; this impact will become progressively larger. These various aspects of agricultural development and, in particular, the specific programmes for increasing agricultural production for which the Plan provides, gain in significance when seen against the wider background of the large-scale transformation in rural life which is being brought about through successive Five Year Plans.

1.2.1 PROGRESS UNDER THE FIRST AND SECOND PLANS

By the end of the Second Plan, the index of agricultural production (base-1949-50) rose to 135, the index for good grains being 132 and that for other crops 142. In the First Plan, agricultural production rose by about 17 per cent. During the Second Plan, two years out of five 1957-58 and 1959-60 were unfavourable, and the overall increase in agricultural production amounted to about 16 per cent.

Before the Second Plan took final shape, it was realised that the programme of economic development with special emphasis on heavy industries which the Plan embodied would demand a larger increase in agricultural production than had been at first envisaged. Accordingly, in consultation with State Governments, the initial targets were reviewed, and in November, 1956, the following revised targets were proposed: foodgrains, 80.5 million tons; oilseeds, 7.6

The coverage of crop statistics gradually increased in the course of the First Five Year Plan and from time to time changes were also introduced in the techniques of estimation. The estimates of production of foodgrains in the table have been adjusted to suit these changes up to 1956-57

(a) Partially revised estimates.

(b) Final estimates.

(c) Provisional.

THIRD FIVE YEAR PLAN
Millions tons, sugarcane (gur). 7.8 million tons cotton, 6.5 million bales; and jute, 5.5 million bales. The level of food production in 1960-61 has been produced at 76 million tons is expected to reach about 78 million tons when the revised estimates of crop production become available. The Second Plan target for the production of sugarcane has been exceeded; on the other hand, there has been stagnation in cotton and jute. In oilseeds also, production has fallen below the target. In view of the production trends during the Second Plan, it is of the highest importance that in the Third Plan, besides achieving self-sufficiency in foodgrains, substantial increases should be secured in commercial crops, specially cotton, oilseeds and jute. With the growth of the economy and increase in domestic demands as well as the need to step up exports, success in increasing the production of commercial crops is as vital as increase in the production of foodgrains.

4. In the Second Plan, out of a total anticipated outlay under agriculture and community development of Rs. 529 crores, agricultural production programmes accounted for about Rs. 290 crores. In addition, there was a total outlay of Rs. 372 crores on major and medium irrigation schemes. In the course of the Plan additional resources were provided for minor irrigation. The following Table summarizes information received from State Governments regarding progress in carrying out programmes of agricultural development.

<table>
<thead>
<tr>
<th>Programme</th>
<th>unit</th>
<th>Achievement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major and medium irrigation</td>
<td>million acres</td>
<td>6.9</td>
</tr>
<tr>
<td>(Gross)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minor irrigation</td>
<td></td>
<td>9.0</td>
</tr>
<tr>
<td>Soil conservation on agricultural lands</td>
<td></td>
<td>2.0</td>
</tr>
<tr>
<td>Lands reclamation</td>
<td></td>
<td>1.2</td>
</tr>
<tr>
<td>Area under improved seeds (foodgrains)</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>Consumption of nitrogen (N)</td>
<td>thousand tons</td>
<td>230</td>
</tr>
<tr>
<td>Consumption of phosphatic Fertilisers (P2O6)</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Urban compost</td>
<td>million tons</td>
<td>3</td>
</tr>
<tr>
<td>Rural compost</td>
<td></td>
<td>83</td>
</tr>
<tr>
<td>Green manuring</td>
<td>million acres</td>
<td>11.8</td>
</tr>
</tbody>
</table>

Apart from the influence of unfavourable seasons, greater progress might have been achieved in agriculture during the Second Plan if the benefits of the substantial
investments incurred, for instance, in the extension of irrigation, both from small and large irrigation works, and in the establishment of seed farms could have been realised more speedily. Programmes which require large-scale participation on the part of the people, such as, soil conservation, made only limited progress. The consumption of fertilisers, which has been recently stepped up to a considerable extent, increased very slowly during the first four years of the Second Plan. This was due both to the shortage of foreign exchange and to the inadequate progress made in establishing the new fertiliser plants. When the agricultural targets for the Second Plan were reviewed in 1956, it was specially emphasised that programmes for the multiplication of improved seeds, for the use of fertilisers and for irrigation, soil conservation, etc., would be implemented so as to yield the maximum benefits within the shortest time. It was envisaged that there would be carefully worked out programmes for covering every acre of land enjoying irrigation or assured rainfall with improved seeds and that the supply of fertilisers and organic and green manures would be ensured. Sufficient progress was not made in these directions. Consequently, a much larger task in agriculture remains to be accomplished during the Third Plan. More than any other factor, the success of the Third Plan will turn on the fulfillment of its agricultural targets.

1.2.2 APPROACH IN THE THIRD PLAN

In formulating agricultural production programmes for the Third Plan, the guiding consideration has been that the agricultural efforts should not be impeded in any manner for want of financial or other resources. Accordingly, finance is being provided on a scale which is considered adequate, and the further assurance is given that if, for achieving the targets of production, additional resources are found necessary, those will be provided as the Plan proceeds. Supplies of fertilisers are also to be made available on a large scale. Efforts are being made to strengthen agricultural administration in the States, and stress is being placed on the closest possible coordination between different agencies, notably, those concerned with agriculture, cooperation, community development and irrigation. Supplies of credit through cooperative agencies are being expanded, and the need for linking credit with production and marketing is emphasised. It may be stressed, however, that while these efforts should go a long way, they are not in themselves a sufficient guarantee that the agricultural objectives of the Third Plan can be realised.

The central task of the community development Organisation and of extension workers at the block and village levels is to mobilize the rural community for intensive agricultural development, to impart a sense of urgency and direction to the work of all the agencies operating on behalf of the Government, and to insure that the requisite supplies, services and technical assistance are available at the right time and place and in the most effective manner possible. At the same time, the Agriculture Departments must place at the disposal of the community development organisation at the block level the supplies, trained personnel, and other resources needed. This means that all families in the village,

AGRICULTURAL PRODUCTION
Specially those engaged in cultivation, must be involved in the agricultural effort through the village cooperative and the panchayat, and enabled to achieve larger results through village production plans. In view of the experience in the Second Plan, these essential conditions cannot be too greatly stressed. As the country enters upon the larger tasks of the Third Plan, there is urgent need to improve the organisation of agricultural programmes at the local level as well as at higher levels in the States and at the Centre.

The Third Plan provides for an outlay on production programmes in agriculture, including large and small irrigation schemes, soil conservation and co-operation, of about Rs. 1280 crores, the comparable outlay in the Second Plan being of the order of about Rs. 667 crores.

<table>
<thead>
<tr>
<th></th>
<th>Second Plan</th>
<th>Third Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural production</td>
<td>98.10</td>
<td>226.07</td>
</tr>
<tr>
<td>Minor irrigation</td>
<td>94.94</td>
<td>176.76</td>
</tr>
<tr>
<td>Soil conservation</td>
<td>17.61</td>
<td>72.73</td>
</tr>
<tr>
<td>Cooperation</td>
<td>33.83</td>
<td>80.10</td>
</tr>
<tr>
<td>Community development (agricultural programmes)</td>
<td>50.00</td>
<td>126.00</td>
</tr>
<tr>
<td>Major and medium irrigation</td>
<td>372.17</td>
<td>599.34</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>666.65</strong></td>
<td><strong>1281.00</strong></td>
</tr>
</tbody>
</table>

Besides resources provided for the Third Plan finance from cooperative agencies will also increase substantially. Short-term and medium-term loans are expected to go up from about Rs. 200 crores and the amount outstanding on account of long-term loans from about Rs. 34 crores in the last year of the Second Plan to about Rs. 530 crores and Rs. 150 crores respectively by the end of the Third Plan.
Programmes and targets for agriculture embodied in the Draft Outline of the Third Plan were based on preliminary studies undertaken by State Governments and the Central Ministries concerned. These were intended to provide a basis for detailed agricultural programmes to be prepared in the light of local conditions and possibilities in districts, blocks and villages. It was suggested that with a view to securing the largest measure of local participation and, in particular, the fullest utilisation of the local manpower resources, programmes relating to agriculture, minor irrigation, soil conservation and the development of cooperation should be formulated through district and block plans. An attempt has been made in several States to draw up local plans on these lines. It has been observed, however, that plans at the local level are easier to formulate after the broad dimensions and objectives of the State plans have been established. Although in proposing targets and in evolving programmes, State Governments have taken advantage of their experience in preparing district and block agricultural plans, on the whole, the programmes and the estimates of production which now form part of the plans of States have been arrived at through studies by the Departments concerned at the State level. Their proposals have been considered in two series of discussions between the States, the Planning Commission and the Central Ministries, and care has been taken to prepare them in some detail. Nevertheless, the limitation persists that they are not yet as firmly based on area plans as had been earlier hoped for. For realising the programmes and targets accepted by States there must, therefore, be continuing emphasis on the drawing up of annual district and block agricultural plans within the general scheme of the five year programme. Without district, block and village agricultural production plans, it will be difficult to ensure the widespread cooperation and local initiative and understanding of the tasks to be accomplished which are the fundamental conditions for success in agricultural development.

1.2.3 PROGRAMMES FOR INCREASING AGRICULTURAL PRODUCTION

The principal technical programmes for increasing agricultural production, around which intensive work is to be organised, are: (1) irrigation, (2) soil conservation, dry farming and land reclamation, (3) supply of fertilisers and manures, (4) seed multiplication and distribution, (5) plant protection, (6) better ploughs and improved agricultural implements, and adoption of scientific agricultural practices. In all areas, and specially in the development blocks taken up under the community development programme, these programmes will need to be implemented with the largest measure of participation on the part of local communities and to reach as many families as possible through the village production plans. In addition, in fifteen districts, in which conditions are specially favourable on account of the availability of irrigation and assured rainfall and the cooperative movement is fairly established, it is proposed to undertake agricultural programmes on a more intensive scale than may be generally feasible. In all areas, and more especially in these, a concentrated effort will be made to reach all farmers and to promote the adoption by them of a minimum combination of improved practices.
The main targets under different development programmes for agriculture are summarised below:

**THIRD FIVE YEAR PLAN**

<table>
<thead>
<tr>
<th>programme</th>
<th>unit</th>
<th>target</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. irrigation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Major and medium irrigation (Gross)</td>
<td>million acres</td>
<td>12.8</td>
</tr>
<tr>
<td>2. Minor irrigation (gross)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Agriculture</td>
<td>&quot;</td>
<td>12.8</td>
</tr>
<tr>
<td>(b) Community development</td>
<td>&quot;</td>
<td>9.5</td>
</tr>
<tr>
<td>(b) Community development</td>
<td>&quot;</td>
<td>3.3</td>
</tr>
<tr>
<td>total</td>
<td></td>
<td>25.6</td>
</tr>
<tr>
<td>II. soil conservation, land reclamation, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Soil conservation on Agricultural lands</td>
<td>&quot;</td>
<td>11.0</td>
</tr>
<tr>
<td>(b) dry farming</td>
<td>&quot;</td>
<td>22.0</td>
</tr>
<tr>
<td>(c) Land reclamation</td>
<td>&quot;</td>
<td>3.6</td>
</tr>
<tr>
<td>(d) Reclamation of saline And alkaline lands</td>
<td>&quot;</td>
<td>0.2</td>
</tr>
<tr>
<td>III. Additional area under im-Proved seeds-foodgrains</td>
<td></td>
<td>148.0</td>
</tr>
<tr>
<td>IV. consumption of chemical fertilisers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Nitrogenous (N)</td>
<td>thousand tons</td>
<td>1000</td>
</tr>
<tr>
<td>(b) phosphatic (P2O6)</td>
<td>&quot;</td>
<td>400</td>
</tr>
<tr>
<td>(c) potassic (K2O)</td>
<td>&quot;</td>
<td>200</td>
</tr>
<tr>
<td>V. organic and green manuring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Urban compost</td>
<td>million tons</td>
<td>5.0</td>
</tr>
<tr>
<td>(b) Rural compost</td>
<td>&quot;</td>
<td>150.0</td>
</tr>
<tr>
<td>(c) Green manuring</td>
<td>million acres</td>
<td>41.0</td>
</tr>
</tbody>
</table>
1.2.4 MINOR IRRIGATION

The gross area irrigated during the Third Plan from irrigation schemes is estimated at 25.6 million acres - 12.8 million acres each from major and medium irrigation works and from minor irrigation works. Of the latter, schemes financed from provisions under the community development programme are expected to irrigate about 3.3 million acres, the rest of the irrigation being secured from schemes within the agricultural programme.

Statistics relating to land utilisation are not yet available beyond 1957-58, and it is difficult to ascertain the actual increase in net irrigated area during the first two Plans as a result of the irrigation programmes which have been carried out. Minor irrigation works include a variety of schemes, some of which stabilise existing irrigation or, as in the case of drainage schemes and embankments, improve the existing irrigation without necessarily increasing the area irrigated. Allowance has also to be made for minor irrigation schemes which go out of use on account of ‘depreciation’ or are replaced by irrigation from major and medium irrigation schemes. In the Draft Outline it was reckoned that at the end of the Second Plan the net irrigated area might be of the order of 70 million acres, increasing to about 90 million acres by the end of the Third Plan. Recent estimates appear to suggest lower figures, but the available data are far from satisfactory. There is considerable discrepancy between statistics of progress reported in respect of both large and small irrigation schemes, and those relating to land utilisation which become available after a lag of about three years. It is proposed to undertake a special investigation into these differences.

In the Third Plan the total outlay on minor irrigation from provisions under agriculture and community development is likely to be about Rs. 250 crores, in addition to such finance as cooperative agencies may provide. Thus, minor irrigation is one of the larger investment programmes in the Third Plan. The principal advantages of minor irrigation works are that they can be executed quickly entail small outlays and there is only a short lag between their completion and the realization of benefits. Moreover, they can be undertaken at the initiative of individuals and small groups and offer scope for participation by the community. Yet, it has been observed that minor irrigation programmes are tending increasingly to develop as programmes for small-scale irrigation works executed by Government agencies with little voluntary labour or participation by the people. It is of the utmost importance that for the greater part minor irrigation should be developed in all States as essentially a community programme in which local contributions in money and labour are specially stressed. When the scale of the minor irrigation programme becomes large, it involves problems of organisation, investigation and utilisation which may in some ways be even more difficult than those which arise in the case of larger irrigation works. In the early phases, of the minor irrigation programme
the simpler categories of works can be taken up and the need for extended surveys is not always felt. Preliminary studies suggest that the possibilities of minor irrigation development could extend eventually to a gross area of about 75 million acres. To realise this potential, surveys and investigations should be undertaken in every State in a systematic manner for various river basins, and there should be adequately staffed investigation units working in different areas. At present few areas have minor irrigation projects which are worked out sufficiently in advance for implementation without delay.

1.3 RESOURCE USE AND EFFICIENCY

The agriculture sector in India uses 85% of the country’s available fresh water. However, irrigation efficiency is only 20-50%. In other words, Indian agriculture wastes up to half of the country’s fresh water supply. Although from a basin perspective, much of the wasted water is reused, significant amount of water is wasted primarily due to inefficiencies.

There are inefficiencies on the energy front as well. Agriculture accounts for about 27% of the total electricity consumption in India. The consumption is somewhat higher in the states like AP, Gujarat, MP, UP, Karnataka and Haryana, where agricultural electricity use is between 35-45%. However, sale of this electricity amounts to no more than 5-10% of the state electricity boards’ revenues.

1.3.1 Flat Wastage

The adoption of flat rate pricing for agricultural power is cause for this perverse state of affairs. Under this system, a farmer pays a fixed price per horsepower per month for electricity. Therefore the marginal cost of pumping water is zero. This leads to energy wastage, over-pumping and inefficient selection of crops. Flat rate pumping also masks the true cost of power to farmers.

The tariff structure and the poor combination of technology and management are responsible for water loss, unsustainable exploitation of groundwater and the high energy losses associated with the distribution and end-use of electricity in irrigation water pumping.

Significant energy losses are associated with the distribution of electricity and in the poor selection, installation, maintenance and operation of the electrical motor pump system. A vicious cycle operates two subsystems in tandem: the electrical distribution system and the water pumping system. This vicious cycle comprises three sub-cycles: The technology sub-cycle, the financial sub-cycle and the socioeconomic sub-cycle.

1.3.2 Technology Sub-Cycle

It starts with the electricity distribution system characterized by poor design and installation of the main distribution LT feeder lines (11 kV). Overloading the 11-kV/415 V distribution transformers (DTRs) and long lengths of undersized secondary lines
resulting in high line losses and large voltage drops compounds this.

Farmers have no control over the quality of supply and on it timing and duration. There are several consequences of poor power quality. Frequent motor burnout cause leads to additional costs of reinstallation.

As a result, farmers tend to select robust motors that have thicker armature coil windings to withstand large current and consequent localized heat generation without coil burnout. These motors are less efficient.

Also, to ensure that the flow rate of water pumped out is not reduced due to voltage conditions; farmers tend to replace existing motors with higher capacity rating. It has been seen in Haryana and Andhra Pradesh that farmers use oversized pumps to obtain the required discharge.

The poor management of load demand by the local distribution sub-station authorities compounds the problem of poor power quality. The substation personnel follow a prescribed system of power regulation (power curtailment policy) whereby power is rotated among the farmers in two blocks of 4-8 hours per day.

This power rostering results in certain undesirable practices that eventually lead to system failure. A common practice amongst farmers is to keep their motors switches turned on so that water is pumped whenever the rostering schedule is in effect for a particular block.

This in effect means that a large number of pumps become active at the same time, resulting in a load demand diversity of nearly unity. This causes the 11 kV/415 V DTR to trip and, in cases where the transformer fuses have been tampered with, the transformer burns-out.

Several other scenarios can also occur. During the evening, households and rural services are provided power. Since peak power capacity is limited, farmers are discouraged from using their pumps, which operate on three-phase supply.

This is achieved by "single-phasing" the supply to alternating groups of feeders in rural areas. However, many farmers circumvent single phasing by installing dummy capacitors that permit them to operate their three-phase pumps on two-phase supply. In addition to the resulting increase in peak demand, this causes problems for utility in the form of overloading of the phases, harmonic disturbance and lower power factor.

1.3.3 Financial Sub-Cycle

Poor quality of power and the resultant impact on performance and efficiency of pump results in low crop yields and incomes. Under these conditions, electricity tariff revisions for farmers are politically resisted and payments on electricity bills are postponed, resulting in low cost recovery.
Low cost recovery, in turn, is linked to under funding of operations and maintenance of the power delivery systems. This coupled with poor engineering standards and state of the LT distribution systems and inappropriate structure, policies and staff skills of many SEBs closes the circle by providing poor quality of supply service.

This sets off a chain reaction of events of motor burnout and transformer overloading. These further depress cost-recovery levels and the vicious cycle sets in. Sub-optimal allocation of resources towards the distribution system places further burden on the already vulnerable system causing deterioration in the quality and reliability of supply.

1.3.4 Causes of Water Loss

There are five causes of water loss. First is the choice of crop. Farmers select crops that bring in maximum benefit to them and not crops that use less water. The natural environment also plays an important role in determining how much water is lost. Soil types, climate and hydrology all affect water losses.

India has a very diverse natural environment. A recent classification by the National Bureau of Soil Survey and Land Use Planning distinguishes 20 broad agro-ecological zones, separated by natural features and crop growing periods.

Each of these agro-ecological zones comprises many myriad microhabitats. Therefore, there are always some regions in India that will have lower water use efficiency than others and any water-efficiency project must be site-specific.

Technology is next on the list of causes. The type of irrigation and delivery systems determines how efficiently water is used. Drip and sprinkler irrigation systems are more complex in design but can be more easily operated with low losses than surface irrigation methods, which require a high degree of flexibility in water supply. Pipe delivery systems generally lose less water than the more commonly used canal systems although canal systems are often more easily maintained.

The type of control structure used in irrigation is also important. Fixed control structures are less flexible but require a lower degree of expertise to operate and maintain. All this lends to the fact that technology that requires less skill to manage may often incur less water loss than systems that are theoretically more efficient. Again, site specific analysis is essential in determining the proper technology to be used.

The fourth cause of water loss is farmers. Farmer characteristics such as skills, knowledge, organization and motivation determine their ability to manage water. The fifth cause of water loss is the central water agency and its policy. This cause should be recognized as the most important cause because it underlies the others.

The efficiency of any water management technology is dependent on the reliability of the
water supply. Farmers cannot function effectively without a reliable supply of water and have no incentive to use water efficiently if it is supplied with little or no charge.

To provide the farmers with the means and incentive to conserve water, municipalities must provide water at a realistic cost and simultaneously improve the quality of the service they provide to the point where farmers will be willing to pay for it.

Attitudes about the public ownership of water make this transition difficult. Throughout history water has belonged to a class of materials called common property resources, to which access is nonexclusive, ownership is held in common by the public and prices are very low, or zero. When the price of input such as water is very low relative to other productive inputs, it is used without regard for quantity or conservation.

In India water is supplied to the agricultural sector virtually free of charge and therefore farmers use as much of it as possible. Unfortunately, municipalities raising the price of water cannot solve this problem. Farmers also must be willing to pay for the water. It has been shown that farmers in India are willing to pay for the water they receive provided that the supply is reliable.

Currently water supply to farmers is very unreliable. Farmers never know how much water they will get and when it will come. As a result of this and the low or nonexistent cost, valves are most always open so that farmers can get the most out of the syncopated water flow.

1.3.5 Store More, Pay More

It should also be noted that improving reliability and timeliness in water supply entails higher costs in terms of additional storage capacity and pumping. For example, in Haryana, where the irrigation charges for surface water supply are less than US$ 10 per hectare per year, farmers are known to spend as much as US$ 90/ha every year in irrigation costs.

These irrigation costs accounts for as much as 20 percent of the net value of output from these crops. Farmers are willing to pay for timely and reliable water supplies for irrigation. Hence, those institutional and financing arrangements that ensure reliable water supplies are likely to be more sustainable for improving water use efficiency than those that concentrate only on cost-recovery.

The pace of groundwater withdrawals and use in India is intimately tied to energy prices. A critical factor in achieving efficiency and sustainability of groundwater use is the quality and price of power supplies to the agricultural sector. The use of flat rates for electricity, combined with unreliable power supply, encourage farmers who own wells to maximize pumping of groundwater.

In Andhra Pradesh power subsidies to the farm sector amount to 2% of the GDP and 12% of the total fiscal outlays, comparable to the state’s expenditures for education and more
than double its expenditures for health.

Similar figures for Uttar Pradesh indicate that accumulated power sector subsidies of $3.7 billion represents a lost opportunity to build 340,000 primary health centers or lay 250,000 kilometers of tarred roads or build 1.13 million primary schools.

Since farmers face little or no marginal electricity cost while pumping, they have little financial incentive for efficient water use. Compounding the problem is a chronic shortage of power and under investment in the agricultural power distribution grid.

As a result, power supply to agricultural users is of poor quality. To compensate for it, farmers have resorted to the usage of oversized and inefficient pump motors to ensure maximum water withdrawal during limited periods of power availability and to avoid motor burnout.

Many regions in India are witnessing shortages in water supply with groundwater levels having fallen as much as 1-3 meters per annum to levels more than 70 meters or more below their level of 30 years ago. Approximately 12% of all aquifers are severely overdrawn. The problem has been exacerbated by the run-off of surface water.

Overexploitation of groundwater by farmers has lowered water tables. Overexploitation is also a significant contributor to India’s growing carbon emissions, as considerable additional pumping energy is required to extract deeper water supplies.

Over withdrawal without aquifer recharge and the loss of topsoil due to commercial exploitation of forests have led to the widespread use of lower quality groundwater. This exposes affected populations to potentially serious long-term health risks from arsenic, fluoride, increased salinity and microbiological contamination.

Finally we can say that, the performance of the Indian power sector is increasingly dependent on how efficiently irrigation water is used and paid for. Water withdrawal is an energy intensive operation performed throughout the agricultural sector that results in a third of the power consumption in the country being used for the roughly 50% of the national irrigation consumption extracted from groundwater resources. Highly subsidized power supply policies for agriculture have major implications for the overall condition of the power sector and associated water resource.

The performance of the Indian power sector is increasingly dependent on how efficiently irrigation water is used and paid for. Water withdrawal is an energy intensive operation performed throughout the agricultural sector that results in a third of the power consumption in the country being used for the roughly 50% of the national irrigation consumption extracted from groundwater resources. Highly subsidized power supply policies for agriculture have major implications for the overall condition of the power sector and associated water resource.

The level of attention paid to water use efficiency is directly proportional to the prices
charged for water servicing. Rising prices lead to increasing attention to water use and, in the long run, more efficient use of water.

Addressing water and energy use efficiencies in the Indian agricultural sector requires a strategic combination of several interdependent components. There has to be central and state policy dialogue on power and water sector reform to develop an energy and water framework.

Commercial practices have to be introduced in rural power distribution in order to expand the domain of power planning beyond the customer side of the electrical meter to encompass the water well, the exploitation and recharge of aquifers and the management of the watershed as a whole.

It is also essential to involve the rural consumer in partnership to advance energy and water use efficiency, thereby improving reform prospects.

**1.4 PRODUCTION FUNCTION ANALYSIS**

Measurement of productivity and criteria to be used in such measurement seem to be a complicated task in the agricultural sector as in all other sectors of economy. Insufficient data that may be effective in determination of productivity and lack of techniques used in measurement are the significant problems in determination of productivity especially in developing countries. In this context, it is very difficult to find the criteria that are applicable to all countries and may be applied in agricultural sectors, while determining the criteria of productivity. This is because of the fact that labor, plot and capital capacities, which are taken as criteria in productivity, as well as the general agricultural policies are not institutionalized sufficiently as providing robust economical results in developing countries.

To discuss production function analysis, we take into consideration the concept of elasticity of production. The concept of elasticity of production for labor ($\alpha_L$) is discussed generally within the production function.

In the argument we usually assume the agricultural function has the constant return ($\Sigma\alpha_i=0$; homogeneity of first degree) as Cobb-Douglas production function supposes as following;

\[
\frac{Y}{A} = \epsilon_0 (\frac{L}{A})^{\alpha_L} (\frac{F}{A})^{\alpha_F} (\frac{S}{A})^{\alpha_S} \quad \text{(1)}
\]

- $Y$= Value of Production; $L$=No. of Agricultural Labor;
- $F$=Value of Fertilizer Invested;
- $S$= No. of Ox and Horse;
- $A$= Land

Transformations and technological developments occurred in the agricultural sector in time have absolutely affected productivity. However, it is a fact that the term productivity
is not only restricted to yield productivity. Yield productivity increases gradually in especially farms, which are engaged in agricultural production. However, it is a fact that productivity will not increase continuously. The producers are unable to utilize the agricultural production factors at an optimum level due to insufficient capital and/or lack of technical knowledge and this influences the yield productivity and thus the income of the producers negatively. Therefore, we need studies that determine input usage levels of the producers for each product within the model and put forth the rate of utilization for each input. In this study, the input-output relations of the enterprises engaged in agricultural production in Aydin province are examined and it is endeavored to put forth the income usage levels of the enterprises in this context.

1.5 FACTOR COMBINATION AND RESOURCE SUBSTITUTION

In agriculture, various inputs or practices can be substituted in varying degrees for producing a given output. A producer has to choose a particular combination of inputs, which would be most profitable.

At a given level of output, he has to decide upon the least cost-combination of practices or inputs. There are large number of alternatives for performing different farm operations and obtaining output through different combinations of inputs. A few of such alternatives can be 1. use of bullocks v.s. tractor for a given size of a farm, 2. harvesting of crops by machines v.s. by manual labour, 3. milking machines v.s. hand milking for a given herd of cows, 4. wheat bhusa, green fodder and grains-mix in dairy feeds, 5. combinations of potash, phosphate, and nitrogen in fertilizers for crops.

A number of combinations of concentrates and green fodder, for example, can be used in producing a given amount of milk. Forage usually substitute at diminishing rate for grain. Problem here is to find the least cost combination of fodders and grains, milk production remaining the same a combination of fodders and grains which, cost remaining the same, will yield maximum output of milk.

Cost minimization will not depend only upon the cost of inputs and prices of products but also on the rate of substitution. For example, if hand labour costs less relative to cost of performing the operations by machines, costs may be lowered by substituting labour for machinery. If machine costs are low relative to labour, labour should get substituted with machine operations.

Procedure for Working Out the Least-Cost Combination

Step 1. – Compute the substitution ratio (marginal rate of substitution) by dividing the number of units of the replaced resource by the number of units of the added resource:

No. of units of replaced resource D X₁

\[ MRS = \frac{\text{No. of units of replaced resource}}{\text{No. of units of added resource}} = \]
No. of units of added resource $D X_2$

Step 2. – Compute the price ratio by dividing the price of the "added" resource by the price of the "replaced" resource:

Cost per unit of added resource $P_{x_2}$

$$PR = \frac{Cost \ per \ unit \ of \ added \ resource}{Cost \ per \ unit \ of \ replaced \ resource}$$

Step 3. – Find the point where the substitution ratios and price ratios are equal:

$$D X_1 \ P_{x_2}$$

$$\frac{D X_1}{P_{x_2}} = \frac{D X_2}{P_{x_2}}$$

Profit Rules:

i. If the substitution ratio is greater than the price ratio, one can reduce the costs by using more of "added" resource.

ii. If the substitution ratio is less than the price ratio, costs can be reduced by using more of "replaced" resource.

iii. If the substitution ratio equals the price ratio, it is the point of least cost.

Application of the principle

The rate at which the inputs can be exchanged to maintain a given level of output may be either constant or varying. Given the technical or physical rate of substitution, the least cost combination of resources will differ with different prices. As an example we consider a simple case of substitution with two variable inputs substitution at either constant or diminishing rate.

Table 4: Least-Cost Combination of Farm Labour-Use for Hoeing of One Acre of Wheat – Men and Women Labour substituting at a Constant Rate.

<table>
<thead>
<tr>
<th>Combination of labour</th>
<th>Added doses of inputs</th>
<th>Marginal rate of substitution</th>
<th>Cost of hoeing one acre with different levels of wages for men ($P_{x_2}$) &amp; women ($P_{x_1}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women Labour ($X_1$)</td>
<td>Men Labour ($X_2$)</td>
<td>$X_1$ $X_2$</td>
<td>$X_1$ $X_2$ $P_{x_2}$ @ Rs.6 $P_{x_1}$ @ Rs.2/- ($PR=3.00$) $P_{x_2}$ @ Rs.4/- $P_{x_1}$ @ Rs.3/-</td>
</tr>
</tbody>
</table>
Special Cases of Substitution

There are certain practices, which substitute for other and also add to the output at the same time. An example is of hybrid maize seed replacing ‘desi’ maize seed. Hybrid maize uses about the same quantity of seed but produces more yield per acre. Here it may increase the cost but it adds more to the value of the production than it adds to the cost. The superiority of the substitute practice is established not only by the cost of the new practice but also by the value of the added yield. In estimating the profitability of such practices, budgeting technique becomes more useful. It is a case of shift in the production function.

### 1.6 LAWS OF RETURN AND VARIABLE PROPORTIONS

**Principle of Variable Proportion**

It has three phases: (a) diminishing returns (b) constant returns, and (c) increasing returns

a. **Diminishing returns**. It is a basic natural law affecting many phases of management of agriculture. It is a law of fundamental importance in agriculture. This law describes the relationship between output and a variable input when other inputs are held constant. The law can be stated as follows: "If increasing amounts of one input are added to a production process while all other inputs are held constant, the amount of output added per unit of variable input will
eventually start decreasing.” It states that if the quantity of one factor is increased with quantities of other factors held constant, the marginal increment to the total product may increase or remain constant at first but will eventually decrease after a certain point. The operation of this law can be, however, delayed by improvements in technology and/or improvement in managerial ability. Ultimately this law must operate in the practical world. The level to which yields per acre, milk per cow or weight per poultry bird should be pushed are the kind of questions which involve the law of diminishing returns. It is, thus, an important point in farming to decide the level to which a farmer should push his output per acre or per cow, etc. to secure the maximum possible profit. This principle of returns is also important in specifying how large a farm should be or how much labour and/or machinery be added. In this context resources can be classified as variable resources and fixed resources. For example, an acre would be a fixed resource with the farmer, but fertilizer would be a variable resource. As addition quantities of fertilizer are given to an acre of crop, the return to each additional dose will eventually become lesser and lesser. When diminishing returns hold true, it is seldom profitable to produce a maximum yield per acre or milk or meat per animal, although exceptions might exist.

It can be said that the quantity of a variable resource applied to a fixed acre of land or given head(s) of livestock adds less and less to the yield or output. Examples are application of seeds, fertilizers, irrigation, etc. which have a characteristic of diminishing marginal productivity.

There are some farmers who lose sight of diminishing returns to variable factor-use and consider the highest yield per acre, the highest milk yield per cow etc. always to be the best level in terms of profit. This way they think only in terms of physical yields and not in terms of costs and profit. True, many farmers would need to raise their production levels in order to increase their profits, but they must consider cost also at some point. One can easily decide the level of resource use or level of production by using the following profit rule under the conditions of diminishing returns. Keep adding variable resource(s) to the fixed resource(s) as long as the added return is more than the added cost. As an example, a farmer might want to know how much fertilizer should be added to one acre of paddy to maximize his profits, the price of paddy being Rs.50/- per quintal and price of fertilizer Rs.30/- per unit and physical input-output data on paddy yield response to fertilizer given as in table

**TABLE 5**

**Marginal Cost and Marginal Returns Analysis of Paddy Yield Response to Application of Fertilizers**

<table>
<thead>
<tr>
<th>Fertilizer Units per Acre (50 kgs)</th>
<th>Yield of Paddy (Qtls)</th>
<th>Total Cost @ (Rs.30)</th>
<th>Marginal Cost (Rs.)</th>
<th>Marginal Product (Qtls)</th>
<th>Marginal Returns (Rs.)</th>
<th>Total Returns (Rs.)</th>
<th>Profit (Rs.)</th>
</tr>
</thead>
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</table>
Analysis begins with comparing marginal or added costs and added returns. One should stop applying additional doses of fertilizer where the fertilizer cost is just balanced by the added returns.

As shown in the table the optimum level of fertilizer to be used in this case is 4 units. Beyond this level the marginal return is less than the marginal cost. If we calculate total profit at each unit of fertilizer, as given in last column, we observe that the net returns/profits per acre are the highest (Rs.455) at four units of fertilizer use. One may not go up to the last profitable unit because apart from the cost of the input (fertilizer units) there may be some indirect costs such as costs of spreading of the fertilizer and extra cost on bigger harvest etc. In practice, therefore, even an economic farmer would apply fertilizer a little below this break-even point. Such simple exercises for taking day to day operational farm decisions can save the farmer from many losses and increase his net returns from the farm business. This principle, should be , therefore, helpful in making decisions such as:

i. The level to which yield per acre, milk per cow, etc. should be pushed to secure maximum profit.
ii. The size of the farm one should operate with given resources of capital, labour and management.
iii. The amount of fertilizer, labour or type of machinery one should use.

a. **Constant returns**: It means each marginal unit of a variable resource adds the same amount of the output to the total production. Though ‘diminishing marginal productivity’ is the rule, constant productivity is frequently observed when no resource is fixed and all are increased together in the same proportion. For example, another acre may be as productive as the first with same inputs. If one acre of wheat requires 20 man-hours of labour, 30 kgs. Of seed and 13 inches of irrigation water and yields 10 quintals of wheat, the second acre will require additional 20 man-hours of labour, 30 kgs. Of seed and 13 inches of irrigation water and will also yield 10 quintals of wheat. The second acre is just as productive. The marginal or added production from each increase in resource input is the same: this is a case of constant productivity.

Another case is when one or more resources are fixed but have excess capacity. For example, family labour or a farmer may not be fully employed. A storage godown may
have surplus capacity. A tractor may be big enough to control 50 acres holding but the farmer may have only 27 acres. If variable input is added to such a resource-mix situation, constant returns may result.

