



President, SEE

Presidential Address

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Sectoral and Spatial Changes in Agri- Rural Environment

Agriculture provides sustenance to two-third of India's population, which has crossed more than one billion and still growing. Agriculture and allied activities contribute 25 percent to its GDP. However, with decreasing share of agriculture to GDP is resulting into rural poverty and people are faced with the livelihood problem. The rural poverty and livelihood issue is aggravated by rising standards and cost of living at one end and on the other shrinking land holdings and rising input costs. Food insecurity among the rural poor in India is a mirror image of poverty, therefore, must be maintained and further consolidated for livelihood security of rural poor. The Economic access to food is the critical component in Indian context and the growth process is the way to achieve lasting development. Growth, which is not accompanied by the improvement of the Social Fabric of society, will be only a hollow shell. Vastness of India and agro-climatic diversity enables it to produce wide range of crops and commodities. It has succeeded achieving quantum jumps in production and productivity of almost all crops and animal products.

Poverty in India is essentially a rural phenomenon particularly among the rural poor. Nearly 70 percent of the poor live in rural India and bulk of them are farmers and agriculture dependent. Despite the Green Revolution, Indian agriculture is not as productive, competitive, remunerative, and sustainable as desired and expected. The Green Revolution has fatigued and an imbalance exists among total production, national food security and household besides individual level food security. The impact of climate change on agriculture could result in problems with food security and may threaten the livelihood activities upon which much of the population depends. Climate change can affect crop yields (both positively and negatively), as well as the types of crops that can be grown in certain areas, by impacting agricultural inputs such as water for irrigation, amounts of solar radiation that affect plant growth, as well as the prevalence of pests. Indian climate is dominated by the south-west monsoon, which brings most of the precipitation. It is critical for the availability of drinking water and irrigation for agriculture. Agricultural productivity is sensitive to two broad classes of climate-induced effects; (1) direct effects from changes in temperature, precipitation, or carbon dioxide concentrations, and (2) indirect effects through changes in soil moisture and the distribution and frequency of infestation by pests and diseases. Rice and wheat yields could decline considerably with climatic changes. However, the vulnerability of agricultural production to climate change depends not only on the physiological response of the affected plant, but also on the ability of the affected socio-economic systems of production to cope with changes in yield, as well as with changes in the frequency of droughts or floods. The adaptability of farmers in India is severely restricted by the heavy reliance on natural factors and the lack of complementary inputs and institutional support systems. Extensive and dramatic changes are occurring in the Indian economy as a result of the globalisation of economic activity and the implementation of structural adjustment reforms. Indian agriculture faces the dual challenge of feeding a billion people in a changing climatic and economic scenario. However, there is not much scope to increase the area under food grains. Agriculture is the predominant means of livelihood for a large number of peasant cultivators and agricultural labourers, for whom it is not easy to shift to other occupations. Due to their low financial and technological adaptability, such groups are potentially vulnerable to both climatic changes as well as economic change.

Hence, it becomes important to examine the vulnerability to climate change not in isolation but in the context of ongoing economic changes. This translates into a dynamic interpretation of vulnerability and has important implications for developing adaptation strategies.

The agriculture will still continue to be the engine of the national growth and development. Rapid and balanced growth of agriculture is thus essential not only to achieve self-reliance at national level but also for household food security and to bring about equity in distribution of income and wealth resulting in rapid reduction in poverty among the rural poor. The Green Revolution process based on the synergy of advanced technology, effective policies and desired political will ushered in the mid 1960's, followed by white, yellow and blue revolutions, almost tripled the agricultural production, halved the real price of major food grains and other food items, increased the per capita food consumption by 30 percent, more than doubled per capita GDP, and also halved the percentages of undernourished and rural poor. India is one of the world leaders in the production of milk, rice, wheat, fruits, vegetables, cotton, sugarcane, poultry and fish. It is poised to achieve an all-time high of 220 million tons of food grain production.

Independent India has been fortunate to have visionary leaders who always assigned due priority to agriculture. Pt. Nehru's "Everything else can wait but not agriculture", Shri Shastri's "Jai Jawan Jai Kisan" and Shri Vajpayee's "Jai Jawan Jai Kisan, Jai Vigyan" pronouncements are eloquent testimony to the nation's commitment. The Presidents of India have invariably lauded the pivotal role of scientists, farmers, policy makers and politicians in ushering the Green Revolution and now Evergreen Revolution giving priority and emphasis on rainfed agriculture so as to make these gray areas green. This is critical for substantially, improved, livelihood and income of resource poor farmers who have no possibility for risk management unless practices of diversified agriculture are adopted- such as silvipastoral approach through crop livestock integration, agri-horticulture, (ex- Maharashtra), agro-forestry – mainly growing of trees around bunds (ex- poplar) or in the fields (ex- khejri). Crop and livestock insurance and linking farmers to markets (LFM) need to be the major strategic policy interventions by the Governments.

India has the largest cattle and buffalo population, second largest population of goats and the third largest of sheep in the world. Total livestock population is around 495 million. We are also the largest milk producers (91 mt) in the world today. Yet, we have not been able to compete globally in the export of milk products, meat and even live animals- as being done by Australia, New Zealand, Holland etc. Today, we also produce 41 billion eggs and have 490 million poultry birds. We need to link farmers to markets – the way it is done in Gujrat – through exemplary cooperative movement. Such efforts need to be replicated fast in other states as well. Supply of fodder and feed, use of silvi- pastoral approach in rainfed areas (especially Rajasthan, Madhya Pradesh, Maharashtra, Andhra Pradesh etc.), establishment of Centers; A.I, Livestock, Clinics, Supply of good quality, vaccines, insurance of livestock (at least of valuable productive ones), establishment of modern laboratories for processing, packaging, storage, and marketing (including export) facilities would all lead to much faster growth in livestock sector- for which India has great comparative advantage but so far not fully exploited. For example, we should be major producer of Mozarella Cheese, being the largest buffalo milk producer, yet our share in global market is almost negligible.

