

## Concept of integrated agriculture

### Integrated Agriculture

- Integrated agriculture involves farming systems with environmental, economic, social, and intergenerational sustainability.
- In an integrated, sustainable agriculture system, the goal is not necessarily producing immediate outputs, but rather maintaining a system of healthful production, over time.
- The major components of a sustainable system include economy, environment, and community.
- The resource that must be managed in such a system takes all of these related components into account.



- Economically, the farm operations fulfill the financial needs of the farmers and those employed by the operations.
- The practices in the agricultural system are executed in an environmentally sound manner, with the preservation of natural resources including soil, water, and air.
- The operations also sustainably provide access to food to individuals in the community, which allows for opportunities for cooperative relationships.

The following modules will review various components of integrated agriculture:

1. Resource Management
2. Organic Crop Production
3. Livestock Management
4. Elementary Veterinary Services

- Integrated Farming means to integrate crop production with livestock management which in a way complement each other with a nice symbiotic relationship which at the time is economically viable and profitable, environmentally suitable, and benefit giver of diversification of production.

### Definition of Farming System

'Farming' is a process of harnessing solar energy in the form of economic plant and animal products. 'System' implies a set of interrelated practices and processes organized into functional entity, i.e. an arrangement of components or parts that interact according to some process and transforms inputs into outputs.

### Goals of Integrated Farming System

### **The four primary goals of IFS are-**

- Maximization of yield of all component enterprises to provide steady and stable income.
- Rejuvenation / amelioration of system's productivity and achieve agro-ecological equilibrium.
- Avoid build-up of insect-pests, diseases and weed population through natural cropping system management and keep them at low level of intensity.
- Reducing the use of chemicals (fertilizers and pesticides) to provide chemical free healthy produce and environment to the society.

### **Advantages of Integrated Farming System**

- Increased productivity through increased economic yield per unit area per time by virtue of intensification of crop and allied enterprises.
- Improved profitability achieved mainly by way of reduced costs due to recycling of wastes of one enterprise as energy inputs for other systems.
- Greater sustainability in production on farm due to integration of diverse enterprises of different economic importance. Recycling of wastes being in built in the system, this helps to reduce dependence on external high-energy inputs thus conserving natural and scarce resources.
- Integration of different production systems provides an opportunity to solve malnutrition problem due to production of variety of food products.
- The recycling of wastes for production helps to avoid piling of wastes and consequent pollution.
- The farming system provides flow of money to the farmer round the year by way of disposal of eggs, milk, edible mushroom, honey, silkworm cocoons etc. This will help resource poor farmer to get out from the clutches of moneylenders/agencies.

- Because of the linkage of dairy/mushrooms/sericulture fruit crops/vegetable crops/flower cultivation etc. cash available round the year could induce small and marginal farmers adopt new technologies such as fertilizer, pesticides etc.
- Recycling of organic wastes reduces requirement of chemical fertilizer. Further, biogas production can meet household energy requirement. Thus, IFS, goes a long way in solving energy crises.
- Fodder/pasture/tree species included in the system help to get more fodder and thus solve fodder crises to some extent.
- Silvi component used in the system provides fuel and timber wood.
- Inclusion of timber component in the farming system reduces pressure on forests.
- Diverse components integrated can provide enough scope to employ farm labour round the year.
- Integrated farming system forces the entrepreneur to know more things and hence improves the literacy level.
- IFS provide opportunity for the growth of agri-oriented industries.
- There is also advantage of increased input use efficiency.
- Overall benefit of IFS is improved standard of living of the farmer because of the products like edible mushroom, fruits, eggs, milk, honey, vegetables etc.

### **Components in IFS**

\* Agriculture \* Fish farming

\* Horticulture \* Duck rearing

\* Forestry \* Pigeon rearing

\* Apiary \* Mushroom cultivation

\* Sericulture \* Azolla farming

\* Dairy \* Kitchen gardening

\* Poultry \* Fodder production

\* Goat rearing \* Nursery

\* Sheep rearing \* Seed Production

\* Piggery \* Vermiculture

\* Rabbitary \* Value addition

### **Elements Of Integrated Farming System**

Following elements may be included in IFS demonstrations depending upon the individual farmers resources, interest and opportunities.

- Watershed
- Farm ponds
- Bio-pesticides
- Bio-fertilizers
- Plant products as pesticides
- Bio-gas
- Solar energy
- Compost making (Vermi, Japanese, Improved etc.)

- Green manuring
- Rain water harvesting

### **Possible output of integrated farming system**

- ✓ Since Integrated Farming System (IFS) is an interrelated complex matrix of soil, water, plant, animal and environment and their interaction with each other enable the system more viable and profitable over the arable farming system.
- ✓ It leads to produce the quality food. To strengthen the food chain, it is essential to eliminate nutritional disorder which has been realized on account of appearing deficiency of mineral nutrients and vitamins in food being consumed.
- ✓ Horticultural and vegetable crops can provide 2-3 times more energy production than cereal crops on the same piece of land and will ensure the nutritional security on their inclusion in the existing system.
- ✓ Similarly inclusion of bee-keeping, fisheries, sericulture, mushroom cultivation on account of space conservative also give additional high energy food without affecting production of food grains. The integration of these enterprises will certainly help the production, consumption and decomposition in a realistic manner in an ecosystem.
- ✓ Likewise, it is pre-requisite in farming system to ensure the efficient recycling of resources particularly crop residues, because 80-90% of the micronutrients remains in the biomass. In the Indo-Gangetic plains, where rice straw is not recycled in an effective way and even in Punjab where rice cultivation is practised on 2.6 m ha produces about 16 m tonnes of paddy straw which is destroyed by burning.
- ✓ To curtail such precious input loss, the use of second generation machinery for efficient crop residue management to conserve moisture, improve soil micro-organism activities, regulate soil temperature, check soil erosion, suppress weed growth and on decomposition improves soil fertility.
- ✓ Its beneficial effect can also be accrued by incorporating with the soil. The crop residue can be used as floor thatch for cattle shed, composting, growing mushroom and for dry fodder also. Multiple use of water for raising crops, fruits, vegetables, and fishery may also enhance the water productivity.

- ✓ Likewise, in villages, the sewerage water can be purified through Hydrilla biomass before its release to fish pond. Besides, the community land in the villages, which are accessible to better use, must be used for productive purpose.
- ✓ Therefore, adoption of concept like social forestry, water harvesting and recycling fishery, and stall feeding to the animals (goatery / piggery) will add to the profit margin with other numerous indirect benefits of employment and improved ecology of the area. Such types of enterprise integration generate additional income varying from Rs 20, 000-25,000/ha under irrigated and Rs 8,000-12,000 under rainfed ecosystem.
- ✓ The income enhancement due to integration of processing and on-farm value addition by 25-50%, yield improvement on account of improved soil health by 0.5-1.0 tonne/ha, cost reduction by Rs.500 - 1,000/ha and employment generation by 50-75 man days/household have also been observed.