Under constant productivity, each unit input increase is just as profitable as another. Under such conditions the profit rule is: If production is profitable on first unit, keep producing till the constant returns hold. Do not produce at all, if production is not profitable on first unit. In a sense, follow the same principle i.e. continue adding the variable resource to the fixed resource(s) as long as the return is greater than the added costs.

Limits on constant returns are reached as some of the factors become fixed. If nothing else becomes fixed, management becomes a fixed resource. The productivity of one resource, depends on the amount of the other(s) with which it is used. For example, if capital is fixed at a low level for the farm as a whole, labour productivity will be lower. Since the productivity of one resource depends on the amount of other resource(s) with which it is combined, farmers having different quantities of land, capital, labour and management will have different programmes. What is best for one farm, is therefore, seldom best for the other(s). Each farmer must get the right balance of resources and a unique optimum farm organization consistent with the resources he has.

(c) Increasing returns: There are few cases in agriculture where increasing productivity may be found. Increasing productivity means added resources give increasing returns. This relationship may hold only over a very limited range of production and is applicable when all resources are increased together and not when some resources are fixed. For example, a cattle shed constructed for 30 cows may cost more per cow than if one is constructed for 60 cows, the cost involved in the latter case may not be double because of some economies on account of joint walls etc., but the gross returns per cow might be the same. Use of added resource(s) thus, will give increasing returns in such case. In this case each additional unit gives higher and higher returns. So long as this relationship holds, production should keep expanding.

1.6 SIZE OF FARMS

1.6.1 Farm size and efficiency

Before embarking on a discussion of the relation between farm size and 'efficiency' we must note two caveats. First, in the presence of transactions costs, efficient farm size is not independent of household endowments of labour and capital. For if labour supervision costs are sufficiently important that 'labour autarky' is optimal, efficient farm size increases with the number of family members of working age. Likewise, in an Eswaran-Kotwal world, efficient farm size is dependent on the household's working capital endowment. So, strictly speaking, the following discussion is from the point of view of an idealised household with no capital endowment. Second, except where stated, we think of efficiency in terms of the maximum expected return to the household thus neglecting exogenous risk.
The efficient scale of farm operation depends both on narrowly-defined scale economies in production (essentially a matter of lumpiness of inputs and specialisation of labour) and on scale-related transaction costs in input and output markets, including both information costs and scale economies in transport and marketing.

These give rise to economies of scale, so it could be that the mechanisation of farming that results from a rise in the price of labour relative to capital would lead to such a large increase in the minimum efficient scale that the family farm would become obsolete. Studies of the UK and US quoted by BDF suggest that the average cost minimising scale might be about 50 ha. in British mixed farms or as much as 250 ha. in cash-grain farms in Illinois, but as is pointed out there, such large-scale farms 'are still managed largely by family labour'. Whether lumpy inputs will have a substantial influence on optimal scale in a given case depends on whether a rental market exists in those inputs, which is itself dependent partly on whether processes are, e.g because of climatic homogeneity, synchronized across farms. In the United States, for instance, there is an active rental market in combine harvesters, which follow the seasons across the country.

Transaction costs associated with the care, maintenance and transport of lumpy inputs may be such as to inhibit renting, with not only a potential impact on optimal scale but also on mode of organisation of farming, which may be essentially driven by the accumulation of wealth in the form of these inputs.

Such a measure not only allows for transaction costs and scale economies, but also for the possibility that optimal factor proportions vary with scale (which would in general imply that narrowly-defined scale economies would vary according to the factor-proportions 'ray' along which they were being measured).

Similarly, it was suggested in a study of rice farming in one area of Andhra Pradesh (Frisvold 1994) that the ownership of 'lumpy' irrigation equipment was determining farm size, at a level above that of the family farm (there were about six hired workers per family worker on the average farm). An extra element in this case was that the farms were almost all owner-operated, suggesting the absence of secure long-term land rental contracts that might allow tenants to amortize investments in immobile lumpy equipment. Yet it may be that choice of technique rather than mode of production will adjust. Examples are the emergence of hand and treadle pumps in Bangladesh and of bamboo tube wells in India, where the initially-introduced tube well and pump technologies had favoured larger scale (Howes 1982, Singh 2002).

Management skill is another lumpy input that may account for scale economies. Moreover good farm managers are likely to find it optimal to manage larger farms than poor managers. To the extent that the availability of new seeds, fertilizers and pesticides, together with the possibility of obtaining credit to pay for them, has increased, one expects the returns to scarce managerial skill to have risen, which is lent support by evidence that the impact of schooling on agricultural productivity is substantially higher in such modernizing environments than in traditional ones [Haddad et al 1991]. Where
this has in fact induced the acquisition of greater skills, one would expect optimal scale to have risen.

Against this, some technological advance may favour local knowledge sufficiently that efficiency demands more intensive managerial input, leading to smaller scale.

1.6.2 Specialization of labour

Economies of scale can arise from this source, but the sequential nature of tasks associated with the annual cycle of production limit such economies in agriculture relative to industry (Smith 1776, van Zyl et al 1995). The implication is that, once scale economies of the lumpy input type have been exhausted, productive efficiency provides few reasons for an increase in farming scale.

1.6.3 Scale economies in processing and marketing

In principle, scale economies in off-farm processing or transportation have no necessary implication, on their own, for the optimal scale of farming. Efficient use of milling machinery implies that it be used year-round in the case of storable crops: whether wheat or rice is brought to market by small or large producers makes little difference. For certain plantation crops, such as bananas, rubber, tea and sugarcane, perishability or specific delivery requirements, together with economies of scale in processing or transport create a particularly severe coordination problem between harvesting and processing/transport (Binswanger and Rosenzweig 1986). Whether there is any implication for efficient farm size depends on how the associated contracting costs depend on scale. If such scale-dependence is not too great, there may be little to prevent production by small farmers, tenants or otherwise, and indeed, according to BDF, this structure is widespread for sugar cane in India and Thailand. In the 1970s the Kenya Tea Development Authority also stimulated provision of competitive leaf purchasing services by factories to small growers.

Bananas for export present an extra difficulty, since they are a long gestation crop. So, while in principle contract farming could work in this case, the transaction costs are more severe than for sugar cane in that long-term tenancy is needed, unless the distribution of owned land is relatively even. It may be that the demand for some farm products depends on product or process characteristics for which transaction costs of monitoring exhibit scale economies. Advanced country consumers, buying exported horticultural products from developing countries, may require not only high and uniform product quality but also assurances concerning pesticide use and/or the employment of child labour. Monitoring itself is likely to exhibit significant scale economies, but it is less certain that monitoring costs will fall as average farm size increases.

1.7 COST AND SUPPLY CURVES
Supply is the quantity of a good or service that a producer is willing and able to supply onto the market at a given price in a given time period.

Normally as the market price of a commodity rises, producers will expand their supply onto the market.

There are three main reasons why supply curves for most products slope upwards from left to right giving a positive relationship between the market price and quantity supplied.

When the market price rises (for example following an increase in consumer demand), it becomes more profitable for businesses to increase their output.

Higher prices send signals to firms that they can increase their profits by satisfying demand in the market. When output rises, a firm’s costs may rise, therefore a higher price is needed to justify the extra output and cover these extra costs of production.

Higher prices makes it more profitable for other firms to start producing that product so we may see new firms entering the market leading to an increase in supply available for consumers to buy. For these reasons we find that more is supplied at a higher price than at a lower price.

The supply curve shows a relationship between the price of a good or service and the quantity a producer is willing and able to sell in the market.

**What causes a shift in the supply curve of agricultural products?**

![Figure 1](image-url)
i) Costs of production

A fall in the costs of production leads to an increase in the supply of agricultural products because the supply curve shifts downwards and to the right. Lower costs mean that a farmer can supply more at each price. For example he might benefit from a reduction in the cost of imported raw materials.

If production costs increase, a business will not be able to supply as much at the same price - this will cause an inward shift of the supply curve. An example of this would be an inward shift of supply due to an increase in wage costs.

ii) Changes in production technology

Technology has changed very quickly in agricultural sector. We expect to see increases in supply (and therefore lower prices for the consumer)

iii) Government taxes and subsidies

Government intervention in a market can have a major effect on supply. A tax on producers causes an increase in costs and will cause the supply curve to shift upwards. Less will be supplied after the tax is introduced.

A subsidy has the opposite effect as a tax cut. A subsidy will increase supply because a guaranteed payment from the Government reduces a firm's costs allowing them to produce more output at a given price. The supply curve shifts downwards and to the right depending on the size of the subsidy.

iv) Climatic conditions
For agricultural commodities such as coffee, fruit and wheat the climate can exert a great influence on supply. Favourable weather will produce a bumper harvest and will increase supply. Unfavourable weather conditions such as a drought will lead to a poor harvest and decrease supply. These unpredictable changes in climate can have a dramatic effect on market prices for many agricultural goods.

v) Change in the price of a substitute

A substitute in production is a product that could have been produced using the same resources. Take the example of barley. An increase in the price of wheat makes wheat growing more attractive. This may cause farmers to use land to grow wheat and less to grow barley. The supply of barley will shift to the left.

vi) The number of producers in the market

The number of sellers in a market will affect total market supply. When new firms enter a market, supply increases and causes downward pressure on the market price. Sometimes producers may decide to deliberately limit supply by controlling production through the use of quotas. This is designed to reduce market supply and force the price upwards.

The entry of new producers in a market causes an increase in market supply and normally leads to a fall in the market price paid by consumers. More producers increase market supply and expand the range of choice available.

1.9 FARM BUDGETING AND COST CONCEPTS

In order to develop a successful pricing strategy, and to keep your operation afloat, you need to calculate your production costs. Most farmers KNOW this, but many will tell you that cost calculations are easy to recommend, but hard to do.

Actually, cost calculations are easier than you might think; they’re just hard to start. Once you define the individual components of your production costs and plug those numbers into a simple record-keeping system, you’ll find that cost calculations get a lot easier. What’s more, these calculations will give you confidence about the current state of your operation and help you find ways to make it more solid, efficient, and profitable.

Basic cost calculations will provide the foundation you need to:

- set sound prices,
- make real money (instead of just breaking even),
- grow your operation, and
- Live the life you want.

When you face the challenge of calculating costs, you create an opportunity to increase your income and take control of your operation.
Let’s begin by defining four basic (and often misunderstood) terms that affect cash flow in every business:

- **Cost**: Money you pay, directly or indirectly, to produce a product or service. Costs include labor (your own labor and any hired help), rent, taxes, utilities, production inputs, equipment depreciation, etc.
- **Price**: Money you receive from a customer for a product or service. Your price should include all your costs, plus some extra money to keep (profit, or “return to management”).
- **Revenue**: Money you receive from all sales of your products and/or services (also known as gross income). Government payments also qualify as revenue. Revenue should cover all your business costs and give you some extra money to keep (profit, or “return to management”).
- **Profit**: Money you get to keep from all sales of your product or services, after all your costs are paid (also known as net income or “return to management”). Profits allow you to buy your daily necessities, invest back into the business, save for retirement, and take that family vacation you have been planning.

![Figure 3: Cycle of money-flow through a business](image)

These definitions may seem unnecessary because we all use these terms every day. But do we use them correctly? Many farmers get into trouble by thinking of revenues and profits as the same thing. In reality, profits are only a part of revenues, the part that’s left after production costs are subtracted. If you confuse the two, you may regularly have to choose between covering your costs or paying yourself (an unpleasant choice).

1. **KNOW YOUR COSTS.**
2. **SET YOUR PRICE.**
3. **MAKE A PROFIT.**

Your profit is determined by three factors: 1) yield, 2) production costs, and 3) market price (which add up to become your gross revenue). The following graph shows how
yield, costs, and revenue work together to generate a profit or loss, depending on where your numbers land:

Figure 4: Yield, cost, and revenue values that generate a profit or loss (also called a “break even analysis”).

You probably already know that you can calculate your profit or loss on any given product by subtracting your product costs from your price. \( \text{Profit [or Loss]} = \text{Price} - \text{Cost} \) But look at this equation again. The take-home point (one that most farmers miss) is that your costs and your prices have equal power to influence your revenue and profits, either negatively or positively.

To prove this point, look at figure 2 again. Notice that the “break even point” is NOT a fixed point. It can move left and right or up and down, depending on adjustments you make to your prices (revenue) and/or costs, as illustrated below:

Figure 5: The influence of cost and price adjustments on profit and loss

In Figure 5-A, prices remain the same, but costs increase, which work together to reduce profit. Similarly, in Figure 5-B, costs remain the same, but prices are too low, which also reduces profits. On the other hand, in Figure 5-C, costs remain the same, but price
premiums increase revenue, which combine to increase profits. You can achieve similar profit increases by keeping your prices the same, but finding ways to lower your costs.

This is simple stuff, and most farmers already know these basic facts. However, few make the effort to use this knowledge to their advantage. A lot of farmers think they don’t have the time to take a close look at their costs, and many also believe that they can’t control the prices they get for their products. These mind-sets are a major obstacle to the development of a good cost calculation system. Too many farmers throw in the towel before they begin, thinking, “If I can’t control my price, then what good does it do me to know my costs?”

The truth is that, while there are some yield, cost, and price factors that you can’t control, there are also many factors that you CAN control - perhaps more than you realize – and cost calculations are the key to that control. Once you make the effort to identify and calculate your costs, you will find ways to control them, set better prices, and adjust your yields accordingly. Cost information can help you:

- **Increase Your Market Power**—You can negotiate and set prices from a position of knowledge and control. When customers ask about your prices, you can clearly describe the value of your product (its production factors, costs, and intrinsic qualities) in ways that will encourage the customer (even the wholesale buyer) to pay the price you want.
- **Build Confidence**—You will know exactly how much money you are making or losing on a product and can adjust your prices and sales plans accordingly. The confidence that cost information gives you will improve every aspect of your business.
- **Reduce the Hassle of Taxes and Financing**—Good cost-tracking records allow you to process taxes and apply for loans, grants, and other funding more easily. Your chance of being approved for loans and grants is greatly improved when you can accurately report current and historic production and cost figures.
- **Increase Your Business Security!**—Cost tracking helps you plan a more secure future for your farm by providing solid facts and numbers to guide your business development.

**WHAT ARE MY COSTS?**

**Standard business costs include:**

- Inputs (seed, amendments, animals, feed, ingredients, etc.),
- equipment and depreciation,
- labor (your own labor and hired help, along with costs for any benefits you may provide),
- packaging,
- fuel and transportation,
- utilities,
- rent and mortgages,
interest on mortgages and loans,
repairs, and
Taxes.

Many farmers are stumped by the prospect of identifying and totaling all the items on this list, but remember: **Knowledge is power!** Even if you calculate only a few of your most basic costs, that information can vastly improve your pricing plan and your profits. Start simple. Identify the costs that are easiest to tabulate (like inputs and transportation), and leave more complex costs (like labor, depreciation, and interest) for later, when you have time to devote to them.

To get you started, the following definitions and the worksheets in Parts 3 and 4 will help you identify some of your own operational costs and compile them into a form that allows you to begin to make easy calculations.

Some essential cost definitions include:

- **Operating (or Input) Costs**: All money spent on supplies and materials needed to produce your product or service, such as seeds, fuel, inputs and amendments, livestock and feed, purchased ingredients to create value-added products, packaging materials, and similar items. To calculate input costs for a service, you must add up the number and cost of supplies and materials that will be used as part of the service.

- **Labor Costs**: All money spent to pay yourself and your employees (if any), and to provide benefits. *Even if only you and your family work on the farm, it’s important that you calculate your labor costs!* To do so, multiply the number of hours required to complete a work task by the hourly wage you pay (or would like to pay) yourself, your family members, or employee(s).

Calculating task-hours may sound “nit-picky” and time consuming, but chances are that you already have good estimates of task-hours in your head! Start with those estimates, and then, if you want to be more exact, keep an occasional start/stop time log for your different tasks. After just a couple entries, you’ll have a very clear record of task-hours, and you may even begin to see a few places where you can improve your efficiency. Later, for more precise labor cost calculation, you can also include the cost of any benefits you provide to yourself, your family, or your employee(s) in the hourly wage figure.

- **Overhead (or Capital) Costs**: All money spent on work-related costs other than materials and labor. Overhead costs can be broken into two categories:

  - **Indirect Overhead Costs**: costs that are not tied to the production of a specific product or service, such as utilities, mortgages and interest, rent, insurance premiums, taxes, depreciation, office supplies, any employee benefits, certification costs, dues and subscriptions, advertising, accounting and attorney fees, and similar expenses.
Direct Overhead Costs: project-specific costs, such as equipment costs, travel costs, and similar expenses.

These are the three primary cost category headings you will find on most crop/livestock enterprise budgets. All of the above costs are also defined as either fixed or variable:

- **Fixed Costs**: Expenses that stay the same each month/year, regardless of the amount you produce or sell. Fixed costs include mortgages, taxes, insurance, loans, and advertising, to name a few. For example, your tractor payments remain the same whether you sell 200 or 20,000 bushels of beans.

- **Variable Costs**: Expenses that change according to the amount you produce or sell. For example, your variable cost for fuel and seed will increase when you increase your bean acreage from 2 to 200.

Operating and labor costs are both variable, but overhead costs can be either fixed (mortgages, equipment loans) or variable (advertising, equipment maintenance)

Once you know your different types of costs and have created a system to capture them, you need to decide how you want to use your cost numbers. There are four distinct kinds of budgets into which you can plug your cost and income data:

- **Enterprise budget**: records the costs and income from the production of one single type of farm product, during one cycle of production. For example, if your farm produces poultry, beef, hay, corn, and soybeans, you will create an individual enterprise budget for each of these five products, covering a single crop growing season, or one animal life cycle. These budgets are usually developed on a per-acre or per-head basis.

- **Whole farm budget**: adds the costs and income from each enterprise budget, along with other miscellaneous income and expenses, to determine total expenses and income for the farm as a whole. This kind of budget includes off-farm income and other small-scale miscellaneous work, expenses, and income.

- **Partial budget**: measures the effects of small changes in a farm operation, leaving out unaffected parts of the overall farm budget. This kind of budget provides quick information to help guide smaller-scale decisions, such as changes in a production practice, or choosing between hired custom harvesting and an equipment purchase.

- **Cash flow budget**: tallies the cash receipts and expenses of the farm over a fixed time period (usually a year). This budget shows whether or not expected total cash income will be adequate to cover cash expenses, which is useful to assess major purchase, and to plan loan repayment or new borrowing.

Of these four types of budgets, an enterprise budget is usually considered to be the most useful because it is the basis on which all the other types of budgets are built, and because it provides practical cost information that you can use right away and over time.

**A yearly enterprise budget can help you to:**
1. **Set reasonable production goals** for each of your farm products,
2. **Accurately calculate your costs of production** for each product,
3. **Estimate the break-even price and net return you need** from each product in order to cover all your costs and make a profit,
4. **Choose management strategies** that can help you achieve your production and price goals,
5. **Identify problems** that can cause you to miss your production and price goals,
6. **Compare the returns you make from each of your farm products**, to better assess and plan for the profitability of the whole operation, and
7. **Quickly gather important information for business planning and loan applications.**

Of course, the value and usefulness of any budget depends on the type and quality of numbers you plug into it. A good record keeping system, like the one described in the Record Keeping fact sheet, can: 1) help ensure that your budget numbers are as accurate as possible, and 2) identify which numbers are “spot on” or “less than perfect”.

At the same time, the numbers you use in your budget will depend on the budget accounting style you choose. Any budget can be presented in one of two different accounting styles:

- **Economic accounting:** includes cash or numeric values for all inputs and outputs, including operations and transactions that aren’t cash based, such as use of farm-raised feeds for livestock, or use of livestock manure as an ingredient in compost. Economic accounting works best for enterprise and whole farm budgets and is often useful for partial budgets.
- **Financial accounting:** lists only inputs and outputs that require actual cash transactions. Financial accounting works best for cash flow budgets and, sometimes, for partial budgets.

In most cases, economic accounting creates a better, more complete budget, especially if you’re developing an enterprise budget. Also, if you start with economic accounting, it’s very easy to pull out the basic financial accounting numbers when you need them.

However, don’t get discouraged if you’re not able to fill in all the blanks in an economic accounting budget. To reiterate the most important point of budgeting and cost calculations, *a few numbers are better than no numbers at all!* It’s good enough to plug in the numbers you have to get started. Just be sure to make an effort to fill in the “blanks” as time goes on.

Enterprise budget work sheets can vary from “short and simple” to “long and comprehensive”, depending on the amount of detail you want to include. Of course, the more detail you include, the more informative your budget will be. For example, by individually listing each fertility amendment you add to the soil (rather than lumping them in a general category of “Fertilizers” or “Soil Amendments”), you can easily see what amendments you’ve used from year to year and how much you spent on each. That
information can help you assess the cost/benefit ratio of each amendment, giving you another valuable tool to guide your future plans.

However, increased budget detail does not necessarily increase your budget’s accuracy. Accuracy depends entirely on the quality of the numbers you plug in. Even the shortest budget will be accurate, as long as you keep good records and include all the costs that fall under each category (drawn from a good record keeping system).

The following work sheet is a “standard” crop enterprise budget (in economic style) that you can start using right now, if you want. To help you choose the level of detail you want to include, some cost categories are followed with a list of possible sub-headings that you might want to use for greater detail. Feel free to include even more detail if it’s useful to you!

<table>
<thead>
<tr>
<th>CROP ENTERPRISE BUDGET</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Crop:</strong> (such as corn, soybeans, wheat, hay, straw, or apples, etc…. create a separate budget for each crop)</td>
</tr>
<tr>
<td><strong>Year:</strong></td>
</tr>
<tr>
<td><strong>Item</strong></td>
</tr>
<tr>
<td>RECEIPTS</td>
</tr>
<tr>
<td>Total receipts for sale of crop</td>
</tr>
<tr>
<td>other income (if any)</td>
</tr>
<tr>
<td>TOTAL RECEIPTS (add the above items):</td>
</tr>
<tr>
<td>VARIABLE COSTS</td>
</tr>
<tr>
<td>Seed</td>
</tr>
<tr>
<td>Fertilizer</td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>P</td>
</tr>
<tr>
<td>K</td>
</tr>
<tr>
<td>lime</td>
</tr>
<tr>
<td>compost</td>
</tr>
<tr>
<td>other</td>
</tr>
<tr>
<td>Chemicals</td>
</tr>
<tr>
<td>individual chemical pesticides</td>
</tr>
</tbody>
</table>

169
<table>
<thead>
<tr>
<th>Category</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual organic preparations</td>
<td></td>
</tr>
<tr>
<td>(if you use nothing, you can delete the category, or just mark 0)</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>acre</td>
</tr>
<tr>
<td>Custom Harvest OR</td>
<td>acre</td>
</tr>
<tr>
<td>Drying (fuel, electric)</td>
<td>points</td>
</tr>
<tr>
<td>Trucking (fuel)</td>
<td>gallon</td>
</tr>
<tr>
<td>Storage</td>
<td></td>
</tr>
<tr>
<td>Fuel, oil, lubrication</td>
<td>gallon</td>
</tr>
<tr>
<td>Equipment Repairs (tractors, self-propelled equipment, implements, etc.)</td>
<td>acre</td>
</tr>
<tr>
<td>Crop Insurance</td>
<td></td>
</tr>
<tr>
<td>Custom Labor AND/OR</td>
<td>hours (acre)</td>
</tr>
<tr>
<td>Hired Labor (labor can be broken down by task)</td>
<td>hours</td>
</tr>
<tr>
<td>Interest on Operating Capital$^1$</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous (equipment rental, soil tests, small tools, etc.)</td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL VARIABLE COSTS:</strong></td>
<td></td>
</tr>
<tr>
<td><strong>FIXED COSTS</strong></td>
<td></td>
</tr>
<tr>
<td>Land charge$^2$</td>
<td>acre</td>
</tr>
<tr>
<td>Interest</td>
<td>acre</td>
</tr>
<tr>
<td>Taxes</td>
<td>acre</td>
</tr>
<tr>
<td>Insurance</td>
<td>acre</td>
</tr>
<tr>
<td>Machinery/Equipment</td>
<td>dollars</td>
</tr>
<tr>
<td>Interest</td>
<td>dollars</td>
</tr>
<tr>
<td>Taxes</td>
<td>dollars</td>
</tr>
<tr>
<td>Insurance</td>
<td>dollars</td>
</tr>
<tr>
<td>Depreciation$^3$</td>
<td>dollars</td>
</tr>
<tr>
<td>Labor (that doesn't vary with the amount of land farmed)</td>
<td>hours</td>
</tr>
<tr>
<td>Marketing</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Unit</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Labor</td>
<td>hours</td>
</tr>
<tr>
<td>Co-op broker, market fees, etc.</td>
<td>dollars</td>
</tr>
<tr>
<td>Advertising</td>
<td>dollars</td>
</tr>
<tr>
<td>Display materials</td>
<td>dollars</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td>Office Expenses (paper, staples, pens, computer, etc.)</td>
<td></td>
</tr>
<tr>
<td>Utilities (those that don't vary with production levels, such as electric, heat, and water for barns and offices)</td>
<td></td>
</tr>
<tr>
<td>Management Charge</td>
<td></td>
</tr>
<tr>
<td>Prorated Establishment Costs</td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL FIXED COSTS:**

**TOTAL COSTS**

(variable + fixed):

**RETURN TO MANAGEMENT**

(total receipts - total costs):

1. Interest on all variable costs over the life cycle of the crop, at a given appropriate interest rate, using the following formula: \( \frac{(\text{total variable cost}/2) \times \text{interest rate} \times (\text{months of the crop life cycle}/12)}{\text{total variable cost}} \).
2. Land charges are based on average cash land rents in the area. Rates vary throughout regions and states, so check your local rates.
3. The initial cost of the item, divided by its expected life-span, to provide a realistic annual value/cost for the item.
4. The salary you pay your farm manager(s) or yourself to manage the overall operation.
5. This figure can be calculated in a few different ways: 1) take all your fixed base costs to start the operation (buildings, equipment, loans, land, perennial crops, etc.) and prorate that amount over a certain number of years to repay yourself or your loans; or 2) total all your fixed costs to establish that season's product "unit" (plants, bushels of corn, bins of apples, etc.) and divide that total by the number of individual units you produced, to define a per/unit fixed base cost.

Though livestock budgets contain some very different items from crop budgets (such as animal purchases, feed and vitamins, veterinary services and medicines, housing and bedding, and breeding), there are a number of key components (such as interest on operating capital, taxes, insurance, office expenses, management, and labor) that are...
similar for both budgets. The following resource section provides information to help you find a wide range of useful livestock and crop budget samples or develop a budget design that works for you. Be sure to look at as many different budget samples as you can, so you can identify the components, lay-out, and level of detail that make the most sense for your operation.

1.10 SUPPLY RESPONSE AND AGGREGATE SUPPLY

Like the majority of countries in Asia, India has been following a structural adjustment programme since the mid-1980s. Significant progress was made during 1986-92: large and frequent devaluations; exchange rate liberalisation; reform and rationalisation of the tax system, especially tariffs; decontrol of agricultural prices and liberalisation of marketing (and the agricultural sector was the principal source of economic growth over 1986-92). The rationale behind agricultural liberalisation is that the biases against agriculture inherent in protectionist policies, evident in India from the late 1960s, discourage production so that reforms which introduce price incentives and efficient marketing will encourage producers to respond.

In many developing countries, governments have been inclined, implicitly or explicitly, to tax the agricultural sector as part of a policy of industrialisation-led growth, justified by the belief that industry is the dynamic sector while the agricultural sector is static and unresponsive to incentives. If supply response is low, then taxing agriculture (ie. Turning the internal terms of trade against agriculture) will generate resources for other sectors of the economy, without significantly affecting agricultural growth. But if, on the contrary, agricultural supply response is high, then taxing agriculture can retard agricultural growth, creating food and input supply bottlenecks which will eventually bring down the rate of growth of the entire economy (Chhibber, 1989), increase reliance on imports to meet food requirements and/or reduce agricultural exports (often the principal source of foreign exchange). In general, policies biased against agriculture have done more harm than good, reducing growth in the agricultural sector and consequently in the economy as a whole.

The performance of export crop production (measured as official purchases), in both the long-run and short-run, can be fully explained by a secular downward trend. The dominance of the trend prevented estimation of price elasticities, although the trend in production is in line with that in prices. The failure to find a short-run response is consistent with the time lags inherent in export crop response, as many of the major crops are perennials. Farmers are indeed responsive, which is consistent with the evidence of agricultural sector growth. Liberalisation of agricultural markets, where it increases the effective prices paid to farmers, can be effective in promoting production, and is consistent with the observed improved performance of the sector following liberalisation in the 1980s. Complementary interventions, to improve infrastructure, marketing, access to inputs and credit, improved production technology etc, can be expected to make producers even more responsive. This latter point is especially important if the objective is to expand total agricultural output; our evidence is consistent with the view that much of the response is substitution between (export and food) crops, although there is a strong
suggestion that total production will respond if constraints are relaxed and incentives improved.

1.11 TRADITIONAL AGRICULTURAL AND RESOURCE USE EFFICIENCY

Today in India, as in many other developing countries with a rich agricultural tradition of their own, the words ‘improved agriculture’ and ‘progressive agriculture’ have become synonymous with the spread of HYVs (High Yielding Varieties of Crops) grown with ever-increasing doses of (often imported) chemical fertilisers and pesticides. Wherever the new crop varieties have spread, time-honoured crop rotations, inter-cropping patterns and other important features of traditional agriculture have been harshly uprooted (this choice, however, has not been made willingly by most farmers, rather it has been forced on them by a package of government policies, subsidies and selective price incentives).

At the back of this trend, and the official policies which support it, is the belief that traditional agriculture is ‘backward’ and incapable of meeting the desired objectives of agricultural planning, i.e. making adequate food available for the Indian masses and improving the living conditions of the peasants who constitute the overwhelming proportion of the Indian population.

But is this belief, widespread as it is among several international ‘experts’ and India's own development planners and policy makers, supported by hard facts?

In 1889, Dr John Augustus Voelcker, the Consulting Chemist to the Royal Agricultural Society of England, was sent by the British government to study Indian agriculture. Voelcker toured the country extensively for over one year. His report was published in 1893, and since then has often been cited as an authoritative work on Indian agriculture of this period. For instance, the Report of the Royal Commission on Agriculture (1928) said of the Voelcker Report, "Although thirty five years have elapsed since this work was written, the ability which Dr Voelcker displayed in his comprehensive survey of the agricultural conditions of India, in his analysis of problems they present and in the recommendations for their solution, still renders it a book of the utmost value to all students of agriculture in India."

How did Dr Voelcker view Indian agriculture as it existed nearly a hundred years back? Did he consider it backward and incapable of giving a good yield? The essence of what Dr Voelcker said can be summarised in the following extract from his report: "I explain that I do not share the opinions which have been expressed as to Indian Agriculture being, as a whole, primitive and backward, but I believe that in many parts there is little or nothing than can be improved, whilst where agriculture is manifestly inferior, it is more generally the result of the absence of facilities which exist in the better districts than from inherent bad systems of cultivation . . . I make bold to say that it is a much easier task to propose improvements in English agriculture than to make really valuable suggestions for that of India . . . the conviction has forced itself upon me that, taking everything together and more especially considering the conditions under which Indian crops are grown, they are wonderfully good. At his best the Indian raiyat or cultivator is quite as good as, and in
some respects, the superior of, the average British farmer, while at his worst it can only be said that this state is brought about largely by an absence of facilities for improvement which is probably unequalled in any other country . . . I have remarked in earlier chapters about the general excellence of the cultivation; the crops grown here are numerous and varied, much more indeed than in England. That the cultivation should often be magnificent is not to be wondered at when it is remembered that many of the crops have been known to the raiyats for several centuries, rice is a prominent instance in point."

More especially he stated, "To take the ordinary acts of husbandry, nowhere would one find better instances of keeping land scrupulously clean from weeds, of ingenuity in device of water-raising appliances, of knowledge of soils and their capabilities as well as of the exact time to sow and to reap, as one would in Indian agriculture, and this not at its best along, but at its ordinary level. It is wonderful, too, how much is known of rotation, the system of mixed crops and of fallowing. Certain it is that I, at least, have never seen a more perfect picture of careful cultivation, combined with hard labour, perseverance and fertility of resource, than I have seen at many of the halting places in my tour. Such are the gardens of Mahi, the fields of Nadiad and many others."

Voelcker did not believe that the existing ploughs and other implements used by the farmers were useless and ready to be replaced, "It has been said that if the native cultivator had ‘improved’ ploughs he could dispense with he many ploughings which he gives to the land, and that he would thus save himself the cost of going over the field again and again, crossing and recrossing. These ploughings are always three or four in number for ordinary crops, and eight, twelve and even as many as twenty, for sugar cane and other special crops. But the answer is that the end is achieved in time, a finer and better tilth is obtained and the moisture is not lost." Further, "If for ploughs of new designs there be but little room, still less is there for more expensive implements, such as seed-drills, mowers, reapers, threshing machines etc. The native seed drill will strike everyone who sees it at work as being wonderfully efficient, and leaving little to be desired . . . Anyone, who has watched the clever devices of the native cultivators in the implements which they use, for harrowing, levelling, drilling, raising water, etc., will see that if anything is to replace the existing implements it must be simple, cheap and effective. He will indeed be a clever man who introduces something really practical."

An important agent of traditional Indian agriculture was the well-developed irrigation system. "Irrigation by wells is at once the most widely distributed system, and also the one productive of the finest examples of careful cultivation . . . Further, as regards wells, one cannot help being struck by the skill with which a supply of water is first found by the native cultivators, then by the construction of the wells, the kinds of wells and their suitability to the surroundings and means of the people; also by the various devices for raising water, each of which has a distinct reason for its adoption. All these are most interesting points with which I am not called upon to deal, for I see little to improve in them which the cultivator does not know perfectly well."

Another aspect, less widely realised, was that of the scientific rotation system. Voelcker pointed out, "It is quite a mistake to suppose that rotation is not understood or appreciated in India. Frequently more than one crop at a time may be seen occupying the same ground but one is very apt to forget that this is really an instance of rotation being
followed. It is not an infrequent practice, when drilling a cereal crop, such as jowar (Sorghum vulgare) or some other millet, to put in at intervals a few drills of some leguminous crop, such as arhar (Cajanus cajan).

"There are many systems in ordinary use which are far more complicated than the above. For instance, not only may there be rows of crops, side by side, as noticed above, but the alternating rows may themselves be made up of mixtures of different crops, some of them quick growing and reaped early, others of slower growth and requiring both sun and air, and thus being reaped after the former have been cleared off. Again, some are deep-rooted plants, others are surface feeders, some require the shelter of other plants and some will thrive alone. The whole system appears to be one designed to cover the bareness and consequent loss to the soil, which would result from the soil beating down upon it, and from the loss of moisture which it would incur."

Voelcker, moreover, was not the only agricultural scientist to point out these assets of traditional agriculture in India. There were several others, scientists and expert scholars, who did so. Here we quote from only two others—J. Mollison and A.O. Hume.

J. Mollison, who later became the first Inspector-General of Agriculture in India, published in 1901 a volume ‘Text Book of Indian Agriculture’. Like Voelcker, Mollison stressed the suitability of the implements used traditionally in Indian conditions. "I believe that the implements in ordinary use are entirely suitable for the conditions of Indian agriculture. This statement may be objected to by other authorities, but if such is the case, I am afraid, I cannot change a deliberately expressed opinion. To those who are skeptical I can show in parts of the Bombay Presidency cultivation by means of indigenous tillage implements only, which in respect of neatness, thoroughness and profitableness cannot be excelled by the best gardeners or the best farmers in any part of the world. That statement I deliberately make, and am quite prepared to substantiate."

Mollison gives the following account of the practice of artificial warping in Bombay Presidency, "Artificial warping differs from the natural formation of alluvium only, in that the water of a turbid stream may be diverted from its course, and held in a particular area sufficiently long to deposit a large amount of sediment, and if the process is often repeated, a soil of considerable depth may be formed on rock or any other sterile area. Many of the small rice-fields on the Western Ghats have been formed by throwing bandheras across the turbid hill-streams and either diverting the water or allowing a small lake to form above the weir. In this way the current is so obstructed that suspended earthy matter is deposited and in time the silt layer becomes so deep that a rice-crop can be raised thereon. The lower terraced rice fields of the Ghats are annually warped and improved by the silt carried down by the drainage water of the uplands."