Supply of quality seeds has not been ensured by enhancing replacement rates of hybrids (100 percent), cereals (10 percent), oilseed and pulses (5-7 percent). There had not been expected growth for quality/ certified seed production over the last 5 years inspite of the adequate budgetary provisions made to the different states.. India currently uses fertilizers (about 107 kg per ha), which is less than half compared to China (245 kg). Hence, it is necessary to accelerate the annual mineral fertilizer consumption rate to at least 5percent from present 3.5percent, and to overcome the existing imbalance of NPK ratio. Fertilizer use has to be based on soil analysis in order to reduce the cost of cultivation and increase the margin of profits per unit to the farmers. Against national average, many states such as Rajasthan, Chattisgarh, Orissa, Assam, and most of NE states presently use half (50 kg) the fertilizer rate. These states must make efforts to overcome this serious gap looking the major productivity constraint. Major thrust would also be required to overcome micronutrient deficiency, such as

Sulphur, Zinc, Iron etc. Also target of atleast 5 percent for biofertilizer use needs to be achieved in the XIth plan. Increased use of efficient farm machinery and equipment for timely operations has to be promoted through large-scale fabrication, required subsidy and easy availability. (eg. Zero Till Drill, Raised Bed Planter, Sugarcane Planter, Rice Transplanter, Wheel Hand Hoe etc.). Precision farming is key for future success both under irrigated and rainfed agriculture. Supply of bio-control agents and biopesticides for enhanced use in crops such as vegetables, pulses, rice, maize, sorghum, sugarcane, cotton etc. will need special emphasis.

Another important issue is regarding crop-livestock integration, especially in arid regions. In some areas, such as Rajasthan and Maharashtra, major thrust should be on silvi pastoral practices using agro-forestry and use of rangeland pastures and legumes, beside, drought tolerant shrubs and trees such as Khejri (*Prosopis*), babool (*Acacia*), etc. In Rajasthan Canal area, especially Bikaner and Jaisalmer Divisions, a re-look is necessary at arable cropping to be replaced by raising pastures and livestock considering the long-term sustainability and profitability. Appropriate mid course correction through needed policy reforms would be desirable. Also we need to protect and improve our local breeds- being most valuable assets.

Most critical factor for faster growth in future will be the input use efficiency. It would demand for timely operations/ precision farming. Integrated Natural Resource Management (INRM) would call for more rational use of water, seeds, fertilizers, pesticides etc. Precision farming through greater emphasis on mechanization (both, in irrigated and rainfed farming systems) would be the major recourse in future. Large-scale manufacture of equipment and machinery/ tools (such as zero till drill, planters, seed and fertilizer drills, sprinklers, mechanical harvesters, combines and small tools for weeding, harvesting and threshing/ cleaning etc.) and their easy availability at appropriate cost will help in accelerating future growth in agriculture. Hence, these aspects being in the national interest, should receive priority attention during the XIth plan.

Overtime Changes in Extension Methodologies and Approaches

Agricultural extension has undergone considerable change over several decades. New policies are resulting in a large proportion of extension now being undertaken by the private sector rather than traditional public sector providers. These changes are continuing and have presented the agricultural community with certain challenges and problems. Traditionally, the major aim of agricultural extension was to advance the transfer of new techniques, new knowledge and new technology from the research sector to the farmers. The linear and mainly technology-driven model reflects the modernistic development perspective of the 1960s and is based on the positivist science paradigm. An example of the Transfer of Technology is the green revolution of the 1970s. The green revolution packages were suitable mainly to areas of high natural potential having uniform and controllable growing conditions. This model, aiming at a widespread adoption of technologies, is likely to be successful in relatively homogenous, low-risk, natural and social environments, where farmers live under similar conditions, perceive the same kinds of challenges and share a common set of beliefs and values. In Farming Systems led more emphasis is laid on (contractual and consultative) farmers' participation for better understand their complex situation and the inter-dependencies among elements of farming systems in order to develop adapted technologies (Biggs, 1989; Farrington and Martin, 1987; Rhoades and Booth, 1982).

India must create at least 100 million new jobs in the short and medium term to overcome the unemployment crises. The population "bulge" reveals that India has perhaps the largest youth mass in the world. Given the soaring current unemployment growth rate of nearly 5percent per annum and low annum elasticity, the youth energy is not being only wasted but also mischanneled leading to social problems and despair. Agriculture being the largest job provider (nearly 56 percent of India's population is directly engaged in agriculture), its growth must be rendered youth-friendly. Agricultural clinics, rural agricultural information centres, private sector based technology assessment and transfer in selected areas and rural agro-processing and small and medium size enterprises (SMEs) are some of the propositions to attract the youth for gainful self-employment. Necessary skill development, investment through short-term loans and micro financing mechanisms, coupled with marketing support are a must for this purpose.

As experienced in China and several other East and South East Asian countries, effective Action Plan and its implementation for improving employment security is fundamental to our fight against hunger and poverty. In India, agriculture must lead this movement. Promotion of small enterprises, skill upgradation marketing improvement, expansion of services, development and promotion of exports under the WTO regime, creation of innovative organizational and management capacities and improved commercial systems in the market place, extending basic education especially in rural areas and particularly to girls dissemination of information and making full use of the newly established Kisan Call Centres, increased velocity and ease of money and other transactions and employment planning by identifying new and untapped growth and employment potentials in agriculture, allied and other industries, export and services must receive high priority in the national planning and deployment of resources which, should be judiciously utilized on the most important elements mentioned above keeping in mind location-specificity and pay off potential.

Analytical the first step is to identify the main issues in the changing landscape of agricultural innovation and development that we need to tackle. What are the main changes that affect agricultural R&D, extension, education and agricultural development in general? Once we have identified these changes, can we ask further questions about how each component and actor in the system has to change? These questions may have to do with the nature and extent of change, possible period or sequencing of change, or partners in change, new norms or rules (such as prioritization, accountability, incentive and reward structure, natural resource accounting and poverty impacts).

There are important milestones of success in green revolution technology. This success, however, must not perpetuate a 'business as usual' approach to the generation and utilization of knowledge and technologies in the agriculture sector. The innovation system must now look for *ways forward to the next stages of excellence and success towards agro-ecological and socio-economic goals*, towards an evergreen revolution in agriculture.