#### **Present status of farming system research**

- ✓ The preliminary investigations clearly elucidated that integration of agricultural enterprises viz., crop, livestock, fishery, forestry etc. have great potential towards improvement in the agricultural economy.
- ✓ These enterprises not only supplement the income of the farmer by increasing the per unit productivity but also ensure the rational use of the resources and further create employment avenues.
- ✓ The following of suitable crop choice criteria having deep and shallow root system, inclusion of legume crop as catch , cover and fodder crops and adoption of bio-intensive complementary cropping system along with other enterprise will certainly prove as a self sustained production system with least cost of production.
- ✓ The farming system is governed by various forces viz., physical environment, socio economic conditions, political forces under various institutional and operational constraints and above all government favorable policies, which may keep the food security intact and livelihood fully protected.
- ✓ In traditional Chinese system, the animal houses were constructed over a pond so that animal waste fell directly into the water fueling the pond ecosystem, which the fish could then feast on for food.

- ✓ Not only were the fish harvested but the pond water, now with extra nutrients was used for irrigation in crops. The maximum return (Rs 79,064/ha) was earned from fisheries + piggery + poultry as compared to Rs 5,33,221 from the rice-wheat system and registered 48.6% gain. This also generated additional employment of about 500 man days/ha/annum.
- ✓ For poor people, it starts small with ducks and chickens; then a few goats are kept for milk or fattening and to slaughter for a day of sacrifice; next a milch cow; then a bullock for ploughing in cooperation with another one buffalo family; then two bullocks.
- ✓ These can be used to plough the fields of others- a very lucrative business in the planting season. In India, one would add a milch buffalo at the apex of desirable animals on the farm.
- ✓ In the Vietnamese concept, the pigs will be the second step in the ladder. The concept means to start with small livestock and women and then the household will step by step get out of poverty.
- ✓ The poorest households kept only poultry and these households were those most dependent on common property resources for their living (e.g. use and sale of firewood from the forest).
- ✓ A similar stratification has been reported in several studies from Asia. Survey on farming systems in the country as a whole revealed that milch animals; cows and buffaloes irrespective of breed and productivity is the first choice of the farmers as an integral part of their farming system.
- ✓ However, from economic point of view, vegetables and fruits (mango and banana in many parts of the country) followed by bee keeping, sericulture, mushroom and fish cultivation was the most enterprising components of any of the farming systems prevalent in the country.
- ✓ The average yield gaps between 27 pre-dominant and 37 diversified farming systems were examined across the agro-climatic zones through detailed survey on characterization of on-farm farming systems.
- ✓ Diversification of farming system by integration of enterprises in varied farming situations of the country enabled to enhance total production in terms of rice equivalent



yield ranging from 9.2% in eastern Himalayan region to as high as 366% in Western-plain and Ghat region when compared to prevailing farming systems of the region.

- ✓ In view of serious limitations of horizontal expansion of land for agriculture, only alternative left is vertical expansion through various farm enterprises requiring less space and time but give high productivity and ensuring periodic income especially for the small and marginal farmers. The highlights about the research investigations carried out in India towards farming system outcome are discussed to conceptualize its significance towards farming community livelihood.

### **Challenges in Pakistan's Agriculture. Present scenario and future prospects**

- ✓ Pakistan being located in South Asia is an arid to semi-arid country. The average annual rainfall is about 250 mm. About 67 percent of rainfall occurs in the summer (July-September; monsoon).
- ✓ In Pakistan, approximately 22 million hectares are cultivated for agriculture out of total area of 80 million hectare.
- ✓ About 17 and 5 Mha of the total cultivated area of 22 Mha are irrigated and rain-fed, respectively.
- ✓ About 90% of the agricultural produce comes from irrigated land. The Indus Basin Irrigation System provides surface water for irrigation of croplands.
- ✓ Groundwater also plays an important role in meeting about 50% irrigation requirements of irrigated land.
- ✓ Rain-fed agriculture contributes about 10% of the total agricultural production in the country.
- ✓ Agriculture is the backbone of Pakistan's economy uses about 20.9% (agricultural GDP) to Pakistan's national GDP and accounts for about 60% of foreign exchange earnings.
- ✓ Agriculture provides food and livelihoods to approximately 68% population living in rural areas.
- ✓ Agriculture has four sub-sectors: i) crops sub-sector, ii) livestock sub-sector, iii) fisheries sub-sector, and iv) forestry sub-sector. Crops sub-sector contributes 8.27% to agricultural GDP.

- ✓ Livestock sub-sector contributes 11.77% to agricultural GDP. Fisheries sub-sector contributes 0.43% to agricultural GDP. Forestry sub-sector contributes 0.41% to agricultural GDP.
- ✓ Agriculture through improved productivity could play a crucial role in future economy development, food security, enhanced livelihoods and poverty alleviation. However, agriculture in Pakistan faces most pressing water, land, environmental, agronomic, institutional and socio-economic challenges, which have severe agricultural productivity implications.
- ✓ Comprehensive strategies and actions for improved management of water and non-water elements of agricultural productivity need to be developed and implemented for enhanced agricultural productivity in Pakistan.
- ✓ Agricultural Cropping Systems In irrigated areas, major cropping systems include ricewheat, cotton-wheat, wheat-maize, sugarcane-wheat and mixed cropping based on various combinations of wheat, rice, cotton and sugarcane.
- ✓ In rainfed areas, major cropping system includes wheat, pulses and oilseeds. The cropped area in Pakistan is about 22 Mha. This includes: wheat 9.18 Mha (41.73% of total cropped area); cotton 2.96 Mha (13.45%); rice 2.89 Mha (13.14%); maize 1.13 Mha (5.14%) and sugarcane 1.14 Mha (5.18%).
- ✓ These five major crops cover about 17.30 Mha representing 78.64% of the total cropped area. This reflects that a large tract of cultivated land is under five major crops. Other crops cover about 4.70 Mha, which is about 21.36% of total cropped area in Pakistan.
- ✓ Cropping system 1 Wheat-Maize (Khyber Pakhtunkhwa)
- ✓ 2 Rice-Wheat (Punjab)
- ✓ 3 Mixed-Wheat (Punjab)
- ✓ 4 Cotton-Wheat (Punjab)
- ✓ 5 Sugarcane-Wheat (Punjab)
- ✓ 6 Cotton-Wheat (Northern Sindh)
- ✓ 7 Cotton-Wheat (Southern Sindh)
- ✓ 8 Rice-Wheat(Northern Sindh)
- ✓ 9 Rice-Wheat (Southern Sindh)