Speaking of the soil-mixing practices, Mollison writes, "Mixing is not unknown in India. Clay is often carted from rice-fields in sufficient quantity to add a layer one to two inches thick on sand land. The addition changes the consistence of the sand, so that it becomes better suited for sugar cane and other garden crops raised under irrigation. The cultivator appreciates the value of tank silt and in those districts where these water reservoirs are common they are cleaned out with the utmost care and regularly each year. The silt which has collected in these tanks being the washings of village sites and cultivated fields, has
some manurial value, and applied as it is at the rate of 40 cart loads or more per acre, adds considerably to the body of the soil."

A.O. Hume, in Agricultural Reform in India, (1878) wrote about weed-control by Indian farmers at that time, "As for weeds, their wheat fields would, in this respect, shame ninety-nine hundredths of those in Europe. You may stand in some high old barrow-like village site in Upper India, and look down on all sides on one wide sea of waving wheat broken only by dark green islands of mango groves—many square miles of wheat and not a weed or blade of grass above six inches in height to be found amongst it. What is to be spied out creeping here and there on the ground is only the growth of the last few weeks, since the corn grew too high and thick to permit the women and children to continue weeding."

Hume's tribute to the grain-storage practices of Indian farmers is no less glowing. "They are great adepts in storing grain, and will turn out of rough earthen pits, after 20 years, absolutely uninjured. They know the exact state of ripeness to which grain should be allowed to stand in different seasons; in other words under different meteorological conditions, to ensure its keeping when thus stored; and equally the length of time that, under varying atmospheric conditions, it should lie upon the open threshing floor to secure the same object."

All these statements were made in the latter part of the 19th century, but more recent research on tribal communities and other farmers following traditional methods of cultivation has also revealed several interesting facts about the assets of traditional agriculture.

Research work done during the last decade by a prominent agricultural scientist of India, Dr R.H. Richharia (former Director of Central Rice Research Institute in India) in the Chhatisgarh region of the state of Madhya Pradesh has revealed the high level of skills of the farmers of remote tribal villages still untouched by the official development programmes. This scientist's travels in Bastar district, one of the most remote areas in Central India, where tribal communities still lead a life of their own, brought him into contact with farmers who were taking comparable and even larger yields from indigenous rice varieties, compared to the HYVs being spread officially in other parts of the state. Another revelation was the very large number of rice varieties being grown by the farmers, who possessed detailed knowledge of each of their properties. Some of those varieties were remarkable for their high yields, some for their supreme cooking qualities, some for their aroma, and some for other cherished qualities.

In the late seventies, Dr Richharia wrote: "A recent varietal cum agronomic survey has shown that nearly 9 per cent of the total varieties grown in MP fall under the category of high yielding types (3,705 kgs and above per hectare).

A farmer planting a rice variety called Mokdo of Bastar who adopted his own cultivation practices obtained about 3,700 to 4,700 kgs of paddy per hectare. Another rice grower of Dhamtari block (Raipur) with just one hectare of rice land, told me that he obtained about 4,400 kgs of paddy per hectare from chinnar variety, a renowned scented type, year after year with little fluctuations. He used farmyard manure supplemented at times with a low dose of nitrogen fertilisers. For low lying areas in Farasgaon Block (Bastar) a non-
lodging mildly scented tall rice variety Surja with bold grains can compete with Java in yield potential at lower doses of fertilisation, according to a local grower who recently showed me his crop. During my visit to the Bastar area in the middle of November, 1975, when the harvesting of new rice crop was in full swing in that locality, I observed a field of Assam Chudi ready for harvest with which the adivasi cultivator named Baldeo of the Bhatra tribe in the village Dhikonga Jugalpur block, had entered in a crop competition. The cultivator had applied fertiliser approximately equal 50 kg N/ha and had used no plant protection measure. He expected a yield of about 5,000 kg/ha.

In the Bichia Block of the Mandla district, Madhya Pradesh, our survey (1973-74) has indicated the following yields:

### Table 6

<table>
<thead>
<tr>
<th>Indigenous rice variety</th>
<th>Yield in bags/acre (1 bag = 75 kgs)</th>
<th>Yield in kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amar Jyoti</td>
<td>20</td>
<td>3,750</td>
</tr>
<tr>
<td>Rani Kajar</td>
<td>30-35</td>
<td>5,625-6,562</td>
</tr>
<tr>
<td>Chattri</td>
<td>20</td>
<td>3,750</td>
</tr>
<tr>
<td>Dubraj</td>
<td>20-25</td>
<td>3,750-4,687</td>
</tr>
<tr>
<td>Luchari</td>
<td>30-35</td>
<td>5,625-6,562</td>
</tr>
</tbody>
</table>

The existing local practices of cultivation have emerged after centuries of experience, based on trial and error and have a sound base for their wide acceptance.

While studying traditional agriculture, attention should not be focused only, or even primarily, on farming methods and on crop varieties. What is more important is the overall harmony of the traditional mixed farming system.

Traditionally, man, animals, trees (including grass lands) and agricultural fields were inseparable and harmonious components of a single system. The villager looked after the trees on his fields and also contributed to the maintenance of the community grazing land. He looked after the animals owned by him, sometimes with the assistance of a grazing hand and cultivated the fields owned by him, with or without hired labour or share croppers.

The trees provided fodder for the cattle. They also provided fuel for the villagers. The leaves that fell were put to uses beneficial to the agricultural fields. Meanwhile their soil and water conservation properties were beneficial for the villagers and contributed to maintaining the fertility of agricultural fields, as well providing shade during the scorching summer, addition, certain trees provided edible fruits medicines, gum, toothpaste and a host of other commodities of every day use. In some villages trees were used for lac cultivation, and for raising silkworms and bees. Owing to their water conservation properties trees were also responsible in several villages for ensuring an adequate supply of drinking water.

Cattle provided milk and milk products and contributed to the nutritional content of the villagers' diet. Cattle dung provided organic fertilisers for the fields, while the poultry
provided eggs and meat. The skins of dead cattle were used for making footwear and other leather products—all such activity being carried out in the village. Not least, bullocks ploughed the fields.

The fields produced foodgrains, pulses, oilseeds and vegetables for the villagers. The residues of those crops, of no direct use to man who could not eat them, were fed to the cattle. Poultry birds scavenged the wasted scattered grain.

Harmonious as the system was, disturbing a single component could have a chain effect of far-reaching consequences. For instance, if for some reason the villagers did not properly look after the community grazing lands and trees or if these were destroyed by some outside force, say a timber merchant, then soil and water conservation would inevitably suffer. The fertility of the agricultural fields would not only be directly affected by also indirectly, because shortage of timber would mean that more dung would have to be used as fuel, thereby leaving less for fertilising the fields. The next consequence would be shortage of fodder, leading to a weakening of the animals. In addition, the villagers would be gradually deprived of several commodities of everyday use, including fruits and medicines.

Over much of India, the traditional harmonious mixed farming system has been disrupted. Thus around most villages the land is eroded, agricultural yields are low, there is shortage of fuel and fodder the bullocks are weak, and the milk yield is low.

Under such conditions it is vital that a massive tree planting programme in and around the village should be undertaken and the grazing lands be rehabilitated. Not only will such activities put agriculture and animal husbandry back on their feet, they will also help solve the problem of fuel shortage and help improve the drinking water situation.

Furthermore planners should study the numerous varieties of crops being grown in those areas, and should then make good quality seeds available to the villagers. Better field preparation and help with manuring, sowing operations, crop management and with post harvest storage will lead to better quality of crops as well as yields. All this can be done within the framework of the traditional system, that is, maintaining the essential harmony of agriculture, animal husbandry and forestry.

Any effort to rebuild or improve the traditional system of mixed farming must be done in a manner in which there is no conflict between agriculture, forestry, animal husbandry and the real needs of the village. It is all too easy to go against the essence of the traditional system—for instance, through planting tree species which while meeting the requirements of industry do not provide fodder to the villagers nor increase the fertility of the fields. Furthermore, breeds of cattle can be promoted which cannot thrive on crop residues but must be fed on foodgrains that before were consumed only by human beings.

Thus some varieties of pine and eucalyptus, both of which are being promoted in the government's tree planting programmes, have leaves that cannot be consumed as fodder, while their acidic properties diminish the fertility of agricultural land as well as lowering its moisture content. Moreover with certain breeds of cow that have been introduced, it becomes necessary to use village land for growing green fodder as well as coarse cereals in order to feed the cattle, thereby diminishing the availability of food in the village, even though milk production is expected to rise. Within the traditional system, milk production
does not rise at the expense of losing food grains since cattle are expected to consume only green tree leaves and crop residues. Moreover, the benefits of cross-bred cows and of higher milk production are likely to accrue at least initially to the better off villages, while the effect of decreased food production will probably be felt by the poorer sections of the community.

New agricultural technology in the form of tractors and fertilisers will again benefit the richer farmers, who will therefore be able to increase their agricultural production and cash receipts. On the other hand, their dependence on organic manure and bullocks is reduced, so that their requirement for fodder becomes less. All those factors may lead them to neglect the growth and proper maintenance of grazing lands. In fact, owing to the high value of any additional land, they may even be tempted to encroach grazing land and grow crops on it, using tractors and chemical fertilisers. In the process the rest of the village becomes worse off than before.

In recent years ambitious programmes of agriculture, dairy development and forestry have been undertaken and even more ambitious programmes will be undertaken in the near future. In view of the massive investments being made, the development planners should pause to think about the merits of the traditional system of the Indian village and the way in which the villagers made the best use of available resources with minimal wastage.

What Voelcker wrote nearly 100 years back may be valid today also: "I believe that it will be possible here and there to graft onto native practice the results of the western experience, but the main advance will come from an enquiry into native agriculture, and from the extension of the better indigenous methods to parts where they are not known or employed."

1.12 TECHNICAL CHANGE IN AGRICULTURE

Agricultural Sector is the mainstay of the rural Indian economy around which socio-economic privileges and deprivations revolve and any change in its structure is likely to have a corresponding impact on the existing pattern of Social equity. Sustainable Agricultural production depends on the judicious use of natural resources (soil, water, livestock, plant genetic, fisheries, forest, climate, rainfall, and topography) in an acceptable technology management under the prevailing socio-economic infrastructure. The existence or absence of favourable natural resources can facilitate or retard the process of economic development. Professor W.A.Lewis writes : "Natural resources determine the course of development and constitute the challenge which may not be accepted by the human mind". Developing countries, embarking on programmes of economic development, "usually have to begin with and concentrate on the development of locally available natural resources as an initial condition for lifting local levels of living and purchasing power, for obtaining foreign exchange with which to purchase capital equipment, and for setting in motion the development process" [Fisher64]. With the basic thrust on higher growth in food grain production and other agricultural commodities, increase in productivity and efficient use of resources in agriculture has received special emphasize all through the process of the development, since
independence. Sustainable agricultural production depends on the judicious use of natural resources (soil, water, livestock, plant genetic, fisheries, forest, climate, rainfall, and topography) in an acceptable technology management under the prevailing socio-economic infrastructure. Food and Agriculture Organization (FAO) has formulated the following definition for sustainable development in the context of agriculture, forestry and fisheries:

The Indian Agricultural sector provides employment to about 65% of the labour force, accounts for 27% of GDP, contributes 21% of total exports, and raw materials to several industries. The Livestock sector contributes an estimated 8.4 % to the country GDP and 35.85 % of the agricultural output. India is the seventh largest producer of fish in the world and ranks second in the production of inland fish. Fish production has increased from 0.75 million tons in 1950-51 to 5.14 million tons in 1996-97, a cumulative growth rate of 4.2% per annum, which has been the fastest of any item in the food sector, except potatoes, eggs and poultry meat. The future growth in agriculture must come from

[GBSingh2K] viz.,

- new technologies which are not only "cost effective" but also "in conformity" with natural climatic regime of the country;
- technologies relevant to rain-fed areas specifically;
- continued genetic improvements for better seeds and yields;
- data improvements for better research, better results, and sustainable planning;
- bridging the gap between knowledge and practice; and
- judicious land use resource surveys, efficient management practices and sustainable use of natural resources.

Informatics for agricultural development requires coordinated inter-sectoral approach and application of appropriate Information Technology (IT) tools, in the areas of :-

- Agricultural Research,
- Agro-meteorology,
- Agricultural Marketing,
- Agricultural Engineering and Food processing,
- Agricultural Extension and Transfer of Technology,
- Credit & Co-operation,
- Crop Production and Protection,
- Environment & Forest,
- Fertilizers and Manure,
- Fisheries,
- Irrigation and Drainage Systems,
- Livestock, Dairy Development and Animal Husbandry,
- Rural Development and Planning,
- Soil and Water Management,
- Watershed Development, and
- Wastelands Development
In view of the recommendations given by ISDA-95 and various sub-Groups for formulation of the Ninth Plan in the Agriculture Sector, MOA is implementing Information Technology Plan, in collaboration with NIC, to implement "NICNET based Agricultural Informatics and Communication (AGRISNET)" in the country, to achieve higher sustainable agricultural productivity and also to make "Indian Agricultural Sector On-line". This is likely to be the largest sharable Internet Portal in the world, for agricultural sector in India, on NICNET having more than 10,000 nodes to government itself.

**Agricultural Resources Information System**

It is clear that sustainable agricultural production depends on the judicious mix of natural resources (soil, water, livestock, plant genetic, fisheries, forests, climate, rainfall, and topography) in an acceptable technology management under the prevailing socio-economic infrastructure. In addition to the natural resources components, it is also essential to combine natural resources with capital resources, institutional resources, and human resources for sustainable agricultural development. Agricultural Resources components include:

- Animal Resources
- Capital resources
- Climate resources
- Environment data
- Fisheries Resources
- Forestry Resources
- Institutional resources
- Land owners data
- Plant Resources
- Socio-economic & Infrastructure data
- Soil resources
- Water Resources

For increasing production at micro level, an inventory of currently used, potentially available, and an evaluation of the quantity and quality of these resources is required. This requires design and development of agricultural resources information system using state-of-the-art IT Tools, as given below, to facilitate effective agricultural planning and development:

- Data warehousing (Data Bases & Model Bases)
- Expert Systems & Knowledge Bases
- Networking (Internet, Intranet and Extranet)
- Geographical Information System (GIS)
- Application of Remote Sensing Data
- Multi-media Information System
- Decision Technology System
- E-Commerce & E-Governance, and
- Digital Library
Agricultural planning and development [Mollet84] require (a) knowledge about recent progress in agriculture, (b) the existing situation (especially the main problems impeding development), and (c) the potentialities for achieving agricultural objectives. This information is needed for re-assessing current investment and other development activities as well as for planning new measures, setting benchmarks against which to monitor progress.

Proper analysis of the agricultural sector requires that it is seen as a system of functionality inter-related and inter-dependent elements, each of which contributes to the existing and potential level of performance of the sector. A stock taking and diagnostic survey is needed early in the planning process to provide information about the wide range of factors influencing agricultural performance.

Both the Ministry of Agriculture and Ministry of Rural Development implement, through corresponding State departments, various central sector and centrally sponsored schemes related to agricultural and rural development, on watershed basis. The landscape, climate, and agronomic characteristics of each watershed vary considerably. Each watershed contains a complex mixture of

- soil types,
- landscapes,
- climatic regimes,
- land use characteristics, and
- agricultural systems.

Each watershed can be subdivided into agro-eco-regions having similar soil types, landscapes, climatic regimes, crop and animal productivity, and hydrologic characteristics. Integrated Watershed Development and Management has been recognized as an effective strategy for sustainable agricultural development in the country. Sources of Agricultural Resources Information and design of system

Remote Sensing has provided a new impetus for the earth resource and environmental scientists. Increasing population and diminishing resources have compelled us to consider better ways for management of natural resources. Soil survey and preparation of soil maps are being carried out by NBSS&LUP, AISLUS, CAZRI, CSSRI, CSWCRTI, NRSA, RRSSC, IIRS, State Departments of Agriculture, State Soil Survey Units, State Agricultural Universities, State Remote Sensing Application Centres, etc.

A review of the soil mapping and land degradation mapping was conducted by an Inter-Agency Expert Committee constituted by the Ministry of Agriculture and the Department of Space, and on the basis of the recommendations, a National Mission on "Mapping of Soils and Land Degradation at 1:50,000 Scale" with the major objective of creation of uniform soil and land degradation database for the entire country is being contemplated. Forestry Survey of India, Geological Survey of India, Fisheries Survey of India, Botanical Survey of India, National Remote Sensing Agency, Survey of India, National Atlas and Thematic Mapping Organization, National Sample Survey Organization, Central Ground Water Board, etc., conducts resources surveys and develop "resources
databases" using ground truths and applications of remote sensing data.

The Report of the Committee on "Natural Resources Information System (NRIS) - Linkage and Networking Project", constituted by the Department of Space in early 1990s, envisaged about 435 district level NRIS nodes in conjunction with DISNIC nodes of NIC, 26 state level NRIS nodes, 182 NRIS project nodes (7 Themes and 26 States), and 42 NRIS Regional nodes (7 themes and 6 regions). Development of "Natural Resources Information System (NRIS) - Linkage and Networking Project" was initiated by NIC in its pilot project districts. Department of Land Resources through its land resources development programmes, Department of Agriculture & Cooperation through its NWDPRA Projects, and Department of Science & Technology through its NRDMS Projects, have been involved in the implementation/ development of Natural Resources Information System (NRIS) to strengthen their schemes through their implementing agencies. The existing data available from the following reports can facilitate strengthening resources databases:

1. Soil survey
2. Geological survey
3. Forest inventories
4. Hydro-meteorological studies
5. Aerial photographs and contour maps
6. Ownership data and infrastructure information
7. Rainfall and stream flow data
8. Land use details
9. Development plans

Development of metadata is required as the overall rate of collection of data increases rapidly with advances in technologies such as high resolution satellite-borne imaging systems and global positioning system, and with growing number of people and organizations who are collecting and using data (spatial and non-spatial). Metadata standards on soil geographic data, vegetation geographic data, developed by [FCDC98], provide a systematic way to collect metadata.

Agricultural Resources Information System will have data and information on basic resources such as (i) soil resources, (ii) water resources, (iii) climate resources, and other data sets (collated from Remote Sensing as well as conventional means) such as (iv) basic data on crops, (v) animal husbandry and fisheries, (vi) genetic (plant, animal & fisheries) materials, (vii) land ownership, (viii) Socio-economic data, (viii) infrastructure for agricultural development. The data sets are as follows:

1. Basic Data on Crops
2. Production of major crops
3. Area cultivated under each major crop
4. Yields per Unit of Area for each crop
5. Areas sown but not harvested
6. Areas of fallow, double cropped, irrigation and inter-cropped land
2. Information on livestock numbers, production and Yield per unit
3. Trade statistics on agricultural commodities and the extent to which imports/exports are involved
4. Information on size, character, technology and organization of farms, by groups

The inventory and appraisal should cover natural, capital, institutional and human (manpower) resources.

Natural Resources

- Information on physical feature [topography, geology, soils, natural vegetation, and hydrology (surface and sub-surface)] to determine the land's capability for agricultural development;

- Maps depicting differences in physical land characteristics, meteorological, climatological, hydrological, geological, and geo-morphological conditions; population densities, types of land tenure systems used, proximity to markets and urban centres, transportation and other infrastructures;

- Areas of immediate growth potential (where climate, soil and water conditions are favourable for agriculture and where technology needed to substantially increase output of major crops already being grown);

- Areas of future growth potential (where favorable climatic and soil conditions exist but lack one or more elements of (i) adequate & controlled supply of water, (ii) technology required for substantially increasing production of a major crop or crops, currently grown, or capable of being grown, and (iii) transportation needed to bring the areas into national economy);

- Areas of low growth potential (where climatological, soil, topological or other deficiencies without economic means for correcting them, exist) which require technological breakthroughs before substantial increases in output are possible

Capital resources

- Investments in agriculture (buildings, water systems, irrigation works, drainage systems
- Agricultural implements and machinery
- Work animals and breeding stock
- Agricultural inputs (seeds, fertilizers, pesticides & insecticides, and credit)

Institutional Resources

- Research
- Extension
- Training
- Provision of short, medium and long-term credits
Marketing, and
Development plans

Human Resources (to find out what extent the human conditions act as a constraint on increased output and can contribute to increased output)

- Labour forces (owner-farmers, sharecroppers, and wage labourers)
- Labour Force (employed, under-employed, and unemployed; seasonal variations)
- Level of literacy, education, nutrition of agricultural population

Since sustainable agricultural development schemes are being implemented on watershed basis, database on watershed basis, as recommended by FAO, is required. AISLUS has brought out Watershed Atlas on 1:1,000,000 scale, which provides a uniform delineation and codification system of the watersheds that could be followed by all concerned agencies dealing with watershed approach, on a common basis. The whole country has been divided into six river resources regions, 35 basins, 112 catchments, 550 sub-catchments and 3,237 watersheds.

**Application of Geomatics Technology**

In order to reduce the risk of marginalisation and vulnerability of the small and marginal farmers, who constitute about 76.3% of total farmers of the country, it is suggested to develop "Agricultural Resources Information System", with the public funding, and make it available to the Resource-Poor-Farmer. Internet Technology based applications (Portals) on agricultural resources are expected to facilitate agricultural development, rural development, and backward area development in the country. Design of agricultural resources information system is to support the various management systems at National, State, District and Village level vis-a-vis catchment, watershed and micro watershed level.

Since MOA has formulated schemes to establish AGRISNET nodes in districts during the Ninth Plan Period and extend to block levels during the Tenth Plan Period, it is required to implement the Geomatics Technology Plan, as suggested below, in mission mode:-

- Reaching-the-Unreached, "Resource-Poor-Farmers", through Information Technology applications;
- "land information system" in district and block levels;
- Strengthening "Agricultural Resources Information System" in all districts (regions) of the Country, "irrespective of past or future growth regions;
- Development of decision support systems on "production practices and systems" which need to be adapted to respond to new market demands and export opportunities, poverty alleviation or growing labour shortages, depending on the agricultural production setting;
- Development of generic decision support systems (DSS) using databases and model bases for agricultural planning and management at micro watershed level; and also to establish GIS centres at block or panchayat level;
• DSS on water allocation in an irrigation system to remove the existing disparities in the availability between the head-reach and tail-end farms and between large and small farms, to achieve "equity and social justice";
• DSS on Land Resources development issues, given in the DSS section;
• Linkages to Development of National Water Database as envisaged in the World Bank aided National Hydrology Project to strengthen water resources management facilitating agricultural planning in districts;
• Development of Agrometeorology Database providing vital information of long-term and short-term objective in agricultural production, planning and management;
• National Agricultural Drought Assessment and Monitoring System (NADAMS) and also Agromet Advisory Services on NICNET;
• DSS on Water Bodies (Basin) based agricultural development, using Watershed and Agro-Eco Region Planning Concepts;
• Development of "metadata" standards and application of "OpenGIS Model" on agricultural resources for Internet/Intranet access; and
• Involvement of Institutions viz., ICAR Institutions, State Agricultural Universities, Rural Development Institutes, NIC, DOS, NATMO, GSI, CGWB, Departments of Geography Research, etc., working on spatial data generation and application of spatial theory for problem solving in respect of agricultural development, rural development and backward area development

Information Technology, Genetic Engineering and Bio-Technology, which are the "drivers" of globalisation with their complementarities of liberalisation, privatisation and tighter Intellectual Properties Rights, are bound to create new risks of marginalisation and vulnerability. Information Technology is able to produce a penetrating and clinical mapping of the land, encompassing the physical, chemical and biological features, and groundwater resources, and forecast of climatic conditions in a focussed manner, that even small geographical segments - the small farms - can be benefited through the guidance provided by the ways in which natural and human resources can be optimally combined with appropriate technologies, inputs and options to enhance and diversify agricultural production [KVS2K]. Information Technology will facilitate dissemination of information on development, education, extension, husbandry, marketing, production, and research, to agricultural farmers.

1.13 LABOR ABSORPTION

A central issue in Agricultural Development is the necessity to increase productivity, employment, and income of poor segments of the agricultural population. Among the rural poor, the small farmers constitute a sizeable portion in the developing countries. Studies by FAO have shown that small farms constitute between 60-70% of total farms in developing countries and contribute around 30-35% to total agricultural output [Randhawa & Sundaram90].

Liberalisation era (1990-91) began in India when over 40% of rural households were landless or near landless, and over 96% of the owned holdings and 68.53% (over 2/3rd )
of owned land belonged to the size groups (marginal, small and semi-medium). The decade of 1981-82 to 1991-92 seems to have witnessed a marked intensification of the marginalisation process - the percentage of small owners increased from 14.70% to 21.75%.

Small farmers emerged as the size group with the largest share of 33.97% in the total land, which is just doubled during this decade. As regards the Large Farmers, they were 1% of the total owners in 1990-91 but owned nearly 13.83% of the total land. An interesting, but speculative, inference is that the changing position of the large owners represents the other side of the marginalisation process, i.e., the presence, and possibly growing strength, of a small but dominant and influential group in agriculture. Analytical reports reveal that marginalisation process could gather further momentum in the years ahead to become an explosive source of economic and political turbulence, due to the features of prevailing policy-cum-market environment in the country.

Trend towards a greater casualisation (erratic and low-paid work) of the workforce that was witnessed in the 1980s appears to have continued in the 1990s. Low productivity and inability to absorb the growing labour force make the agricultural sector in India witness to a pervasive process of marginalisation of rural people. This process is likely to get intensified in the coming years, raising formidable problems in achieving sustained development of rural areas and rural people[VMRao&Hanumappa99].

Labour-intensive practices have led to the view that labour is not a binding constraint in agriculture, which is the most important of occupations for settled populations. Women and children augment the male labour force and keep production costs relatively low. However, there is considerable variation in the availability of farm labour across regions. The migration patterns are evidence of this.

While agriculture continues to bear the burden of a residual labour force and provides livelihoods, it also benefits from cheap labour in the process. Off-farm employment in the immediate neighborhood of the land worked on was relatively less easy to come by and the process of migration to other occupations from agriculture was slow.

The inadequate rate of industrialisation and particularly slow manufacturing growth may have meant correspondingly slow transition from rural to urban employment. The pulls from agriculture, such as high-yielding varieties, irrigation, and so on, increased labour absorption in agriculture.

Mechanisation in the Indian context may not have actually reduced farm employment as most farm holdings continued to be small. At the end of 2009, agriculture may still have employed more than 50 per cent of the labour force of the economy.

The changes induced by the dynamics of economy and policy have similar, and sometimes quite the opposite, effects on agriculture. Economic factors such as urbanisation and growth of non-agricultural sectors, should, in theory, help move the
excess supply of labour away from agriculture, especially if wage rates are the equilibrium force.

1.13.1 Policy dynamics

If the transfers are rapid enough, these changes may set off choice of technologies in agriculture that are less labour-intensive. But the rates of urbanisation and industrialisation have, so far, been quite modest. They may also have been relatively less widespread geographically. The option of encroaching on more and more forest land was also quickly rejected. Acceleration in overall economic growth should have a positive impact on agriculture. Will the current phase of higher economic growth be the right opportunity agriculture has long waited for?

The policies for a prosperous agricultural sector have attempted to make inputs cheaper through subsidies. Labour also remained cheap because there were no other outlets for its application. With the faster growth in non-agricultural sectors, wage rates can only rise for agriculture. Ironically, this is also the time when subsides are likely to be on the decline. Agriculture will have to find sources of growth and productivity that offset the rise in input prices.

The policies for the rural sector have also focused on improving infrastructure, such as roads, electricity, water supply, schools and health services. These investments provide not only the enabling infrastructure but also new employment opportunities. The village economies are changing in ways where labour for agriculture would not be as abundant as before.

The changes bring in non-farm activities to the rural areas and their environs. It is likely that these changes will be slow, given the likelihood of ineffective implementation of the programmes, but they will happen eventually.

1.13.2 Employment guarantee

Finally, what may alter the slow dynamics of rural employment is the National Rural Employment Guarantee Scheme. The availability of employment on demand is limited to a fixed number of days per person, and at a minimum wage rate or thereabouts, it provides an alternative to agriculture as the occupation of last resort.

In places where alternative options are available, there is a view that takers for the employment guarantee scheme at low wage rates would be hard to find. But where the new option is still attractive, the smaller farmers would see a trade-off in working on their own land for an uncertain income, against being ensured more stable source of earnings. It is now sometimes argued, however, that the NREGS has contributed to the recent food inflation, at least in the rural areas.

The implications of these changes for agriculture will be far-reaching. An increase in wage rates for rural labour is a desirable outcome for its implications in improving the
lifestyles of the rural population. But they require significant changes to be brought about in the way farm operations are carried out. The adjustments would mean that productivity or output prices would have to offset the rise in input prices, particularly wage rates.

The policies are likely to discourage the process of adjustment, especially when it comes to land consolidation. If adjustments in land are difficult, agriculture will need to find ways of aggregating services that provide economies of scale to achieve the transition from cheap to more expensive labour. While a reduction in input subsidies is necessary to remove the inefficiencies they create, more expensive farm operations will also end up having the same effect.

1.14 GENDER ISSUES IN AGRICULTURE

According to the 2001 Census, 28 per cent of all working women are farmers — even though not all have land titles — and 46 per cent are labourers, the remaining being in non-agricultural areas. In agricultural labour, 56 per cent are men and 44 per cent women.

"In the previous Census it was 62 per cent men and 38 per cent women, which mean that more women are becoming labourers as men either migrate or do something else. In Tamil Nadu, it is already 51 per cent women and 49 per cent men, with men migrating to other jobs," says Ms Mina Swaminathan, adding that farming too is getting more feminised thanks to men's migration, leaving women to take care of the land.

On the gender curriculum, she says that "hundreds of letters" sent to vice-chancellors of agricultural universities, the ICAR, the Agriculture Ministry, etc., have had no impact. Recently, AFPRO (Action for Food Production), a Non-Governmental Organisation provides socio-technical support to village-level NGOs, asked for a course for 15 of its officers. And she is still waiting "for at least one agricultural university to introduce this course; we're willing to do a demo, train the teachers, etc, but so far there is absolutely no interest. And it is frustrating to see so many years of work go waste."

Another concern is that though more girls are entering the agricultural stream of education, "after they finish, they don't want to go to the field; they want lab or teaching jobs." But this is more because of the lack of transport and accommodation facilities in the field and issues related to safety and security. "Also, when women with children prefer to return home during field trips, this is considered a privilege; people don't understand that women need to be given support services if they are to do a good job," she says.

She adds that the recent murder of a woman in the ITES industry had raised such a hue and cry, "but in the rural areas the security of women is always an issue. Where are the transport or hostel facilities for women? The BPOs get so much publicity, but the women working there do not face any more a problem than faced for years by women who work as nurses or telephone operators on night shifts."
Another drawback on the gender front in agriculture is the other extreme, "when people say 'Ayyo pavam' (poor women), we must do something for them and immediately talk about starting SHGs (self-help groups). Women in agriculture need technical help, credit, title to land... everybody can't join an SHG. And why should a woman with land join an SHG? She is an agriculturist in her own right." The other response, Ms Mina Swaminathan says, is to say, "let's teach her tailoring or to make sauce and jam'. Now how much sauce can a woman make, and where is she going to sell it?"

Another concern on women in agriculture and related areas is that in horticulture or dairy, where labour is provided usually by women, they do not get the profits. "Similarly women take care of the cattle, milk the cows, etc., but in the milk co-operatives, the members are mostly men. Right from the early days the women do all the work in the milk co-operatives, but the profits come in the name of men."

The Regional Expert Consultation on Gender Issues in Agricultural and Rural Development Policy in Asia and the Pacific was held in the FAO Regional Office for Asia and the Pacific (RAPA), from 1 to 5 November, 1993. It was attended by 12 participants from 11 countries, plus two observers and the FAO Secretariat. A list of participants appears in Annex IV, page 21, of this publication. The meeting was opened by Mr. A.Z.M. Obaidullah Khan, FAO Assistant Director-General and Regional Representative, who said:

"Women have had almost two decades since the International Women's Year in 1975 to 'integrate into development,' but it has not happened yet. Rural women are lagging behind rural men', and are plunging into poverty faster than their male counterparts...

Women are increasingly seeing patriarchy as an institution not to be won over, but torn down, dismantled, and the rubble to be burned. It is less clear what they have in mind to replace that institution, but certainly most of us men are not going to surrender our current privileges without a fight.

However, we also know that the boundaries of the battlefield are not absolute, and that a battlefield Cal? also be used as a negotiating arena.... Now we look to policy instruments to help redress imbalance, and we look to you to help us."

The gender issues which emerged focussed on the disadvantages faced by women farmers. Grouped under the six headings in note form, these are summarized below:

1.14.1 The Economic Issues

1. Lack of title to productive assets, access to "inputs" (land, credit, water, fertilizer, seeds, information, technology, training, etc.) and access to markets.
2. Sustainable Development Policies' impact on agriculture, particularly food security, on such marginal groups as poor women, and especially on female-headed households, as well as on family nutrition.

3. The increasing drudgery and time spent by women is not compensated by increases in value added. The limited availability and/or relevance of technology and other aids for women, displacement of labour/employment and the absence of alternatives are other common issues.

4. State imperatives sometimes increase productivity, but without ensuring commensurate income or wage increases and other benefits for women.

5. Structural adjustment policies, and transition to market economies, do not pay adequate attention to their impact on women, especially poor women, and are often forced at a pace which imposes sudden, catastrophic hardship on women.

6. Changes in macro-economic policy, including terms of trade and cropping systems, do not include gender considerations.

1.14.2 The Planning Issues

1. Inadequate gender-differentiated and disaggregated data, as well as data gaps with regard to rural women, which results in overlooking gender issues for macro (national and regional) and micro (intra-household, farm, community, etc.) planning. Chronically-biased data causing skewed policies in favour of male farmers and men in general.

2. Lack of appropriate methodologies that recognize and value women's contribution, actual and potential, to productive activities and which result in women's marginalization in projects and programmes.

3. Women are marginalized in the planning process. Existing institutional structures and practices exclude or at least do not facilitate women's participation. Few women in official decision making.

4. Lack of women's participation, especially in terms of gender differences, in the design, monitoring and evaluation of policies, projects and programmes and failure to monitor and evaluate gender differences, or to provide feedback (especially to women).

5. a) Women are treated as welfare recipients in many employment and income-generating projects rather than as assets developing their own productive potential. "Soft" criteria applied in feasibility assessments, leading to non-viable women's projects.

b) Inadequate appreciation of the impact of policies on women (especially in food security, land tenure, and credit).
c) Inadequate appreciation of the impact of population, growth, migration, fertility and other demographic changes on women.

6. a) Absence of clear linkages and coordination between policy formulation and resource allocations.

b) Policy statements addressing gender issues are often vague or ambiguous, and easily overlooked.

c) There is usually an absence of any direct relationship between policy formulation, resource allocations, and implementation.

7. The formulation of macro policy rarely draws on micro planning and analysis.

8. Low technical and management skills among rural females.

1.14.3 Political Issues

1. Institutional barriers to women's political participation and organization (patriarchy, non-organization of women, rural isolation).

2. Lack of gender equity in remuneration, opportunities, conditions of service, access, etc., rural/urban biases and inequity.

3. Covert and overt policy biases against women, due to policies overlooking or excluding gender-equity considerations.

4. Mandates in regard to women are either absent, weak or not enforced.

5. Human rights documents are not explicit on women's rights. There is little monitoring of human rights protocols and instruments, and even less accountability.

6. Agricultural policies do not articulate gender issues so they are not considered.

1.14.4 Socio-Cultural Issues

1. Lack of gender awareness at all levels in all cultures. Stereotypes.

2. Social and cultural constraints on women's participation, for example, women's triple burden, male orientations in policy making.

3. Low status and disadvantaged position of women resulting in lower education; little access to training; non-participation in decision making, lower income, nutrition, health, etc; few property rights; and limited access to resources.
4. Traditional knowledge systems become distorted, eroded and undermined, while new knowledge is often inaccessible to rural women. Non-recognition of the value of traditional knowledge.