The agricultural extension system in our country was devised to support the multifaceted approach for achieving the goals of self-reliance in the sector. The agencies, directly or indirectly associated with the task, include national institutes/directorates, SAU's network, input companies, NGOs, agro-processor, private consultants, farmers associations and other organizations. The transfer of technology, human resource development and information and communication system formed the key components of extension strategies. A re-evaluation of the role of extension and restating the strategic approaches to agricultural extension was necessitated due to the challenges offered by sustainability considerations, complex problems arising from the Agreement on Agriculture under WTO, the changing nature of agricultural technology, rapid developments in Information and Communication Technology (ICT) and the changing development agenda. Public expenditure on agricultural extension and its control have been justified on the ground that support for agriculture leads to reduced food prices and increased food security, poverty alleviation, employment generation, environmental conservation, etc. which benefit the whole population specially the poorest of the poor in the society. Important and pertinent questions are raised in this connection as to who should fund and deliver extension particularly agricultural extension which has to play various roles ranging from provider to coordinator, facilitator, arbitrator, regulator, guarantor, etc.

Farmers need to be supported with information, knowledge and the skills to adopt improved technologies that would enhance productivity, employment opportunities and sustainability. Therefore, the ambit of agricultural extension has remarkably widened and the onus of managing the complex affairs rests with agricultural scientists and extension specialists working with public and private sectors as well as NGO's of the country so as to help the farmers to produce according to the requirements of the markets.

The supply pool for agricultural commodities is no more confined to domestic production alone. The countries having competitive edge in cost of production are looking for opportunities to dump their output anywhere in the world. Despite our complex and diversified agriculture, it is yet to pass the test for comparative advantage in terms of cost effectiveness for many important commodities. Unless, we succeed in inducing cost effectiveness

having locational advantage, it may not be possible for us to harness the benefits of WTO through export of agricultural commodities. Besides, we have to face a number of emerging threats including unrealized opportunities in agricultural marketing; unwarranted imports by other countries; under exploited export opportunities for Indian products and distortion in domestic markets.

Since India has entered in global market and signed WTO, it is necessary to change our outlook on agricultural marketing system, especially in view of the Exim- policy and the existing dynamics in domestic markets and the new agricultural policy. Market- oriented agricultural extension is the need of the time, which is the real challenge for our public sector dominated agricultural extension system. Following factors are to be taken into consideration for a sound agricultural marketing extension for the sustainable agricultural development:

Farmer- Agro- Industry-Consumer Linkages : There is a need to have strong linkage between agricultural marketing and agricultural production system as ‘what to produce’, ‘how much to produce’, ‘how to produce’ and ‘for whom to produce’.

Shift in Physical Output Value Realization : Ensuing shift in the approach from increased physical output to increased value realization by the producers in the need of the time.

Agro- Processing and Value Addition of Agricultural Produce : India has great potential for expanding its export of processed products in view of the increasing production of fruits and vegetables, dairy products, meat and marine products, etc. The practice of contract farming is coming up around such processing centers. More and more processing facilities for such commodities need to be augmented.

Grading and Packaging : In view of tremendous potential for export of fruits and vegetables, it is necessary to give greater attention to grading and packaging of these commodities by creating required infrastructural support.

Diversification of Agriculture: India has enormous inherent potentials for diversification and scope to introduce new areas in agricultural production such as hi-tech horticulture, precision farming, organic farming, etc.

Augmented Infrastructural Facilities: A strong infrastructural support has to be developed in terms of cold storage chains, transport, credit support, market information and insurance to fully exploit opportunities for export.

Cost Effectiveness : The country’s agriculture has to become more cost effective to meet the growing challenges and opportunities arising out of WTO agreements and the consequent globalization impacts. For this, future growth of agriculture has not only been yield based but should be tilted towards ensured demand in the national and international markets.

Export Promotion : There is a great need to orient our agricultural production system for enhanced export promotion.

Global Market Research and Information Center: An apex center at the national level for market research, international price analysis, global demand, availability and also to pass on this information to the concerning authorities is very much required.

Upgrading of Human Resource through Trainings : There is a need to train the farmers in the areas like product planning, marketing information, preparation of produce for marketing, improved marketing practices, rules and regulations, input marketing, etc.

Involvement of Private Sector : Efforts should be made to involve private sector in creating necessary marketing infrastructures.

Marketing Information Network : Easy access to timely and relevant information to farmers, traders, policy planners and other marketing agencies so as to enable them to have proper marketing decisions is very much needed. Application of IT in this area is still a miss-link.

Marketing of Agro-Inputs : For the marketing agro-inputs like seeds, it is necessary to streamline and

simplify seed certification procedures, modify the Seed Act and enforce it strictly. Greater participation of private sector, coo-operatives and NGOs in the production and distribution of seeds is required.

Declared EXIM Policy (2002-07) by Government of India : The knowledge on freely exportable and importable commodities, restricted as well as non-exportable/ importable at various levels as it has implications on the marketing of agricultural products.

Effect of Rural Migration and Urbanization on Agriculture

Rural population has migrated to cities due to lack of employment in agriculture sector as livelihood security of rural poor is uncertain in this sector, hence there is need to empower rural women to secure their livelihood through other alternatives. Livelihood of rural poor can be secured by way of adopting agro based highly remunerative and income generating enterprise like Mushroom production, IPM, Processing and preservation, Vermi composting, Nutritional garden, Dairying, Poultry, Strawberry cultivation and value addition etc. The intervention like crop enterprise technology, approach and service diversification can contribute significantly in sustaining livelihood.

In advance countries like USA there has not only been a substantial increase in employment of women but the last decade has seen the number of self employed women increased by 9 percent as compared to 13 percent in the number of self employed men (D. Lalitha Rani). This trend depicts that entrepreneurs seem to be ideal for women who would like to participate in the country's socio- economic development. Moreover, the role and degree of integration of women in economic development is an indicator of women's socio- economic dependence and social status, therefore, immense need is felt by developing nations to mobilize women into different professional fields including entrepreneurship in a planned manner.

The economic development of a country is correlated with the population, employment, literacy and effective utilization of resources together with industrialization process, which accelerates the growth including social change. The mobilization of economic resources of the country is highly beneficial by the technological advancement depending on human resources development, which has gained momentum in the recent past. Human resources comprise both men and women.

For all round development and empowerment of rural women and for reducing gender inequality, it is imperative to disseminate right kind of relevant information to the society in general and rural women in particular. Empowerment of women can become a reality only when they have the confidence and ability to engage in independent and income generating activities and enterprises. The country needs to mobilize and utilize fully, all its resources, including human resources. The participation of rural women in economic activities is necessary not only from a human resource point of view but is essential even for the objective of raising the status of women in society. Although, women form almost half of the world's population and form an integral part of the society, yet, women world over have been suffering from various types of discrimination and deprivation from times immemorial, owing to socio-cultural ostracism and other ethos. During the last few decades, there has been a global concern to bring women interested in mainstream of economic activities so as to ensure their quality and empowerment.