- ✓ Two measures of productivity are frequently used: partial measure of productivity and total measure of productivity.
- ✓ Partial Measures of Productivity Partial measure of productivity is the output quantity per unit of a single input.
- ✓ Crop yield per unit of land is the generally used partial measure of agricultural productivity.
- ✓ Partial measure of productivity is in common because of easy availability of the required data.
- ✓ In Pakistan, generally partial measure of productivity is used to quantify the agricultural crop productivity, such as wheat production per hectare of land.
- ✓ Total Measures of Productivity Total measures of productivity considers all inputs to quantify the agricultural productivity.
- ✓ The economic models, namely; growth accounting model, Cobb-Douglas econometric model and nonparametric model are used for measuring agricultural productivity.
- ✓ Ali and Byerlee (2000) applied econometric cost function model to estimate changes in total measures productivity in wheat & rice, wheat & mixed, wheat & cotton, and wheat & mungbean crop production systems of Pakistan's Punjab.
- ✓ Nadeem et al. (2010) estimated total measures productivity of Pakistan's Punjab agriculture for the period of 1970 to 2005, using the index number approach; Tornqvist Theil Approximation.
- ✓ Partial measure of productivity also known as Single Factor Productivity (SFP) considers only a single input to the production process and does not consider other inputs used.
- ✓ So SFP can be misleading, as there is no clear indicator of why they change. For example, crop yields could increase simply because of farmers' increased addition of other inputs, such as fertilizers, pesticides, irrigation water, labor, or machinery, to their land base.
- ✓ In order to address this weakness of SFP, a total measure of productivity (called as Total Factor Productivity; TFP) was devised.

- ✓ TFP considers all of the inputs (land, labor, capital, livestock, chemical fertilizers and pesticides) used in production process. Though compared to SFP, TFP measure is a more vigorous and preferred method to measure agricultural productivity but it requires intensive and extensive agricultural input and output data, which is usually not available easily.
- ✓ So under the situation where quantification of marginal contribution of each input to aggregate production is required and also detailed crop production input and output data is easily available, TFP is preferred.
- ✓ Under the conditions where objective is to quantify the contribution of only a single input to the production process and also less data is available, SFP is suggested. Current Scenario of Agricultural Productivity Agricultural productivity here refers to crop yield obtained from a unit land area, i.e. one hectare.
- ✓ Pakistan's current scenario of wheat, cotton, rice, maize and sugarcane productivity per unit land area is reviewed below.
- ✓ Current Scenario of Pakistan's Various Yield Levels and Gaps
- ✓ Provides national average crop yields currently obtained from average farmer's fields in Pakistan.
- ✓ Average crop yields in Crop Yield (ton/ha) Wheat 2.26 Cotton 1.87 Rice 2.88 Maize 1.77 Sugarcane 48.06
- ✓ Best Practice Crop Yields Best practice crop yields which are obtained using the best available technology are presented. Progressive farmers get best practice yields by adopting modern technology.
- ✓ Best practice crop yields Crop Yield (ton/ha) Wheat 4.50 Cotton 2.89 Rice 4.58 Maize 7.46 Sugarcane 106.70
- ✓ Research Potential Crop Yields reveals research potential crop yields which could be obtained by adopting innovative agriculture and irrigation technologies through applied agriculture research.
- ✓ Research potential crop yields Crop Yield (tons/ha) Wheat 6.80 Cotton 4.30 Rice 5.20 Maize 9.20 Sugarcane 300

- ✓ various yield levels and gaps for the major crops of Pakistan. There are huge yield gaps in Pakistan. Average yields are quite low compared to yields obtained by progressive farmers and through applied research.
  - ✓ For considered crops; wheat, cotton, rice, maize and sugarcane, the extension and research gaps range from 35 to 76% and 12 to 64%, respectively. Pakistan's average yields are 53 to 82% lower than the yields obtained internationally.
  - ✓ The big crop yield gap reflects the potential for increasing crop yield in future.
  - ✓ Major Constraints to Agricultural Productivity Environmental Constraints Land degradation causes huge reduction in land productivity. Soil salinity, waterlogging, soil nutrient deficiency and soil erosion hugely degrade the land's productive capability.
  - ✓ Soil salinity: Soil salinization severely devours the productive capability of land and causes considerably low crop yields.
  - ✓ Currently in Pakistan, about 4.5 Mha area is salinized because of saline groundwater lying close to land surface and cropland irrigation with poor quality tube well water.
  - ✓ Secondary salinization is taking place due to use of poor quality groundwater for irrigation.
  - ✓ About 70% of tube wells of the Indus Basin pump sodic or saline-sodic water because of which 2.3 Mha of land have become sodic/saline.
  - ✓ Estimates of losses due to salinization are 28,000 to 40,000 ha of land and about US\$ 230 million of revenue per year because of low crop yield due to salinity/sodicity problems.
  - ✓ Waterlogging: Waterlogging is another environmental problem which degrades land productive capability. Currently, about 5 Mha (30%) of irrigated area (17 Mha) is potentially waterlogged with water table within 3 m depth from ground surface and 2 Mha (12%) area having water table depth of 1.5 m is seriously waterlogged , some reported that rise in the water table from 1–2 m to less than 1 m resulted in 27 and 33% yield loss for wheat and sugarcane, respectively.
  - ✓ For cotton, a rising water table from 2–3m to less than 1 m caused 60% yield loss.
- Soil fertility depletion:

- ✓ In Pakistan, low fertilizer use efficiency causes low soil fertility which results in low land productivity. Every crop harvest results in depletion of more nutrients from soils compared to addition of nutrients to soils due to imbalanced use of fertilizers.
- ✓ Soil Erosion: In rain-fed and mountainous areas soil erosion results in huge soil nutrients depletion causing low soil fertility which results in low agricultural productivity.
- ✓ Climate impacts: Unfavourable climatic conditions such as heavy rains, floods and droughts adversely affects agricultural productivity.
- ✓ About 20% reduction in crop productivity occurs due to adverse climatic situations in Pakistan.
- ✓ Irrigation Water Management Constraints Inequitable canal water distribution: The water distribution irregularities within a watercourse along with variability of outlet discharge results in low irrigation application efficiencies which cause significant reduction in crop yields.
- ✓ Adequate and reliable water supplies with equitable water distribution are vital for improved agricultural productivity.
- ✓ Research has shown that unreliable and inadequate canal water supplies along with inequitable water distribution cause low crop yields.
- ✓ Improper conjunctive use of canal and groundwater: About 8.4 MAF of public tube wells water and 37 MAF of private tube wells water are being used for irrigation by Pakistani farmers.
- ✓ Direct use of saline-sodic tube well water cannot be made for crop productivity without having a proper soil, water and crop management system in place.
- ✓ Majority of the farmers do not follow proper conjunctive use patterns and also use poor quality groundwater for irrigation without considering a proper soil, water and crop management.
- ✓ This results in secondary salinization which causes low land productivity.
- ✓ Low water use efficiency: Watto and Muger (2016) reported that in Pakistan, water use efficiency of wheat is 0.76 kg/m<sup>3</sup> which is 24% lower than the world average of 1.0 kg/m<sup>3</sup> and water use efficiency of rice is 0.45 kg/m<sup>3</sup> which is 55% less than the Asian average of 1.0 kg/m<sup>3</sup>.