5. Women's low self perception and self-esteem, and few positive role models.

**1.14.5 The Ecological Issues**

1. Complexity of ecological issues; their impact on gender at macro and micro levels.

2. Conflicts or the potential for conflict over resources in development interventions need to be anticipated, and gender issues addressed.

3. Food security and sustainable development need to be accorded priority.

**1.14.6 The Moral Issues**

1. Macro policies are usually concerned more with economic growth than with people and equity.

2. There are major gaps between policies, attitudes (to resource allocation, for example) and practice.

3. Women's lower status/position and their access to opportunities, resources, and assets. Women's rights as human rights.

4. Structural adjustment and economic growth models disregard many critical moral and ethical issues. These affect women disproportionately.

**1.14.7 Recommendations**

With the above issues agreed as major items for consideration, participants then examined the efficacy of policy instruments to address each issue. Recognizing the inter-linkages between many of the issues within and across each category, a set of recommendations emerged.

Underpinning economic, planning, political, socio-cultural and ecological imperatives in development, moral issues were identified as critical to and influencing each and every other imperative. Those of particular concern in relation to gender in agricultural and rural development included questions of agricultural growth - particularly as it affects household food security and poorer people - and linkages between growth, productivity, equity, ecological impact, population and social transformation.

Human rights and women's rights within human rights protocols were identified as of fundamental importance in relation to mainstreaming women. The economic payoff in
mainstreaming was considered an inadequate justification in itself, although it is perhaps the most powerful argument at women's disposal. Accountability was also recognized as inadequate to reflect the participation of women in agricultural and rural development. This should be addressed in mandates for the monitoring of progress, by developing and using suitable gender-sensitive social, economic, political and environmental indicators for monitoring and evaluation.

**The Economic Imperative**

1. Policies should spell out specific legislation and programmes of action to entitle women to productive assets, access to inputs (land, credit, water, fertilizer, seeds, information, technology and training, etc.), access to markets, and women's full membership in organizations.

2. Efforts to formulate sustainable development policies should recognize the impact of unsustainable practices on women, especially in relation to food security and marginal groups (women, households headed by women). Intra-household food allocation should be investigated, and addressed if necessary.

3. Agricultural policies and technology must seek to eliminate drudgery, to improve economic efficiency and wages for the time spent by women, and to mitigate against the displacement of female labour.

4. Measures to increase productivity must be accompanied by policies to ensure commensurate increase in incomes, wages and other benefits for women.

5. The manner and sequencing of structural adjustment policies, and changes in the macroeconomic policies to be implemented, must take into consideration their impact on women, especially the poorest, and provide safety nets for vulnerable groups.

**The Planning Imperative**

1. a) Policy directive needed so that all relevant data are disaggregated, from household to national level, and data gaps identified and filled

   b) Compilation of data from alternative sources to complement and/or correct misleading information from traditional sources

2. Appropriate methodologies and guidelines are needed to recognize and value women's contribution, actual and potential, to productive activities in the economy. Indicators to evaluate the inclusion of gender concerns in programmes, projects and policies should also be developed.

3. Planning, project formulation and design, and monitoring and evaluation must include women and their concerns. A feedback mechanism should be built-in at all these stages, with gender responsive persons involved in planning exercises.
4. a) Policies and programmes should explicitly aim to mainstream women by addressing their concerns and facilitating their participation.
b) Policy planners must be sensitized to the impact of their policies on women, so that they pay due attention to such issues as food security and demographic changes. This implies gender-sensitising and gender analysis training for policy planners.

5. b) and c) Policy planners must be made aware of the impact of their policies on women, so that they pay due attention to such issues as food security, etc., and also be responsive to rapid demographic changes.
a) Agricultural and rural development policies should accord women access to and control over productive assets, rather than merely transferring income for consumption
b) Gender issues should be clearly identified and goals or targets explicitly stated in policies and programmes, accompanied by appropriate methodologies and guidelines.
c) Policy makers and planners should be gender-sensitized and equipped with the skills
a) The planning process should consider gender concerns in prioritizing policies and programmes, and demonstrate commitment by allocating commensurate resources.

7. There should be effective forward and backward linkages between micro and macro planning and policies.

8. Women's development should be given priority as an indispensable part of human resource development, recognizing women's needs and their potential as partners in development.

9. Governments should provide a policy framework to capitalize on the positive experiences of NGOs to facilitate a coherent, collaborative approach to NGO programmes which assist vulnerable groups, such as poor rural women.

**The Political Imperative**

1. Policies must seek to dismantle all barriers to full participation by rural women, especially poor women farmers, from household to national levels.

2. Agricultural and rural development policies must explicitly state the various ways and means by which gender equity can be assured in relation to remuneration, opportunities, access to resources and institutions.

3. Explicit and implicit policy biases against women in agricultural and rural development must be identified and removed.

4. b) Policy makers must write mandates into policies, programmes and plans to address specific gender issues.
a) Policy makers must familiarize themselves with relevant international protocols to which their States are party (for example, the United Nations Convention on the
Elimination of all forms of Discrimination Against Women) and incorporate these into national policies. They must also be held accountable.

5. Policy must recognize women's rights as an integral part of human rights.

**Social and Cultural Imperatives**

1. Policy makers and other decision makers at all levels must be made aware of gender equity issues and internalize the skills for gender analysis.

2. Agricultural policy makers should recognize, identify and seek to redress the social and cultural constraints which prevent women farmers' equal participation in agricultural and rural development programmes, such as women's triple burden, and male orientation in policy making.

3. Policy instruments should be applied to encourage an enabling environment for women's participation.

4. Agricultural and rural development policy makers should recognize and acknowledge the value of women's traditional knowledge systems, incorporating and developing these where appropriate in planning initiatives and strategies. At the same time, measures must be taken to increase women's accessibility to new knowledge (science and technology).

5. Agricultural and rural development policy must address the issue of women's low self-esteem through policy measures in agricultural and rural development education, reorientation and mobilization of the mass media, extension and training, and support services to women farmers.

**Ecological Imperatives**

1. Policies must recognize the complexities of gender in ecological issues, and their impact at macro and micro levels on rural women. This will require examination of the relationship between women and men in access to and control over common property resources, "family" land, water resources, such external inputs as fertilizer, credit, technology, and so on.

2. Conflicts over natural resources need to be anticipated and addressed in order to protect the interests of women and vulnerable (powerless, assetless) groups.

3. Women should not be held responsible for environmental degradation and restoration of the natural resource base, even though they are disproportionately affected. "User pays" principles should be adopted.
Activity 1

1. Discuss in detail the agricultural production in India. What do you understand by production function analysis?
2. Give an account of resource use efficiency in Indian agriculture.
3. Write an essay on laws of return and variable proportions.
4. Discuss gender issues in India. Also explain the imperatives to solve these issues.

1.15 SUMMARY

The unit discusses the agriculture production and productivity in India. Agriculture is the production of food and goods through farming. Agriculture was the key development that led to the rise of human civilization, with the husbandry of domesticated animals and plants (i.e. crops) creating food surpluses that enabled the development of more densely populated and stratified societies. The study of agriculture is known as agricultural science. Agriculture production has been discussed this way and production function analysis was explained. Resource use efficiency and factor combination and resource substitution were discussed in later section. Laws of return and variable proportions were described followed by cost and supply curves. In later section size of farms was discussed and farm budgeting and cost concepts were discussed in detail. Supply response and aggregate supply; traditional agriculture; technical change in agriculture; gender issues in agriculture and labor absorption were some other areas of discussion.

1.16 FURTHER READINGS

Objectives

After reading this unit, you should be able to:

- Understand the role of rural capital and credit in India.
- Know the organised and unorganised capital market in Indian economy
- Discuss the rural savings and capital formation
- Explain rural credit and credit agencies
- Appreciate role of agricultural cooperatives; commercial banks; regional rural banks and NABARD

Structure

2.1 Introduction
2.2 Organised and unorganised capital markets
2.3 Rural savings and capital formation
2.4 Rural credit
2.5 Cooperative banks; societies and rural financing
2.6 NABARD refinancing
2.7 Summary
2.8 Further readings

2.1 INTRODUCTION

A number of features of the rural economy are of particular relevance to farmer tree growing. They are mainly concerned with the ways in which land and labour are used within the Indian agricultural economy. Needless to say agricultural credit, improved technologies and institutional access to markets and development programmes have played an instrumental role in meeting these objectives of self-sufficiency. While it is an undisputed fact that considerable progress has been made since Independence in the sphere of agricultural development in terms of increase in crop production and productivity, technological developments, and crop diversification, the credit for the same should go not only to agricultural research, irrigation systems, and public policy on agriculture, but also to the impressive agricultural credit delivery systems through an extensive network of co-operative societies. Before dwelling into the details of agricultural credit, let us examine the impressive growth of agriculture, and the emerging land holding patterns in India, which will give us an idea of the critical role, which the co-operative organisations have played.

The entire picture of rural capital and credit has changed since decades due to strong public policy, means of transportation and communication and due to migration of rural
population to urban areas. The unit discusses various aspects pertaining to rural capital and credit in India.

### 2.2 ORGANISED AND UNORGANISED CAPITAL MARKET

In India, although the ultimate goals of monetary policy, *viz.* growth and price stability, have remained unchanged over the years, the Reserve Bank has modified its operational and intermediate objectives of monetary policy several times in response to changes in the economic and financial environment. For instance, in the mid-1980s, the Reserve Bank formally adopted monetary targeting with feedback as a nominal anchor to fight inflation, partly induced by the large scale monetisation of fiscal deficits. The operating procedure in this regime was modulation of bank reserves by varying reserve requirements. In order to meet reserve requirements, banks borrowed primarily from the inter-bank (call money) market. Hence, these transactions were reflective of the overall liquidity in the system. Accordingly, the Reserve Bank focused on the money market, in particular, the call money market by using various direct instruments of monetary control to signal the policy stance consistent with the overall objectives of achieving growth and price stability. As interest rates were regulated, monetary management was undertaken mainly through changes in the cash reserve ratio (CRR), which was used to influence indirectly the marginal cost of borrowing by having an initial impact on the call money market. As the success of this strategy was crucially dependent on the stability of the call money market and its inter-linkages with other money market segments, reforms since the late 1980s, along with changes in the reserve maintenance procedures, have aimed at developing various money market segments through introduction of new instruments, increased participation and improved liquidity management in the system.

Until recently, it has been under strict regulation and control with interest rates being tightly regulated by the Reserve Bank or by a Voluntary agreement between participants through the intermediation of the Indian Banks’ Association (IBA). The various rates so prescribed on the money market instruments have been often violated particularly during periods of tight liquidity.

It is in this context that the informal or unorganized money market has also sustained on the scene. While the unorganized market did not equilibrate the organized sector, it endeavors to meet the sector financing gaps in the sense that the fringe of unsatisfied borrowers in the organized financial system seeks finance from the unorganized market. The rates of interest in the unorganized money market are market-related depending upon the demand and supply of funds, and in the very nature of its operations, the unorganized sector is characterized by interest rates substantially higher than in the organized sector.

Certain Important segments of formal money market in India are:

a. Call Money Market

b. Treasury Bills Market
c. Commercial Bills Market

d. Inter-Bank Participation Certificates

e. Certificates of Deposits (CDs)

f. Commercial Papers (CPs)

**2.3 RURAL SAVINGS AND CAPITAL FORMATION**

Rural savings are determined by both "ability" and "incentives" to save. Past time-series estimates of rural savings are characterized by reporting, measurement, and analytical weaknesses. Some of these lead to underestimation of these savings. This, however, does not mean that all of the additional savings are mobilizable by the financial institutions.

This is because rural households hold their savings in monetized as well as non-monetized forms. Moreover, some of the monetized savings are held in the form of physical assets. Thus, only those monetized savings which are invested in financial assets of the informal rural financial market (RFM) can be considered as potentially mobilizable by the financial agencies. Institutionalization of such savings would improve their efficiency by promoting better allocation among different areas, sectors, economic activities, and also to entrepreneurs. To identify appropriate policies, further literature may be developed by promoting and researching programmes with better rates of return on financial savings, besides those with opportunities to transact other businesses.

The rural households' decision to consume now or in the future is influenced by both ATS and ITS. While the former is primarily related to income, current or permanent, the latter is determined by the rate of return these households expect from foregoing present consumption. For households the returns to savings represent a price for current consumption. Such cost would vary with the type of saving opportunities available to these households. The importance of "incentives" as a determinant of savings was emphasized by Schultz, who stated that, "although there has been a long standing concern about the effects of the level of per family income upon percentage of income that is saved, there has been no comparable concern about the effect of difference in relative prices of new income streams upon savings and investment.

**2.3.1 Rural household savings estimates of the RBI**

The savings of the rural households are measured by utilizing Asset Account method of determining savings. the RBI series overemphasize the concept of net saving even though the estimates of depreciation are considered imprecise. These estimates are derived by making liberal allowances for replacement, repairs, and maintenance of various farm assets. For rural housing and farm assets it is extremely difficult to distinguish expenditure on repairs from maintenance, and replacements from new investments. For this reason,
estimates of gross instead of net saving are preferred to judge the savings capacity of rural households whose farm technology is not highly capital-intensive. Use of "net" instead of "gross" savings concept would therefore underestimate rural household savings. Some of these excluded savings are not mobilizable if they are created in non-monetized form. Those that are in monetized form can, however, be mobilized by the financial institutions provided they have deposit facilities that match well with the size and nature of such savings. These savings are often in small amount and are perhaps seasonal too. Institutionalization of such savings could improve the efficiency of the use of these funds by promoting their better allocation among regions, sectors, economic activities and also to entrepreneurs. the RBI series exclude rural savings in the form of non-monetized investments. Such investments take the form of land improvements, digging of wells and water channels, reclamation of lands, lying of new orchards and plantations, construction and repair of farm buildings and cattle sheds etc.

These investments have genuine costs even if they are undertaken with family labour. This is because the direct cost of such labour would be its consumption without which it cannot contribute to the capital formation process. Savings in the form of non-monetized investments is by definition non-mobilizable by the financial institutions. Even if the banking institutions were to finance consumption expenditure needed to support family labour utilized for the creation of farm assets, it would be very difficult to separately estimate such expenditure from the total consumption expenditure. the RBI series also exclude savings in the form of gold and jewellery on the grounds that it is a consumer durable. Such a form of savings is often undertaken to hedge against emergencies and inflation. It is also held when the access to the formal RFM is non-existent and/or imperfect on account of such policies as insistence on providing self-owned tangible collateral. Under these circumstances, rural households borrow from informal credit agencies by providing such an asset as collateral. Providing loans against such collateral has become popular among some formal financial agencies.

### 2.4 RURAL CREDIT

India is essentially Rural India and Rural India is virtually the cultivator, the village handicraftsman and the agricultural labourer. Rural India, where 70% of all Indians live, still depends heavily on agriculture. However, it is increasingly becoming diversified market with a strong demand for credit for agriculture and non-agricultural purposes, savings, insurance and money transfers.

To achieve the objectives of production and productivity, the stance of policy towards rural credit was to ensure provision of sufficient and timely credit at reasonable rates of interest to as large a segment of the rural population as possible. The strategy devised for the purpose rested on three pillars: expansion of the institutional structure, directed lending to disadvantaged borrowers and sectors and lower interest rates. The basic aim of the financial sector reforms was to improve the soundness, efficiency and productivity of
all credit institutions, including rural credit institutions whose financial health was far from satisfactory. The reforms sought to enhance the areas of commercial freedom, increase their outreach to the poor and stimulate additional flows to the sector. The reform programme also included far reaching changes in the incentive regime through liberalising interest rates for cooperatives and RRBs, relaxing controls on where, for what purpose and whom rural financial institutions [RFIs] could lend, introducing prudential norms and restructuring and recapitalising of RRBs.

As a result of the reform process, the financial health of commercial banks has improved in terms of parameters such as capital adequacy, Non Performing Loans and return on assets consistent with international standards for classification of advances and prudential norms being applied in almost all areas. However, commercial banks being more focused on profitability, tend to cherry pick and give comparatively less priority to marginal and sub-marginal farmers.

2.4.1 Sources of Agricultural Credit

The sources of agricultural finance are broadly classified into two categories:
(A) Noninstitutional Credit Agencies or informal sources, and
(B) Institutional Credit Agencies or Formal Sources.

A. Non-institutional Credit Agencies

i) Traders and Commission Agents: Traders and commission agents advance loans to agriculturists for productive purposes against their crop without completing legal formalities. It often becomes obligatory for farmers to buy inputs and sell output through them. They charge a very heavy rate of interest on the loan and a commission on all the sales and purchases, making it exploitative in nature.

ii) Landlords: Mostly small farmers and tenants depend on landlords for meeting their production and day to day financial requirements.

iii) Money lenders: Despite rapid development in rural branches of different institutional credit agencies, village money lenders still dominate the scene. Money lenders are of two types- agriculturist money lenders who combine their money lending job with farming and professional money lenders whose sole job is money lending. A number of reasons have been attributed for the popularity of moneylenders such as:
(a) they meet demand for productive as well as unproductive requirement;
(b) they are easily approachable at odd hours; and
(c) they require very low paper work and advances are given against promissory notes or land.

Money lenders charge a very high rate of interest as they take advantage of the urgency of the situation. Over the years a need for regulation of money lending has been felt. But lack of institutional credit access to certain sections and areas had facilitated unhindered operation of money lending.
B. Institutional Credit Agencies

The evolution of institutional credit to agriculture could be broadly classified into four distinct phases - 1904-1969 (predominance of co-operatives and setting up of RBI), 1969-1975 [nationalisation of commercial banks and setting up of Regional Rural Banks (RRBs)], 1975-1990 (setting up of NABARD) and from 1991 onwards (financial sector reforms). Institutional funding of the farm sector is mainly by commercial banks, regional rural banks and co-operative banks. Share of commercial banks in total institutional credit to agriculture is almost 48 percent followed by cooperative banks with a share of 46 per cent. Regional Rural Banks account for just about 6 per cent of total credit disbursement.

i) **Government**: These are both short term as well as long-term loans. These loans are popularly known as "Taccavi loans" which are generally advanced in times of natural calamities. The rate of interest is low. But it is not a major source of agricultural finance.

ii) **Cooperative Credit Societies**: The history of cooperative movement in India dates back to 1904 when first Cooperative Credit Societies Act was passed by the Government. The scope of the Act was restricted to establishment of primary credit societies and non-credit societies were left out of its purview. The shortcomings of the Act were rectified through passing another Act called Cooperative Societies Act 1912. The Act gave provision for registration of all types of Cooperative Societies. This made the emergence of rural cooperatives both in the credit and noncredit areas, though with uneven spatial growth. In subsequent years a number of Committees were appointed and recommendations implemented to improve the functioning of the cooperatives. Soon after the independence, the Government of India following the recommendations of All India Rural Credit Survey Committee (1951) felt that cooperatives were the only alternative to promote agricultural credit and development of rural areas. Accordingly, cooperatives received substantial help in the provision of credit from Reserve Bank of India as a part of loan policy and large scale assistance from Central and State Governments for their development and strengthening. Many schemes involving subsidies and concessions for the weaker sections were routed through cooperatives. As a result cooperative institutions registered a remarkable growth in the post-independence India.

iii) **Commercial Banks**: Previously commercial banks (CBs) were confined only to urban areas serving mainly to trade, commerce and industry. Their role in rural credit was meagre i.e., 0.9 per cent in 1951-52 and 0.7 per cent in 1961-61. The insignificant participation of CBs in rural lending was explained by the risky nature of agriculture due to its heavy dependence on monsoon, unorganized nature and subsistence approach. A major change took place in the form of nationalisation of CBs in 1969 and CBs were made to play an active role in agricultural credit. At present, they are the largest source of institutional credit to agriculture.
In so far as commercial banks are concerned, competition and search for higher returns is driving these banks to look for profitable avenues and activities for lending such as financing of contract farming, extending credit to the value chain, financing traders and other intermediaries etc. Simultaneously, we are witnessing the emergence of institutional systems and products such as futures markets, weather and crop insurance designed to minimise the risk of lending. The direction is clear that commercial bank lending will be to clientele which can bear the load of commercial considerations. The coverage of excluded sections of the population by them is currently being supported under government sponsored schemes and targets for weaker targets within the Priority Sector. The efficacy of this, if measured by the yardstick of “collections”, is poor. Merging and revamping of RRBs that are predominantly located in tribal/ backward regions is seen as a potentially significant institutional arrangement for financing the excluded. Such an exercise is currently on and the State Government’s and Sponsor Banks have to come together and cooperate in this area.

iv) Regional Rural Banks (RRBs): RRBs were set up in those regions where availability of institutional credit was found to be inadequate but potential for agricultural development was very high. However, the main thrust of the RRBs is to provide loans to small and marginal farmers, landless labourers and village artisans. These loans are advanced for productive purposes. At present 196 RRBs are functioning in the country lending around Rs 9,000 crore to rural people, particularly to weaker sections.

Regional Rural Banks in India are an integral part of the rural credit structure of the country. Since the very beginning, when the Regional Rural Banks in India (RRBs) were established in October 2, 1975, these banks played a pivotal role in the economic development of the rural India. The main goal of establishing regional rural banks in India was to provide credit to the rural people who are not economically strong enough, especially the small and marginal farmers, artisans, agricultural labours, and even small entrepreneurs.

The history of regional rural banks in India dates back to the year 1975. It's the Narsimham committee that conceptualized the foundation of regional rural banks in India. The committee felt the need of 'regionally oriented rural banks' that would address the problems and requirements of the rural people with local feel, yet with the same level of professionalism of commercial banks. Five regional rural banks were set up on October 2 with a total authorized capital of Rs. 1 crore, which later augmented to Rs. 5 crore. There were five commercial banks, viz. Punjab National Bank, State Bank of India, Syndicate Bank, United Bank of India and United Commercial Bank, which sponsored the regional rural banks. The equities of rural banks were divided in a proportion of 50:35:15 among the Central Government, the Sponsor bank and the concerned State Government.

The following years have not been so easy for the regional rural banks in India, as there were major concern of financial viability. A number of committees were formed to find out solution. Studies were conducted to find out the factors that influence RRBs performance. The roles played by the sponsor banks were also analyzed.
v) **Microfinancing**: Microfinancing through Self Help Groups (SHG) has assumed prominence in recent years. SHG is group of rural poor who volunteer to organise themselves into a group for eradication of poverty of the members. They agree to save regularly and convert their savings into a common fund known as the Group corpus. The members of the group agree to use this common fund and such other funds that they may receive as a group through a common management. Generally, a self-help group consists of 10 to 20 persons. However, in difficult areas like deserts, hills and areas with scattered and sparse population and in case of minor irrigation and disabled persons, this number may range from 5-20. As soon as the SHG is formed and a couple of group meetings are held, an SHG can open a Savings Bank account with the nearest Commercial or Regional Rural Bank or a Cooperative Bank. This is essential to keep the thrift and other earnings of the SHG safely and also to improve the transparency levels of SHG’s transactions. Opening of SB account, in fact, is the beginning of a relationship between the bank and the SHG. The Reserve Bank of India has issued instructions to all banks permitting them to open SB accounts in the name of registered or unregistered SHGs.

Some of the main sources of rural finance are being discussed in later sections.

### 2.5 COOPERATIVE BANKS, SOCIETIES AND RURAL FINANCING

The Co-operative banks in India started functioning almost 100 years ago. The Cooperative bank is an important constituent of the Indian Financial System, judging by the role assigned to co-operative, the expectations the co-operative is supposed to fulfill, their number, and the number of offices the cooperative bank operate. Though the co-operative movement originated in the West, but the importance of such banks have assumed in India is rarely paralleled anywhere else in the world. The cooperative banks in India play an important role even today in rural financing. The businesses of cooperative bank in the urban areas also has increased phenomenally in recent years due to the sharp increase in the number of primary co-operative banks.

Co-operative Banks in India are registered under the Co-operative Societies Act. The cooperative bank is also regulated by the RBI. They are governed by the Banking Regulations Act 1949 and Banking Laws (Co-operative Societies) Act, 1965.

**Cooperative banks in India finance rural areas under:**

- Farming
- Cattle
- Milk
- Hatchery
- Personal finance

The general policy on agricultural credit has been one of progressive institutionalization aimed at providing timely and adequate credit to farmers for increasing agricultural production and productivity. Providing better access to institutional credit for the small
and marginal farmers and other weaker sections to enable them to adopt modern technology and improved agricultural practices has been a major concern of the policy. In pre-independent India the majority of the population was impoverished and lived in sub-human conditions. The Land Improvement Loans Act of 1883 was the first consolidated law intended to provide advancement of agriculture. The Cooperative Land Mortgage Banks were created for providing long-term loans to agriculturists for redemption of debts. This was followed by the enactment of Co-operative Credit Societies Act of 1904 to meet the short-term credit needs of the farmers.

In fact, the major thrust in the area of agricultural credit during this period was more the prevention of exploitation of the peasants by moneylenders, rather than the promotion of capital formation in agriculture. The fact that agricultural sector would require an organised flow of funds to break the ‘inertia’ came to focus the only when the All India Rural Credit Survey Committee (ARCSC): 1954 came to the conclusion that the existing structure of primary credit societies was not sufficient to meet the credit requirements of the Indian peasants – especially those of a small and marginal farmers.

It was in this context that the Reserve Bank of India (RBI) and Government of India (GoI) thought of the `state partnership with co-ops’, and there was a massive infusion of funds to the sector. Not only was funding provided, managerial assistance and restructuring of PACs was initiated to make the system viable. The ‘primaries’ therefore became instruments of government policy - they started performing an important development task – but in the process the ‘loss of autonomy’ also started. However, this should not negate the very positive role that the PACs performed.

**The PACSs**

The Primary Agricultural Credit Societies (PACS) constitute the `hub’ of the Indian co-op movement. Every fourth co-operative in India is a primary credit society. The main objectives of a PACS are:

- To raise capital for the purpose of giving loans and supporting the essential activities of the members.
- To collect deposits from members with the objective of improving their savings habit.
- To supply agricultural inputs and services to members at remunerative prices.
- To arrange for supply and development of improved breeds of livestock for the members.
- To make all necessary arrangements for improving irrigation on land owned by members.
- To encourage various income-augmenting activities such as horticulture, animal husbandry, poultry, bee-keeping, pisciculture and cottage industries among the members through supply of necessary inputs and services.
The details of PACS are given below.

Table 1: The Primary Agricultural Co-operative Societies

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Village covered by PACS</td>
<td>99.5%</td>
</tr>
<tr>
<td>Total Number of PACS</td>
<td>91,110</td>
</tr>
<tr>
<td>Percentage of viable PACS</td>
<td>61.4%</td>
</tr>
<tr>
<td>Percentage of potentially viable PACS</td>
<td>20.0%</td>
</tr>
<tr>
<td>Total membership (Million)</td>
<td>90.6</td>
</tr>
<tr>
<td>Percentage of small farmers</td>
<td>27.6%</td>
</tr>
<tr>
<td>Percentage of marginal farmers</td>
<td>42.5%</td>
</tr>
<tr>
<td>Membership per PACS (Average)</td>
<td>995</td>
</tr>
<tr>
<td>Total share capital</td>
<td>Rs. 19,978 Million</td>
</tr>
<tr>
<td>Share capital per PACS</td>
<td>Rs. 219,272</td>
</tr>
<tr>
<td>Percentage of Govt. participation in Share Capital</td>
<td>15.2%</td>
</tr>
<tr>
<td>Total deposits</td>
<td>Rs. 29,618 Million</td>
</tr>
<tr>
<td>Deposit per PACS</td>
<td>Rs. 325,077</td>
</tr>
<tr>
<td>Total loans advanced</td>
<td>Rs. 110,000 Million</td>
</tr>
<tr>
<td>Percentage of Deposits to Advances</td>
<td>26.9%</td>
</tr>
</tbody>
</table>

There have been ups and downs in the ‘Number of PACS’ due to liquidation of unviable PACS between 1950-51 to 1995-96. The ‘Deposits’ in PACS are considerably less than the ‘Loan’ taken by them from Central Banks and CFAs.
**Table 2: Human Resource and Financial Indicators of Primary Agricultural Co-operative Societies**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Societies</th>
<th>Member (in Thou.)</th>
<th>Deposits (in Thou. Rs.)</th>
<th>Loans (in Thou. Rs) from</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Government</td>
<td>Central Banks &amp; CFAs</td>
</tr>
<tr>
<td>1950-51</td>
<td>115462</td>
<td>5154</td>
<td>44829</td>
<td>4265</td>
<td>187843</td>
</tr>
<tr>
<td>1955-56</td>
<td>159939</td>
<td>7791</td>
<td>70469</td>
<td>10148</td>
<td>417849</td>
</tr>
<tr>
<td>1960-61</td>
<td>212129</td>
<td>17041</td>
<td>145800</td>
<td>38617</td>
<td>1747216</td>
</tr>
<tr>
<td>1965-66</td>
<td>191904</td>
<td>26135</td>
<td>344918</td>
<td>90908</td>
<td>3444092</td>
</tr>
<tr>
<td>1970-71</td>
<td>160780</td>
<td>30963</td>
<td>694558</td>
<td>98819</td>
<td>6354271</td>
</tr>
<tr>
<td>1975-76</td>
<td>134838</td>
<td>39521</td>
<td>1133100</td>
<td>126500</td>
<td>10992100</td>
</tr>
<tr>
<td>1980-81</td>
<td>94484</td>
<td>57653</td>
<td>2905800</td>
<td>480200</td>
<td>23187500</td>
</tr>
<tr>
<td>1985-86</td>
<td>92403</td>
<td>71217</td>
<td>5719800</td>
<td>367167</td>
<td>20155057</td>
</tr>
<tr>
<td>1990-91</td>
<td>82905</td>
<td>80115</td>
<td>13489700</td>
<td>428620</td>
<td>23539147</td>
</tr>
<tr>
<td>1995-96*</td>
<td>86217</td>
<td>86015</td>
<td>9147302</td>
<td>490074</td>
<td>26923237</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>33696276</td>
<td>2131053</td>
<td>116760469</td>
</tr>
</tbody>
</table>

**The DCCBs**

The PACS are affiliated to the District Central Co-operative Banks (DCCBs) who perform the following functions.

- Serve as balancing centre in the district central financing agencies
- Organise credit to primaries
- Carry out banking business
- Sanction, monitor and control implementation of policies

The details regarding DCCBs are given below
Table 3: District Central Co-operative Banks

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Banks</td>
<td>361</td>
</tr>
<tr>
<td>No. officers including headquarters</td>
<td>11,787</td>
</tr>
<tr>
<td>Total membership (Million)</td>
<td>1.579</td>
</tr>
<tr>
<td>Membership of Co-ops (Million)</td>
<td>0.261</td>
</tr>
<tr>
<td>Total share capital</td>
<td>Rs. 14,345 Million</td>
</tr>
<tr>
<td>Government participation in share capital</td>
<td>18.9%</td>
</tr>
<tr>
<td>Total deposits</td>
<td>Rs. 203,425 Million</td>
</tr>
<tr>
<td>Deposits of co-ops</td>
<td>38.7%</td>
</tr>
<tr>
<td>Reserves</td>
<td>Rs. 15,263 Million</td>
</tr>
<tr>
<td>Total borrowings</td>
<td>Rs. 90,293 Million</td>
</tr>
<tr>
<td>Borrowings from SCB/NABARD</td>
<td>88.7%</td>
</tr>
<tr>
<td>Total working capital</td>
<td>Rs. 334,700 Million</td>
</tr>
<tr>
<td>Total loans advanced</td>
<td>Rs. 326,995 Million</td>
</tr>
<tr>
<td>Percentage of Deposits to Advances</td>
<td>62.2%</td>
</tr>
</tbody>
</table>

**The SCBs**

The DCCBs in turn are affiliated to State Co-operative Banks (SCBs), which perform the following functions.

- Serve as balancing centre in the States
- Organise provision of credit for credit worthy farmers
- Carry out banking business
- Leader of the Co-operatives in the States

The statistics of the State Co-operative Banks is also given below.
### Table 4: State Co-operative Banks

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of Banks</td>
<td>28</td>
</tr>
<tr>
<td>No. of branches</td>
<td>742</td>
</tr>
<tr>
<td>Total membership</td>
<td>139,676</td>
</tr>
<tr>
<td>Membership of Co-ops</td>
<td>20.360</td>
</tr>
<tr>
<td>Total share capital</td>
<td>Rs. 3,640 Million</td>
</tr>
<tr>
<td>Government participation in share capital</td>
<td>10.4%</td>
</tr>
<tr>
<td>Total deposits</td>
<td>Rs. 118,166 Million</td>
</tr>
<tr>
<td>Deposits of co-ops</td>
<td>79.3%</td>
</tr>
<tr>
<td>Reserves</td>
<td>Rs. 16,712 Million</td>
</tr>
<tr>
<td>Total borrowings</td>
<td>Rs. 55,170 Million</td>
</tr>
<tr>
<td>Borrowings from NABARD</td>
<td>78.8%</td>
</tr>
<tr>
<td>Total working capital</td>
<td>Rs. 219,600 Million</td>
</tr>
<tr>
<td>Total loans advanced</td>
<td>Rs. 221,450 Million</td>
</tr>
<tr>
<td>Percentage of Deposits to Advances</td>
<td>53.4%</td>
</tr>
</tbody>
</table>

The following organogram depicts the network of agricultural co-operative societies in India.
Table 5: Network of Agricultural Co-operative Societies

(Production Credit)

<table>
<thead>
<tr>
<th>National Federation Of State Cooperative Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>State Cooperative Banks</td>
</tr>
<tr>
<td>(28)</td>
</tr>
<tr>
<td>District Cooperative Banks</td>
</tr>
<tr>
<td>(361)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Farmers service Co-operative Societies</th>
<th>Primary Agricultural Co-operative Societies</th>
<th>Large Size Multi-Purpose Coop</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societies (2577)</td>
<td>(91110)</td>
<td>(3352)</td>
</tr>
</tbody>
</table>

Members: 90.62 Million

Although the entire structure looks very impressive- and it would appear that it enjoys all the advantages of forward, backward and horizontal integration as in addition to short term production credit, their is an entire edifice of long term investment credit as well, the fact is that although NABARD does not figure anywhere in the organization chart, its pervasive influence extends to the entire structure. And although the National Federation of State Co-op Banks appears at the top, there is very little of practical help and utility that it can extend to its constituent units. Its functions border mainly on advocacy, and has little or no teeth.

The National Federation of State Co-operative Banks

The NCUI information brochure lists the following functions for the National Federation of State Co-op Banks.

- Provides a common forum to the member banks.
- Promotes and protects the interests of the member banks.
- Co-ordinates and liaison with GoI, RBI, National Banks and others.
- Provides research and consultancy inputs to the member banks.
- Organises conferences/seminars/workshops/meetings.
2.6 REFINANCING

2.6.1 The NABARD

However, the refinance of all the constituents is done by the National Bank of Agriculture and Rural Development (NABARD), which was set up in 1982 by the Government of India with the following mandate.

- To serve as a refinancing institution for all kinds of production and investment credit to agriculture, small scale industries, cottage and village industries, handicrafts and rural crafts and rural artisans and other allied economic activities with a view to promoting integrated rural development;
- To provide short-term, medium-term and long-term credits to state Co-operative Banks (SCBs), RRBs, LDBs and other financial institutions approved by RBI;
- To give long-term loans (upto 20 years) to the State Governments to enable them to subscribe to the share capital of co-operative credit societies;
- To give long-term loans to any institution approved by the Central Government or contribute to the share capital or invest in securities of any institution concerned with the agriculture and rural development;
- Responsibility of co-ordinating the activities of Central and State Governments, the Planning Commission and other All-India and State Level Institutions entrusted with the development of Small Scale Industries, Village and Cottage Industries, Rural Crafts, Industries, in the tiny and decentralised sectors etc.;
- Responsibility to inspect RRBs and co-operative banks, other than primary co-operative banks; and
- To maintain a research and development fund to promote research in agriculture and rural development to formulate and design projects and Programme to suit the requirements of different areas and to cover special activities.