Rural India accounts for nearly 60 percent of the country's house hold consumption, and thereby, represents the largest potential market demanding immediate attention in our efforts to project the country as a global force in terms of agriculture and economy. Sustainable development can be realized only when economic growth benefits the poor and underprivileged section of the population, which live in rural areas. Food processing industry has enormous significance towards ushering speedy transformation of the rural economy, in particular, and the national economy, in general, besides reduction in rural migration.

Food processing helps in promoting a synergy between the two major components of the economy, namely, the agriculture and industrial sectors. Strengthening the agri-industrial base of the country will also be beneficial in preventing population shift from rural areas to urban areas, improving economic condition of the

rural people, promoting entrepreneurship and in generating employment in rural areas. Having become aware of the vast potential of promoting agri-business in rural India. Some of the corporate houses have taken a lead by establishing processing units and strengthening marketing activities in rural areas.

Growers have no share in value-addition to their produce and by-products. Large part of year of their family labour is un or under employed. Landless often migrate in search of wage earning dislocating education of children. Scientists, policy makers and development agencies are looking towards rural food and agro-processing as a tool for additional income and employment to the rural people in rural areas having potential scope for enabling them to meet their needs at the least cost, retain and use waste and by-products usually to feed, fuel and industrial raw material value in the production catchments and market surpluses after value addition. Leading luminaries of Indian agriculture consider PHT and Value Addition as half the agriculture story.

Food and agro-processing is not something new. It has existed all along with human cultivation and progressively advanced with it. In modern times it has emerged as a multi-disciplinary area of academics, research and development. Some 3000 years BC, the hunter-gatherers transformed themselves in to farming-cum-semi-pastoral livestock husbandry society, after they learned to domesticate plants and animals. They were remarkable people who invited tools and implements of farming using men and draft animals, irrigation, transport, storage, primary processing etc.

In the developed countries of the West, the rural to urban migration and the urbanization are associated with a vertical shift in the labour force from the agricultural sector to the urbanised-industrial sector, whereas in the developing regions as India, migration is from rural agricultural sectors to urban informal sectors. This is a typical manifestation of under-development, poverty, and spatial disorganisation of economy of underdeveloped sectors of the society, which arose partially as a result of past colonisation and its adverse consequences on space economy. These displacements are not due to structural changes within the labour force as seen in the West, but as a dislocation of uprooted workers and peasants from the marginalised countryside to involuted urban centres. This displacement in India is a typical characteristic of urban growth that has outpaced industrialisation. It is a system of underdevelopment, and it tends to compound further underdevelopment (Mukherji S. 2002)

There is overwhelming evidence that internal migration can lead to positive change in both sending and receiving areas (Deshingkar and Grimm, 2004). Migration can help to reduce poverty or to halt the slide into poverty. For example, the income earned by women migrating from West Bengal to Delhi to work as housemaids meant that they had been able to move out of poverty (Mukherjee 2004). It can increase income, savings and assets. For example, a study of 955 migrant households in Tamil Nadu found that 57 percent of lower income migrants had seen their income increase and 53 percent had increased their asset holdings (Sundari, 2005) and migrants from Mahbubnagar District, Andhra Pradesh, and to the paddy fields of Karnataka have been found to save an average Rs. 2000-3000 per season (Khandelwal, 2002). It can lead to the sending of remittances to marginalised sending localities, which can be used to invest in human capital or in productive assets in sending localities and can play an important role in reducing vulnerability, improving food security, stimulating land markets in sending areas, increasing local wages and the demand for local goods and services and generally improving the economy (Deshingkar, 2006). It also helps tighten rural labour markets (Wiggins and Deshingkar, 2007). Poverty in India is essentially a rural phenomenon although lately urban poverty has also been increasing, but a good proportion of it comprises the rural migrants. Nearly 70 percent of the poor live in rural India and bulks of them are farmers and agriculture dependent. Despite the Green Revolution, Indian agriculture is not as productive, competitive, remunerative, and sustainable as desired and expected. The Green Revolution has fatigued and an imbalance exists among total production, national food security and household and individual level food security.

There are some negative impacts to acknowledge, however, migration can lead to an acute shortage of labour and high dependency ratios in sending areas. Mass male migration can lead to worsening poverty, but these risks are off-set where wage rates are sufficiently high to allow regular remittances. People who are away for a long time may lose access to natural resources and lose their voice in community decision-making. Migration

can also have a negative effect on collective action and natural resource management, where significant labour inputs are required (Deshingkar, 2003).

Emerging Innovative Methodologies /Models /Cases of Extension Education

Today, the transfer of technology model is often viewed as the antithesis of participatory research. However, this is often not the case. In fact, much of the present participatory practices can still be classified as an expansion of the transfer of technology model because information is obtained from farmers and incorporated into scientific research. Participatory methods are used to better meet farmers' needs and to adapt technologies to site-specific circumstances at a relatively late stage of the research process. By the mid-1980s, people were re-thinking the transfer of technology model and emphasis was on the farmer. There are different types of approaches summarized under 'Farmers First'. Farmers became part of the process of generating, testing and evaluating technologies that promoted sustainable agricultural production. The main outcome expected from these approaches is the generation and adoption of new, appropriate technologies by small, resource-poor farmers to aid in solving production constraints in order to increase farm productivity and income (Selener, 1997). Most of the current NRM research initiatives focus on the generation and provision of technologies, assume a functioning linear research-development continuum, use mostly consultative forms of participation, and consider participatory research as a tool for applied and adaptive research. Therefore, they principally fall into the categories of 'transfer of technology' and 'farmers first' approaches. Longer-term participatory learning and action research approaches are only beginning to be chosen by international agricultural research centres (IARCs) as they require a different kind of professionalism and challenge the mandate, i.e., they are considered to fall under the sphere of development rather than research.