- ✓ Water use efficiency for cereal crops is 0.13 kg/ m<sup>3</sup> which is very low compared to India's 0.39 kg/m<sup>3</sup> of India and 0.82 kg/m<sup>3</sup> of China.
- ✓ It reflects that in Pakistan, potential water productivity is not realized, and this is largely due to poor irrigation management and low irrigation water quality.
- Agronomic Constraints Traditional methods of cultivation: Small poor farmers use traditional methods of cultivation.
- ✓ This results in low crop yield, despite investing more on inputs and increased application of fertilizers.
- ✓ Lack of awareness about modern farming practices and technologies, poverty and high prices of modern technologies are the main reasons for using traditional methods of cultivation. Inadequate availability of improved quality seed:
- ✓ In Pakistan, inadequate supply of improved quality seed (high yielding variety seed) is also a big constraint for enhanced agricultural productivity.
- ✓ Clearly, there is a huge gap between requirement and supply of good quality crop seed
- Improper use of fertilizers: Poor economic condition of farmers and high prices of fertilizers cause the imbalanced use of fertilizers. Intensive cultivation and imbalanced use of fertilizers are depleting essential plant nutrients which consequently results in low land productivity.
- ✓ Plant diseases: Pests and plant diseases also caused which results in low crop productivity.
- ✓ Rice, wheat, cotton and sugarcane are often attacked by pests and insects and lack of proper use (dose and timing) of good quality pesticides results in low crop yields (Planning Commission, 2012).
- ✓ Technological Constraints Application of traditional agricultural technology: The term technology means application of knowledge and tools accurately for achieving the desired goals and economic objectives.
- ✓ Here desired goal refers to the achievement of enhanced agricultural productivity, which requires application of innovative and modern agricultural technology. In Pakistan, majority of the farmers use old traditional agricultural technology which results in low land productivity.

- ✓ Lack of awareness and poverty of farmers: Farmers are unaware of the modern agriculture technology that can increase land productivity.
- ✓ Poverty also hinders the access of farmers to modern technology.
- ✓ Small land holdings are also a big impediment for adoption of modern technology.
- ✓ Lack of upscaling of modern agriculture technologies: Though some modern agriculture technologies like laser land leveling (LLL), zero tillage, bed-furrow, high efficiency irrigation technologies (sprinkler & drip), precision surface irrigation, etc. have shown considerable increase in land productivity (for example LLL results in 20% increase in crop yield and zero tillage causes 12-15% increase in crop yield, but still these technologies could not be up-scaled.
- ✓ The lack of financial resources & high costs, lack of access & timely availability, lack of machinery, small landholdings, lack of familiarity, lack of adequate advice and preference for traditional practices are the major constraints to accelerate the adoption of new technologies especially among small farmers.
- ✓ Farmers also do not have comprehensive knowledge and training on selection and use of modern agriculture technologies.
- ✓ Socio-economic Constraints Fragmented/small land holdings: As a result of population increase and land division, land holdings are becoming very small. About 81% of Pakistani farmers own less than 5 hectares of land.
- ✓ About 58% of the total farms in Pakistan are 2 hectares or less in size.
- ✓ The small land holdings cause inefficient and uneconomical use of land resulting in low crop yields.
- ✓ Small land holdings are also a big impediment for adoption of modern agriculture technology.
- ✓ Large Land Holdings: In Pakistan, a large area of land is owned by big landlords (feudal-lords) having more than 10 ha land and the farmers who work on their lands, are just tenants.
- ✓ The tenants have no or less incentive for their hard work and also have no interest in capital investment (World Bank, 2006). It has been reported that large landholdings barely result in high agricultural productivity rather they are very unproductive.



- ✓ Lack of access to improved quality inputs and services: In Pakistan, small farmers having 2 ha of land generally do not get credit facilities thereby they do not have access to improved quality inputs like seeds, pesticides, fertilizers etc.
- ✓ They also do not have access to extension services.
- ✓ All this results in low crop productivity. Illiteracy and poverty: Illiteracy and poverty of the farmers also lead to low agricultural productivity.
- ✓ In Pakistan, farmers are mostly poor and un-educated about high productivity farming. They are untrained and inefficient to enhance agricultural productivity.
- ✓ Institutional Constraints Inadequate institutional seed production capacity: In Pakistan, the public sector seed production institutes have inadequate seed production capacity due to financial, human resource and infrastructural problems.
- ✓ Though public and private institutes are busy in producing seed, but their current seed production meets only 40% of yearly seed requirement.
- ✓ Inadequate agricultural research and extension: There has been very modest pace in technological change in yields per hectare during past two decades compared to 1960s and 1970s resulting in low agricultural productivity.
- ✓ Though a large number of federal and provincial agriculture research institutes conduct research, but their output did not help develop new varieties, improving water utilization practices.
- ✓ Research projects are not need, demand and economic benefit based. In order to raise agricultural productivity, agricultural research needs to be improved continuously.
- ✓ Lack of coordination between research and extension organizations is also a major constraint to increasing agricultural productivity.
- ✓ Consequently, improved quality inputs, new agriculture and irrigation technologies, practices and strategies do not reach farmers and they just continue to apply inefficient old traditional technologies which result in low crop yield. Ineffective agricultural education and training:
- ✓ Lack of education and training of farmers also causes low agricultural productivity. Presently, farming community in many areas of Pakistan due to inactive and ineffective agriculture extension services, does not get any guidance and messages on

modern and improved agriculture, irrigation and waterlogging and salinity management practices and technologies to enhance agricultural productivity.

- ✓ Farmers do not get any kind of training and education on modern and innovative techniques (Laser land levelling, zero tillage, bed planting, sprinkler and trickle irrigation methods, leaching) and strategies to manage their water, soils and crops properly for enhanced land productivity.
- ✓ The progressive farmers could not prove helpful to effectively transfer their experiences to the nearby farmers.
- ✓ Inadequate credit facilities: Inadequate loan, high interest rate and untimely availability impact adversely crop productivity in Pakistan (Ministry of Finance, 2009).
- ✓ The informal loans are also not dependable due to their non-availability on time. Generally poor farmers do not get credit to buy good quality agricultural inputs and consequently, they get low crop yields.
- ✓ Lack of access to credit and its improper use result in low agricultural productivity (Planning Commission, 2012).
- ✓ Future Prospects for Increasing Agricultural Productivity Upscaling of Modern Technology Agriculture productivity can be increased by the use of modern technology and improvement in the existing technology.
- ✓ The evaluation of laser land technology revealed 20% increase in crop yield.
- ✓ The zero tillage technology results in 12-15% increase in crop yield. The impact evaluation of bed and furrow irrigation technology also revealed better crop yield and water use efficiency compared to traditional method.
- ✓ In Pakistan, pace of adoption of these technologies by farmers is very slow. In order to enhance land productivity these technologies need to be up-scaled. In order to accelerate rate of adoption of modern technology, practical policy measures of enhanced supply of equipment and field demonstration of their use would be needed. Arrangements need to be made for financial support and easy access of the farmers to these technologies.