While it is fact that outreach of the primary co-operative banks extends to almost every corner, the fact remains that their disbursement of Rs. 12,500 million is much higher than the total deposits and share capital (including the government share). Moreover, Kerala alone accounts for nearly 50 per cent of the total mobilization by PACS which reflects rather poor credit mobilisation by PACS in the rest of the country.

The objectives of the PACS when they were set up were primarily mobilisation of local resource and disbursement of credit. Most primary societies in the country, with the exception of Kerala, have failed miserably in these tasks. In fact, if refinance from higher structure were not available, these co-operative societies would soon have to close shop. The availability of easy finance from NABARD is therefore preventing growth and development potential of the primary agricultural co-operative societies. Likewise in the case of district Central Co-operative Banks, we see that the borrowings from SCB/NABARD account for 88.7% of the total borrowings. Similarly, the state Co-operative Banks borrowings from NABARD are to the extent of 78.8%. The message is quite clear – without the support of NABARD, the entire structure would become unviable.
The primary transaction cost advantage which the primary society was supposed to enjoy on account of the fact that its operations were spatially confined and restricted to a group of people who were the primary stakeholders has now been lost as the PACS must borrow from the DCCB which in turn must borrow from the SCB which is refinance by the NABARD. The National Federation plays only a very nominal role in the business transactions- at best it is an advocacy group, which means that the transaction costs are much higher. Likewise we also have instances of all the three tiers operating in the same catchment area and competing, rather than collaborating for business. Transfer of funds from the NABARD to the primary society through the channel of SCBs and DCCBs is not only costly, but also time consuming, and worse leaves the borrower totally dependent on external sources of funds.

2.6.2 Commercial Banks and Agricultural Credit

In the beginning, Commercial Banks (CBs) were not interested in financing agricultural operations and confined themselves largely to financing trade and exports. Consequently, co-operative credit structure could not achieve desired results till independence. The All India Rural Credit Review Committee (1969) therefore recommended multi agency approach to rural and especially agricultural credit. It therefore suggested enhancing the role of the CBs in providing agricultural credit.

Further, under the Social Control Policy introduced in 1967 and subsequently the nationalisation of 14 major CBs in 1969 (followed by another six banks in 1980), CBs have been given a special responsibility to set up their advances for agricultural and allied activities in the country. In 1975, another agency for providing institutional credit, i.e., the Regional Rural Banks (RRBs) emerged on the rural credit scene, on the recommendation of the Working Group of the Rural Banks, to fill the credit gap of small and marginal farmers and the weaker sections.

In order to meet the growing demand for production and investment credit for agriculture and rural development activities the scheduled CBs and RRBs have expanded their geographical coverage, particularly in rural areas, in a big way during the last decade or so. As on 30th June, 1995, there were 47,236 branches of Scheduled Commercial Banks and 14,506 branches of 196 RRBs. The share of Commercial Banks and RRBs in agricultural credit constituted about 57% (estimated figure) in 1997-98. The agricultural credit profile for 1992-98 is given below;
Table 6: Institution-wise flow of Credit to Agriculture sector in India in Million Rs.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Source &amp; Type of Credit</th>
<th>1992-93</th>
<th>1996-97*</th>
<th>1997-98#</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Co-operative Banks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Short-term</td>
<td>71700</td>
<td>97500</td>
<td>115000</td>
</tr>
<tr>
<td>2.</td>
<td>Medium &amp; Long-term</td>
<td>22080</td>
<td>27290</td>
<td>32750</td>
</tr>
<tr>
<td></td>
<td>Sub-Total</td>
<td>93780</td>
<td>124790</td>
<td>147750</td>
</tr>
<tr>
<td></td>
<td>Commercial and Regional Rural Banks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Short-term</td>
<td>29210</td>
<td>79410</td>
<td>93770</td>
</tr>
<tr>
<td>4.</td>
<td>Medium &amp; Long-term</td>
<td>28700</td>
<td>82330</td>
<td>101220</td>
</tr>
<tr>
<td></td>
<td>Sub Total</td>
<td>57910</td>
<td>161740</td>
<td>194990</td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>151690</td>
<td>286530</td>
<td>342740</td>
</tr>
</tbody>
</table>

* Anticipated
# Targets

Table 7: Comparative Share of Co-operative Banks vis-a-vis CBs & RRBs

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992-93</td>
<td>61.82</td>
</tr>
<tr>
<td>1993-94</td>
<td>61.34</td>
</tr>
<tr>
<td>1994-95</td>
<td>50.18</td>
</tr>
<tr>
<td>1995-96</td>
<td>47.56</td>
</tr>
<tr>
<td>1996-97</td>
<td>43.55</td>
</tr>
<tr>
<td>1997-98*</td>
<td>43.11</td>
</tr>
</tbody>
</table>

* An estimated figure.
The Centrality Measures, defined by S.K. Datta & S. Kapoor, also reveal a continuous decline for the period 1992-98 in the ‘Absolute Member Centrality with respect to the Agricultural Credit’, when Commercial Banks and Regional Rural Banks are taken as rivals of Co-operative Banks. It has declined from 0.62 in 1992-93 to 0.43 in the year 1997-98. The ‘Relative Member Centrality with respect to the Short-term Credit’ has declined from 0.71 to 0.55 in the same period. Similarly, the ‘Relative Member Centrality with respect to the Medium and Long-term Credit’ has also declined from 0.43 to 0.24 in the same period. The various centrality measures calculated using the data of Table-11 are as follows:

### Table 8: Centrality Measures with respect to Agricultural Credit
(CBs & RRBs as rivals of Co-operative Banks)

<table>
<thead>
<tr>
<th>Measure Type</th>
<th>1992-93</th>
<th>1996-97</th>
<th>1997-98*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute Member Centrality with respect to the Agricultural Credit</td>
<td>0.62</td>
<td>0.44</td>
<td>0.43</td>
</tr>
<tr>
<td>Relative Member Centrality with respect to the Short-term Credit</td>
<td>0.71</td>
<td>0.55</td>
<td>0.55</td>
</tr>
<tr>
<td>Relative Member Centrality with respect to the Medium and Long-term Credit</td>
<td>0.43</td>
<td>0.25</td>
<td>0.24</td>
</tr>
</tbody>
</table>

It is therefore quite clear that even NABARD is moving from Co-operative Banks to Commercial Banks/Regional Rural Banks for meeting the agri-credit needs of the Indian farmers.

### 2.6.3 The Challenge to the Co-op Sector

The biggest challenge to the co-op sector, especially in the area of agri credit co-ops is one of sustainability and relevance. As mentioned earlier, in the absence of any transaction cost advantages to the primary co-operative, the village level branch of a CB/RRB may find it easier to access funds from its own headquarters than the PACS. There are no easy solutions to this dilemma of easy credit adversely affecting the relationships of primary societies with their members and their federal structures.

The process of change has already begun in India with the ILO CO-OPNET/CO-OPREFORM Programme supporting the change in the macro-policy environment for co-ops. As co-ops become member centred, and mobilises their own resources, the quality of capital and management is bound to improve. They will then be able to function as true member organisations, with supplemental /incremental support from state agencies, but not critically dependent as the scenario is today. This will require that the co-op credit
structure at all three levels make a comprehensive effort to manage the funds and resources internally. There are several examples within the country to show that primary co-op societies can manage and finance the entire credit requirements of agricultural operations in a village. Unless the other co-op societies look within themselves, and search for their own answers, the possibilities would appear to be rather grim.

The fact that rural lending can be run on commercially sound principles has been vindicated by the success of several thrift and credit societies in different regions of the country. The GRAMEEN Bank in Bangladesh, the SEWA in Ahmedabad and CDF supported groups in AP (although operating on different principles) are instances which show that a proper design, management and governance structure with involvement of stakeholders holds the key to succession fact, NABARD is now encouraging the CBs to set up SHGs for group loaning in the rural areas- both in the farm and the non-farm sector

Activity 2

1. Differentiate between organised and unorganised capital market.
2. Give a brief account of rural credit in India. What do you understand by institutional and non institutional credit agencies?
3. What is the contribution of agricultural cooperatives in rural development of India?
4. Write short notes on the following:
   - NABARD
   - Commercial banks in rural areas
   - Regional rural banks
   - Micro financing

2.7 SUMMARY

This unit deals with capital formation and rural credit in India. Rural India, where 70% of all Indians live, still depends heavily on agriculture. However, it is increasingly becoming diversified market with a strong demand for credit for agriculture and non-agricultural purposes, savings, insurance and money transfers. To achieve the objectives of production and productivity, the stance of policy towards rural credit was to ensure provision of sufficient and timely credit at reasonable rates of interest to as large a segment of the rural population as possible. After discussing the need of rural credit and capital unit focuses on organised and unorganised capital markets followed by rural credit. Further it discusses cooperative banks, societies and rural financing. Finally the unit reveals refinancing and role of NABARD in rural financing in India.
2.8 FURTHER READINGS

- Indian Co-operative Movement: A Profile, (1998), National Resource Centre of NCUI, New Delhi, India.
M.A. FINAL ECONOMICS

PAPER IV (B)

AGRICULTURAL ECONOMICS

BLOCK 4

AGRICULTURAL PRICES AND AGRICULTURAL GROWTH
# PAPER IV (B)

## AGRICULTURAL ECONOMICS

### BLOCK 4

## AGRICULTURAL PRICES AND AGRICULTURAL GROWTH

### CONTENTS

<table>
<thead>
<tr>
<th>Unit</th>
<th>Page number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1 Agricultural pricing in India</td>
<td>4</td>
</tr>
<tr>
<td>Unit 2 Agricultural growth in India</td>
<td>31</td>
</tr>
</tbody>
</table>
This block comprises two units. The first unit deals with agricultural prices in India. It discusses the behaviour of agricultural prices in India followed by Cobweb model of prices and income instability. Agricultural marketing and warehousing will be discussed and agricultural marketing policy will be dealt in detail. Agricultural price policy; agricultural taxation in India; crop insurance and terms of trade between agricultural and non agricultural prices will remain some other areas of concern of this unit.

The second unit gives you the understanding of the agricultural growth in India. Agricultural growth in India since 1991 will be discussed and areas like food security in India; Public distribution system in India; supply of inputs; distribution of gains from technological change; strategy of agricultural development; sustainable agriculture; globalisation and agriculture and impact of WTO on Indian agriculture will be explained in a detailed manner.
UNIT 1

AGRICULTURAL PRICING IN INDIA

Objectives

On successful completion of this unit, you should be able to:

- Identify the behaviour of agriculture prices in India
- Know the Cobweb model of prices and income stability
- Recognize the approaches to agricultural marketing and warehousing
- Explain the agricultural marketing policy and agricultural price policy
- Understand the agricultural taxation and crop insurance in India
- Discuss the terms of trade between agricultural and non agricultural prices in India

Structure

1.1 Introduction
1.2 Behaviour of agricultural prices in India
1.3 Cobweb model of prices and income instability
1.4 Agricultural marketing and warehousing
1.5 Agricultural marketing policy
1.6 Agricultural price policy
1.7 Agricultural taxation in India
1.8 Crop insurance
1.9 Terms of trade between agricultural and non agricultural prices
1.10 Summary
1.11 Further readings

1.1 INTRODUCTION

The beneficial impact on agricultural situation in India of a host of well-intentioned government policies has not been as great as originally envisaged. Agriculture being a State subject, India lacks an Agricultural Policy at the National level and the onus of framing policies for agricultural development lies with the State government. The Standing Advisory Committee on Agriculture, appointed during 1989-90 made a note of it and commented, even after four decades of independence, India has not been able to come out with a comprehensive agricultural policy nor has there been any worthwhile debate on the role of agriculture in the process of economic development. The earlier school of thought, that growth and advances in the industrial and service sector would transitorily benefit the agricultural sector on the whole, has always cast agricultural development in the shadows of industrial growth.
Industrial growth in India has always been given precedence over agricultural growth and the emphasis and favours bestowed on it have continued even beyond the stage of infancy. The simplistic, reductionist assumption that agricultural sector would automatically respond to the exogenous stimuli through the trickle-down effect generated by the forces of development in industrial, trade and service sectors has prove to be a misplaced conceptualisation under the existing agrarian structure and socio-economic setup of the farming community. Industrial sector so far has been receiving a major portion of the incentives and subsidies, at the cost and neglect of the agricultural sector. It has led to a constant decline in the share of agriculture in India's Gross Domestic Product since independence, with no decrease in proportion of employment provided by this sector.

Nevertheless, statistics pertaining to performance of Indian economy in the late nineties indicate that agricultural performance has a vital role to play in boosting the overall economy. The economic data for 1998-99 reveals that agriculture has once again come to the rescue of Indian economy by maintaining a high growth rate. Projections for 1999-2000 provided by Central Statistical Organisation points out that even if the industry maintains a low growth rate of 5.7 percent, the bumper agricultural performance during this year could help scale India's Gross Domestic Product of 6 percent.

Agricultural sector is too vital for India's economy to be put on the back-burner. It needs to free from the discriminatory policies, and resurrected with necessary incentives and safeguards, and provided with benefits similar to the industries such as easy availability of inputs, credit and infrastructural facilities. The Government should strive to channelize greater private and public investment in areas of infrastructural development, research and development, marketing and processing etc., leading to higher productivity and greater efficiency in agricultural production. Critics may note that higher agricultural productivity raises the disposal incomes in the rural households and pushes up the demand support that industry so desperately needs.

The protagonists of liberalization propagate a policy of free trade in foodgrains and edible oils. The hope is that reduced protection to the industry and removing restrictions on agricultural exports will turn the terms of trade towards agriculture. Such a step to expose the internal economy to vagaries of international demand and supply position, when the growth of agricultural production in India seemed to be reaching a plateau, is fraught with danger.

Liberalisation of agriculture, unless accompanied by a massive step up in public expenditure on agricultural investment and targeted subsidies, along with the necessary rise in incoming revenue to finance these, may prove to be counter-productive. Agricultural prices and exports would rise, but would not be accompanied by a significant increase in agricultural output. This would result in a sharp rise in inflation, and cast an adverse effect on non-agricultural output and employment.

1.2 BEHAVIOR OF AGRICULTURAL PRICES IN INDIA
Agricultural prices particularly of foodgrains and oilseeds play an important role in the whole national economy of India. They affect production decisions by the farmers and their incomes. Variations in prices of agricultural commodities are a big problem in Indian agriculture because of the dependence of production on monsoons. Agricultural prices exhibit spatial and temporal price fluctuations. Temporal price variations include seasonal, annual and long-term fluctuations. The present book analyses the temporal price variation in foodgrains and oilseeds and makes suggestions to minimize the variation in prices of agricultural commodities in India.

The Commerce Minister, Mr Arun Jaitley, is focussing on free trade in agricultural commodities at the WTO negotiations. The assumption is that the farmers in the rich countries will not be able to compete with Indian farmers in such crops as cotton, wheat and soybean without the subsidies, and farmers of the developing countries will then get larger markets and better prices for their produce.

Indeed, the supply of cotton, wheat and soybean in the world markets will reduce upon the dismantling of these subsidies. But it is not necessary that this will translate into a rise in prices for the farmers.

If the rich countries dismantle the subsidies being given in cotton, wheat and soybean and stop producing those crops, the situation in respect of these crops will become same as that prevailing in coffee and so on today. If the prices of coffee and other crops have risen in the last few years then we can assume that the prices of wheat, cotton and soybean will also rise on the dismantling of subsidies by the rich countries.

The World Bank's *Global Economic Prospects 2003* gives us details about the long-term price behaviour of crops. The real price of coffee today is about one-third of those prevailing in 1960. There are two reasons for this decline in price.

There has been a huge increase in production of coffee in Vietnam and Brazil; thus, supply in the world markets has increased. On the other hand, the consumption of coffee in the rich countries is stable, at about 4.5 kg per person. The increase in supply, together with stagnant demand, has led to this decline.

There has been a 6 per cent decline in the price of tea in 2002. There was an increase of 4 per cent in tea production in India, Kenya and Sri Lanka. China and Vietnam are also increasing their production.

The price of sugar has moved between 10 and 30 cents per kg in the last 20 years. They have been around 15 cents per kg in 2002 — the lower end of the range.

The reason is that there has been an 8 per cent increase in production in Brazil, the major exporter. The other exporters are Thailand and Australia, which have had a 50 per cent and a 70 per cent increase in production in the last 20 years, respectively.
The prices of rubber declined much after the Asian crisis in 1997. There has been an increase of 32 per cent in 2002 from the low levels after the crisis. But the prices are still much below those in 1997. The recent increase in prices is more in the nature of a minor correction within the long-term declining trend. Further, the World Bank predicts that the prices are likely to decline by 3 per cent in the next 10 years.

The reason is that the demand of rubber in rich countries for making automobile tyres is declining. Two per cent less rubber was consumed in the OECD countries last year.

The prices of these four major agricultural commodities which are not grown in the rich countries have declined in the last few decades and are likely to decline further in the coming years. Indeed, the prices of these commodities, as also of cashew and ginger, have risen for a year or two due to temporary factors such as drought. But the long-term tendency is clearly downwards.

This is the story of those crops which are mainly grown in the poor countries. The prices of such crops as wheat, cotton and soybean, which are also grown in the industrial countries today, can be expected to behave similarly if the rich countries stop giving agricultural subsidies.

The decline in production in the rich countries due to the removal of subsidies will be more than made up for by increased supply from other developing countries. Indian farmers, therefore, will in the end not benefit much by the dismantling of the subsidies by the rich countries. This does not mean that India should not ask for removal of those subsidies. It must ask for them because they are a good bargaining point and also exposes the true intentions of the rich countries. The farmers will also gain by the expansion of the markets.

India should instead focus its attention on the expansion of the services sector and loosening of the patents laws.

Simultaneously, India should protect its agricultural markets from imports and force an increase in the domestic agricultural prices. That will provide relief to the farmers in the interim period till we can shift them into services in a big way.

1.3 COBWEB MODEL PRICES AND INCOME STABILITY

The cobweb model or cobweb theory is an economic model that explains why prices might be subject to periodic fluctuations in certain types of markets. It describes cyclical supply and demand in a market where the amount produced must be chosen before prices are observed. Producers' expectations about prices are assumed to be based on observations of previous prices. Nicholas Kaldor analyzed the model in 1934, coining the term 'cobweb theorem' (see Pashigian, 2008), citing previous analyses in German by Henry Schultz and U. Ricci.
1.3.1 The model

The cobweb model is based on a time lag between supply and demand decisions. Agricultural markets are thought to be a situation where the cobweb model might apply, since there is a lag between planting and harvesting. Suppose for example that as a result of unexpectedly bad weather, farmers go to market with an unusually small crop of strawberries (this example follows Kaldor, 1934, p. 134). This shortage, equivalent to a leftward shift in the market's supply curve, results in high prices. If farmers expect these high price conditions to continue, then in the following year, they will raise their production of strawberries relative to other crops. Therefore when they go to market the supply will be high, resulting in low prices. If they then expect low prices to continue, they will decrease their production of strawberries for the next year, resulting in high prices again.

![Diagram of the cobweb model]

Figure 1

This process is illustrated by the diagram on the right. The equilibrium price is at the intersection of the supply and demand curves. A poor harvest in period 1 means supply falls to $Q_1$, so that prices rise to $P_1$. If producers plan their period 2 production under the expectation that this high price will continue, then the period 2 supply will be high, at $Q_2$. Prices therefore fall to $P_2$ when they try to sell all their output. Notice that as this process repeats itself, oscillating between periods of low supply with high prices and then high prices again.
supply with low prices, the price and quantity spiral inwards and the economy converges to the equilibrium price where supply and demand cross.

Simplifying, the cobweb model can have two main types of outcomes:

- If the slope of the supply curve is greater than the slope of the demand curve (in absolute value), then the fluctuations decrease in magnitude with each cycle, so a plot of the prices and quantities over time would look like an inward spiral, as shown in the diagram. This is called the stable or convergent case.
- If the slope of the supply curve is less than the slope of the demand curve (in absolute value), then the fluctuations increase in magnitude with each cycle, so that prices and quantities spiral outwards. This is called the unstable or divergent case.

Two other possibilities are:

- Fluctuations may also remain of constant magnitude, so a plot of the equilibria would produce a simple rectangle, if the supply and demand curves have exactly the same slope.
- If the supply curve is less steep than the demand curve near the point where the two curves cross, but more steep when we move sufficiently far away, then prices and quantities will spiral away from the equilibrium price but will not diverge indefinitely; instead, they may converge to a limit cycle.

In either of the first two scenarios, the combination of the spiral and the supply and demand curves often looks like a cobweb, hence the name of the theory.

1.3.2 Role of expectations

One reason to be skeptical about this model's predictions is that it assumes producers are extremely shortsighted. While assuming that farmers look back at the most recent prices in order to forecast future prices might seem very reasonable, this backward-looking forecasting (which is called adaptive expectations) turns out to be crucial for the model's fluctuations. When farmers expect high prices to continue, they produce too much and therefore end up with low prices, and vice versa.

In the stable case, this may not be an unbelievable outcome, since the farmers' prediction errors (the difference between the price they expect and the price that actually occurs) become smaller every period. In this case, after several periods prices and quantities will come close to the point where supply and demand cross, and predicted prices will be very close to actual prices. But in the unstable case, the farmers' errors get larger every period. This seems to indicate that adaptive expectations are a misleading assumption: how could farmers fail to notice that last period's price is not a good predictor of this period's price?

The fact that agents with adaptive expectations may make ever-increasing errors over time has led many economists to conclude that it is better to assume rational expectations,
that is, expectations consistent with the actual structure of the economy. However, the rational expectations assumption is controversial since it may exaggerate agents' understanding of the economy. The cobweb model serves as one of the best illustrations of why understanding expectation formation is so important for understanding economic dynamics, and also why expectations are so controversial in recent economic theory.

1.3.3 Evidence

Livestock herds

The cobweb model has been interpreted as an explanation of fluctuations in various livestock markets, like those documented by Arthur Hanau in German hog markets; see Pork cycle. However, Rosen et al. (1994) proposed an alternative model which showed that because of the three-year life cycle of beef cattle, cattle populations would fluctuate over time even if ranchers had perfectly rational expectations.

Human experimental data

In 1989, Wellford conducted twelve experimental sessions each conducted with five participants over thirty periods simulating the stable and unstable case. Her results show that the unstable case did not result in the divergent behavior we see with cobweb expectations but rather the participants converged toward the rational expectations equilibrium. However, the price path variance in the unstable case was greater than that in the stable case (and the difference was shown to be statistically significant).

One way of interpreting these results is to say that in the long run, the participants behaved as if they had rational expectations, but that in the short run they made mistakes. These mistakes caused larger fluctuations in the unstable case than in the stable case.

1.4 AGRICULTURAL MARKETING AND WAREHOUSING

The agricultural marketing system in India operates primarily according to the forces of supply and demand in the private sector. Indian Government intervention is limited to protecting the interests of producers and consumers and promoting organized marketing of agricultural commodities. In 1991 there were 6,640 regulated markets to which the central government provided assistance in the establishment of infrastructure and in setting up rural warehouses. Various central government organizations are involved in agricultural marketing, including the Commission for Agricultural Costs and Prices, the Food Corporation of India, the Cotton Corporation of India, and the Jute Corporation of India. There also are specialized marketing boards for rubber, coffee, tea, tobacco, spices, coconut, oilseeds, vegetable oil, and horticulture.

A network of cooperatives at the local, state, and national levels assist in agricultural marketing in India. The major commodities handled are food grains, jute, cotton, sugar, milk, and areca nuts. Established in 1958 as the apex of the state marketing federations,
the National Agricultural Cooperative Marketing Federation of India handles much of the domestic and most of the export marketing for its member organizations.

Large enterprises, such as cooperative Indian sugar factories, spinning mills, and solvent-extraction plants mostly handle their own marketing operations independently. Medium- and small-sized enterprises, such as rice mills, oil mills, cotton ginning and pressing units, and jute baling units, mostly are affiliated with cooperative marketing societies.

In the late 1980s, there were some 2,400 agro processing units in India in the cooperative sector. Of all the cooperative agroprocessing industries, cooperative sugar factories achieved the most notable success. The number of licensed or registered units remained at 232, of which 211 had been installed by March 1988. During the October 1987-September 1988 sugar season, 196 cooperative sugar factories were in production. They produced nearly 5.3 million tons of sugar, accounting for about 57.5 percent of the country's total production of 9.2 million tons. The National Federation of Cooperative Sugar Factories (India) rendered advice to member cooperatives on technical improvement, financial management, raw materials development, and inventory control.

In the early 1990s, the cooperative marketing structure comprised 6,777 primary marketing societies: 2,759 general-purpose societies at the mandi (wholesale markets in India) level and 4,018 special commodities societies for oilseeds and other such commodities. There were also 161 district or central societies covering nearly all important mandis in the country and twenty-nine general-purpose state cooperative marketing federations. The total value of agricultural produce marketed by cooperatives amounted to about Rs54.2 billion in FY 1988, compared with Rs18 billion in FY 1979. The total value of food grains handled by marketing cooperatives increased from Rs5 billion in FY 1979 to about Rs11.3 billion in FY 1986.

The Indian Ministry of Agriculture's Directorate of Marketing and Inspection is responsible for administering federal statutes concerned with the marketing of agricultural produce. Another function is market research. The directorate also works closely with states to provide agricultural marketing services that constitutionally come under state purview.

Under the Agricultural Produce (Grading and Marketing) Act of 1937, more than forty primary commodities are compulsorily graded for export and voluntarily graded for internal consumption. Although the regulation of commodity markets is a function of state government, the Directorate of Marketing and Inspection provides marketing and inspection services and financial aid down to the village level to help set up commodity grading centers in selected markets.

By the 1980s, warehouses for storing agricultural produce and farm supplies played an increasing role in government price support and price control programs and in distributing farm commodities and farm supplies. Because the public warehouses issue a receipt to the owners of stored goods on which loans can be raised, warehouses are also becoming important in agricultural finance. The Central Warehousing Corporation, an
entity of the central government, operates warehouses at major points within its jurisdictions, and cooperatives operate warehouses in towns and villages. The growth of the warehousing system in India has resulted in a decline in weather damage to produce and in loss to rodents and other pests.

Most agricultural produce in India is sold by farmers in the private sector to moneylenders (to whom the farmer may be indebted) or to village traders. Produce is sold in various ways. It might be sold at a weekly village market in the farmer's own village or in a neighboring village. If these outlets are not available, then produce might be sold at irregularly held markets in a nearby village or town, or in the mandi. Farmers also can sell to traders who come to the work site.

The Indian government has adopted various measures to improve agricultural marketing. These steps include establishing regulated markets, constructing warehouses, grading and standardizing produce, standardizing weights and measures, and providing information on agricultural prices over All India Radio (Akashvani), the national radio network.

The government's objective of providing reasonable prices for basic food commodities is achieved through the Public Distribution System, a network of 350,000 fair-price shops that are monitored by state governments. Channeling basic food commodities through the Public Distribution System serves as a conduit for reaching the truly needy and as a system for keeping general consumer prices in check. More than 80 percent of the supplies of grain to the Public Distribution System is provided by Punjab, Haryana, and western Uttar Pradesh.

The Food Corporation of India was established in 1965 as the public-sector marketing agency responsible for implementing government price policy through procurement and public distribution operations. It was intended to secure for the government a commanding position in the food-grain trade. By 1979 the corporation was operating in all states as the sole agent of the central government in food-grain procurement. The corporation uses the services of state government agencies and cooperatives in its operations.

The Food Corporation of India is the sole repository of food grains reserved for the Public Distribution System. Food grains, primarily wheat and rice, account for between 60 and 75 percent of the corporation's total annual purchases. Food-grain procurement was 8.9 million tons in FY 1971, 13.0 million tons in FY 1981, and 17.8 million tons in FY 1991. Food grains supplied through the Public Distribution System amounted to 7.8 million tons in FY 1971, 13.0 million tons in FY 1981, and 17.0 million tons in FY 1991. The corporation has functioned effectively in providing price supports to farmers through its procurement scheme and in keeping a check on large price increases by providing food grains through the Public Distribution System.

1.5 AGRICULTURE MARKETING POLICY
The Agricultural Marketing Policy is governed by the Agricultural Produce (Grading and Marketing) Act of 1937. The Directorate of Marketing and Inspection of the Ministry of Agriculture is responsible for administering federal statutes concerned with the marketing of agricultural produce. Other Central Government organizations that are involved in agricultural marketing and promotion of exports are the Commission for Agricultural Costs and Prices, the Food Corporation of India, the Cotton Corporation of India and the Jute Corporation of India. There are also special marketing boards for rubber, coffee, tea, tobacco, spices, coconut, oilseeds, vegetable oil and horticulture. A network of cooperatives societies at the local, State and national levels and the National Agricultural Cooperative Marketing Federation of India are also involved in marketing and export promotion functions.

These boards have come up with various schemes to better marketing and boost exports. This includes the establishment of regulated markets, storage facilities, grading and standardizing agricultural products and providing standard measuring instruments.

Here is some information on major agricultural export marketing agencies in India:

a. The Agricultural and Processed Food Products Export Development Authority or APEDA. This organization was established in 1986 to develop the agricultural commodities and processed foods industry in India and to promote export. It spreads information about agri exports by organizing or participating in product promotions, seminars, buyer seller meets and international trade fairs.

b. Central Silk Board - is involved in creating publicity and promoting the export of natural silk goods.

c. The Marine Products Exports Development Authority - This organization offers subsidies to buy equipment to increase the production of fish at capture and culture facilities. This includes free installation of Turtle Excluder Devices in fishing trawlers and financial assistance for installation of other gear like fish finders, refrigerated fish holds and ice making machines.

d. The Federation of Indian Export Organizations - This is the apex body of different export promotion organizations.

e. NAFED - is the National Agricultural Cooperative Marketing Federation of India.

1.5.1 POLICY INITIATIVES IN AGRICULTURAL MARKETING DIVISION

1. Marketing Research and Information Network (MRIN)

With a view to disseminate price and market related information in respect of agricultural commodities to farmers, this Department has implemented a Scheme of Agricultural Marketing Research and Information Network. Under the scheme, so far 735 agricultural markets have been inter-connected on AGMARKNET portal wherein daily prices of more than 300 commodities and about 2000 varieties are being reported. During 10th Plan 2000 more agricultural markets are planned to be connected to the portal with a central outlay of Rs. 35 crores thereby providing on-line connectivity to 37 per cent of
total number of wholesale markets in the country. So far an amount of Rs.11.48 crores has been released for providing internet connectivity to 950 markets; for developing 8 state level portals and for market led extension activities in 16 states. The commodities covered include cereals, pulses, oilseeds, fruits and vegetables, spices, fibre crops, livestock, poultry, etc. IFFCO, a cooperative fertilizer company, has been involved in disseminating the price information to a large net work of farmers’ cooperatives spread all over the country. National Multi Commodity Exchange of India Ltd, Ahmedabad has been interlinked with the portal to provide on-line information in respect of future prices of selected commodities.

2. Construction of warehouses and Rural Godowns

The main objectives of the scheme include creation of scientific storage capacity with allied facilities in rural areas to meet the requirements of farmers for storing farm produce, processed farm produce, consumer articles and agricultural inputs; promotion of grading, standardization and quality control of agricultural produce to improve their marketability; prevention of distress sale immediately after harvest by providing the facility of pledge financing and marketing credit; to strengthen agricultural marketing infrastructure in the country by paving way for the introduction of national system of warehousing receipts in respect of agricultural commodities stored in such godowns and to reverse the declining trend of investment in agriculture sector by encouraging private and co-operative sectors to invest in the creation of storage infrastructure in the country. Under this scheme, 25 percent of the capital cost is to be provided as credit-linked, back-ended subsidy. For the north east and other hilly areas in the country and entrepreneurs belonging to SC/ST, the subsidy would be 33.33 percent.

The eligible promoters for construction of rural godowns can be individual farmers, group of farmers/ growers, partnership/ proprietary firms, NGOs, companies, corporations, co-operatives, Agricultural Produce Marketing Committees, Marketing Boards and Agro Processing Corporations. The scheme is being implemented since March,2001 and so far 6974 storage projects have been sanctioned by NCDC and NABARD to create 115 lakh tonnes of rural storage capacity in the country. During the years 2004-07, this scheme is continued with certain modifications with a central outlay of of Rs.115 crores for creation of 36 lakh tones capacity. Under the revised scheme, 15% subsidy will be provided to individuals, companies and corporate and 25% subsidy will be provided to all categories of farmers, agricultural graduates, co-operatives and CWC/ SWC.

The scheme has helped the farmers in storing their commodities near their fields, obtain pledge loan and marketing credit from the banks, thereby avoiding distress sale at the time of harvest. Capital subsidy to the entrepreneurs is credit linked and back ended and is adjusted in the entrepreneurs’ account after the repayment of loan which is usually of 7 to 9 years duration. This arrangement ensures utilization of godown project for agricultural purposes. Participation of multiple agencies in the implementation of the scheme has in addition to benefiting the farming community, generated huge investment in creating storage infrastructure in rural areas of the country.

Warehousing facilities are necessary to prevent the loss arising out of defective storage and also to equip the farmers with a convenient instrument of credit. Both the
Agricultural Finance Sub-Committee (1945) and the Rural Banking Enquiry Committee (1950) emphasized the importance of warehousing as a method of promoting rural banking and finance in India.

All India Rural Credit Survey Committee (1954) recommended a three-tier system of warehousing: at the national level, state and district level, village and rural level.

At present there are three main agencies in the public sector which are engaged in building large-scale storage/warehousing capacity. They are: the Food Corporation of India (FCI), Central Warehousing Corporation (CWC), and State Warehousing Corporation (SWC).

FCI provides storage capacity for food grains. It has its own godowns and it also hires storage capacity from other sources such as CWC, SWC’s, State Governments and private parties. In 1960-61, there were only 40 general warehouses in the country with a total capacity of less than 0.1 million tonnes. By the end of 1988-89, the three public sector units had a storage capacity of nearly 32 million tonnes.

Besides, public sector agencies, co-operatives have also constructed warehouses in rural areas for storage of their members’ produce, for stocking of fertilizers and other inputs and consumer articles. To avoid unfair competition with the godowns of the co-operative marketing societies, the state warehousing corporations do not open warehouses at any place below the sub-divisional level. By 1987-88, a total storage capacity of over 10 million tonnes in the co-operative sector was available.

3. Development/Strengthening of Agricultural Marketing Infrastructure, Grading and Standardisation:

A new Central Sector Scheme ‘Development/Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization’ has recently been approved (on 20.10.2004) with a view to induce large investments from private and Co-operative sectors in the development of marketing infrastructure for agricultural and allied commodities in the country by providing credit linked back-ended subsidy on capital investment for setting up/strengthening of agricultural markets, marketing infrastructure and support services such as grading, standardization and quality certification. Assistance will be available to individuals, group of farmers, NGOs, SHGs, companies, corporations, cooperatives, local bodies, agricultural produce market committees etc. The Central outlay for the scheme is Rs. 190 crores during 2004-07. This scheme will be implemented through NABARD and NCDC in those States which amend their APMC Acts, wherever required, to allow direct marketing and contract farming and to permit setting up of markets in private and cooperative sectors. The scheme would provide increased access to small and marginal farmers to agricultural marketing infrastructure for better price realization and to open greater market opportunities to growth, employment and poverty reduction. Further details can be viewed on the website www.agmarknet.nic.in.

4. Marketing Reforms:

To make the agricultural marketing system more vibrant and competitive, Government of India had taken the initiative in this regard by setting up of an Inter Ministerial Task
Force on Agricultural Marketing Reforms which recommended amendment to the State APMC Act for promotion of direct marketing and contract farming, development of agricultural markets in private and cooperative sectors, stepping up of pledge financing, expansion of future trading to cover all agricultural markets, introduction of negotiable warehouse receipt system and use of information technology to provide market led extension services to the farmers. In order to guide the States in the implementation of suggested reforms, Central Government had now drafted a Model Act on Agricultural Marketing which inter-alia provided for the establishment of direct purchase centers and farmers’ markets for direct sale to consumers, complete transparency in the pricing system, and payment to farmers on the same day, public private partnership for professional management of existing markets and setting up of Market Standards Bureau for promotion of standardization, grading and quality certification of produce. The Model Act and the suggested reforms were discussed at the national conference of State Agriculture Ministers held on 7th January 2004 at New Delhi and on 19th November, 2004 at Bangalore. The States were requested to complete the process of amendment to the APMC Act within 2-3 months time

5. Small Farmers Agribusiness Consortium (SFAC)

With a view to aggressively promote agri-business in the country, the SFAC is in the process of formulating a new scheme to provide Venture Capital Assistance to agri-business projects and a Project Development Facility to assist producer groups/organizations in formulation of economically viable agri-business projects. Venture capital assistance will be provided to the projects that link producers to assured markets. The scheme envisages a single window operation for the disbursement and disinvestment of venture capital to be operated through the participating banks and would involve a close partnership between the SFAC and the lending banks.