The present departmental mode of organization and management public systems in agricultural research and extension need to be moulded in an innovation system framework. This implies demolishing dichotomies like research /extension, plan/non-plan, centre/state, public/private, agricultural/rural, and so on. More effective mechanisms must be identified and developed to internalise stakeholder involvement in decision-making and improve partnerships across the board. There is need to shift from an hierarchical and linear technology generation-diffusion model to a non-linear and holistic learning mode.

This will necessitate creating and nurturing a broad-base 'think-tank' at the ICAR and SAU levels. The model of the Technical Advisory Committee (TAC) of the CGIAR with its own secretariat and loop in the funding process may be adopted with suitable modifications. At the level of institutes also, there is need to expand and back up bodies like the Research Advisory Committee (RAC), governing Councils etc. to play this role effectively.

Bureaucratic and financial norms of functioning and accountability processes have proven inadequate for meeting scientific goals. These need to be replaced by more autonomous, flexible and performance-centered processes and management climate.

Improving Extension Research Linkages : The reforms in agricultural extension on the aspects of research extension linkages include promotion of direct interface between farmers and scientists to minimize transmission losses. Activating existing interface mechanism and institutional linkages through various forum and research prioritization based on strategic research and extension plans are the means suggested for improving research extension linkages.

Capacity Building of Extension Functionaries : Various measures are suggested for capacity building of extension functionaries include formulation of HRD policy by states to avail central support to HRD and formulation of a long term training plan for extension functionaries. Such training plan covers two major aspects, namely foundation courses and professional courses. The foundation courses may cover areas like need assessment technique, group formation, development of entrepreneurial skills Agri-business, Agri-business management, WTO and its implication, marketing of agricultural production, post- harvest management, management of common property resources, use of different type of media, communication, project preparation, data collection, analysis

and documentation, etc. The other steps suggested for capacity building are (i) one time catch up grant for developing infrastructure for training (ii) upgrading of state level extension management training institutions (iii) developing professionalism in cost-effective manner (iv) strengthening the role of MANAGE and (v) networking among all SAUs.

Empowerment of Farmers : In order to project farmers as major stakeholders of the extension system, it was suggested to involve farmers in setting extension system agenda and also in the implementation of programmes through farmers user group. Contracting arrangements between government agencies, organizations for extension services and farmers have also been suggested. Acquisition of skill by farmers through training and other programmes also form integral component for empowerment of farmers.

Main Streaming of Women in Agriculture : The necessity of targeting women to receive information related to their work is highlighted. Special programmes for improving access to extension and training by rural women farmers are the other measures suggested in this direction.

Use of Information Technology : Increased use of information technology in agricultural extension has been advocated. It is pinpointed that information technology can be effectively applied in agricultural marketing extension. Farmers participation in IT programme, support to develop information technology for agricultural extension by various states, development of private information shop, effective use of IT, etc. are the other important aspects covered under the reforms in information technology. With the launching of 'Kisan T.V Channel' and Call Center Services the relevance of IT in farm information has become more pronounced.

Financial Sustainability and Resource Mobilization : Realizing that public funded extension will continue to play a predominant role in technology dissemination, cost effective mechanisms for extension services has been suggested. The steps suggested for financial sustainability include (i) efficient use of available resources (ii) privatization of agro- services (iii) realistic cost of recovery of agro- services (iv) co- financing of public extension by farmers and (v) initiating new financial system.

Changing Role of Government : The states will have to play an effective role for the regulation and enforcement of the extension system. Enhanced competition among extension agencies, strengthening of farmers association and development of physical infrastructure are the other parameters to be taken care of by the state government.

The extension system with the involvement of Government agencies, NGOs, farmers organizations, private sector agencies, para workers, etc is going to be more effective and dynamic. The agricultural extension system will have to transform itself with the capacity building to meet the challenges arising out of farming system approach. The transfer of technology system is likely to undergo radical reforms as the farmers need a wide range of services on aspects like marketing, credit insurance, infrastructure (including cold- chains), entrepreneurship, etc. It is possible only through changes in the institutional and organizational set up of our extension system. The extension system has to be sent on a "system management" mode, since the goal of extension has to make a shift from "technology dissemination" to "system management".

As high competitiveness is a priority in the globalized world and much of it, is underpinned by information revolution, increasingly knowledge will substitute monetary inputs. Technology packages largely will become knowledge-based. The existing agricultural technology development and transfer system in India, including the human resources and infrastructures, are outmoded, causing serious technology gaps and slippage. The extension and technology transfer system must be updated and the huge urban-rural digital divide must be narrowed. A crash training and skill development programme and establishment programme and establishment of rural information centers must assume high priority. Such programmes would particularly be attractive to the rural youth, who are mostly unemployed or underemployed.

Introduction of para-professional/ vocational courses in specific, but applied areas of agriculture for grass root level services to limit the undesirable intake in higher education and also to support self-employed graduates in areas like Agri-business and Agri clinics must form part of our strategy for employment oriented agricultural education. Such para professionals should have the advantage of fluency and flare to communicate in local

language; base the line information on village life, livelihood means, soils, water, flora and fauna (domestic and wild), traditional practices and beliefs and modern knowledge and skills on diverse crops, livestock including their varieties and breeds, agronomic practices, methods of soil and water conservation and testing; necessary information on ecological principles in managing diverse natural resources, practical exposure to general field problems and experience to administer prescribed treatments.

It is unaffordable to refrain ourselves from reorienting agricultural education in consonance with contemporary and futuristic needs of job markets. The foremost task is to regulate number of admissions in subjects and disciplines based upon regular reviews and assessment of job markets and corresponding manpower needs. In order to foresee the future employment avenues it is necessary reengineer agricultural education in consonance with requirements of various stakeholders i.e., public institutions, private enterprises, graduates seeking self-employment, NGO's and farming community. Keeping the focus on job market in view, the introduction of subjects and methods of teaching and learning aligned fully with employability should form the core of the strategy on new courses of agricultural education. While making the blue print to reengineer the course curricula, there is a great need to orient it with other sectors of the economy, country's national commitments and international obligations. The course curricula must find adequate importance on newly emerging frontier technologies, global concerns like sustainability, food security, livelihood security, poverty alleviation, bio-diversity and conservation, natural resource management, environmental safety and new areas like farming systems, hi-tech horticulture, precision farming, green cultivation, Agri-business, international trade and regulation and other enabling aspects.