- ✓ Private sector should be encouraged and given technical and financial support to manufacture modern agricultural and irrigation technologies locally for upscaling of adoption of these technologies.
- ✓ Modern Agricultural Biotechnology Modern agricultural biotechnology could play a key role in increasing crop productivity by developing higher yielding, resilient to plant pests and diseases and environmental stresses crop varieties. Thus, modernization of agricultural biotechnology is vital for future improvement in agricultural productivity.
- ✓ Drainage and Reclamation Water logging and salinity devour productive capability of lands.
- ✓ Soil salinization is causing 25% reduction in the production potential of major crops in Pakistan.
- ✓ Research revealed that rise in the water table from 1–2 m to less than 1 m resulted in 27 and 33% yield loss for wheat and sugarcane, respectively.
- ✓ A rising water table from 2–3 m to less than 1 m resulted in 60% yield loss of cotton. Rice yield loss was 7% at 1–2 m water table depth. Soil salinity (more than 4 dS/m) reduced the wheat, cotton, rice and sugarcane yields considerably.
- ✓ WAPDA have completed 61 salinity control and reclamation projects (SCARPs) in 7.35 Mha irrigated area of the Indus Basin during 1960 to 2001.
- ✓ The SCARP tube wells lowered groundwater level below 1.5 m in 2 Mha area and below 3 m in 4 Mha area.
- ✓ Salt-affected area was reduced from 7 to 4.5 Mha.
- ✓ Though SCARPs have controlled water logging and salinity considerably, but these problems are still there.
- ✓ Government of Pakistan should continue to strengthen drainage and reclamation efforts by providing adequate drainage infrastructure and bio-chemical amendments.
- ✓ Land Reforms As both the small and large land holdings are inefficient and unproductive, there is a dire need to determine the optimal farm size through research and to implement the land reforms intervention to have majority of farms of optimal size.

- ✓ Land reforms will cause incentive for cultivators/tenants to invest in land and adopt new technologies thereby increased land productivity.
- ✓ Thus, effective land reforms are vital to increase land productivity. Political will, sincere and serious government's commitment and proper laws are essential for successful implementation of land reforms.
- ✓ Improved Agricultural Credit Facilities Improved availability of agricultural credit to farmers enhances agricultural productivity.
- ✓ Financial resources are needed to use improved variety seeds, fertilizers, pesticides, insecticides, and modern agricultural and irrigation technologies. Small farmers generally lack in adequate financial resources.
- ✓ Increasing the volume and outreach of formal banking network for timely and easy access to credit by farming community is vital for accelerating the adoption of latest agro-irrigation technologies and better agricultural inputs.
- ✓ Revolving credits which make disbursement and repayment convenient for farmers should be promoted by the banks of Pakistan.
- ✓ Effective Communication The information and communication technologies like internet, mobile phones, radio and television are the most important and effective communication tools to provide agriculture information and knowledge to farmers.
- ✓ The use of these technologies in different countries like Iran and Nigeria impacted positively on agricultural productivity.
- ✓ To make radio and television more effective in dissemination of agriculture information to farmers: i) agricultural programs presenters must be competent and knowledgeable in agriculture, ii) agricultural programs should be broadcasted in local languages, and iii) the airing times of these programs must be suitable from farmers' point of view.
- ✓ In Pakistan, proper & effective dissemination of latest information and assistance on modern technology and improved soil, crop and water management practices to farmers through improved TV, radio and print media agriculture programs broadcasted in regional or local languages at proper times could also play a key role in enhancing agricultural productivity.

- ✓ Currently, there is a big communication gap between agriculture and irrigation professionals and farmers.
- ✓ This gap must be bridged through ensured availability of agriculture and irrigation professionals in the rural areas. Enhanced Good Quality Seed Production Good quality crop seeds are vital for enhancing agricultural productivity.
- ✓ In Pakistan, currently seed production meets only 40% of yearly seed requirement (Iqbal and Ahmad, 2005; Planning Commission, 2012).
- ✓ Agricultural research systems and private sector are the main sources of seeds. The private sector can play a vital role to meet the demand of improved quality seeds. To enhance production of good quality seeds: i) private sector should be provided with appropriate legal cover, technical and financial support, ii) a strong partnership should be developed between agricultural biotechnology research institutes and private sector seed producing firms and iii) farmers should be encouraged to adopt good practices to enhance effectiveness of crop seeds produced by them.
- ✓ Improved Availability and Use of Inputs
- ✓ The backbone of any agricultural revolution is access of farmers to modern agricultural inputs. These agricultural inputs range from improved seeds, fertilizers and crop protection chemicals to machinery, irrigation and knowledge.
- ✓ Research in Nigeria revealed that, adoption of improved agricultural inputs and technology to rice farming resulted in 358.89 kg/ha (9%) more yield compared to that obtained by the farmers who neither adopted improved inputs nor technology.
- ✓ In Pakistan, crop productivity can be enhanced significantly by improving availability of good quality agriculture inputs like seed, fertilizers, pesticides, herbicides, water and their efficient, judicious and balanced use.
- ✓ Improvement in farmers' access (timely & doorstep availability at reasonable price & subsidy) to these inputs and services through improved agriculture credit would improve land productivity tremendously.
- ✓ Support Price Policies In the past, government support price policies resulted in higher crop yields. Research has revealed that farmers are very responsive to support prices.

- ✓ Also, the increases in prices do induce higher land productivity through use of improved and new agriculture inputs. So, for enhanced agricultural productivity, a proper price policy of government is vital.
- ✓ Thus, keeping the prices aligned with international prices provides the right incentives to the farmers to increase their land productivity.
- ✓ Farmers' Education and Training Farmers' education and training results in improved agricultural productivity.
- ✓ Education opens the mind of farmers to knowledge, provides hands-on training and better methods of farming and keeps the farmer well informed about innovations and allows farmers to share their experiences.
- ✓ Investment in education, its planning, expansion, location and delivery need to be integrated in rural areas with its thrust for raising agricultural productivity.
- ✓ As education of farmers can lead towards considerable increases in agricultural productivity, there is a dire need to expand educational and training facilities in rural areas of Pakistan to provide education and training to farmers regarding productive agriculture.
- ✓ Farmers' days, field visits and awareness campaigns should also be launched to educate and train the farmers about seeds of high-yielding varieties, modern cultivation and irrigation technologies and efficient and judicious inputs use.
- ✓ Improved Irrigation Water Management Water shortage is becoming a major constraint for agricultural productivity. GoP (2005) reported that Pakistan has moved from reasonable per capita water availability ( $>1700 \text{ m}^3 / \text{capita}$ ) to the current situation of becoming a water stress country ( $< 1700 \text{ m}^3 / \text{capita}$ ) and fast heading towards water scarce country ( $< 1000 \text{ m}^3 / \text{capita}$ ).
- ✓ Growing shortfall in water availability compared to demand will continuously increase in future. According to estimates, water shortage would increase from 28 MAF in 2015 to 41 MAF in 2025 (GoP, 2010).
- ✓ The major causes of an increasing water scarcity are cited as reduced storage capacity of existing dams due to silting, slow development of new dams and an inefficient irrigation systems.