The amount of Venture Capital that SFAC will ordinarily provide to Qualifying Projects shall be the lowest of i) 10% of the total project cost assessed by Lending Banks; ii) 26% of the project equity; and iii) Rs.75.00 lakhs. Higher Venture Capital Assistance can be provided to deserving projects on merit and/or to projects that are located in remote and backward areas, North-eastern and hilly States and projects promoted by State SFACs. SFAC will defray the cost of preparation of bankable DPRs up to a ceiling of Rs.5.00 lakhs normally depending on the size, location and linkage issues on a case to case basis. Intending projects must be over Rs.50.00 lakhs in size

6. Ch. Charan Singh National Institute of Agricultural Marketing (NIAM)

NIAM has taken the initiative in establishing collaborative arrangements with FAO/AFMA. At the instance of FAO/AFMA, the Institute is undertaking a countrywide study on ‘Role of Associations of Trade, Millers and Service Providers’. This would be a pioneer study and first of its kind on such a large scale. The Institute has also taken up the task of preparation of a website for AFMA, Bangkok. It was requested by FAO that NIAM should lead in organising some training programmes for Traders Associations which would be unique in nature and the Institute has initiated action on the same.

1.6 AGRICULTURAL PRICE POLICY
The government has formulated a price policy for agricultural produce that aims at securing remunerative prices to farmers to encourage them to invest more in agricultural production. Keeping this in mind, the government announces minimum support prices for major agricultural products every year. These prices are fixed after taking into account the recommendations of the Commission for Agricultural Costs and Prices (CACP).

The main objectives of the Government's price policy for agricultural produce aims at ensuring remunerative prices to the growers for their produce with a view to encouraging higher investment and production. Towards this end, minimum support prices for major agricultural products are announced each year which are fixed after taking into account the recommendations of the Commission for Agricultural Costs and Prices (CACP). The CACP, while recommending prices takes into account all important factors, viz:

- Cost of production
- Changes in input prices
- Input/Output Price Parity
- Trends in market prices
- Inter-crop Price Parity
- Demand and supply situation
- Effect on Industrial Cost Structure
- Effect on general price level
- Effect on cost of living
- International market price situation
- Parity between prices paid and prices received by farmers (Terms of Trade)

Of all the factors, cost of production is the most tangible factor and it takes into account all operational and fixed demands. Government organizes Price Support Scheme (PSS) of the commodities, through various public and cooperative agencies such as FCI, CCI, JCI, NAFED, Tobacco Board, etc., for which the MSPs are fixed. For commodities not covered under PSS, Government also arranges for market intervention on specific request from the States for specific quantity at a mutually agreed price. The losses, if any, are borne by the Centre and State on 50:50 basis. The price policy paid rich dividends. The Government have raised substantially the MSPs in recent years as may be seen from the statement enclosed.

**Public Distribution System** - This system provides reasonable prices for basic food commodities through a network of 350,000 fair-price shops that are monitored by State Governments. It also keeps the situation of price rise in check.

**The Food Corporation of India** - is a public-sector Price agency that is responsible for implementing the government price policy through its procurement and public distribution operations. It procures wheat, paddy and rice for which minimum support prices have been announced well before the commencement of Rabi and Kharif Price seasons. Only Fair Average Quality (FAQ) food grains that have been previously specified by the Government of India are purchased. Surplus stock is exported.
The price support policy was initiated by the Government to provide protection to agricultural producers against any sharp drop in farm prices. If there is a good harvest and market prices tend to dip, the government guarantees an MSP or floor price to farmers, which covers not only the cost of production, but also ensures a reasonable profit margin for the producers. MSP is announced each year and is fixed after taking into account the recommendations of the CACP (Commission for Agricultural Costs and Prices).

Procurement prices are the prices of kharif and rabi cereals at which the grain is to be domestically procured by public agencies (for example, FCI [Food Corporation of India]) for release through PDS (public distribution services). Normally, the procurement price is lower than the open market price and higher than MSP. In the case of paddy, these two official prices were being announced with small year-to-year variations till 1973/74. However, in case of wheat this system was discontinued in 1969 and then started again in 1974/75 for one year only. Due to lack of demands for increasing the MSP, in 1975/76, the present system was evolved in which only one set of prices was announced for paddy and other kharif crops. Wheat was procured for buffer stock operations. PDS consists of a network of 350,000 fair-price shops that are monitored by state governments. Supplying basic food commodities through PDS not only serves the purpose of reaching the needy, it also acts as a control for general consumer prices. FCI is the sole repository of food grains reserved for PDS. The Corporation has functioned effectively in providing price support to farmers through its procurement scheme and in keeping a check on large price increases by providing food grains through PDS.

FCI was established in 1965 as the public-sector marketing agency responsible for implementing, government price policy through procurement and public distribution operations. It was intended to secure for the government a strong position in the food-grain trade. By 1979 the corporation was, operating in all states as the sole agent of the central government in food-grain procurement. FCI operates through a countrywide network with its Corporate Office in New Delhi, five Zonal Offices, 23 Regional Offices practically in all the State capitals, 168 District Offices (as on 1 January 2006) and 1452 depots (as on 1 January 2006).

The arrival of the Green Revolution in India proved otherwise. The area under food grains increased from 101 million ha in 1950/51 to 128 million ha in 1990/91; expansion of irrigated area increased from 20.9 million ha in 1950/51 to 50.2 million ha in 1995; and availability of short duration, high yielding varieties increased as well. Widespread promotion of Green Revolution technologies during the 1960s increased agricultural yields in India for some crops by introducing high-yielding varieties that depended on input such as irrigation, chemical fertilizers, and pesticides (Goldman and Smith 1995).

The Government introduced tremendous agrarian reforms, made institutional changes, and encouraged the development of major irrigation projects. Furthermore, aggressive food-grain marketing in India began in a big way in the mid 1960s (Chand 2003a; Figure This was meant to create a favourable, incentive-driven environment for the adoption of this new technology based on HYV (high-yielding varieties) of wheat and rice. India was
then facing severe food shortage and mass hunger. The new technology provided a ray of hope to tackle the problem of food shortage and hunger.

Evolution of agricultural pricing policy in India

Adoption of the new technology involved the use of non-conventional input and investments on the part of the farmers. This made it necessary to create a stable and profitable environment for farmers adopting the new seeds. At the same time, it was to be ensured that an increase in production benefited the consumers. The rationale of the twin policy of minimum support and procurement prices is easily understandable. The Green Revolution necessitated a stepping up of per hectare outlay but this was compensated by a much larger output of grain from each hectare of land. Larger output results in the lowering of market price.

To protect enterprising farmers from possible loss, MSP was introduced. At the same time, should production be far below than expected, be it due to poor rainfall or any other reasons, market prices are bound to rise. In such an event, procurement price helps consumers access the necessary food grains through a PDS. Government supplies irrigation water, input like fertilizers and HYV seeds at a price lower than the cost of production. Even for the part of the output that would be claimed by the government in the form of procurement, the farmers would be offered a remunerative price which would be higher than its MSP but less than the current market price.

The Agricultural Prices Commission was set up in January 1965 (Figure 5.1) to advise the government on price policy of major agricultural commodities. The objective was to give due regard to the interests of the producer and the consumer, while keeping in
perspective the overall needs of the economy. Since March 1985, the Commission has been known as CACP. The Commission consists of a Chairman, a Member Secretary, two official members, and three non-official members. The non-official members are representatives of the farming community. They are usually persons with considerable field experience and an active association with the farming community.

### Adaptive policy analysis

The MSP instrument of APP exhibited several features reminiscent of adaptive policies and policymaking. One of the most prominent is CACP. MSPs for major agricultural products are announced each year after taking into account the recommendations of CACP. CACP takes into account all important factors (Table) including cost of production, changes in input prices, input/output price parity, trends in market prices, inter-crop price parity, demand and supply situation, parity between prices paid and prices received by farmers, etc. Among these factors, the cost of production is the most significant one. A meaningful support price policy should have minimum guaranteed prices, which would cover at least the reasonable cost of production in a normal agricultural season obtained from efficient farming.

### Adaptive policy elements in determination of MSP

CACP carries out state-specific analyses for the cost of production in respect of various commodities. This is done through consultations with the state governments. After a meeting of the state Chief Ministers, the MSP/procurement prices are declared. Cost of production for the same crops varies between regions, across farms within the same region, and for different producers. This makes it difficult to have a norm for the level of costs. In fixing the support prices, CACP relies on the cost concept, which covers all items of expenses of cultivation including the imputed value of input owned by farmers such as rental value of owned land and interest on fixed capital. Some of the important cost concepts used by CACP are the C2 and C3 costs.
C2 cost includes all actual expenses, in cash and kind, incurred during production by the actual owner, plus rent paid for leased land, plus imputed value of family labour plus interest on value of owned capital assets (excluding land), plus rental value of owned land (net of land revenue). C3 cost is defined as the C2 cost plus 10% of C2 cost, to account for managerial remuneration to the farmer. Costs of production are calculated both, on a per quintal and per hectare basis. Since cost variations are large over states, CACP recommends that MSP should be considered on the basis of C2 cost. However, increases in MSP have been so substantial in case of paddy and wheat that in most of the states MSPs are far greater than not only the C2 cost but the C3 cost as well.

The regional segmentation of the markets resulted in a large gap between the costs of production and the MSP. Market prices were often lower than MSPs, which led to the unabated build-up of foodgrain stocks with FCI. The excess stocks, which were much higher than the actual buffer requirement, led to a significant increase in the cost of carrying and also food subsidy. The Government reviewed this situation in considerable detail, ultimately resulting in modest price increases in the past five years for the kharif and rabi crops. It is believed that the Government’s policy of not hiking the MSP of principal cereals is likely to encourage crop diversification in an indirect way.

### 1.7 Agricultural Taxation in India
Agricultural property and some agricultural income were being taxed in the early 1990s, but the revenue from these taxes was negligible. In the early 1950s, however, land revenue agricultural property taxes were a significant form of government income, providing just fewer than 10 percent of the tax revenue of the central, state, and union territory governments. At the end of the 1980s, that proportion was less than 1 percent because land revenue had been fixed. For instance, land revenue was an average of Rs28 per hectare in Kerala and Rs23 per hectare in Uttar Pradesh, the two states with the highest assessment rates.

The national average was Rs16.50 per hectare. Agricultural property also was subject to stamp duties and registration fees. (All property transactions have to be made on official, stamped forms, and registration fees have to be paid to register transactions.) No data were available in early 1993 on the proportion of these fees that came from the agricultural sector, but a taxation inquiry committee put it at approximately 20 percent. Between 1950 and 1990, only about 1.5 percent of the total taxes collected by the central, state, and union territory governments came from the agricultural sector. Overall, the impact of tax on agricultural property was negligible but was a likely target for economic reform in the mid-1990s.

Since the 1950s, agricultural income tax has been collected as a federal tax, but it has been levied only on income from plantations. All other agricultural income has been exempt from tax. The total collection from this tax was less than 1 percent of the total taxes collected by the central, state, and union territory governments in FY 1950; in the late 1980s, it had dropped below 0.3 percent.

### 1.8 CROP INSURANCE

In our country crop production has been subjected to the vagaries of the climate. Some of the other problems that the Indian agriculture is constantly tackling with are the large-scale damages that are caused as a result of the attack of pests and diseases. It is in a scenario such as this in India that the issue of crop insurance assumes a vital role in the stable growth of the agricultural sector. Tracing the Crop Insurance History in India we see that it was started with the introduction of the All-Risk Comprehensive Crop Insurance Scheme (CCIS) that covered the major crops. This scheme was introduced in 1985. In fact this period of introduction also coincided with the introduction of the Seventh-Five-year plan. This initial scheme was of course later substituted and replaced by the National Agricultural Insurance Scheme. This substitution came into effect from 1999. These Schemes that have been introduced throughout the crop insurance history have been preceded by years of preparation, studies, planning, experiments and trials on a pilot basis.

In the crop insurance history, the question of introducing a crop insurance scheme was taken up for examination soon after the Indian independence. The first aspect that was examined related to the modalities of crop insurance. The issue under consideration was about whether the crop insurance should be offered under an Individual approach or on Homogenous area approach.
The Individual approach of the scheme indemnifies the farmer to the full extent of the losses. Also the premium that is to be paid by him is determined with reference to his own past yield and loss experience. The Individual approach for these schemes necessitates reliable and accurate data of crop yields of individual farmers for a sufficiently long period, for fixation of premium on actuarially sound basis.

The Homogenous area approach on the other hand was aimed at envisaging a homogeneous area from the point of view of crop production and similarity of annual variability of crop production. The homogenous area approach was found to be more favorable. This is because it would facilitate the provision of a single unit treatment to various agro-climatically homogenous areas and the individual farmers and allow them to pay the same rate of premium and receive the same benefits, irrespective of their individual fortunes.

### 1.8.1 Crop Insurance Risks covered

The Crop insurance schemes aim at providing comprehensive risk insurance which cover the yield losses that occur to the agricultural output of small and marginal farmers due to non-preventable risks. The crop insurance risks covered under the non-preventable category are listed below:

1. Natural Fire and Lightning
2. Storm, Hailstorm, Cyclone, Typhoon, Tempest, Hurricane, Tornado etc.
3. Flood, Inundation and Landslide
4. Drought, Dry spells
5. Pests/ Diseases etc

The crops insurance risks does not cover any of the losses that arise out of war and nuclear risks, malicious damage and other risks which are preventable risks.

The sum insured under the crop insurance risks covered usually extends to the value of the threshold yield of the insured crop. This is usually subject to the option of the insured farmers. Nevertheless, a farmer may also choose to insure his crop beyond value of the threshold yield level up to 150% of average yield of the notified area on payment of premium at commercial rates.

Apart from the risks covered in the crop insurance scheme, what is important is the sum insured. In case of Loanee farmers the sum insured would be at least equal to the amount of crop loan advanced. Further, in the case of the Loanee farmers, the insurance charges that will be levied will be additional to the Scale of Finance for the purpose of obtaining loan.

Apart from the above mentioned issues, the matters of Crop Loan disbursement procedures, which have been outlined by the RBI / NABARD are binding. The insurance
premium issues still stand at an undecided state as the transition to the actuarial regime in case of cereals, millets, pulses & oilseeds is expected to be made in a period of five years.

1.8.2 Crop Insurance Schemes in India

In order to provide a boost to the agriculture in India, a number of experimental crop insurance schemes have been introduced in the country. The first ones of the experimental crop insurance schemes has been a Pilot Crop Insurance scheme. This was introduced by GIC from the year 1979.

Some of the important features of the scheme were that the scheme was based on "Area Approach". This scheme covered crops such as Cereals, Millets, Oilseeds, Cotton, Potato and Gram. The scheme was confined to loanee farmers only and on voluntary basis. The risk was shared between General Insurance Corporation of India and State Governments in the ratio of 2:1. The maximum sum that could be insured under the scheme was 100% of the crop loan, which was later increased to 150%.

Under this scheme, 50% of the subsidy was provided for insurance charges which was payable to the small / marginal farmers by the State Government & the Government of India on 50:50 basis. Among the earlier crop insurance schemes that were introduced was a comprehensive Crop Insurance Scheme. The Government of India introduced the Comprehensive Crop Insurance Scheme with effect from 1st April 1985. This scheme was introduced with the active participation of State Governments. The Scheme was optional to State Governments.

This Scheme was linked to the short-term crop credit that was extended to the farmers and was implemented using the Homogeneous Area approach. The number of states that were covered under the scheme were 15 States and the number of UTs that were included were 2. This Scheme was implemented until Kharif 1999. Some of the important features of this scheme allowed a cover to the farmers availing crop loans from Financial Institutions for growing food crops & oilseeds on compulsory basis. The coverage under this scheme was restricted to 100% of crop loan subject to a maximum of Rs. 10,000/- per farmer. The premium rates for Cereals and Millets were 2% and for Pulses and Oil seeds 5%. The premium and risk claims were shared in a ratio of 2:1 by the central and state Government. The Scheme was optional to State Governments.

1.9 TERMS OF TRADE BETWEEN AGRICULTURE AND NON AGRICULTURAL PRICES

The Agricultural Prices Commission was set up in January, 1965 to advise the Government on price policy of major agricultural commodities with a view to evolving a balance and integrated price structure in the perspective of the overall needs of the economy and with due regard to the interests of the producer and the consumer. Since March 1985, the Commission has been known as Commission for Agricultural Costs and Prices.
The Commission is composed of a Chairman, a Member Secretary, two official members and three non-official members. The non-official members are representatives of the farming community. They are usually persons with long field experience and active association with the farming community.

Assurance of a remunerative and stable price environment is considered very important for increasing agricultural production and productivity since the market place for agricultural produce tends to be inherently unstable, which often inflict undue losses on the growers, even when they adopt the best available technology package and produce efficiently. Towards this end, minimum support prices (MSP) for major agricultural products are fixed by the government, each year, after taking into account the recommendations of the Commission for Agricultural Costs and Prices (CACP).

While formulating these recommendations, the Commission analyses a wide spectrum of data, covering the costs of cultivation/production, trends and spread of input use, production and productivity of the crop concerned, market prices, both domestic and global inter-crop price parity, emerging supply-demand situation, procurement and distribution, terms of trade between agriculture and non-agriculture sectors, and so on. Since the price policy involves certain considerations of long-run consequences, the Commission also looks at the yield-raising research being conducted by institutions like ICAR. The basic data are generally collected from the Directorate of Economics and Statistics, State Governments, Central Ministries and the nodal agencies concerned with the implementation of agricultural price policy. Besides, the Commission undertakes field visits for close interaction with farmers in different parts of the country and also have wider consultation with senior officers, researchers and managers of relevant organizations.

1.9.1 Terms of reference

The terms of reference of the Commission, were framed as under:-

1. To advise on the price policy of paddy, rice, wheat, jowar, bajra, maize, ragi, barley, gram, tur, moong, urad, sugarcane, groundnut, soyabean, sunflowerseed, rapeseed and mustard, cotton, jute, tobacco and such other commodities as the Government may indicate from time to time with a view to evolving a balanced and integrated price structure in the perspective of the overall needs of the economy and with due regard to the interests of the producer and the consumer.

2. While recommending the price policy and the relative price structure, the Commission may keep in view the following:

   i) The need to provide incentive to the producer for adopting improved technology and for developing a production pattern broadly in the light of national requirements:

   ii) The need to ensure rational utilization of land, water and other production resources:
iii) The likely effect of the price policy on the rest of the economy, particularly on the cost of living, level of wages, industrial cost structure, etc.

3. The Commission may also suggest such non-price measures as would facilitate the achievement of the objectives set out in 1 above.

4. To recommend from time to time, in respect of different agricultural commodities, measures necessary to make the price policy effective.

5. To take into account the changes in terms of trade between agricultural and non-agricultural sectors.

6. To examine, where necessary, the prevailing methods and cost of marketing of agricultural commodities in different regions, suggest measures to reduce costs of marketing and recommend fair price margins for different stages of marketing.

7. To keep under review the developing price situation and to make appropriate recommendations, as and when necessary, within the framework of the overall price policy.

8. To undertake studies in respect of different crops as may be prescribed by Government from time to time.

9. To keep under review studies relating to the price policy and arrangements for collection of information regarding agricultural prices and other related data and suggest improvements in the same, and to organize research studies in the field of price policy.

10. To advise on any problems relating to agricultural prices and production that may be referred to it by Government from time to time.

From time to time, the terms of reference of the Commission have been modified and expanded to keep in step with the changes in agricultural scenario of the country. From the year 1994-95 onwards, Niger-seed and Sesame were included under the Minimum Support Price (MSP) Scheme of CACP, in addition to the edible oilseeds already covered by the Commission. Similarly, during 2001-2002, the government enhanced the terms of reference of the Commission by including one additional commodity, namely, lentil (masur). The number of crops covered by the MSP scheme has thus increased to 25.

1.9.2 Functions

Determination of Minimum Support Prices

In formulating the recommendations in respect of the level of minimum support prices and other non-price measures, the Commission takes into account, apart from a comprehensive view of the entire structure of the economy of a particular commodity or group of commodities, the following factors:
i) Cost of production*

ii) Changes in input prices

iii) Input-output price parity

iv) Trends in market prices

v) Demand and supply

vi) Inter-crop price parity

vii) Effect on industrial cost structure

viii) Effect on cost of living

ix) Effect on general price level

x) International price situation

xi) Parity between prices paid and prices received by the farmers.

xii) Effect on issue prices and implications for subsidy

* The estimates of cost of cultivation/Cost of production which is an important input for forming the recommendation of MSP, are made available to the Commission through the Comprehensive Scheme for Studying the Cost of Cultivation of Principal Crops, operated by Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Govt. of India. These estimates take into account real factors of production and include all actual expenses in cash and kind incurred in production by the farmer, rent paid for leased in land, imputed value of family labour, interest value of owned capital assets (excluding land), rental value of owned land (net of land revenue), depreciation on farm implements and buildings and other miscellaneous expenses.

The Commission makes use of both micro-level data and aggregates at the level of district, state and the country. The information/data used by the Commission, inter-alia include the following:

(i) Cost of cultivation per hectare and structure of costs in various regions of the country and changes there in;

(ii) Cost of production per quintal in various regions of the country and changes therein;

(iii) Prices of various inputs and changes therein;

(iv) Market prices of products and changes therein;

(v) Prices of commodities sold by the farmers and of those purchased by them and changes therein;

(vi) Supply related information - area, yield and production, imports, exports and domestic availability and stocks with the Government/public agencies or industry;

(vii) Demand related information - total and per capita consumption, trends and capacity of the processing industry;
(viii) Prices in the international market and changes therein, demand and supply situation in the world market;
(ix) Prices of the derivatives of the farm products such as sugar, jaggery, jute goods, edible/non-edible oils and cotton yarn and changes therein;
(x) Cost of processing of agricultural products and changes therein;
(xi) Cost of marketing - storage, transportation, processing, marketing services, taxes/fees and margins retained by market functionaries; and
(xii) Macro-economic variables such as general level of prices, consumer price indices and those reflecting monetary and fiscal factors.

As already mentioned, 25 agricultural commodities are currently covered under the mandate given to the CACP for advising the government in respect of the price policy. The Commission is required to convey its recommendations to the Government well before the sowing season of the crop. With a view to interacting with various interest groups, the Commission follows the sequence of steps indicated below:

(i) The Commission identifies the main issues of relevance for the ensuing season (short, medium or long turn).

(ii) The Commission sends a questionnaire to Central Ministries, State Governments and other organisations related to trade, industry, processors, and farmers both in the cooperative and the private sector and seeks their views on certain issues and factual information on related variables.

(iii) Subsequent to step (ii), the Commission holds separate discussions with the State Governments, Central Ministries/Departments and other organisations. The Commission also interacts with research and academic institutions and keeps track of relevant studies and their findings.

(iv) The Commission visits certain areas for on-the-spot observations and feed back from local level organisations and farmers.

1.9.3 Non price measures
While recommending the price policy, the Commission also suggests such non-price measures as would facilitate achievement of the objectives of the policy. In this regard, the Commission has been emphasizing, inter-alia, the following:

(i) Establishment/Strengthening of agencies for implementation of declared price support policy;

(ii) Extension of proven technology to areas where it still needs to be adopted;

(iii) Evolution of suitable technology for augmenting yield and production of crops;
(iv) Reform of market regulations and setting up new markets in areas where agricultural production has made sizeable improvement;
(v) Improvement in grading of agricultural produce and expansion of proper storage facilities;
(vi) Arrangement for timely and speedy transportation of agricultural commodities from surplus areas;
(vii) Buffer-stock operations to impart stability to domestic price stabilization;
(viii) Utilizing the medium of external trade for domestic price stabilization;
(ix) Fiscal measures including adjustments in duties/taxes/levies;
(x) Development of appropriate technology for processing of agricultural produce;
(xi) Improving the data base for formulation of price policy.

**Activity 1**

1. What do you understand by Cobweb model? Discuss its relevance in agricultural pricing.
2. Discuss the behaviour of agricultural prices in India.
3. Give an account of agricultural marketing and warehousing. Discuss how warehousing is an important factor in boosting the agricultural productivity.
4. Write short notes on agricultural price policy and agricultural taxation in India.

**1.10 SUMMARY**

The unit discusses the agricultural pricing and related policies in India. Agricultural sector is too vital for India's economy to be put on the back-burner. It needs to free from the discriminatory policies, and resurrected with necessary incentives and safeguards, and provided with benefits similar to the industries such as easy availability of inputs, credit and infrastructural facilities. The Government should strive to channelize greater private and public investment in areas of infrastructural development, research and development, marketing and processing etc., leading to higher productivity and greater efficiency in agricultural production. After introducing the importance of agriculture sector unit throws light on behaviour of agricultural prices in India. Cobweb model of prices and income stability was discussed followed by agricultural marketing policy and price policy. Agricultural taxation in India had been described and crop insurance in India was explained in detail finally terms of trade between agricultural and non agricultural prices were discussed.

**1.11 FURTHER READINGS**

UNIT 2

AGRICULTURAL GROWTH IN INDIA

Objectives

Upon successful completion of this unit, you should be able to:

- Understand the pattern of agricultural growth since liberalization
- Know the approaches to food security and public distribution system
• Elaborate the way of supply of inputs
• Describe distribution from technological change and strategy of agricultural development
• Explain the concept of sustainable agriculture
• Discuss globalisation and its relevance in agricultural growth of India
• Describe the impact of WTO on India agriculture

Structure

2.1 Introduction
2.2 Agricultural growth in India since 1991
2.3 Food security in India
2.4 Public distribution system in India
2.5 Shifts in cropping patterns
2.6 Supply of inputs
2.7 Distribution of gains from technological change
2.8 Strategy of agricultural development
2.9 Sustainable agriculture
2.10 Globalisation and agriculture
2.11 Impact of WTO on Indian agriculture
2.12 Summary
2.13 Further readings

2.1 INTRODUCTION

The overall growth and technical change in the agricultural sector has large implications on expanding the economic base and poverty alleviation process in India. Past empirical studies have shown that ultimately the growth in productivity of all factors (TFP) in agriculture is the backbone for alleviating rural poverty in developing countries (Fan et al., 1999; Mellor, 2001 and 2000; Desai, 2002). Agricultural growth has a profound impact on poverty reduction in the developing countries including the reduction of the inequity over time.

Agriculture Growth Rate in India GDP had been growing earlier but in the last few years it is constantly declining. Still, the Growth Rate of Agriculture in India GDP in the share of the country's GDP remains the biggest economic sector in the country.

India GDP means the total value of all the services and goods that are produced within the territory of the nation within the specified time period. The country has the GDP of around US$ 1.09 trillion in 2007 and this makes the Indian economy the twelfth biggest in the whole world.

The growth rate of India GDP is 9.4% in 2006-2007. The agricultural sector has always been an important contributor to the India GDP. This is due to the fact that the country is
mainly based on the agriculture sector and employs around 60% of the total workforce in India. The agricultural sector contributed around 18.6% to India GDP in 2005.

Agriculture Growth Rate in India GDP in spite of its decline in the share of the country’s GDP plays a very important role in the all round economic and social development of the country. The Growth Rate of the Agriculture Sector in India GDP grew after independence for the government of India placed special emphasis on the sector in its five-year plans. Further the Green revolution took place in India and this gave a major boost to the agricultural sector for irrigation facilities, provision of agriculture subsidies and credits, and improved technology. This in turn helped to increase the Agriculture Growth Rate in India GDP.

The agricultural yield increased in India after independence but in the last few years it has decreased. This in its turn has declined the Growth Rate of the Agricultural Sector in India GDP. The total production of food grain was 212 million tonnes in 2001-2002 and the next year it declined to 174.2 million tonnes. Agriculture Growth Rate in India GDP declined by 5.2% in 2002-2003. The Growth Rate of the Agriculture Sector in India GDP grew at the rate of 1.7% each year between 2001-2002 and 2003-2004. This shows that Agriculture Growth Rate in India GDP has grown very slowly in the last few years.

Agriculture Growth Rate in India GDP has slowed down for the production in this sector has reduced over the years. The agricultural sector has had low production due to a number of factors such as illiteracy, insufficient finance, and inadequate marketing of agricultural products. Further the reasons for the decline in Agriculture Growth Rate in India GDP are that in the sector the average size of the farms is very small which in turn has resulted in low productivity. Also the Growth Rate of the Agricultural Sector in India GDP has declined due to the fact that the sector has not adopted modern technology and agricultural practices. Agriculture Growth Rate in India GDP has also decreased due to the fact that the sector has insufficient irrigation facilities. As a result of this the farmers are dependent on rainfall, which is however very unpredictable.

Agriculture Growth Rate in India GDP has declined over the years. The Indian government must take steps to boost the agricultural sector for this in its turn will lead to the growth of Agriculture Growth Rate in India GDP.

### 2.2 AGRICULTURAL GROWTH IN INDIA SINCE 1991

Following are the highlights of a DRG (Development Research Group) study by the RBI titled "Agricultural Growth in India since 1991". The authors have studied the movements in various factors post 1991 identified by past researchers as detrimental to agricultural growth in India. This study focuses only on crop agriculture and not other components of agriculture such as animal husbandry, fisheries and forestry. The main observations of the study are

- The period since 1991 has been a turning point for Indian agriculture when the growth in the sector resurgent from the middle sixties was arrested.
• An across the-board slowing of output and yield growth since 1991 for the two main groups (Food and Non-food) in Indian crop agriculture was witnessed.
• Shrinking farm size has been one of the reasons for a slowdown in the growth. Smaller holding-size makes it more difficult for the majority of Indian farms to access new technology and adopt more efficient forms of production.
• Thus capital intensive investment also called the 'land improvement factor' is very likely inconceivable for the largest number of Indian farmers today not only due to their meager asset base but also due to small holding size. The slower growth of yield since 1991 may, at least to an extent, be related to this aspect.
• Along with the shrinking farm size environmental/ecological stress is also reported for the agricultural sector which is reflected in loss of soil nutrients and declining water availability.
• This contributes directly to potential yield loss that can be compensated, if at all, only via greater expenditure which eventually increases cost of production which a smaller farm strapped for credit cannot handle.
• Capital formation in Indian agriculture is undertaken by both government and the private sector. However, there is an economic distinction between these. Almost all of the public investment is in the nature of a public good, i.e., it is non-excludable, and for that reason unlikely to be undertaken by the private sector.
• Hence, public investment is a vital input in the agricultural production but it has more or less remained stagnant since 1991.
• For agricultural production, irrigation is arguably the most important input after seed, and the most important element of public capital formation. However, growth in coverage of irrigated area in all the main crop categories has slowed in the nineties.
• Agricultural economists have long pointed to the importance of research and extension to the acceleration of agricultural growth in the past which enhance productivity. Since acreage expansion is more or less infeasible the future growth has to come from a rise in productivity.
• Hence, expenditure is imperative on research and extension front however, public support for expanding the knowledge base for agriculture is shrinking since 1991. Public expenditure on this item is low as a share of agricultural output in India by international standards.
• However, it should not be inferred from the entire study that these are the only problems faced by Indian agriculture and a solution to these problems will yield a greater growth but no doubt they are among the key and most talked about factors.

2.3 FOOD SECURITY IN INDIA

Food security has been a major developmental objective in India since the beginning of planning. India achieved self-sufficiency in food grains in the 1970’s and has sustained it since then. But the achievement of food grain security at the national level did not percolate down to households and the level of chronic food insecurity is still high. Over 225 million Indians remain chronically under nourished. In 2000-01, about half of the rural children below five years of age suffered from malnutrition and 40% of adults
suffered from chronic energy deficiency. Such a high level of wasting away of human resources should be a cause for concern.

In recent years, there has been a shift in policy focus towards household level food security and per capita food energy intake is taken as a measure of food security. The government has been implementing a wide range of nutrition intervention programmes for achieving food security at the household and individual levels. The Public Distribution System (PDS) supplies food items, such as food grains and sugar, at administered prices through fair price shops. There have been a range of food-for-work and other wage employment programmes. Another approach adopted by the government is to target women and children directly; this includes mid-day meal programme for school going children and supplementary nutrition programme for children and women.

According to NSS, per capita cereal consumption has been declining since the early 1970’s despite a significant rise in per capita cereal production. This can be attributed to changes in consumer tastes, from food to non-food items and, within food group, from coarse to fine cereals. The decline in cereal consumption has been greater in rural areas, where the improvement in rural infrastructure has made other food and non-food items available to rural households.

The reality is that the bottom 30% of the population has not shown any improvement in cereal and calorie intake in the rural and urban areas despite a significant improvement in their real per capita expenditure. Their per capita calorie intake (1600 to 1700) falls short of the required norm. Intra-family food distribution is also inequitable in the rural households and the pre-school children get much less than their physiological needs as compared to adult males and females. Micronutrient deficiency is common among people. Diets of about 80% of the rural population contain less than half of the normal requirement of vitamin-A. This deficiency leads to preventable blindness. Iron deficiency is widely prevalent among pregnant women. This results in a high incidence of low birth weight children, which in turn contributes to malnutrition.

The most important challenge is to increase the energy intake of the bottom 30% of the population and at the same time facilitate diet diversification to meet micronutrient deficiency. The food gap can be met from the existing foodgrain stocks in the medium term and by increasing their purchasing power in the long run through increasing job opportunities. The micronutrient deficiency can be rectified through supplementary nutrition and supply of fortified food. There is also a need to improve the efficiency of the various food schemes initiated by the government and make it more available and free of corruption and urban bias.

### 2.4 Public Distribution System in India

A combination of good monsoon years and a policy of ensuring relatively higher returns on production of rice and wheat has ensured that the country has a surfeit of foodgrains accumulated in the godowns of the Food Corporation of India (FCI), far beyond the prescribed buffer stock norms. The problem facing the country today is not one of
shortage of foodgrains but of managing the surplus. Ironically, even as the godowns of the FCI are overflowing, stray cases of starvation deaths are still being reported. A civilised society in the 21st century cannot allow this to happen.

Therefore, while there is need to produce adequate food grains domestically, supplementing with imports whenever required, it is also necessary to look at the food grain distribution network. The Public Distribution System (PDS) in the country facilitates the supply of food grains to the poor at a subsidised price. However, doubts have been raised about the efficacy and cost-effectiveness of the PDS, especially in the light of the growing food subsidy and food stocks. The PDS needs to be restructured and there is a need to explore the possibility of introducing innovative ideas such as smart cards, food credit/debit cards, food stamps and decentralized procurement, to eliminate hunger and make food available to the poor wherever they may be in cost-effective manner.

There are two aspects to the paradox of overflowing godowns and vulnerable sections of society not consuming adequate food. One is the issue of having enough purchasing power or income to buy food and the other is the access to food in terms of physical availability of food. Though the overall employment generation is closely connected to efficient economic growth, there are some issues that must be kept in mind. In remote, inaccessible and backward regions both job opportunities and access to food may be constrained. In such situations, food-for-work and related schemes are necessary. These may need to be supplemented by more innovative schemes like grain banks.

Community grain banks can be set up in such areas from where the needy can borrow grain in times of need and repay the grain once the crisis is over. Natural disasters such as earthquakes also create conditions in which the Government must provide emergency assistance and the administration has to be alert to such situations. Finally, a minimal amount of social security must be provided to those who are old, sick or disabled and cannot take on work even if it is available. Special schemes must ensure that they do not go hungry.