The curricula must be framed in such a manner that the graduate professionals must have fluency to convincingly communicate in local language; expertise and upto date knowledge on production, protection, processing marketing and managerial aspects of agriculture and allied areas. Entrepreneurship ability, capacity to take initiatives in new ventures; business acumen, marketing skills and competence to infuse primary processing activities (grading and labeling) so that produce earns maximum price and profitability; leadership and team working, managerial qualities, computer literacy to update technical management and commercial knowledge and national policies and global happenings to offer latest and viable information on and solutions for problems faced by farming community must be the added focus of agricultural education. Subsequently, suitable revision of post-graduate courses in terms of subject matter knowledge as well as capability and willingness to work in inter and multi-disciplinary team and ability to build and lead research teams should follow.

With changing accent of education on producing professionals suiting market needs, the teaching methodology will require a radical change. Envisaged strategy is to move from teaching to learning with increasing emphasis on hands-on practice in real life situations infusing self-learning. A life-size and level ground for learning will require creation of facilities and enabling environment for practice. Strategy towards this goal may require to forge intensive tie-ups with development departments, industrial/business houses and NGOs enabling students using their facilities and expertise for practical training.

Relevance and excellence must underpin the functioning of our universities. None other than Nobel Laureate Professor Amartya Sen had stated on November 14, 1999 that "University education in India is in a state of crisis. It is not a crisis of lack of resources, it is deterioration of quality quite a lot of our success depend on not what we inherit but on what we acquire and how we apply it". What is needed today is extra-ordinary teachers and scientists who will be able to face challenges of future agriculture and produce the product which will be competitive in the international market. For this, universities must nurture and nourish extra-ordinary teachers and scientists devoted to the cause of science and at the same time are dedicated to their profession of teaching, research and extension.

In order to make way for teaching in real life subject and expanding room for practice and innovativeness through hands-on training it will also be necessary to build competence and capability of teaching faculty in emerging areas of science and technology and skills in vocational courses. The periodic refresher programmes for knowledge upgradation of teaching faculty must be ensured through centre of excellence in various professional areas. In fact, investment to develop faculty is a key strategy to facilitate change through introduction of new

subject of learning, optimally utilize the institutional infrastructure for practical training and forge linkages with other sector of economy for skill development during internship.

Policy Initiatives for Improving Environment for Different Stakeholders

The policy regimes of the past, which had put in place a huge public R&D system, have changed. These systems themselves have started showing sign of attrition. This has far reaching implications for the future of Indian agriculture. Unfortunately, there is little indication of awareness or response on the part of the apex bodies in some cases ill-conceived and hasty response either at central or state levels.

There is a felt need for insights into the relationship between agricultural science and policy in the Indian context. While the latest National Agricultural Policy document of the Government of India provides an immediate focus concerning the capacity of R&D to identify and respond to the crucial and durable elements of agricultural policy on the one hand, and to contribute effectively to policy formulation it self on the other. The nature, extent and direction of changes in agricultural R&D, education, and extension demand detailed deliberations among the stakeholders – the community of professionals, farmers, NGOs, policy makers; both from private and public sectors. Other changes include increasing private sector presence and profit motives in agricultural R&D on erosion of public sector commitment to basic and poverty oriented research, and the potential and uncertainties of emerging biotechnology and information technology regimes. The demand for sustainable agriculture and poverty alleviation, the need for introspection and evaluation in R&D, are other challenges demanding critical changes in R&D paradigms.

A progressive and dynamic R&D system to address agro-ecologically relevant strategies demands decentralized of ideas, approaches and power in the conduct of research. The agro-ecological paradigm also implies a shift from commodity – based organization of applied agricultural research and development. Since the productivity of disciplinary/ subject matter research has reached a plateau, a system oriented, inter-disciplinary, issue-based approach is now necessary. This will necessitate reorganization of research at functional levels (institutes, research stations). Basic and strategic research is the precursor of productive applied research, a fact, which is being lost sight of in the quest for relevance and visible impact. Policy makers and planners need to take note of this disturbing trend. Central research entities (in ICAR) need to push their research upstream and funding agencies should accord priority to supporting basic and strategic discipline – based research also.

Funding for public agricultural research extension and education continues to be stressed, more so at the state level, with conflicting policy signals. The government makes a commitment to raise public investment in R&D on the one hand; it enjoins ICAR and SAUs to mobilize their own resources on the other. It is high time that the issue of the level of investments, roles of public, private and international players are discussed and stored out in a consultative mode. Past efforts have been partial, ad hoc and ineffective.

There is a need for enhanced social science research capabilities both for policy analysis and to develop R&D strategies for specific agro-ecological regions and farming systems. There is need for greater interaction between natural and social sciences. This will help the R&D system to build bridges with policy making on the one hand and the endures (farms) on the other hand in interactive ways. The National Agricultural Policy visualizes technological upgradation of Indian agriculture as a core element of the agricultural development strategy. The goals of sustainable agriculture, food and nutrition security, risk management as well as growth and agricultural trade depended critically on improved R&D processor in the sector. Specifically, it endorses the concept of regionalization of agricultural research based on identified agro-eco regions, (location-specifically). Use of frontier sciences, participatory and proprietary approaches in R&D, strengthening research-extension linkages, and a “well-organised, efficient and result-oriented agricultural research and education system to introduce technological change in Indian Agriculture”. It calls for a redefinition of the partnership between central and state governments, assigning an upstream role for the centre. It also charts a pathway of incentives, support systems, investment imperatives and policy to “actualise that vast untapped potential of Indian agriculture”.

The National Academy of Agriculture Sciences recognized that the Indian agricultural innovation system needs to prepare itself for the imminent changes in agricultural R&D and education systems necessitated by this challenge. Unlike other public support systems, the public R&D sector has had the tradition of being more open to reform. Several internal and external reviews have been undertaken over the last decade or two. In fact, for the central system- the ICAR, such scrutiny is mandatory at the level of each institute / centre at quinquennial intervals. Yet, in view of the rapid and far-reaching changes in the agricultural scenario, emerging pressures on public systems across the abroad, and indications of slackening tempo in research and transfer of technology, the National Academy of Agricultural Sciences felt the need for an interactive dialogue for further reforms in the agricultural R&D system in the country in the changed scenario. The contours of Indian agriculture are changing and, the national system must also articulate new paradigms.