- ✓ This situation needs the urgent attention of the planners and decision makers regarding immediate water storage development, conservation and efficient utilization of water.
- ✓ In Pakistan, estimated overall average irrigation efficiency ranges from 38.7 to 42.6%, which is quite low and is largely due to poor operation and maintenance of the irrigation infrastructure.
- ✓ Based on completely lined canal systems, watercourses and high efficiency irrigation system (sprinkler & drip) at farm could result in an overall irrigation efficiency of about 81.2%.
- ✓ In Pakistan, distribution of surface water along the main canals (between distributaries) and along the distributaries (between the outlets) is substantially inequitable.
- ✓ Inequitable water distribution contributes to declining agricultural productivity. Innovative measures are needed to improve operation of irrigation canals thereby improved water distribution required for enhancing agricultural productivity. In Pakistan water use efficiency (WUE) is not realized.
- ✓ Low WUE is mainly due to poor irrigation management (lack of adequate and timely availability of irrigation water, inefficient irrigation practices and technologies, lack of adoption of irrigation scheduling, improper conjunctive use of surface and groundwater for irrigation) and low irrigation water quality .
- ✓ WUE could be increased through innovative improvements in agronomic and water management practices which would require shifts in agricultural practices, policies and effective institutions.
- ✓ Effective Research and Extension Services Various studies have evidenced a positive impact of research and extension on agricultural productivity.
- ✓ So, investment in research, extension and education and support services for new agricultural technologies is vital to increase agricultural productivity.
- ✓ in order to realize full potential of agricultural productivity: i) public sector should design and implement a research program to develop technologies for farmers, and ii) also public sector should involve private sector in the research program.

- ✓ In Pakistan, in order to make research more effective, a comprehensive research and development policy, well developed human resource and essential institutional and physical setup are vital.
- ✓ Efforts should also be made to make extension services more effective for dissemination of information, knowledge guidance and training of farmers required for rapid adoption of modern technologies and practices by farmers.
- ✓ Improved Agriculture-Education-Training-ResearchExtension-Nexus The strong linkages in the agricultural research-extension-education nexus are vital to realize improved and sustainable agricultural productivity.
- ✓ A model was proposed to integrate information and communication technologies in agricultural education, research and outreach for improving coordination across the agricultural nexus, bridging the information gap, sharing information and generating knowledge.
- ✓ Currently, Pakistan lacks in an improved nexus between agriculture, education and training, research and extension. A strong private-public partnership (PPP) is vital for fostering this nexus and delivering a set of inputs, services and guidance. Internationally PPP has performed well thereby contributed to enhanced agricultural productivity.
- ✓ Thus, an effective and improved nexus between agriculture, education and training, research and extension could contribute significantly to increase agricultural productivity in Pakistan.
- ✓ Conclusions and Policy Implications In Pakistan, crops sub-sector of agriculture is not performing well because the national average yields of major crops (wheat, cotton, rice, maize and sugarcane) are far below their research potential yields.
- ✓ This reflects that potential agricultural productivity is not being realized, and this is largely due to agronomic, irrigation, environmental, technological, institutional and socio-economic constraints.
- ✓ The gap between current average and potential crop yields offers a huge opportunity to enhance agricultural productivity in future.
- ✓ The goal of enhanced agricultural productivity could be achieved by making huge investments to improve agricultural research and extensions systems, accelerate



diffusion and adoption of latest agricultural and irrigation technologies and improved inputs use, irrigation water management, and reclamation and drainage.

- ✓ Following policy implications are suggested for implementation to enhance agricultural productivity in Pakistan.
- ✓ Improving Agricultural Research and Extension Systems
- ✓ The Government of Pakistan should invest considerable financial resources for improving agricultural research and extension systems.
- ✓ The required actions would include: strengthening of national research systems by: developing human resources through higher education, improving physical (labs with latest equipment and digital libraries, etc.) infrastructure, improving institutional structure, improving inter and intra institutional coordination among education, research and extension institutions; establishing an effective collaboration with reputable foreign universities and research institutes, enhancing public-private partnerships, and developing capacity of extension professionals of the provincial agricultural departments.
- ✓ Accelerating Diffusion and Adoption of Latest Agriculture Technologies and Inputs  
For this purpose, Government of Pakistan needs to make arrangements for: i) dissemination of information and knowledge on latest technologies and improved inputs to farmers through Agricultural Extension Directorates of the provincial Agriculture Departments, ii) easily available agricultural credit to farmers so that they may buy and adopt latest technologies. Pakistan's banks should promote revolving credits which make disbursement and repayment easy for farmers, and iii) provision of subsidies on latest technologies.
- ✓ Enhancing Good Quality Seed Production
- ✓ The Government of Pakistan should encourage private sector seed producing firms by providing a legal cover and technical and financial support for seed production and also help develop a strong partnership between agricultural biotechnology research organizations and private sector seed producing firms. Improving Irrigation Water Management Improved availability, reliability and equity of irrigation water and enhanced water use efficiency are vital for enhancing agricultural productivity in Pakistan. Currently, the scenario of water shortage, inefficient irrigation systems and

low water use efficiency does not match water supply with water demands for enhancing agricultural productivity. This situation demands an urgent and immediate water storage development, conservation and efficient utilization of water. So Federal and Provincial Governments must consider and invest in development of small, medium and large dams through WAPDA and Provincial Irrigation Departments. Provincial Governments through Provincial Irrigation Departments must invest in rehabilitation and improvement of operation & maintenance of irrigation canal systems. Provincial Governments through Provincial Agriculture Departments (OFWM & Agri. Extension) must continue to upscale resource conservation technologies (watercourse improvement, bed-furrow irrigation, laser land levelling, zero tillage and high efficiency irrigation technologies (sprinkler & drip) to improve water use efficiency.

- ✓ Improving Reclamation and Drainage
- ✓ Waterlogged and salinized lands offer great potential for agricultural production if they are reclaimed by providing drainage infrastructure and using chemical and biological amendments. These lands need urgent attention for drainage and reclamation on priority basis for productive and sustained agricultural productivity. Though SCARPs launched by WAPDA have played an important role in controlling the water logging and salinity to a great extent, but these problems are not yet solved completely and effectively. The Government of Pakistan must continue to improve performance of on-going drainage and reclamation projects by strengthening the institutional, technical and financial capacity in the drainage sector. New drainage and reclamation projects should also be launched in critical areas.