2.4.1 Changes in Food Consumption Pattern
Dramatic changes in food consumption patterns have taken place in India in the post Green Revolution period. Between 1972-73 and 1993-94, the food basket has become much more diversified, with the share of cereals seeing a dramatic decline of ten percentage points in most regions. At the all-India level, cereal consumption in the rural areas declined from 15.3 kg per capita per month in 1972-73, to 13.4 kg per capita per month in 1993-94.

The corresponding decline in the urban areas was more modest — from 11.3 kg to 10.6 kg over the same period. At the same time, consumption of milk and meat products as well as vegetables and fruits has increased. Such changes are a natural outcome of economic development. This trend towards a more diversified diet is also discernible among the poorest 25 per cent of the population. Thus although cereals continue to dominate food expenditures, over time their importance has decreased. At the same time,
cereals have become cheaper in relation to other food groups. In rural Uttar Pradesh, for example, the per capita monthly consumption of cereals for the lowest quartile income group has declined from 13.6 kg in 1972-73 to 12.3 kg in 1993-94.

During the period, the consumption of coarse cereals declined from 5.0 kg per capita per month in 1972-73 to 0.8 kg per capita per month. This was only partly offset by an increase in the per capita monthly consumption of rice from 2.6 kg to 3.5 kg and that of wheat from 6.1 kg to 8.1 kg. During the same period, the share of cereals in the total food expenditure among the lowest quartile income group in the state declined from 69 per cent to 49 per cent while that of milk, meat, vegetables and fruits increased from 7 to 12 per cent and that of other food items from 17 to 28 per cent. 3.4.6 Thus the growth of aggregate demand for cereals in the country can be said to have been kept in check due to two factors — slowdown in the pace of population growth and shift in consumer preference towards non-cereals.

However, some of the studies on cereal consumption requirements in the country have not taken into consideration the full implications of changing consumer preferences and have led to exaggerated demand projections for cereals. At the same time, other demand projections which take these changing preferences into account come out with estimates which match the supply projections, indicating that the requirements of cereals will be adequately met by domestic supplies at least up to 2020. Thus there is no need for undue concern on this front.

2.4.2 MSP and Food Procurement Policy

The stock of food grains available with the government agencies as on 1 July 2002 was 63.01 million tonnes (mt) — 21.94 mt of rice and 41.07 mt of wheat. This was well above the prescribed buffer stock norms. While the changing demand patterns is one reason for the accumulation of surplus food grains, another factor is the tendency of successive governments to fix minimum support prices (MSP) for paddy and wheat in excess of the levels prescribed by the Commission for Agricultural Costs and Prices (CACP) (Table 3.4.1). While this has given the farmers an incentive to produce more, it has raised the market prices and reduced the demand for cereals. Studies conducted at the National Council of Applied Economic Research, New Delhi, show that fixing of procurement prices at levels higher than the CACP’s recommendations has led to the procurement of an additional quantity of 12.8 mt of wheat and 3.4 mt of rice. This point to the need to strictly adhere to the recommendations of the CACP. A realistic MSP will help promote the diversification of cropping patterns.

led to much higher average productivity of these two crops, compared to the average productivity of pulses or coarse cereals. The higher MSP increased the profitability of these crops and motivated the farmers to divert their areas to these crops from coarse cereals, pulses and even oilseeds, as in the case of Punjab. This enabled the country to achieve higher output of food grains and achieve surpluses. However, the need to rethink this approach is overdue.
Cropping activities go on all the year-round in India, provided water is available for crops. In northern India, there are two distinct seasons, *kharif* (July to October), and *rabi* (October to March). Crops grown between March and June are known as *zaid*. In some parts of the country, there are no such distinct seasons, but there they have their own classification of seasons. The village revenue officials keep plot-wise record of crops grown in each season. These are annually compiled district-wise, state-wise and on all-India basis. From these records one could calculate the relative abundance of a crop or a group of crops in a region. These crops are grown sole or mixed (mixed-cropping), or in a definite sequence (rotational cropping). The land may be occupied by one crop during one season (mono-cropping), or by two crops (double-cropping) which may be grown in a year in sequence. Of late, the trend is even more than two crops (multiple-cropping) in a year. These intensive cropping may be done either in sequence or even there may be relay-cropping-one crop undersown in a standing crop. With wide-rowed slow growing cropping patterns, companion crops may be grown. There are various ways of utilising the land intensively. It is proposed to give a synoptic view of cropping patterns prevalent in the country. Before dealing with the cropping patterns, brief descriptions of the factors that determine the cropping systems of an individual locality or region are briefly presented here.

In any locality, the prevalent cropping systems are the cumulative results of past and present decisions by individuals, communities or governments and their agencies. These decisions are usually based on experience, tradition, expected profit, personal preferences and resources, social and political pressures and so on. Essentially, they are answers to some of the following questions:

- What with the present pest-and-disease control methods are ecologically practicable?
- What interactions occur among the ecologically practicable crops, and the chosen crops and must be combined in a special way (rotations) in the farming systems?
- Are any of the ecologically feasible crops ruled out by infrastructural factors?
- Which of the crops, now remaining on the list, are most profitable (or yield most food in a subsistence agriculture)? In what combinations and at what level of input application would they make the best use of local land, climate and input resources in short-term and long-term situations bearing in mind the degree of food and income security required by the individual farmer and the community?
- What operational factors rule out or amend the size and the method of any of the economically preferable crop combinations thereof?
- Finally, are the crop combinations, the farming systems and the input levels suggested by this process of the individual farmers compatible with his own skills, enterprise preferences, health, age and capital?

The climatic, edaphic and socio-economic diversity of the Indian crop-production scene is dotted with many cropping patterns. With a geographic area of 328.048 million hectares, stretching between 8°N and 36°N latitude and between 68°E and 98°E longitude,
its altitude varying from the mean sea-level to the highest mountain ranges of the world, India presents a range and diversity of climate, flora and fauna, with a few parallels in the world. The country presents a paradox of containing in it the station with the highest mean annual rainfall in the world (Cherrapunji in Assam) and also dry, semi-desert area in Rajasthan. The variability of rainfall is most important in all the states, but especially where rainfall is low. In parts of Rajasthan and the Deccan, the variability is more than 100 per cent of the mean. Years of drought account for only too frequent a history of crop failures, whereas the years of flood also cause very considerable loss of agricultural production. Temperatures also vary greatly, both geographically and seasonally. Northern and central parts of India in January have temperature comparable with those in Europe in July, though with a greater daily range, but in these places in the pre-monsoon months the maximum temperatures of over 40°C are reached over a large area. Frost may occur in winter in the plains, as far south as a line drawn through Madhya Pradesh and may be heavy in Kashmir and areas north of Punjab.

Socio-economically, the peasantry ranges from the relatively affluent Punjabi farmers who operate with a high input intensity in agriculture to the subsistent farmers of eastern and central India. They even today, sometimes practice shifting cultivation. Between these two extremes, various intensities of cultivation are practised. The outstanding fact on the socio-economic is the smallness of holdings, the average farm-size in most areas being lower than that is in most tropical countries.

Crops production, therefore, presents such an enormous diversity owing to differences in latitude, altitude and variability of rainfall and edaphic diversity which have presented in detail in the book. Thus it may not be possible to enumerate and describe here every type of cropping pattern prevalent in the country. Some broad contours of farming, however, emerge. The most important element of farming in India is the production of grains and the dominant food-chain is grain-man. On this basis, the country may be divided broadly into five agricultural regions.

- The rice region extending from the eastern part to include a very large part of the north-eastern and the south-eastern India, with another strip along the western coast.
- The wheat region, occupying most of the northern, western and central India.
- The millet-sorghum region, comprising Rajasthan, Madhya Pradesh and the Deccan Plateau in the centre of the Indian Peninsula.
- The temperate Himalayan region of Kashmir, Himachal Pradesh and Uttar Pradesh and some adjoining areas. Here potatoes are as important as cereal crops (which are mainly maize and rice), and the tree-fruits form a large part of agricultural production.
- The plantation crops region of Assam and the hills of southern India where good quality tea is produced. There is an important production of high-quality coffee in the hills of the western peninsular India. Rubber is mostly grown in Kerala and parts of Karnataka and Tamil Nadu. There are some large estates, but most of the growers would come under the category of small holders. Sugarcane, which in
many countries is a plantation crop, is almost entirely grown by small holders in India.

There had been substantial investments in major irrigation works in the colonial days. The post-Independence era saw many multi-purpose irrigation works. Lately, interest in the medium and minor irrigation works has increased, especially after the drought of 1966. Thus, at present, an all-India irrigation potential of 38.5m ha has been created and is expected to increase up 110 m ha by 2025. Irrigation, especially the minor works, has provided a base for multiple-cropping. The All-India Co-ordinated Crops-Improvement Projects run co-operatively by the Indian Council of Agricultural Research and the agricultural universities have generated short-season, photo-period-insensitive high-yielding varieties of various crops suitable for a high intensity of cropping. The adaptability of these varieties on the farmer's fields has been demonstrated in the National Demonstration Programme spread all over the country. The various developmental and the educative programmes, especially the High Yielding Varieties Programme, have also resulted in newer cropping patterns involving intensive cropping. The area of rice has increased in Punjab and Haryana. Similarly wheat is now grown in West Bengal and to some extent in the southern states of the country.

All these factors have led to the present cropping patterns, which are getting more and more intensive both in respect of the number of crops grown per year and in respect of the intensity of inputs utilized in the production of these crops.

2.5.1 THE PRESENT CROPPING PATTERNS

As indicated earlier in this chapter, we can hardly describe all the cropping patterns within the framework of this chapter. Therefore only important ones are highlighted. There are many ways in which a cropping pattern can be discussed.

A broad picture of the major cropping patterns in India can be presented by taking the major crops into consideration. To begin with, the south-westerly monsoon crops (kharif), bajra, maize, ragi, groundnut and cotton. Among the post-monsoon crops (rabi), wheat, sorghum (rabi)and gram can also be considered to be the base crops for describing the cropping patterns. With such an approach, the crop occupying the highest percentage of the sown area of the region is taken as the base crop and all other possible alternative crops which are sown in the region either as substitutes of the base crop in the same season or as the crops which fit in the rotation in the subsequent season, are considered in the pattern. Also these crops have been identified as associating themselves with a particular type of agro climate, and certain other minor crops with similar requirements are grouped in one category. For example, wheat, barley and oats, are taken as one category. Similarly the minor millets (Paspalum, Setaria and Panicum spp.) are grouped with sorghum or bajra. Certain other crops, such as the plantation crops and other industrial crops are discussed separately.

2.5.2 THE KHARIF-SEASON CROPPING PATTERNS
Among the kharif crops, rice, jowar, bajra, maize, groundnut and cotton are the prominent crops to be considered the base crops for describing the kharif cropping patterns.

**The rice-based cropping patterns:** Rice is grown in the high-rainfall area or in areas where supplemental irrigation is available to ensure good yields. If the crop has to depend solely on rainfall, it requires not less than 30 cm per month of rainfall over the entire growing period. However, only 9 per cent of the area in the country comes under this category, and it lies in the eastern parts. Nearly 45 per cent of the total rice area in India receives 30 cm per month of rainfall during at least two months (July and August) of the south-westerly monsoon and much less during other months. In contrast to these parts, the eastern and southern regions comprising Assam, West Bengal, coastal Orissa, coastal Andhra Pradesh, Karnataka (most part), Tamil Nadu and Kerala receive rainfall of 10 to 20 cm per month in four to eight consecutive months, starting earlier or going over later than the south-westerly monsoon months. With supplemental irrigation, 2 or 3 crops are taken in these areas. However, it has been observed that on an all-India basis, nearly 80% of rice is sown during June-September and the rest during the rest of the season. Area-wise the mono-season belt occupies 53.6 per cent of the area (comprising Assam, West Bengal, coastal Orissa, coastal Andhra Pradesh, parts of Tamil Nadu, Karnataka and Kerala).

On an all-India basis, about 30 rice-based cropping patterns have been identified in different states. In the most humid areas of eastern India comprising Tripura, Manipur and Mizoram, rice is the exclusive crop. In Meghalaya, rice is alternated with cotton, vegetable and food-crops, whereas in Arunachal Pradesh, where rice is not grown exclusively, the alternative crops being maize, small millets and oilseeds. In parts of Assam, West Bengal, Bihar, Orissa and northern coastal districts of Andhra Pradesh, jute forms an important commercial crop alternative to rice. In West Bengal, besides rice and jute, pulses and maize are grown on a limited scale. In Bihar, rice is grown over 49 per cent (5.3 m ha) of its cropped area (14.2 per cent of all-India area), whereas pulses, wheat, jute, maize, sugarcane and oilseeds are the alternative crops. In Uttar Pradesh rice is grown on 19 per cent (4.6 m ha) of its cropped area and represents about 12.4 per cent of the all-India area under this crop. Rice is concentrated in the eastern districts of Uttar Pradesh where the alternative crops are pulses, groundnut, sugarcane, bajra and jowar in the decreasing order of their importance. Tobacco is grown in some districts.

In Orissa, rice is grown on more than 50 per cent of the area, whereas the alternative crops are: pulses, ragi, oilseeds, maize and small millets. In Madhya Pradesh rice is grown in the Chattisgarh area on 4.3 m ha (11.7 per cent of the all-India rice area), but the crop suffers because of inadequate rainfall and irrigation. The important alternative crops of this area are: small millets, pulses and groundnut. Wheat is also grown on a limited scale.

In the southern states, namely Andhra Pradesh, Tamil Nadu and Kerala rice is grown in more than one season and mostly under irrigation or under sufficient rainfall. Together, these three states have over 6.0 m ha, representing over 17 per cent of the all-India area
under rice. Important alternative plantation crops in Andhra Pradesh are: pulses, groundnut, jowar, maize, sugarcane and tobacco. In Karnataka the crops alternative to rice are: ragi, plantation crops, bajra, cotton, groundnut, jowar and maize. In Kerala plantation crops and tapioca form the main plantation crops alternative to rice. In Maharashtra rice is grown mostly in the Konkan area over 1.3 m ha, along with ragi, pulses, rabi jowar, sugarcane, groundnuts and oilseeds. in other states, namely Gujarat, Jammu and Kashmir, Rajasthan and Himachal Pradesh, rice forms a minor plantation crop and is mostly grown with irrigation. However, in Punjab and Haryana and to some extent in western Uttar Pradesh owing to high water-table during this monsoon season, rice has become a major crops in such areas.

**The kharif cereals other than rice:** Maize, jowar and bajra form the main kharif cereals, whereas ragi and small millets come next and are grown on a limited area. by and large, maize is a crop grown commonly in high-rainfall areas, or on soils with a better capacity for retaining moisture, but with good drainage. Next comes jowar in the medium rainfall regions whereas bajra has been the main crop in areas with low or less dependable rainfall and on light textured soils. The extent of the area under these crops during the south-westerly monsoon season is maize, 5.6 m ha; jowar (kharif), 11 mha, and bajra, 12.4 m ha. Even though these crops are spread all over the western, northern and southern India, the regions of these crops patterns are demarcated well to the west of 80° longitude (except that of maize). Ragi as a kharif cereal (2.4 m ha) is mainly concentrated in Karnataka, Tamil Nadu and Andhra Pradesh which account for main than 60 per cent of the total area under this crop in India. The cropping patterns based on each of these kharif cereals are discussed.

**The maize-based cropping patterns:** The largest area under the kharif maize is in Uttar Pradesh (1.4m ha), followed by Bihar (0.96 m ha), Rajasthan (0.78 m ha), Madhya Pradesh (0.58 m ha) and Punjab (0.52 m ha). In four states namely Gujarat, Jammu and Kashmir, Himachal Pradesh and Andhra Pradesh, the area under maize ranges from 0.24 to 0.28 m ha in each, whereas other states have much less area under it. Taking the rainfall of the maize growing areas under consideration, over 72 per cent of the areas receive 20-30 cm per month of rainfall in at least two months or more during the south westerly monsoon season.

On the all-India basis, about 12 cropping patterns have been identified. They have maize as the base crop. In the maize growing areas of Uttar Pradesh and Bihar, rice in kharif and wheat in rabi are the main alternative crops. In some areas, bajra, groundnut, sugarcane, ragi and pulses are taken as alternative crops. In Rajasthan maize is grown as an extensive crop in some areas, whereas at other places, it is replaced by small millets, pulses, groundnut and wheat(rabi) as alternative crop. in madhya Pradesh mainly the kharif jowar is replaced by maize, whereas rice and groundnut are also grown to a limited extent. In Punjab maize has groundnut, fodder crops and wheat(rabi) as alternative crops. In other states, e.g. Gujarat, rice, groundnut, cotton and wheat form the alternative crops in the maize-growing areas of Himachal Pradesh, whereas in Andhra Pradesh, rice, kharif jowar, and oilseeds are grown in these areas.
The kharif jowar-based cropping patterns: The area under the kharif jowar in India is highest in Maharashtra (2.5 m ha), closely followed by Madhya Pradesh (2.3 m ha), whereas in each of the states of Rajasthan, Andhra Pradesh, Karnataka and Gujarat, the area under this crop is between 1.0 and 1.4 m ha. Jowar is mainly grown where rainfall distribution ranges from 10-20 per month at least for 3 to 4 months of the south-westerly monsoon or is still more abundant.

On the all-India basis, about 17 major cropping patterns have been identified. In them the base crops is kharif jowar. Most of the alternative crops are also of the type which can be grown under medium rainfall.

In Maharashtra cotton, pulses, groundnut and small millets are sown as alternative crops. In the adjacent states of Madhya Pradesh, besides the above alternative crops, wheat and fodder are sown. In Rajasthan wheat, cotton, bajra and maize are grown in the kharif-jowar tract, whereas in Andhra Pradesh, groundnuts, cotton, oilseeds and pulses form the main alternative crops. Besides cotton and groundnut, ragi is sown in the kharif-jowar tract of Karnataka, whereas in Gujarat, bajra, cotton and groundnut are the major alternative crops.

The bajra-based cropping patterns: Bajra is more drought-resistant crop than several other cereal crops and is generally preferred in low-rainfall areas and on light soils. The area under the bajra crop in India is about 12.4 m ha and Rajasthan (4.6 m ha) shares about the 2/3 total area. Maharashtra, Gujarat and Uttar Pradesh together have over 4.6 m ha, constituting an additional 1/3 area under bajra, in India. Over 66 per cent of this crop is grown in areas receiving 10-20 cm per month of rainfall, extending over 1 to 4 months of the south-westerly monsoon.

On the all-India basis, about 20 major cropping patterns have been identified with bajra. However, it may be observed that jowar and bajra are grown mostly under identical environmental conditions and both have a wide spectrum adaptability in respect of rainfall, temperature and rainfall.

Considering the cropping patterns in different states, bajra is grown along with pulses, groundnut, oilseeds and kharif jowar in Rajasthan. Gujarat has a similar cropping pattern in its bajra areas, except that cotton and tobacco are also grown. In Maharashtra besides having some areas solely under bajra, pulses, wheat, rabi jowar, groundnut and cotton are substituted for it. In Uttar Pradesh, maize, rice and wheat form the main alternative crops to this crop.

The groundnut based cropping patterns: Groundnut is sown over an area of about 7.2 m ha, mostly in five major groundnut-producing states of Gujarat (24.4 per cent area), Andhra Pradesh (20.2) per cent), Tamil Nadu (13.5 per cent), Maharashtra (12.2 per cent) and Karnataka (12.0 per cent). Five other states viz. Madhya Pradesh, Uttar Pradesh, Punjab, Rajasthan and Orissa together have about 17.3 per cent of the total area under this crop. The rainfall in the groundnut area ranges from 20-30 cm per month in one of the monsoon months and much less in the other months. In some cases the rainfall is even
less than 10 cm. per month during the growth of the crop. The irrigated area under groundnut is very small and that too, in a few states only, viz. Punjab (16.4 per cent), Tamil Nadu (13.3 per cent) and Andhra Pradesh (12.5 per cent).

On the all-India level, about 9 cropping patterns have been identified with this crop. In Gujarat besides the sole crop of groundnut in some areas, bajra, is the major alternative crop, whereas the kharif jowar, cotton and pulses are also grown in this tract. In Andhra Pradesh and Tamil Nadu, this crop receives irrigation in some areas and rice forms an alternative crop. Under rainfed conditions, bajra, kharif jowar, small millets, cotton and pulses are grown as alternative crops. In Maharashtra both the kharif and rabi jowar and small millets are important alternative crops. In Karnataka also, jowar is the major alternative crop, whereas cotton, tobacco, sugarcane and wheat are also grown in this tract.

**The cotton-based cropping patterns:** Cotton is grown over 7.6 m ha in India. Maharashtra shares 36 per cent (2.8 m ha), followed by Gujarat with 21 per cent (1.6 m ha), Karnataka with 13 per cent (1 m ha) and Madhya Pradesh with 9 per cent (0.6 m ha) of the area. Together, these four states account for about 80 per cent of the area under cotton. Other cotton-growing states with smaller areas are Punjab, with 5 per cent (0.4 m ha), Andhra Pradesh and Tamil Nadu each with 4 per cent (0.31 m ha), Haryana and Rajasthan with 3 per cent of each (0.2 m ha each). Most of the cotton areas in the country are under the high to medium rainfall zone. The cotton grown in Madhya Pradesh, Maharashtra, Karnataka, and Andhra Pradesh (4.8 m ha) is rainfed, whereas in Gujarat and Tamil Nadu (1.93 m ha) it receives partial irrigation 16-20 per cent of the area. The area under cotton in Punjab, Haryana, Rajasthan and Uttar Pradesh (0.8 m ha) gets adequate irrigation, ranging from 71 to 97 per cent of the area. These growing conditions, together with the species of cotton grown, determine the duration of the crop which may vary from about 5 to 9 months.

On the all-India basis, about 16 broad cropping patterns have been identified. In Maharashtra, Madhya Pradesh, Andhra Pradesh and Karnataka, the cropping patterns in the cotton-growing areas are mostly similar owing to identical rainfall. These patterns include jowar (kharif and rabi), groundnut and small millets. Pulses and wheat are also grown in a limited area. In some pockets, where irrigation is available, rice and sugarcane are also grown. In Gujarat, rice, tobacco and maize are grown, besides the rainfed crops, e.g. jowar and bajra.

**Mixed Cropping:** In mixed cropping, crop mixtures are widely grown, especially during the kharif season. Pulses and some oilseeds are grown with maize, jowar and bajra. Lowland rice is invariably grown unmixed, but in the case of upland rice, several mixtures are prevalent in eastern Uttar Pradesh, with Chotanagpur Division of Bihar and in the Chhatisgarh Division of Madhya Pradesh. During the rabi season, especially in the unirrigated area of the north, wheat and barley and wheat and gram or wheat + barley + gram are the mixtures of grain crops. Brassica and safflower are grown mixed with gram or even with wheat. Mixed cropping was considered by researchers a primitive practice, but now many researchers regard mixed cropping as the most efficient way of using land.
Several new mixtures have recently been suggested. They ensure an efficient utilization of sunshine and land. Breeders are developing plant types in pulses and oilseeds, with good compatibility with row crops.

**The future of cropping patterns:** With the increase in population, the irrigated area is increasing and with advances in agricultural science, most of the extensive cropping patterns are giving way to intensive cropping. The development in minor irrigation works has especially provided the farmers with opportunities to crop their land all the year round with high-yielding varieties. This intensive cropping will require an easy and ready availability of balanced fertilizers and plant protection chemicals and an appropriate price policy for inputs and agricultural produce.

India is a country of small farmers. In the future the size of the holdings will diminish further. The country has to produce enough for its people without deteriorating the quality of the environment. This is the challenge of the future for the farmers, agricultural scientists, extension workers and administrators.

### 2.6 SUPPLY OF INPUTS

The use of Satellite Remote Sensing with high spatial resolution and hyper spectral resolution is not yet common. High spatial resolution data of one metre and even less has been used, though not in India. This was available more than two years ago, although its distribution in India is through the National Remote Sensing Agency and is more expensive than direct purchase from the United States, which is not permissible. The application of such data to agricultural activity is much more now. Our future lies in agricultural and rural development. Unfortunately a great majority of farmers are small landholders and the use of satellite data towards their benefit has to be tackled innovatively. Precision Agriculture, which people in India have started advocating only recently, has also not been clearly evolved. The details of the ground and its three dimensional character are not clearly known. Geographically accurate topographical maps with close contours to show the drainage pattern at micro level are not available. So people try to use 1: 50,000 scale topographical maps with 20 metre contour interval to define micro-watershed to exploit and conserve the limited rainwater.

The Water Technology Centre of Indian Agricultural Research Institute (IARI) has understood this, but, according to them, financial resources available are inadequate. But once such infrastructure is developed, it is perpetual and gives a sustainable base, whatever the size of the landholding. About 49 per cent of our food comes from semi-arid, area, where the rainfall is low, runoff and evaporation loss is high. Even in reasonably well-irrigated areas, water use efficiency is rather low and efforts should be made to improve this, not only by creating check dams, but also by other means.

Ground levelling is an important aspect to define micro-watershed. In fact, precision farming, if adopted to suit Indian conditions, may bring in another kind of food production revolution, helped by a proper Land Information System and high-resolution satellite data. The "IKNOS" one-metre resolution data is said to be geographically
accurate only to the extent of two to four metres and it needs to be corrected for effective utilisation. This is done by using differential Global Positioning System (G.P.S.), although this also has its some limitations. We now use lasers and digital levels to reduce field level cost and if these were combined with high-resolution satellite data, our productivity would certainly go up. It is not that our leaders are unaware of this, but limited action on the ground is standing in the way. To involve people with resources, we need to persuade them to adopt contract farming, towards which government leaders should work.

There are also other methods of improved rice growing, as this is one of the staple foods of many in developing countries where methods like "Systems Rice Intensification programme" (SRI), initially perhaps evolved in Madagascar in Africa. In this too high-resolution satellite data may find great use. Mapping and analysing variability in field conditions and linking such spatial relationships, to management action, places production agriculture at the cutting edge of Geographical Information Systems (G.I.S.)/Land Information Systems (L.I.S.) applications supported by near real time satellite remote sensing data. Since high spatial resolution satellite data is now available, we need not feel that small landholdings are a disadvantage, but can be an advantage.

Therefore let us not under estimate the correct and proper scientific use or input into our agricultural activity, in the innovative use of such satellite data. Inputs for agricultural production can be distinguished by their cost relevance and their infrastructural requirements. Some inputs like grain seeds or granular mineral fertilizer in bags have lower requirements and are fairly easy to handle, others like liquid chemical pesticides have higher requirements particularly in terms of handling and user knowledge in order to avoid environmental and safety hazards.

Agricultural equipment, implements and machinery are among the most demanding of agricultural inputs. Mechanization inputs usually represent a fairly high share of investment capital of a farm, their correct use can be complicated and requiring high level of knowledge and abilities and they usually need a complex infrastructure to be operated in a sustainable way. This infrastructure includes repair facilities, spare and wear part supply as well as a supply of other inputs for their operation like fuel and lubricants.

Experience in the past has shown that the traditional approach of a centralized procurement and supply of agricultural mechanization inputs has proven not to be sustainable. It often has led to undesirable side effects in social structures and is counter-productive for the development of independent sustainable supply structures. Economical losses for the countries and farmers were often a consequence and were counterbalancing the obvious savings achieved by tendering large quantities of similar items.

2.6.1 Chemical Fertilizers

After independence the use of fertilizers in India in the last 50 years has grown nearly 170 times. In 1950 use of fertilizer per hectare in India was 0.55 Kg but by 2001-02 this figure has increased to around 90.12 Kg per hectare. Green revolution during 1960s and subsequent increased intensification of agriculture were major causes behind this growth
as seen in Fig. No. 1. Fertilizers and pesticides have become major cost of production in India along with the cost of other input like seeds, and labor cost.

Fig: 1 Consumption of Total Plant Nutrient per hectare of Gross Cropped Area

![Consumption of Total Plant Nutrient per hectare of Gross Cropped Area (1951-52 to 2000-2001)](image)

Source: Adapted by authors from the data at [http://www.indiastat.com/](http://www.indiastat.com/)

Given the differences in the intensity of agriculture and cropping patterns across the country there are wide variations in the extent of fertilizer consumption patterns across India. For instance states like Punjab, Andhra Pradesh, Haryana, Karnataka, Tamilnadu, West Bengal and Uttar Pradesh have very high average fertilizer consumption per hectare in comparison to the states like Rajasthan, Madhya Pradesh, Himachal Pradesh, Orissa, Goa and northeastern states. Per hectare fertilizer use in Andhra Pradesh as high as 179.2 Kg in 2000-01 and on the other hand in most of Eastern states it was less than 10Kg per hectare and in Rajasthan it was only 29.78 kg/hectare. Unfortunately increase in chemical usage has not inevitably led to increasing incomes of the farmers at the same rate at which it enhanced the agricultural production costs (As seen in Fig. 2 & Fig. 3).

The marginal income from land because of additional unit of chemical fertilizer and pesticide is decreasing. Another reason for increasing cost is decreasing govt. subsidies on farm inputs. The fertilizer subsidy bill for 2002-03(BE) is Rs. 11,228 crore that is Rs.716 crore less than the revised estimate of Rs. 1,944 crore and budgeted expenditure of Rs12,808 crore for 2001-02 (Economic Survey, 2002-03).

Fig: 2 Trends in Economics of Fertilizer Input on Wheat Production in India (1971-2002)
Use of fertilizer in improper ratio of N: P: K is also a major problem for Indian agriculture. While the recommended ratio is 4:2:1 this ratio of N: P: K has been around 8.5:2.6:1. This “induces initial vegetative growth, susceptible to pests, diseases, lodging and causes poor floral induction and delayed maturity thereby reducing the yield” (Hegde N. G. 2000).

2.6.2 Pesticides

Other major input for Indian agriculture is use of various pesticides, like insecticides, weedicides, fungicides, rodenticides etc. As the cropping pattern is becoming more intensive use of these pesticides is also increasing. Consumption of insecticide in agriculture has been increased more than 100% from 1971 to 1994-95. For instance, insecticide consumption in India, which was to the tune of 22013 tonnes has increased to 51755 tonnes by 1994-95. Consumption of all of these pesticides in same duration has increased more than two times, that is from 24305 tonnes to 61357 tonnes.
But in recent past, change has been observed in trends of pesticides consumption. As a consequence of adoption of bio intensive Integrated Pest Management Programme in various crops the consumption of chemical pesticide (Tech. Grade) has come down from 66.36 thousand MT during 1994-95 to 43.59 thousand MT during 2001-02 with a reduction of 27.69% (Thirty Seventh Report of Standing Committee on Petroleum and Chemicals, 2002). Consumption pattern of pesticides in India is also very different from world.

In India insecticide account for 76% of the total domestic market while herbicides & fungicides have a significantly higher share in the global market. There are wide ranges of regional variations in pesticide consumption in the country. In the year 2000-01, States of Haryana, Punjab and Uttar Pradesh by consuming more than 5,000 MT (technical grade) pesticides annually come under category I state in consumption of pesticides. States viz., Andhra Pradesh, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Rajasthan, Orissa and Tamil Nadu, which consumed between 1000 MT and 5000 MT fall in the category II states. States viz., Assam Bihar and Himachal Pradesh that consumed pesticide between 100 and 1000 MT come under category III. States viz., Arunachal Pradesh, Jammu & Kashmir, Manipur, Mizoram, Nagaland, Tripura, Delhi and Union Territory (UT) of Pondicherry consumed pesticides between 10 and 100 MT annually fall under category IV. States viz., Goa, Meghalaya, Sikkim and UTs viz., Andman & Nicobar Islands, Chandigarh, Dadara & Nagar Haveli, Daman & Diu and Lakshadweep consumed less than 10 MT pesticide annually as fall in the last category in pesticide consumption (Thirty Seventh Report of Standing Committee on Petroleum and Chemicals, 2002).

One of the consequences of indiscriminate use of pesticide is the adverse health impact on society in general and vulnerable population like children in particular. Some of the well-known health effects of pesticide exposure include acute poisoning, cancer, neurological effects and reproductive and developmental harm (CSE, 1997). The major
causes of concern in this respect are bio-accumulation of pesticides and the prolonged time period that it takes to express the negative health consequences.

2.6.3 Agricultural subsidies

The issue of agriculture subsidies is a highly politically sensitive issue and arouses strong passions both among the supporters of such subsidies and the opponents of these subsidies. The supporters have argued that food subsidy in India is essential to maintain & sustain the food security system & ensure a safety net for the poor. On the other hand, subsidies on agriculture inputs such as irrigation, power & fertilizers are necessary to enable the poor & marginal farmers to have access to them. If agriculture inputs are subsidised, the poor farmers will not be able to use them & this will lead to a decline in their income & productivity levels.

The benefits of subsidies on agricultural inputs are mostly concerned by large farmers & the industry while small & marginal farmers fail to derive much gain.

The issue of agricultural subsidies is not to be examined only from the point of view of ‘fiscal unsustainability’ but from a much wider perspective of ensuring food security & safety net for the poor & protecting the interests of the country in the new emerging international economic order that is taking shape under the aegis of the WTO.

Subsidies on agricultural inputs

Introduction of the high yielding varieties programme in the 1960s demanded to supplying irrigation, water & fertilizers to the farmers. Since these were ‘critical inputs’ for the new agricultural strategy, the Government tried to ensure that they were accessible & affordable. Subsidization of agricultural inputs thus becomes an important instrument of agricultural policy. Subsidy on fertilizers is provided by the Central Government while subsidy on water is provided by the State Governments. In this context, it is important to remember that subsidy on water is divided into two parts-power subsidy & irrigation subsidy. Total subsidy on agricultural inputs was Rs.14069 crore which rose as much as Rs.36514 crore in 2002-03, i.e., in the span of a decade, subsidy on agricultural inputs increased by two & half times.

Power & irrigation subsidies

Power & irrigation subsidies are provided by the State Governments as water & electricity fall within their domain. The main reason for the high level of high subsidies is the pricing policy of the State Electricity Boards (SEBs). The most important consequence of rapidly increasing power and irrigation subsidies is the heavy fiscal burden. Critics have been arguing that these subsidies have reached fiscally unsustainable levels & unless checked can pose serious problems for State finances. Moreover, the pricing policy on power has pushed the SEBs into heavy losses & this has, in turn, hampered their ability to undertake modernisation & upgradation of the power systems in the country. The marginal cost of power to the farmer is almost
zero. This power pricing framework provides, what Gulati & Narayanan term, ‘perverse incentives’ to the farmers leading to excessive & inefficient use of power.

The rate at which exploitation of ground water has proceeded is likely to make ground water scarcer in coming years. This could adversely affect the very sustainability of agricultural development in future as water table is likely to drop drastically. The whole method of calculating ‘power subsidy to agriculture’ is defective as the very base of calculating power consumption in agriculture is defective.

Because power is used for drawing water for irrigation, the water intensive crops (like rice & sugarcane) account for the significant portion of the subsidies. Larger farmers have benefited more from power subsidies as compared with small farmers. As far as irrigation subsidies are concerned, low price of canal water induces inefficient use of surface water & its over-exploitation. It also leads to the problems of water-logging & salinity. According to Gulati & Narayanan, rapidly increasing subsidies on canal irrigation also have adversely affected public sector investment in agriculture.

**Fertilizer subsidy**

Fertilizer subsidy is borne by the centre. This policy has been governed by the following two objectives: 1. making fertilizers available to the farmers at low & affordable prices to encourage intensive high yielding cultivation & 2. Ensuring fair returns on investment to attract more capital to the fertilizer industry. To fulfill the former objective, the Government has been statutorily keeping the selling prices of fertilizers at a largely static, uniformly low level through out the country. This has helped in increasing the demand for fertilizers considerably over the years. As far as the latter objective is concerned, the Government, under the Retention Price Scheme (introduced with effect from November 1, 1977) fixes a fair ex-factory retention price for various products of different manufacturers which allows for reimbursement of reasonable cost of production including a margin of profit, at 12% on net worth if the factory utilizes 90% of installed capacity from the second year of the plant & achieves certain norms with regard to consumption of raw materials, utilities & other inputs.

Fertilizer subsidy becomes necessary due to the twin objectives of fertilizer pricing policy under which the farmer gets fertilizers at a low rate which is predetermined, called the maximum selling price. The manufacturer is paid an amount, called the retention price which is high enough to cover his costs & yet leave a 12% post tax return on the net worth. The difference between the retention price & the selling price is the subsidy paid by the Government. For imports, the subsidy is equal to the difference between the cost of imported material & the selling price.