There is increasing recognition that farmers obtain technical information from a wide range of sources, that such information has to be adapted to a variety of agro-ecological and socio-economic conditions, and that farmers' own knowledge is essential in the selection and adaptation processes. The boundary between public sector extension services and farmers is shifting: farmers are reaching higher into the technology generation and transfer system in order to 'draw down' suitable technologies. The boundary is also becoming more uneven: those producing commercial crops are obtaining technical information from private sector input supply, processing and marketing agencies; those growing food crops are drawing on a much wider range of information supply channels and institutions than government alone, and where they do interact with government, they frequently do so not individually but via organisations representing their interests.

An important implication is that the view that 'government must provide' through blanket extension services reaching directly to farmers is outmoded: the most efficient extension services of the future will focus on spheres (geographical; thematic) inadequately serviced by the private commercial sector, which are likely to include soil and water conservation, other environmental, health and safety issues, and the provision of advice (and inputs) to food crop production especially in remote areas. Nor will extension services of the future restrict themselves to direct interaction with farmers: they will also aim to service in different ways and at different levels a multiplicity of intermediate organisations which themselves represent or work with farmers.

Institutional pluralism and farmer participation are important facilitating conditions for effective extension, and are themselves best served by political and macroeconomic climates which encourage: the formation of local groups; administrative and fiscal decentralisation of government agencies, and procedures to allow rural people a voice in the processes of planning and decision- taking. The enabling environment can be further improved by strengthening physical (roads; telecommunications) and social (literacy, numeric) infrastructure.

Alliances between government extension (and research) services and other organisations such as NGOs or farmers' associations enhance the prospects of technical effectiveness, cost sharing and of cost recovery, thereby increasing the impact of extension per unit of government expenditure. The evidences suggest that, outside commercial settings, farmers are unlikely to pay for technical advice alone. However, it is clear that even low-income farmers will pay (if necessary via credit) for tangible inputs expected to be profitable (pesticides; vaccinations; certain tree seedlings), that they seek advice at the time of purchase, and that government efforts selectively to expand the types of advice that input suppliers can provide, are likely to yield high returns.

Mechanisms for feedback from farmers through extensionists to researchers have been weak in the past and a high proportion of technologies deriving from research have remained non-adopted. Extension structured around a strong management system (T&V) has failed to improve this. The main constraints may lie elsewhere such as in researchers' reward systems, which in many countries are, based more on papers published than on levels of adoption. Similarly, systems for accountability focus more on regular report-writing and financial integrity than on adoption. Both sets of pressures discourage the search for feedback but institutions such as NGOs and farmers' organisations are often better motivated than extension services to exert pressure on research. Donors and governments could usefully search for ways of enhancing the volume and impact of such pressure.

NGOs have developed a number of farmers participatory approaches relying on such institutions as local groups moulded on 'empowering' principles, with volunteer extensionists representing the interests of the group. These experiences have demonstrated the substantial improvements in type and pace of technical change that

participatory approaches can bring. However, these approaches are time-consuming and it has not been demonstrated how they might be replicated on a large scale. A shrewd assessment will be needed to screen out unjustified assumptions about the representativeness of groups, the sustainability of volunteer extensionists and the amount of time that poor people have available for meetings, discussions and the like.

It is, therefore, necessary that we continue having appropriate policy interventions in future as well. If we have to attain the growth rate target of 4 percent in agriculture sector. As such, following areas would need specific attention during the XI Plan period:

- * Enhanced capital investment in agriculture;
- * Creation of enabling environment to link farmers to markets (LFM);
- * Credit availability to farmers at low interest rate;
- * Announcement of MSP well in advance for essential and strategic crops/ commodities;
- * In view of globalisation of agriculture, a new policy on agricultural exports to capitalize on our comparative advantages –linked with well-organized action plan;
- * Major incentives for greater use of growth linked agricultural, inputs (seeds, fertilizers, both mineral and bio-fertilizers, pesticides, both chemical and bio-pesticides, farm machinery and equipment etc.);
- * Continued support for buffer stocking of essential commodities at a threshold level (ex: around 15 million tons for cereals)–with creation of ultra modern silos and cold storage facilities to avoid any post harvest losses;
- * Insurance of crops and livestock with premium rates that are affordable by the resource poor farmers;
- * Incentive oriented and simplified laws and procedures for the establishment of small-scale cooperatives for processing and value addition of their farm produce in rural areas;
- * Accelerated pace for the consolidation of land holdings in states lagging behind so far and future land use planning on the scientific and eco-regional basis.

Food insecurity in India is a mirror image of poverty. It emphasizes that while adequate and sustained production and physical and timely access to food—two important components of food security, must be maintained and further consolidated, the third component i.e. is economic access to food is the critical component in Indian context. The growth process is the way to achieve lasting development. Growth, which is not accompanied by the improvement of the Social Fabric of society, will be only a hollow shell.

Strategies for Developing Sustainable Approaches and Models :

The three vital strategic components based on which the Indian agriculture was meticulously transformed during the planned era included technology packages, institutional support and policy interventions. The radical metamorphosis of agriculture could be made possible through technically qualified manpower produced within the country. The institutional network for agricultural education developed after independence has assumed the status of “National Education System”, which is one of the largest in the world. The task of agricultural education in the country is mainly taken care of by 261 colleges. The 42 SAUs and three Deemed-to-be Universities are also meant to impart education in Veterinary, Fishery, Dairying and Animal Sciences.

The research and development efforts targeted for achieving self-reliance in agriculture opened up a series of avenues during this period. The agricultural education system was well set to prepare the graduates to meet the requirements of various public sector organizations. The goal of accelerated agriculture production was largely entrusted to government sponsored public sector departments and institutions. Tailoring the research and development programmes in order to cater to the standards of domestic and export markets through establishment of laboratory facilities for quality control in State Agricultural Universities and Development Departments could not meet the requirements, therefore, special attention required in view of the commercialization of agriculture efforts required to encourage co-operative/ contract farming with buy- back arrangements to initiate market-led production. Implementing suitable programmes for promotion of value added products out of arid zone covering suitable dry land crops.

Promoting the use of eco-friendly inputs, practice of precision agriculture and participatory technology development for sustainable increase in productivity and production of exportable surplus by bringing down the cost of production and improving the competitiveness of Indian Agriculture. For exploitation of the agro-ecological

diversity of the country, programmes should be evolved for production/ export of agricultural produce from different regions during the off seasons in importing countries. The APEDA and SAD's can work on this and the State Departments of Agriculture, Horticulture, Agricultural Marketing and State Agricultural Marketing Boards can implement this.