## Issues and strategies for improvement of crop management, livestock management, fisheries

### INTEGRATED FARMING OF FISH, CROP AND LIVESTOCK

- The most impressive aspect of Chinese aquaculture that the study group observed was the integration of fish farming with livestock production and farming of agricultural crops, including vegetable farming. Integrated farming is a traditional.
- Chinese practice and, as mentioned earlier, has in recent years been further supported by the concept of an all-round 'development of agriculture, animal husbandry, fisheries and other sideline occupations.
- Although integrated farming is economically and environmentally sound, the motivation for integration would appear to be the national policy of diversification of production.

### Nature of integration

- The fish cultivated and the general farming practices are amenable to easy integration, The grass carp feeds on grass and other vegetable matter which can be grown on the dikes and adjacent agricultural land.
- They also feed on aquatic plants which can be raised in canals and other adjacent water bodies.
- Aquatic plants such as Pistia stratiotes, Eichhornia crassipes, Alternanthera phyloxorides and duck weeds, are grown for feeding fish or pigs and poultry on land.
- Sugar cane, corn and bananas are some of the other crops grown in association with fish farms. Ipomea aquatica, Lolium perenne, sorghum, maize and mulberry are also grown in many areas.
- The leaves, stalks or other waste products are chopped or crushed and fed directly to the fish or composted to be used as fertilizer. Silver carp and big head feed on plankton which can be grown by the application of organic manures provided by pigs, cattle, and chicken raised by the side of fish farms.
- As mentioned, pigsties are often built on pond dikes, facilitating the application of manure, either directly or after fermentation.

- Duck farming in association with fish, is also reported to be practised in a few places. In areas where silk production is prevalent, mulberries are planted on the pond dikes.
- The silkworm pupae and other wastes are used to feed the fish. Fish pond silt is an excellent fertilizer for land crops and is commonly used by farmers.
- In areas without adequate irrigation, pond water may also be used for irrigating crops, when necessary.
- The commune or production brigade members can also be considered as an element in this type of integration and recycling, as they eat fish and other farm products and human wastes are used to fertilize ponds and crop land.
- In Lin Fu State Fish Farm in Hengyang, farming is closely associated with a winery. Waste water from the winery goes to the fish ponds for fertilizing and feeding fish and the solid wastes are fed to the pigs.
- The fish and wine, of course, go to feed man! In many places fish farms are also used for the rearing of the freshwater mussels, Anodonta and Hyriopsis, for the production of pearls.
- The allocation of land and water for fish, crops and livestock varies. For example, in one state farm, about 60 percent of the land was devoted to fish culture, 14 percent to pigs and cattle, 14 percent to cultivation of fodder and 10 percent to growing rice and wheat.
- The experiences gained over several years of integrated farming of this type, when critically analysed and rationalized, could be of considerable value to all developing countries interested in integrated rural development.
- There are many aspects of such farming that are fascinating subjects for research, which, when carried out, could give a scientific understanding of the processes involved and consequently, lead to better management of the system.
- **Advantages of integration**
- As far as fish production is concerned, it serves the major purpose of providing cheap feedstuffs and organic manure for the fish ponds, thereby reducing the cost and need for providing compounded fish feeds and chemical fertilizers.
- By reducing the cost of fertilizers and feedstuffs the overall cost of fish production is reduced and profits increased.

- The study group was told that the profit from fish culture is often increased 30-40 percent as a result of integration.
- Secondly, the overall income is increased by adding pig and/or poultry raising, grain and vegetable farming, etc., which supplement the income from fish farming.
- Thirdly, by producing grain, vegetables, fish and livestock products, the community becomes self-sufficient in regard to food and this contributes to a high degree of self-reliance.
- Fourthly, the silt from the ponds which is used to fertilize crops, increases the yield of crops at a lower cost and the need to buy chemical fertilizer is greatly reduced. It is estimated that about one third of all the fertilizer required for farming in the country comes from fish ponds.
- The production of freshwater pearls in fish ponds provides one more additional source of income.
- **Management of integrated farms**
- Integrated farming calls for skill in different types of activity such as raising pigs and poultry, crop and vegetable farming, growing grass and aquatic plants and farming of fish.
- One person can take care of 6-8 ponds of 5-7 mu each; or 30-50 pigs or 500-1 000 chickens, but many of the activities, including harvesting, will need a large number of people.
- Obviously, if integrated farming has to be done on a large scale, a sufficient number of people with the required skills have to work together. The organization of production brigades and communes appears to be very well suited for the adoption of the practice. A production team may be found to be too small a unit, as was reported in Hengyang, where, with the introduction of integrated farming, the organizational and accounting unit was changed to production-brigade-level.

## Rural development

- The concept of rural development has changed significantly during the last three decades. Until the 1970s, rural development was synonymous with agricultural development and, hence, focused on increasing agricultural production.
- Today's concept of rural development concerns not only with improvements in growth, income, and output but it also includes an assessment of changes in the quality of life, such as improvement in health and nutrition, education, environmentally safe living conditions, and reduction in gender and income inequalities.
- Agriculture and Pakistan's Economy Agriculture remains the hub of Pakistan's economy, which consists of crops and livestock products.
- It directly contributes 25% to GDP and provides employment to 44 percent of the total labour force of the country and accounts for nearly 65% of the country's export earnings. Agriculture alone is responsible for about 67% of our foreign exchange earning directly or indirectly (GOP, 2008).
- Moreover, this sector provides raw material to domestic agro-based industries such as sugar, vegetable, leather, and textiles. Hence, the importance of agriculture to the economic growth of Pakistan and the well being of its people cannot be overstated. Most importantly, 67 percent of country's population living in rural areas is directly or indirectly dependent on agriculture for their livelihood (GOP, 2008).
- The agriculture sector is, thus a major determinant of the overall economic growth and well-being in Pakistan. In addition to the direct impact of agriculture growth on poverty reduction, there is also a much larger indirect effect through the linkages between agriculture and non-farm growth in rural areas. Non-farm growth is closely linked with agricultural growth since peasant farmers spend a large portion of their incremental income on locally produced non-agricultural goods thus generating employment and incomes in the adjoining areas.
- The increased demand for non-farm goods leads to a much larger increase in employment, which could be a key vehicle for poverty reduction.
- **Issues of Rural Sector Rural scenario** can generally be characterized as follows: 1. Rural development policy always had a heavy bias towards large farmers, whereas small

landholders making more than 90 percent of total farms were ignored along with landless labor community.