The burden of subsidy on the Government has increased enormously. Fertilizer subsidy was Rs. 505 crore in 1980. It rose to Rs. 4562 crore in 1993-94 & to 13800 crore in 2000-01 and further to Rs. 16127 crore in 2004-05.

Presently urea is the only fertilizer which is under Statutory Price Control. To ensure
adequate availability of fertilizers to the farmers at reasonable rates, subsidy is provided by the Government of India. Urea, the most consumed fertilizer, is subsidised under the New Urea Pricing Scheme, whereas phosphatic & potassic fertilizers, which are de-controlled, are covered, are covered under the Concession Scheme.

This had led to distorted & lopsided pattern of application of urea, phosphate & potash. The ideal average Nitrogen (N), Phosphate (P), & Potash (K) ratio use in India is 4:2:1. As against this, the ratio in India in 1991-92 was 5.9:2.4:1—not very much away the ideal ratio. However, due to the distortion in fertilizer pricing policy which made nitrogen (urea) much cheaper vis-à-vis phosphate & potash, the ratio becomes 9.7:2.9:1 in 1993-94 & stood at 10:2.9:1 in 1996-97. This imbalance in NPK consumption implying excessive use of urea had adverse environmental effects & aggravated soil fertility problems. However, imbalance has been considerably rectified in recent years. The NPK ratio in 2006-07 was 5.9:2.4:1.

As stated in the beginning, fertilizer subsidy was initiated originally to encourage increased use of fertilizers by all farmers in a bid to boost up foodgrains production so that increasing requirements of the population could be met at affordable prices. Many economists have argued in recent times that RPS has outlived its utility & must be abandoned.

It is now being suggested that investment in irrigation is a better option. Studies conducted by James B. Quizon, Kirit S. Parikh & M.H. Suryanarayana & Ashok Gulati & Pradeep K. Elasticity of foodgrains output to irrigation is much higher than that to fertilizers, & also that investment in irrigation is superior to fertilizers, & also that investment in irrigation is superior to subsidizing fertilizers from the point of view of raising foodgrains production, & equity in its distribution.

2.6.4 The Approach

In view of these well known problems AGSE has developed a different approach to donor supply of agricultural engineering inputs. Basic feature of this approach is that it is demand driven relying on commercial procedures and market forces. The new approach really starts after the need for agricultural mechanization input supply in a country has been identified, in quantitative and qualitative terms assessed and a donor has agreed upon the amount of money. In the recipient country then persons or structures are identified that qualify as commercial distribution channels for the required inputs. Those could be actually existing implement or machinery dealers, workshops with scope for widening their business, actual or potential entrepreneurs. Important is that they have a long term interest and commitment as well as the infrastructural, economical, technical and personal characteristics to successfully initiate and run the operation of an agricultural machinery dealer including the after sales service. It is desirable that these dealers have already established contacts to actual or potential clients for the mechanization inputs.
Based on the information obtained during the project formulation regarding the most urgent needs, the project identifies with a small team of experts together with the dealers the most suitable countries of origin for the supplies. For the selection information on historic supply channels or traditional regions to which the country has trade relations are considered. A market survey in the form of requests for quotation is carried out on international level, however, special consideration will be given to the above mentioned traditional supply regions. Manufacturers are approached, informed about the scope of the operation and asked for prices and eventually the provision of sample equipment in commission.

Out of the different offers which could also include the same type of equipment from different manufacturers, representing different quality and price levels, a catalogue of "project equipment" is assembled. Selection criteria should not only be the price, but also an assessment of the long term interest of the supplier in the specific market, the suitability of this supplier to the market (avoiding exotic brands unless they really show commitment) and technical quality criteria. This market survey is offered to the dealers along with technical assistance and advice on the technical features of the equipment as part of the service the project provides.

On bases of this catalogue a fair in the country and some regional field days or equipment exhibitions are organized where the farmers can see the equipment and obtain information about features and prices. Potential local dealers will be involved actively in these activities. They might at that stage not be able to cover any of the costs from their side, but they should certainly not be paid for participating. The activity should be understood by them as investment into future business. Equipment used for demonstrations would later be sold for promotional prices or returned to the supplier (depending on the arrangements made).

The dealers make their choice and approach with their offer their clients. The clients can also come directly to the project to get information about available equipment. However, the project will never deal directly with a client (farmer) but always send him to the most suitable, normally the local, dealer for purchase.

Parallel to this the potential beneficiaries would have been informed by public media campaigns or similar approaches about the scheme, the conditions and selection criteria. Subsequently they would be asked to place orders for the equipment they want with the dealers. These orders will then be collected, the applicants screened for their eligibility. Some selection might be necessary in case the orders exceed the budget available. According to the demand the dealers prepare their orders and hand them in to the project where they are consolidated into one list.

The orders will then be placed in bulk to the specific suppliers. At this stage a tendering process is not recommended, because the client should, if ever possible, receive what he/she asked for. It would therefore be preferable to negotiate with the supplier the final conditions. In any case the initial offer of the first request for quotation is available as guideline but the numbers of each item might differ from the original request. Only in
case that the supplier is abusing or withdrawing, alternative makes should be selected and the beneficiaries duly informed. This case should, however, not happen if the initial selection of potential suppliers was done thoroughly.

During this process the dealers are involved in the procedures and receive so an on the job training in international procurement. They further get into direct contact with the suppliers and eventually create direct links which can end up in formal representations. The equipment is then delivered to the project and immediately distributed to the different local dealers according to the specific orders they placed. Assembly and distribution is carried out by these dealers and their workshops, training to them provided by the supplier. The dealers would thus be involved in the operation and carry out also a major part of the distribution work. Decentralized specific project implementation structures might only be required where the bank, handling the credit contracts, does not have these structures themselves. This should, however, not be the normal case as the bank will later need decentralized structures to follow up on the payment of the credit. While the supplier will be paid directly by the donor, the farmer will pay back his/her loan to the local bank.

The dealer will receive from the project a mark-up corresponding to the equipment he has handled. This mark-up should be sufficiently large to give the dealer an incentive and allow, also from his side, investment into his business and own initiative. It should be avoided that the project equipment is very much cheaper than equipment available on the free market. The benefit for the beneficiaries, the "social component" would be the favorable credit conditions. It should under any circumstances be avoided to introduce heavily subsidized equipment into a market even if it is for a "good reason". The effects of subsidized agricultural equipment on the sustainability of farming, employment and market development are well known.

Dealers with their connections to suppliers and their experience would then decide to supply on their own more equipment under market conditions for other clients not qualifying under the project scheme. They would in this way consolidate their operation. Eventually dealers might specialize on specific brands or product lines providing after sales service and spare part supplies for these specific products. The project encourages the dealers in that case to cooperate with other dealers and supply clients that prefer other brands through the respective specialized dealer. With this approach a diversified offer with good after sales services can be established even in fairly small countries with a limited market.

Due to the flexibility of this approach and the commercial procedures applied it is not necessarily slower than a traditional centrally planned and often bureaucratic tendering and procurement procedure and also the cost of the equipment is not necessarily higher. However, the initial start may appear slower until a suitable group of dealers is identified. But very soon the procurement activities increase exponentially. The project gives technical assistance to the dealers in all required aspects from business administration to mechanics’ training and supports public relations activities like fairs, commercials, field days. Financing of the equipment is promoted preferably through commercially available
channels at normal market conditions but this approach allows operation either under credit schemes as under cash payment. However, the details will have to be adjusted from country to country and from case to case.

The input supply project in the AGSE approach is more a catalytic unit using the funds available for machinery input supply not only for the procurement and supply of the inputs but for the establishment of sustainable commercially oriented and self-supporting supply structures. A technical assistance component of the project might assist this development and provide also advice to the government on how to set the right environment for the project to have a longer lasting sustainable impact. The question of feasibility of farming and costs for equipment as affected by possible tax regulations will probably the most important issue in that aspect. The concept could first be applied successfully in an Italian Trust Fund project in Albania. In that case the equipment was not distributed through a credit scheme but mainly against cash payment. After the first phase of that project the money for the procurement of the equipment had been recovered by the project and remained in Albania for other capacity building and rural development tasks. The dealers received from the project a manufacturers credit which means the dealers paid in cash at delivery or at the latest 1 to 3 months later. Some of the dealers provided a dealers credit to their clients, others sold in cash.

2.6.5 The Benefits

With this concept the farmers receive the equipment they really want and benefit through the technical supervision function of the project guaranteeing that "project-dealers" follow a certain codex and have quality equipment for a fair price. If farmers lack capital for the purchase, the social component of the project could be a soft loan. However, the equipment as such and its price should not be subsidized and should represent a feasible investment in the farming operation. The dealers benefit from the technical advice of the project and the cheaper prices due to bulk orders and transports. The country finally benefits as there are no such things like unrecoverable credits, abandoned machines, premature breakdowns or warehouses full of unsuitable and not salable implements or spare parts. While AGSE believes that this approach is in general the preferable one for all sort of agricultural input supply projects, it is for agricultural engineering inputs absolutely essential to obtain a sustainable long term impact in a country through input supplies.

2.7 DISTRIBUTION OF GAINS FROM TECHNOLOGICAL CHANGE

The post-Independence history of Indian agriculture can be broadly grouped into four periods. Before describing them, I should mention that during the colonial era famines were frequent and famine commissions were abundant. The growth rate in food production during the 1900-1947 period was hardly 0.1 per cent. Most of the important institutional developments in agriculture emanated from the recommendations of famine
commissions. The great Bengal Famine of 1942-43 provided the backdrop to India’s Independence.

It is to the credit of Independent India that famines of this kind have not been allowed to occur, although our population has grown from 350 million in 1947 to 1,100 million now.

**Phase I: 1947-64**

This was the Jawaharlal Nehru era where the major emphasis was on the development of infrastructure for scientific agriculture. The steps taken included the establishment of fertilizer and pesticide factories, construction of large multi-purpose irrigation-cum-power projects, organisation of community development and national extension programmes and, above all, the starting of agricultural universities, beginning with the Pant Nagar University established in 1958, as well as new agricultural research institutions, as for example the Central Rice Research Institute, Cuttack, and the Central Potato Research Institute, Shimla.

During this period, the population started increasing by over 3 per cent a year as a result of both the steps taken to strengthen public health care systems and advances in preventive and curative medicine.

The growth in food production was inadequate to meet the consumption needs of the growing population, and food imports became essential. Such food imports, largely under the PL-480 programme of the United States, touched a peak of 10 million tonnes in 1966.

**Phase II: 1965-1985**

This period coincides with the leadership of Lal Bahadur Shastri and Indira Gandhi, with Morarji Desai and Charan Singh serving as Prime Ministers during 1977-79. The emphasis was on maximising the benefits of infrastructure created during Phase I, particularly in the areas of irrigation and technology transfer. Major gaps in the strategies adopted during Phase I were filled, as for example the introduction of semi-dwarf high-yielding varieties of wheat and rice, which could utilise sunlight, water, and nutrients more efficiently and yield two to three times more than the strains included in the Intensive Agriculture District Programme (IADP) of the early 1960s. This period also saw the reorganisation and strengthening of agricultural research, education and extension, and the creation of institutions to provide farmers assured marketing opportunities and remunerative prices for their produce. The National Bank for Agriculture and Rural Development (NABARD) was set up. All these steps led to a quantum jump in the productivity and production of crops such as wheat and rice, a phenomenon christened in 1968 as the Green Revolution. C. Subramaniam (1964-67) and Jagjivan Ram provided the necessary public policy guidance and support.

The Green Revolution generated a mood of self-confidence in our agricultural capability. The gains were consolidated during the Sixth Five Year Plan period (1980-85) when for the first time agricultural growth rate exceeded the general economic growth rate. Also,
the growth rate in food production exceeded that of the population. The Sixth Plan achievement illustrates the benefits arising from farmer-centred priorities in investment and in the overall agricultural production strategy.

**Phase III: 1985-2000**

This was the era of Rajiv Gandhi, P.V. Narasimha Rao and Atal Bihari Vajpayee, with several other Prime Minister serving for short periods.

This phase was characterised by greater emphasis on the production of pulses and oilseeds as well as of vegetables, fruits, and milk. Rajiv Gandhi introduced organisational innovations like Technology Missions, which resulted in a rapid rise in oilseed production. The Mission approach involves concurrent attention to conservation, cultivation, consumption, and commerce. Rain-fed areas and wastelands received greater attention and a Wasteland Development Board was set up. Wherever an end-to-end approach was introduced involving attention to all links in the production-consumption chain, progress was steady and sometimes striking as in the case of milk and egg production. This period ended with large grain reserves with the government, with the media highlighting the co-existence of “grain mountains and hungry millions.” This period also saw a gradual decline in public investment in irrigation and infrastructure essential for agricultural progress as well as a gradual collapse of the cooperative credit system.

**Phase IV: 2001 to the present day**

Despite the efforts of Prime Ministers Atal Bihari Vajpayee and Manmohan Singh, this phase is best described as one characterised by policy fatigue, resulting in technology extension and production fatigues. No wonder that the farmers, who keep others alive, are now forced to take their own lives and 40 per cent of them want to quit farming, if there is an alternative option.

The agricultural decline is taking place at a time when international prices of major foodgrains are going up steeply, partly owing to the use of grain for ethanol production. Land for food versus fuel is becoming a major issue. For example, the export price of wheat has risen from $197 a tonne in 2005 to $263 a tonne in 2007. Maize price has gone up from about $100 a tonne in 2005 to $166 a tonne now. International trade is also becoming free but not fair. Compounding these problems is the possibility of adverse changes in rainfall, temperature, and the sea level as a result of global warming. Melting of Himalayan ice and glaciers will result in floods of unprecedented dimensions in north India. If agricultural production does not remain above the population growth rate and if the public distribution system is starved of grain, there is every likelihood of our going back to the pre-Independence situation of recurrent famines. The grain mountains have disappeared and we are today in the era of diminishing grain reserves, escalating prices, and persistence of widespread under-nutrition.

**Where do we go from here?**
The Green Revolution of the 1960s was the result of synergy among technology, public policy and farmers’ enthusiasm. The post-60th anniversary era in agriculture will depend upon our determination to implement Jawaharlal Nehru’s exhortation, “Everything else can wait, but not agriculture” in both letter and spirit.

If farm ecology and economics go wrong, nothing else will go right in agriculture. This is the principal message of the current agrarian crisis. The agrarian crisis is likely to spread if the economics of small-scale farming is not improved. At the same time, State governments should not promote policies for ecocides (that is, acts of ecological suicide such as free electricity to pump groundwater, leading to the exhaustion of aquifers). How can we resolve the crisis? The first and foremost priority should go to making the era of farmers’ suicide history.

2.8 STRATEGY OF AGRICULTURAL DEVELOPMENT

The National Development Council (NDC) meeting under the chairmanship of the PM in the last week of May has done well to bring agriculture to the forefront of India’s development agenda. Enhanced agricultural growth is fundamental to the objective of inclusive growth. The objective of this meeting was to reflect on issues relating to the sector and to identify steps that should be taken to improve the lot of farmers and the sector as a whole. The Planning Commission’s base paper, ‘Agricultural Strategy for the Eleventh Plan’ formed a basis for discussions. Here are some concerns which emerged:

1) The sector’s growth has slowed considerably and production and productivity of most crops has stagnated since the mid-1990s. Agricultural GDP growth, which was more than 3.5% from 1984-85 to 1995-96, fell to under 2.0% from 1995-96 to 2004-05. Foodgrain production during the 10th Plan was less than during the 9th Plan, bringing per capita foodgrains production to the level of 1970s.

2) Among factors responsible for deceleration in productivity growth, widespread degradation of natural resources (decline in soil fertility, organic matter content and overall quality, depletion of groundwater resources and quality deterioration and overall ecological degradation) form the core of the problem.

3) Overall fatigue afflicts the research system with consequent lack of any technological breakthroughs.

The 11th Plan must reverse the slide. The sector must achieve a growth rate of 4% per annum in the Plan period ending 2012. For this, India must ensure growth in foodgrain production of at least 2 to 2.5% per annum, and of other sectors (such as dairying, poultry, horticulture, fisheries) of about 6% per annum. This implies that by end of the 11th Plan, we must aim to increase production of wheat by 8 million tonnes (mt), rice by 10 mt and pulses by 2 mt over the current production levels. The key elements of the strategy proposed to revitalise the sector include:
1) In the short-term, productivity gains to meet the Plan targets should be achieved through a focus on ‘yield gap reduction’ of select crops. State-specific measures, based on district-level plans which take into account the local agro climatic conditions, resource endowments and constraints, will be needed. The Centre would provide support to the states for implementing specific plans, and will launch a Food Security Mission covering wheat, rice and pulses, aimed at producing additional 8 mt of wheat, 10 mt of rice and 2 mt of pulses over a period of four years. Together with crop diversification, this will be the main source of agricultural growth.

2) In the longer run, to overcome technology fatigue, we must restructure and strengthen the national agricultural research system to make it more result-oriented. The NDC discussions emphasise the need for agro-climate and region-specific planning, plus stronger linkages between researchers, extension personnel and farmers. Also underlined is the need for new resources for irrigation and water management, restructuring of fertiliser subsidies and land reforms.

But will these strategies yield the desired results?

The issues involved in reversing the agriculture deceleration are multifaceted and complex, and it is these that hinder us from fully grasping the problem and acting in response. In a speech at Harvard once, Bill Gates recommended a four-point plan to attack a complex problem: 1) determine the goal 2) find the highest leverage point 3) discover the ideal technology for that approach, and in the meantime 4) make the smartest application of the technology that you already have. This appears a good way to look at the agriculture sector.

Our goal is quite clear—enhancing productivity growth in a sustainable way that makes economic, social and environmental sense and delivers food security. The highest leverage point could be a shift from individual crop-focused research to an eco-region specific strategy. Agricultural research and development strategies must take into account natural resource endowments as also the prevailing socio-economic conditions (as reflected in current crop patterns, yields, market access and so on) under which farmers work. These factors largely determine what interventions can be made and what can be achieved.

Note that a shift in approach in no way implies a reduced emphasis on the mission to raise productivity of individual crops, but it does imply a more effective addressal of the issues limiting productivity by bringing into the frame issues of equity, integrity of natural resources, climate change and so on.

2.9 SUSTAINABLE AGRICULTURE

For centuries, farmers around the world have spent their waking hours turning their ingenuity towards improving their crops and driving out pests. And they tried everything. Nothing was completely effective and nothing was easy. But farming had never been a game for cowards.
In contemporary agriculture, however millions of farmers across the world use chemical pesticides. These chemicals are sold with the promise of efficiency seemingly taking away the drudgery of farming. These chemicals formulated in laboratories and manufactured in factories seek to replace the skill sets of farmers who would have otherwise knock together solutions that suited their land, their weather and their budget. The culture of chemical pesticides comes from the same mythic land as cures for baldness and free size garments. But unlike most free size garments or baldness cures, pesticides have done severe damage in several spheres, from ecology to community health and rural social structures.

Sustainable agriculture needs to be brought back into the development agenda! This book not only shows that sustainable agriculture works; it also outlines what should be done and how it can be done. All the agricultural practices described in this book highlight in one or the other way how sustainable agriculture contributes directly to the United Nations’ Millennium Development Goals (MDGs).

Although agricultural production amounts to one-and-a-half times the global population’s basic needs – and is growing constantly – there is still widespread hunger in the world. So hunger is not simply a function of how much food is produced. Differences in purchasing power and access to land and resources are among the major causes of underdevelopment in rural areas. Agriculture can be sustainable when it not only produces a lot of high-quality food, but also generates income for poor people. That means rural development: improving transport, development of market facilities and linkages, improving (access to) information, participation of the rural poor in decision making, providing access to credit, and so on.

2.9.1 India – Policies for Sustainable Agriculture

The Indian government’s policies have always emphasized food grain self-sufficiency, which has not necessarily coincided with agricultural sustainability. The growth of agricultural production and productivity, which had risen significantly during 1970s and 1980s, declined during 1990s. These slowdowns have worsened since 2000; both overall agricultural production and food grains production have shown negative growth rates in 2000-01 to 2002-03 periods (GoI, 2002). Decline in the growth rates of agricultural production and productivity is a serious issue considering the questions of food security, livelihood, and environment. As such, a critical examination of the approaches for sustainable agricultural development is necessary. This examination must be framed not only by India’s ongoing need to ensure food self-sufficiency but also by the consequences of access to international markets.

2.9.2 Environmental Challenges in Indian Agriculture

The challenge for Indian agriculture, to put simply, is to increase production, while minimizing environmental impact. This includes conserving and protecting the quality of the resources that determine the performance of agriculture like land, water and air.
Reductions in yield, although determined by many factors, may be partially a consequence of land and water exploitation.

Land degradation is one major constraint for Indian agriculture. By the early 1980s approximately 53 percent (173.6 million hectares) of India’s geographical area had been considered degraded according to the Ministry of Agriculture (GoI, 2001a): Water logging affected about 6 percent of the cultivated area, while alkali and acidic soils both affected about 3 percent. The major process of land degradation is soil erosion (due to water and wind erosion) contributing to over 71 percent of the land degradation (GoI 2001a). Data compiled by the National Remote Sensing Agency (NRSA) indicated that 15 percent of India’s total geographical area was comprised of degraded cultivatable wasteland (NRSA 2000). One third of this land was degraded by human activities, while nearly one half was degraded by a combination of human and natural causes (NRSA 2000). Chadha et al. (2004) found a negative and significant negative relationship between land degradation and foodgrain productivity in both the 1980s and 1990s.

Water is another major constraint for Indian agriculture. Agriculture, through irrigation, accounted for 83 percent of the total water use in the country during 1990 (Vyas 2003). During the Green Revolution period water consumption in agriculture rose sharply as the net irrigated area increased from 31.1 to 54.68 million hectares between 1970-71 and 2000-01, while the area irrigated more than once per year increased from 7.09 million to 20.46 million hectares during the same period. Groundwater, one of the India’s major sources for irrigation, is being rapidly depleted. The number of dark blocks (taluk or mandals), where groundwater extraction is more than 85 percent of the availability, increased from 253 to 428 out of over 5700 blocks between 1984-85 and 1998-99 (GoI 2002). The problem of groundwater depletion has been reported from rainfed states like Andhra Pradesh, Karnataka, Rajasthan, Madhya Pradesh, Chattisgarh and Gujarat.

The introduction of modern technology based agricultural systems, in addition to encouraging increased water usage, meant the application of inputs like chemical fertilizers, chemical pesticides and high yielding varieties (HYVs). Fertilizer application rose more than five-fold between 1970 and 2002 to 17360 thousand tonnes. Imbalanced proportioning of chemical nutrients is a major problem associated with fertilizer application in India. Pesticide consumption increased from 24.32 million tonnes in 1970-71 to 46.2 million tonnes in 1999-00, with a peak application of 75.42 million tonnes during 1988-89 (CSE 1999). High yielding seed varieties have lead to mono-cropping of certain grains reducing farmers’ cropping flexibility and reducing agricultural biodiversity.

Although, the Indian government has recognized the necessity of managing and conserving resources for agricultural development since the First Five Year Plan, the measures initiated have been inadequate. For example, the government’s efforts have only been able to regenerate 17.28 percent of the total degraded area (173.6 million hectares; GoI 2001a).
India’s National Agricultural Policy (NAP) (GoI 2000) has stressed the importance of management and conservation of resources by stating that, ‘the policy will seek to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable use of country’s natural resources – land, water and genetic endowment to promote sustainable development of agriculture’. The Central and state governments have initiated several measures to promote sustainable agricultural development. The NAP stated that improving the quality of land and soil, rational utilisation and conservation of water, and sensitizing the farming community to environmental concerns would receive high priority (GoI 2000).

The Tenth Five Year Plan (GoI 2002), for 2002 through 2007, has put emphasis on natural resource management through rainwater harvesting, groundwater recharging measures and controlling groundwater exploitation, watershed development, treatment of waterlogged areas. With regard to application of agricultural inputs like fertilizer and pesticides, the Plan stated that factors such as imbalanced use of nitrogenous (N), phosphatic (P) and postassic (K), increased deficiency of micronutrients and decreased soil organic carbon would be addressed through a holistic agri-environmental approach stressing Integrated Plant Nutrient and Pest Management. Further, the Tenth Plan document recognizes organic farming as a ‘thrust area’ in the sustainable use and management of resources in agriculture.

Sustainable agriculture is more profitable in terms of money and soil conservation in the long run. Without doubt, it can meet the requirements of the country. Prakruti [a non-governmental organisation Kisan Mehta is associated with] tried to study this issue in the earlier years but very few farmers follow the whole set of practices required in sustainable agriculture. Sustainable agriculture means not only the withdrawal of three things - synthetic chemicals, hybrid-genetically modified seeds and heavy agricultural implements; it is an elaborate system that tries to simulate the conditions found in nature. Multiculture, intercropping, use of farmyard manure and remnants, mulching and application of integrated pest management... If this is followed then there is no reason why agriculture cannot be economically viable in addition to being environmentally sustainable.

The abrupt withdrawal of all this would reduce the yields initially but within three years normal yields can be got. After this yields will keep increasing. Multiculture and intercropping, as against monoculture followed in commercial farming, also provide a cushion against money loss. Viability is misunderstood. Also, farmers do not consider the invisible savings in money and labour as a benefit.

There is no question of sustainable agriculture not being viable or not meeting the needs of the country for food and fibre. Following U.S. sanctions, Cuba was left with no option other than to have recourse to sustainable practices. Its agriculture is now fully organic.

*Could you explain how subsidies have affected farming practices? What can help speed up the organic/sustainable farming movement?*
It is a global cancer. All rich industrialised countries dole out heavy subsidies in a bid to take over the entire food business of the world. The U.S. gives $339 billion a year as subsidies to its farmers, practically one billion a day. France, Germany, Britain, Australia, Canada and others do the same. With the World Trade Organisation operational, no country can refuse to allow imports of food from any country.

On the other hand, rich countries, especially the countries of the European Union, have developed large-scale animal husbandry to meet their meat needs. They export processed foods, milk and meat on a large scale. In order to maintain their cattle stock, they import coarse food items at cheap rates from poor countries. Poor countries, in order to earn foreign exchange, have shifted from crop for humans to crops for animals.

In India, the government fixes a Minimum Support Price (MSP) for all crops year after year. The MSP has to be lower than the lowest international prices for crops in order to prevent them from flooding the Indian market. Thus the MSP is not a price based on the cost of farming or the sustenance of farmers. In order to avoid handing over the material to the government at the lowest MSP, the big business and all grain merchants purchase food in the markets at a price slightly higher than the MSP. This is not a fair or reasonable price for farmers. But they have no recourse but to sell the produce to meet their debt and other obligations.

Prakruti and a few other NGOs understand that farmers should be paid reasonable and fair prices higher than the mandi prices to ensure a good basis for them to survive. Sustainable food should be preferably consumed within the region to avoid other expenses. We, therefore, recommend linkages between farmers and consumers. In some countries, the concept of community-supported agriculture is working satisfactorily, whereby farmers and consumers are formally linked to assure quality food and reasonable rates and necessary support to farmers. In the U.S., small farmers [that is, those owing less than 120 ha] are under threat. The community-supported agriculture helps in sustaining small farmers.

What are the implications for sustainable farming in the present context of contract farming?

Contract farming is totally against sustainable agriculture. For example, the Nashik region [of Maharashtra] represents the sale of our soil and resources to European wine-makers. Foreigners send their strains of grapes to be grown in India and take away the crop. Our resources are priced lower than those in the rich countries... just as our highly qualified technicians are used for their technical advancement at a lower cost.

2.9.3 Way Forward

The trajectory of Indian agriculture and its associated environmental problems has brought about recognition that future agricultural growth and productivity will have to occur simultaneously with environmental sustainability. The environmental challenges, especially in terms of land degradation and groundwater depletion, water logging and
excessive use of chemical inputs are posing problems for the future of Indian agriculture. To address the problems, policies have laid emphasis on promoting sustainable agriculture including organic farming. Differential approaches and policy instruments, however, will be required to address these problems. The shift from input-intensive to sustainable, particularly organic farming is a difficult task as it involves a number of policy measures dealing with a variety of issues ranging from the transfer of information and technology to the development of markets. Another difficult task, and perhaps more difficult, relates to marginal and small farmers – which comprise a substantial part of Indian agriculture.

2.10 GLOBALIZATION AND AGRICULTURE

Globalisation is the new buzzword that has come to dominate the world since the nineties of the last century with the end of the cold war and the break-up of the former Soviet Union and the global trend towards the rolling ball. The frontiers of the state with increased reliance on the market economy and renewed faith in the private capital and resources, a process of structural adjustment spurred by the studies and influences of the World Bank and other International organisations have started in many of the developing countries. Also Globalisation has brought in new opportunities to developing countries. Greater access to developed country markets and technology transfer hold out promise improved productivity and higher living standard. But globalisation has also thrown up new challenges like growing inequality across and within nations, volatility in financial market and environmental deteriorations. Another negative aspect of globalisation is that a great majority of developing countries remain removed from the process. Till the nineties the process of globalisation of the Indian economy was constrained by the barriers to trade and investment liberalisation of trade, investment and financial flows initiated in the nineties has progressively lowered the barriers to competition and hastened the pace of globalisation

Following macro economic reforms introduced in the Indian economy in the early 1990s, and the reforms in the multilateral trading order brought about in the wake of GATT negotiations and setting up of WTO, the Indian agriculture has entered in to the phase of globalization and diversification. It is expected that the combined effect of the reforms in the domestic policies and international trade reforms would result in a much larger integration of the Indian economy with the rest of the world, and such a scenario would bring about substantial benefits to the Indian farmers. The reforms undertaken so far have however failed to bring about the expected gains to Indian farmers. The process of reforms is still continuing and it is hoped that once the negotiations on reforms conclude and the envisaged reforms are implemented in letter and spirit, the gains to Indian agriculture would be positive and substantial.

To realize the expected gains from trade liberalization, apart from improvement in infrastructure, Indian agriculture would need to become more competitive. The recent deceleration of growth in Indian agriculture- both in production as well as in crop productivity- has however been a cause of worry. Unless this trend is reversed, India may not be able to take on the opportunities that may be made available to it in the wake of
globalization. Reversal of this trend would however require action on a number of fronts the most important being reversing the trend of declining public investment in agriculture and extending the coverage of irrigation to a much larger cultivated area. Based on some of the available literature on the subject, the present paper attempts to present a brief review of the recent growth performance of Indian agriculture and some of the agricultural support policies that have a major impact on agriculture.

2.11 IMPACT OF WORLD TRADE ORGANIZATION ON INDIAN AGRICULTURE

Agricultural production and consequent food security of the nation is determined in farmers' field. However, farmers' well being is ultimately determined at market place. With the changing scenario, quantities are giving way to quality. Local mandies are networking with national mandies. And WTO would accelerate the process eventually for a global network.

WTO and its impact upon Indian Agriculture has been a subject matter of heated debates, frayed tempers, extreme views and eventually more confusion. To clarify doubts in this regard, honourable Prime Minister convened a meeting at the highest level in New Delhi on May 21, 2001. It was decided to undertake Awareness building exercise at state levels.

Trade is an engine of economic development. The establishment of W.T.O is an important landmark in the history of international trade. When developing countries were liberalizing their economies, they felt the need for better export opportunities. The W.T.O provides opportunities for countries to grow and realize their export potentials, with appropriate domestic policies in place. The issue of globalization in the Indian context has occurred in the patterns of trade and capital flow in recent years; unfortunately, so far we have not made much use of it. At one time a country’s trade pattern was determined by its natural resources and the productivity of its land. Leaving aside political and institutional factors, a country’s level of income was also largely determined by the global demand for its natural resources and its relative efficiency in exploiting them. The importance of land as a source of comparative advantage, however, changed dramatically after the industrial revolution. Today, it is almost insignificant. After the industrial revolution, the availability of “capital” became the most dominant source of comparative advantage.

India will be able to expand its exports of agricultural products in which it has tremendous comparative advantage. The provisions of W.T.O offered ample opportunities to India to expand its export market. Contrary to this, the price situation changed dramatically after 1996, which was the first year after implementation of Uruguay Round Agreement and formation of W.T.O. International price of agricultural commodities have since then plummeted, because of which domestic price turned higher than international price, which made India an attractive market for import of most agricultural commodities. This situation resulted in a widespread decline in agricultural export and had also pressure on domestic prices. The impact of W.T.O on agriculture was
severely felt by India as cheap imports have frequently hit the Indian market, causing shock waves among the agriculture producers. The changes in agricultural exports reveal that during pre W.T.O period the increase was significantly remarkable than post W.T.O period and the rising export trend could not be sustained in the post W.T.O period whereas imports rose steadily. The agricultural products from India can be made competitive in international market and the prices of agricultural goods in the domestic market can be improved by taking serious steps of reform.

“Globalize or perish” is now the buzzword synonymous to “Do or Die” which conveys that there is no alternative to globalization and everybody should learn to live with it. India, being a signatory to the agreement that led to W.T.O, can no way step backwards. This is not the time to curse the darkness but to work for making India emerge as a global market leader.

2.11.1 WTO Agreements and Agriculture: An Overview and Current Status of Negotiations

After the Uruguay Round negotiations, agriculture trade is now firmly within the multilateral trading system. The WTO Agriculture Agreement, together with individual countries’ commitments to reduce export subsidies, domestic support and import duties on agricultural products formed a significant first step towards reforming the agricultural trade. The Uruguay Round agreement had set up a framework of rules and started reductions in protection and trade-distorting support. But this was only the first phase of the reform. Article 20 of the Agriculture Agreement committed members to start negotiations on continuing the reform at the end of 1999 (or beginning of 2000). Those negotiations, currently underway, began using Article 20 as their basis. The November 2001 Doha Ministerial Declaration set a new mandate by making the objectives more explicit, building on the work carried out thus far, and setting deadlines. The negotiations have been difficult because of the wide range of views and interests among member governments.

The prominent issues in the negotiations mandated under Article 20 have been referred to as a “tripod” whose three legs are export subsidies, domestic support, and market access (more commonly called “the three pillars” of agricultural trade reform). Non-trade concerns and special and differential treatment for developing countries would be taken into account as appropriate. The negotiations are now in their fifth year. Negotiators missed the 31 March 2003 deadline for producing numerical targets, formulas and other “modalities” for countries’ commitments. A revised draft “modalities” paper was put up in March 2003 and although it was not agreed, it was used to discuss technical details in subsequent months. A number of “framework” proposals dealing with main points of the modalities were submitted and discussed before and during the Fifth Ministerial Conference in Cancun, Mexico, September 2003, but it was not until 1 August 2004 that a “framework” was agreed. The next stage now is to agree on full “modalities”, which will in turn be used to work out the final agreement on revised rules, and individual countries’ commitments. The Doha Declaration had envisaged that countries would submit comprehensive draft commitments, based on the “modalities”, by the Cancun
Ministerial Conference — but without modalities, this target was not met either. Meanwhile, the final deadline for completing the negotiations, 1 January 2005, was officially postponed on 1 August 2004, without a new date set, though unofficially it is now set for December 2006.

Activity 2

2. What do you understand by food security in India and public distribution system?
3. Write a detailed note on distribution of gains from technological change.
4. What do you understand by sustainable agriculture? Discuss the impact of globalization on agriculture.

2.12 SUMMARY

The unit highlights the agriculture growth in India. Agriculture growth since liberalisation had been discussed followed by the concept of food security. Food security has been a major developmental objective in India since the beginning of planning. Further, public distribution system in India was dealt and supply of agricultural inputs had been revealed. Another area of discussion was distribution of gains from technological change. Strategy of agricultural development was described and sustainable agriculture had been explained. Differential approaches and policy instruments will be required to address the problems of Indian agriculture to obtain required growth of Indian agricultural sector. Impact of globalization on Indian agriculture had been discussed and finally role of WTO in agricultural development in India was focused.

2.13 FURTHER READINGS

- Gulati, A. and t. Kelly (1999), Trade Liberalisation and Indian Agriculture, Oxford University Press, New Delhi