Sensitizing the policy makers on creation of community level infrastructure for grading, packing and packaging, storage and promoting grower's association to empower them to negotiate on price. By undertaking the human resource development activities on latest technologies of value addition and post harvest processing capable entrepreneurship at village level need to be developed effectively.

Credit availability must be enhanced by improving Institutional lending to convert agriculture in to agri-business besides creating awareness to use crop insurance programmes and encouraging public private partnership. Adoption of suitable national strategies on augmenting animal productivity, production, consumption and marketing of animal products will generate capital formation per unit of animal resources. Creation of realistic database on meat, milk and egg production, handling transportation, pre and post harvest loss, marketing etc for better economic return. Cutting edge technologies on processing, preservation and value addition on animal products by integrating newer bio-technological tools with the ITK need to be developed. To improve the export oriented meat production, buffalo male calves management with high input ration be made for increased growth rate for marketing. Scientific infrastructure support for in poultry sector, public private partnership may be encouraged in areas like cold chain, processing equipments, distribution net works etc. to produce locally acceptable, cost effective value added poultry products with due consideration of the post harvest losses and efficient utilization of by-products.

Technology specific extension models based on agro-ecosystem need to be developed. Demand driven approach is to be emphasised instead of supply driven approach. Quality extension services like ISO certification, HACCP, EUREPGAP for both public and private service providers are to be encouraged. Role delineation and linking ATMA and KVKs for effective implementation of extension programmes at district level is another critical measure to be taken up for proper coordination and integration of extension approaches of Department of Agriculture and Cooperation (DAC), Government of India and Indian Council of Agricultural Research (ICAR). Feedback should be strengthened and its effective use for improving the quality of extension services at the grass root level must be ensured. Participation of front line extension scientist/subject matter specialist in technology generation, assessment, refinement and transfer can play a greater role. Cost economics of technologies are to be focussed, accountability of the extension service providers are to be ensured through proper monitoring and involvement of farmers and other stakeholders. Village knowledge centres and Agri-clinics may be linked and integrated with public extension system (SAU, ICAR, line departments) for providing farm advisory services and quality inputs as well. The effectiveness of front line extension of SAUs and ICAR and extension services of state line departments has gone down due to lack of adequate qualified manpower. Vacant posts in SAUs, ICAR and the line departments at all levels should be filled up regularly with priorities.

Capacity building of the staff involved in extension needs to be enhanced for knowledge and management. A functional and organisational relationship between development departments involved in providing extension services needs to be delineated. Village extension committees should be formed. Filtration of farm information of private agencies is required at KVK/ZRS/ATMA to check the misleading information flow to the farmers by different private agencies. Farming system model should be developed for small holders keeping in view the food security at priority and regular cash flow for household needs. Focus of extension programmes need to be given on rural artisans and landless farmers in order to provide them agro-based economic enterprises. Zonal Research Stations have attained the status of non-performing, therefore, the support to extension as regards to local technological demands is lacking. Therefore, reviving Zonal Research Stations having strong interface with KVKs may enhance the effectiveness of extension system. The ICAR institutions and development departments are required to involve and participate more in the activities of KVKs and so that better utilization of technologies developed by these institutions may be ensured. All institutions such as KVKs, ZRSs, ICAR institutions, development departments, etc. are required to be brought at one platform for agro-climatic zone in order to chalk out a comprehensive strategy for carrying out technology assessment and refinement required for a particular

zone and accordingly carrying out various programmes avoiding duplication and using strength of all the available resources.

Dealers of different agencies, who are also engaged in advising farmers while selling their products, are required to be considered as extension agents and trained them accordingly. Contract farming needs to be grounded in a organised way and the state governments are required to bring out effective legislation and enforce law for contract farming. Strong Farmers' Organizations capable of providing extension and advisory services to the farmers may be an alternative in pursuing an extension mechanism sustainable on its own. Agricultural credit has to be made available to the farmers by adapting simple procedure and cases of suicides need to be seen very specifically. Community radio stations, farm broadcast on low frequency FM band and TV channels are to be used by extension agencies operating at zonal or district level. There is a need for assessing requirement of seed of a district and the concerned agencies like ATMA/NSC/KVK should plan and produce required quantity of seed in collaboration with private agencies in terms of using the structures crated by private agencies for flow of advice to poor farmers.

Technological revolutions, climate and environment changes, globalisation of trade, change in economic policies, regional economic integration, developments in information and communication technologies have opened new vistas which have to prudently pursued to accelerate agricultural development process. Growth in agriculture sector would have wider impact in both rural and urban areas. Agriculture has been the largest employer of workforce and its contribution for alleviating poverty in India has been well documented by various studies. Through its strong backward and forward linkages with the other sectors, agricultural growth would have a greater multiplier effect. This is finding out from the market, what product or products are wanted and in what form i.e. customer wants. At this stage one need to know who currently supplies the market? At what times? At what prices? What volumes are sold? How the produce are packed and presented? All these market information will help the extension functionary in understanding either to increase/ start supply to the market and answering all these questions is again the process of information gathering. Opinions of knowledgeable individuals, who are commercially involved with trading valuable statistics, such as price data/ information on the volumes of produce delivered to the market and the self experience of the extension officer helps in getting fruitful information.

It involves building up an understanding of how produce is distributed and sold and binds the relationships between different sales points in the marketing chain. In this stage, the extension worker needs to understand the various aspects of:

1. Produce distribution system
2. How the marketing system works
3. Marketing margins at various levels
4. Whole sales & middlemen selection as trade partners
5. Information Service available

The following four potential activities can help the extension functionary to achieve the desired goals in marketing extension would be :

- Giving advice to an individual farmer
- Providing market advice to farmer groups particularly through mass extension methods
- Providing advice/ information to critical individuals, organisations or private sector companies in the marketing chain whose actions can have a beneficial effect on marketing.
- Adopting a project approach by coordinating the activities of a number of different intermediaries in a marketing chain

With this background, it is imperative to design an effective and efficient agricultural marketing extension model that would enable farmers and others stakeholders to orient their action to the needs of the market and thereby increase the profitability of their operations.