- Rigid cropping pattern prevailing in the country results in lack of intensification and diversification of agriculture sector, thereby increasing unemployment in rural areas. 3. Natural resource base is deteriorating overtime.
- Due to inappropriate agricultural practices and climate change, land degradation is more and land productivity is declining. Almost 40 percent of land in Sindh alone has turned saline.
- The rangelands on which 70 percent of local livestock thrives have been degraded and no rehabilitation plans are in place.
- 4. Literacy rate is very low in these areas and illiterate farmers cannot realize the benefits of modern, scientific and technical know-how in farming business.
- Moreover, rural areas are deprived of schools. In case, if schooling facilities are available, then qualified staff is not available.
- Basic health care is the prime need of every individual. Unfortunately, this component is totally ignored by the Govt.
- Most villages in Pakistan still are lacking in hospitals, dispensaries and other health centers. According to an estimate 70-80 million people do not have requisite access to education and health services.
- 5. Poor health, malnutrition and high population growth rates are widespread in rural areas, badly affecting productivity. According to an estimate, 30-50 million people are malnourished.
- 6. Water supply and sanitation condition is not satisfactory in rural areas. Population having access to safe water is 87 percent and 35 percent of total population has access to sanitation.
- 7. Appropriate facilities for healthy activities are not available in rural areas. So, the frustrated young people indulge in obnoxious activities such as drug addiction, rape, robbery, murder, etc.
- Past Rural Development Programmes in Pakistan Since its independence, Pakistan has embarked upon a number of rural and agricultural development programmes to increase the productivity and quality of life of rural people.

- These programmes were Village Aid Programme, Basic Democracies system, Rural Works Programme, Integrated Rural Development, Peoples Works Programme, Local Govt. and Rural Development, Peoples Programme, Tameer-e-Watan, Social Action Programmes, Khushal Pakistan, Tameer-e-Pakistan and Khushal Pakistan Programme-1. These programmes were partially or fully extended to all parts of the country.
- The overall objectives of these programmes were the social welfare, improvement in quality of life and agricultural development. These programmes did not achieve the desired results because the objectives of one programme conflicted with those of others, and there was no institutional mechanism for reconciling them.
- Consequently, many programmes not only failed to produce the intended benefits, but also caused harm to other programmes.
- Common causes of failure of these programmes were loose and uncoordinated institutional framework; lack of mutual understanding and collaboration within the nation-building departments and with the departments of rural development; absence of efforts to help evolve rural leadership from the grass roots; lack of proper supervision, follow-up, research and evaluation of projects.
- Conclusions Pakistan had a very long history of Government intervention in the rural sector, with a view to improve the socio-economic condition of rural people, especially the poor. However, there is no comprehensive integrated national policy for agricultural and rural development yet declared and adopted by the Government.
- What is, therefore, needed is a long-term comprehensive integrated national policy, which clearly charts the future course of agricultural and rural development in the country in the twenty-first century.
- This is all the more necessary in the wake of new economic policy characterized by liberalization, privatization and globalization of Pakistan's economy.
- **Future Strategies**
- To develop rural community to become active participants of the economy, the following steps needs to be prioritized:
  - 1. The rural poor (small landholders and landless class) need to participate in the development and implementation of the relevant policies and programs. It requires institutional and technological reforms.



- 2. For sustainable rural development, conservation and development of natural resources, focusing on protection of environment and biodiversity must be undertaken.
- Strengthening rural institutions in the country can satisfy the thrust for rural development. There is a need to address the issues of inequality in terms of resources along with the innovation and adoption of cost saving technologies.
- 4. There is a strong need to develop and promote agro-based industry in rural areas to create employment opportunities through private-public interventions.
- This will definitely help in reducing the rural urban migration on one hand and rural poverty on the other. It could be achieved by promoting savings in rural areas, thereby increasing investment opportunities for overall improvement in the income of the rural communities.
- 5. Proper monitoring and evaluation of rural development programmes must be carried out to ensure successful implementation of programme activities and those who are responsible for not achieving the results must be accounted for.
- 6. Initiatives must be taken to address the problems of public health and education for fast growing population. This demand for establishment of schools and health facilities on modern lines. Such facilities would provide productive, healthy and educated labour force to agriculture in particular and to the economy in general.

### Cottage industry

Cottage industry is the one which is run by an individual with the help of his family members with very little amount of capital. Most of the cottage industries do not use power. The products produced in cottage industries are usually to satisfy the local demands. Number of labour hired in this sector is very limited and the capital investment is also small. Despite government's several institutional and policies support for enhancing the capacity of small and medium scale enterprises, the results have fallen short of expectations. SMEs are facing major challenges that compromise their ability to function properly and to contribute optimally to the economy.

- ✓ Small-scale sector requires a multi-dimensional package of assistance. They can play their equitable role provided they have a sound base.

- ✓ The Industrial Policy of 1991 was a landmark policy particularly for the small-scale industries which emphasized on pro output ratio is the lowest in small scale sector but employment generation capacity is eight times that of large scale sector.
- ✓ The net capital-output ratio of small and medium scale industrial sector worked out to be 4 & 3.2 times(approximately) that of large scale sector despite low productivity of labour while the net capital-output ratio of large enterprises worked out to be three times that of small enterprises.
- ✓ Mahalanobis quoting Myrdal (Asian Drama, 1963) said in view of meagerness of capital resources there is no possibility for creating much employment in the short-run through the factory industry.....
- ✓ Now consider household or cottage industry, which have very little capital requirements, with any given investment, employment possibilities would be 10 or 15 times greater as compared to the corresponding factory industry.
- ✓ The estimated relative total factor productivity of SSI during the period 1980-81 to 1994-95 was greater than one, suggesting that at the country level, this sector is far more efficient than large-scale sector.
- ✓ This is despite the fact that government intervention did not contribute much to the growth of small scale sector and concessional credit induced efficiency.
- ✓ Background (Pre-Reform Era) Government in pursuance of its policies has come out openly with various measures from time to time which include reservation, modification of investment ceiling, modernization, technological upgradation, marketing etc. Further, the focus has shifted from 'protection' to 'promotion' in the post-reform period by altering the investment limits, partial de-reservation, foreign participation, establishment and organization of growth centers and so on.
- ✓ This led to an exceptional growth in this sector, yet it manifested some of the maladies which can be enlisted as: Concentration of growth in only a few metropolitan cities and large towns♣ motion and strengthening of this sector.
- ✓ There is no denying the fact that Small fraction of institutional credit going to this sector; Under-utilization of capacity and sickness;♣

- ✓ Unorganized sector within SSI remained unripe.♣ In addition to that, the non-availability of power, communication and other infrastructural facilities which are external and beyond the control of this sector creates additional hurdles.
- ✓ Moreover, the policies which are intended to favour SSI in terms of reservation and financial incentives, are neither favorable for employment nor improving the competitive base of this sector.
- ✓ One of the measures taken to overcome this malady incorporated in 'Decentralization.' Basically it helps in tapping local resources such as raw materials, idle savings which, in turn, improves the standard of living of the backward regions and helps to solve the congestion problem.
- ✓ Reform Period When economic reforms were initiated in 1991, measures were undertaken based on proper understanding of the problems faced by this sector and were well directed towards mitigating these handicaps.
- ✓ A policy package for small, tiny and village industries was announced in August 1991 with the primary objective of imparting more strength and growth momentum to this sector.
- ✓ Other features of this policy were related to setting up of a monetary agency to fulfill the credit needs of this sector, reviewing of all statutes, regulations, procedures and their modifications depending upon the situation, quality counseling, testing facilities, entrepreneurship development programs, Single Window Loan etc.