National Commission on Farmers

Serving Farmers And Saving Farming
From Crisis to Confidence

SECOND REPORT

Contents

TERMS OF REFERENCE
FOR
NATIONAL COMMISSION ON FARMERS

- Work out a comprehensive medium-term strategy for food and nutrition security in the country in order to move towards the goal of universal food security over time.
- Propose methods of enhancing the productivity, profitability, stability and sustainability of the major farming systems of the country based on an agro-ecological and agro-climatic approach and the harnessing of frontier technologies.
- Bring about synergy between technology and public policy and recommend measures for enhancing income and employment potential in rural areas through diversification, application of appropriate technology including IT for information on market, weather, credit facilities and e-commerce, training and market reforms.
- Suggest measures to attract and retain educated youth in farming and recommend for this purpose; methods of technological upgrading of crop husbandry, horticulture, animal husbandry, fisheries (inland and marine), agro-forestry and agro-processing and associated marketing infrastructure.
- Suggest comprehensive policy reforms designed to enhance investment in agri-research, substantially increase flow of rural credit to farmers including small and marginal, triggering agricultural growth led economic progress, which can lead to opportunities for a healthy and productive life to rural families.
- Formulate special programmes for dryland farming for farmers in the arid and semi-arid regions, as well as for farmers in hilly and coastal areas in order to link the livelihood security of the farming communities living in such areas with the ecological security of such regions. Review in this context, all ongoing Technology Missions like those relating to pulses, oilseeds, maize, cotton, watershed etc. and recommend methods of promoting horizontal integration of vertically structured programmes. Also suggest credit-linked insurance schemes which can protect resource poor farm families from unbearable risks. Further, suggest methods of strengthening and streamlining the National Horticulture Development Board.
- Suggest measures for enhancing the quality and cost competitiveness of farm commodities so as to make them globally competitive through providing necessary facilities and application of frontier science and promote quality literacy for codex alimentarius standard, sanitary and phyto-sanitary measures among farmers through reorienting and retooling extension machinery. Also suggest methods of providing adequate protection to farmers from imports when international prices fall sharply.
- Recommend measures for the credit, knowledge, skill, technological and marketing empowerment of women, taking into consideration the increasing feminization of agriculture and the proposed conferment of right to land ownership.
- Suggest methods of empowering male and female members of elected local bodies to discharge effectively their role in conserving and improving the ecological foundations for sustainable agriculture like land, water, agro-biodiversity and the atmosphere with priority attention to irrigation water.
- Consider any other issue, which is relevant to the above or is specially referred to the Commission by Government.

The Commission is to submit a medium term policy for food and nutrition security in the country in order to move towards the goal of universal food security over time within the next three months and to submit its recommendations on other Terms of Reference as soon as practicable and in any case on or before 13th October, 2006. The Commission, however is permitted to submit interim reports on any of the Terms of Reference it deemed fit or expected of it.

[Ministry of Agriculture Resolution No.8-2/2003-Policy(ES) dated 18th November, 2004]

COMPOSITION OF THE
NATIONAL COMMISSION ON FARMERS

The composition of the reconstituted National Commission on Farmers is as under:-

Chairman

Prof. M.S. Swaminathan

Full-time Members

Dr. Ram Badan Singh
Shri Y.C. Nanda

Part-time Members

Dr. R.L. Pitale
Shri Jagadish Pradhan
Ms. Chanda Nimbkar (Yet to join)
Shri Atul Kumar Anjan

Member Secretary

Shri Atul Sinha

[Ministry of Agriculture Resolution No.8-2/2003-Policy (ES) dated 18th November, 2004]

EXECUTIVE SUMMARY

CHAPTER 1 - FROM CRISIS TO CONFIDENCE

Our agriculture is in a state of serious crisis. The rate of growth in food production has fallen below population growth rate. To achieve a 4% growth rate in agriculture, we must aim at a 8% growth rate in horticulture and animal husbandry. This calls for higher investment in irrigation, animal husbandry, fisheries, post-harvest technology, rural energy supply and communication. The investment in agriculture has stagnated at 1.3% of GNP during the last three Five Year Plans. **If we place faces behind figures, over 400 million children, women and men belonging to families with small and marginal holdings, as well as landless labour families are in deep distress.**

2. **Several solutions offered in our first report** on implementing a Million Wells Recharge Programme, establishing a network of advanced soil testing laboratories, setting up Farm Schools in the fields of farmer achievers, strengthening the post-harvest technology and quality literacy wings of KVKs, organizing Small Holders Horticulture Estates and Cotton Estates to harness the economies of scale, large scale demonstrations to initiate a productivity revolution in pulses, setting up a Livestock Feed Corporation of India, convergence of appropriate Technology Missions around a Watershed or the command area of an irrigation project, need to be implemented without further delay.

3. **Enhancement of small farm productivity coupled with assured and remunerative marketing opportunities is the most effective means of reducing rural poverty.** Among the immediate steps needed to prevent farmers' suicides are - credit reform to enhance the total amount available for farm loans, a reduction in interest rates, linkages with technology and market and reduction in dependence on the informal sector for loans; a corpus (on the line of calamity funds) for assisting farmers affected by crop losses; expansion of crop insurance to cover the entire country and all crops; Cultivation of water intensive cash crops in "dark and grey zones" should be regulated; there should be appropriate legislation to regulate and deter the sale

of spurious seeds and chemicals; implementation of MSP for coarse cereals and pulses, which are the primary crops in rainfed drylands across the country;

5. It would be prudent to introduce a **Farmers' Livelihood Security Compact,** consisting of the following integrated package of measures:

i) Set up **State level Farmers' Commission** for the purpose of ensuring dynamic government response to farmers' problems.

ii) Conduct **Census of Suicides** to have a proper understanding, assessment of reasons and count of suicides

iii) Initiate a **Paradigm shift from Micro-finance to Livelihood Finance**

iv) **Debt survey** to take into account newer forms of credit and indebtedness and newer forms of bondage

v) Decide on cut-off for **Debt waiver** in consultation with Panchayats and farmers' representatives in the distress hotspot areas.

vi) Examine **revival of lapsed insurance policies;** there are provisions in the insurance laws that allow LIC to revive them.

vii) The integrated family insurance policy (**Parivar Bima)** recommended by NCF in its first report deserves to be examined and introduced to begin with, in dry farming areas.

viii) Revision in import policies, measures to expand farm exports and conduct of quality literacy programmes.

ix) Swift action to overhaul the **ryuthu bazars** or farmers' markets. **Most of these are presently controlled not by farmers but by traders, from whose control they must be released**. There is also need for introducing focused Market Intervention Schemes (MIS) in the case of life-saving crops such as cumin in arid areas.

x) **Agricultural and Animal Sciences Universities could form Hope Generation Teams (like NSS) of young male and female students who could stay in the distress villages during vacations and extend both technical and psychological support.**

xi) There is need for establishing Village Knowledge Centres (VKCs) in the farmers' distress hotspots operated to the extent feasible by the wives or children of the farmers who had unfortunately taken their lives. These VKCs could be linked to a Block level Village Resource

Centre (VRC) with the help of the Indian Space Research Organisation (ISRO). The VRC-VKC grid could provide dynamic and demand driven information on all aspects of agricultural and non-farm livelihoods.

6. The NCF supported Travelling Workshop for **Agronomic Rehabilitation of Tsunami affected coastal agriculture** has made detailed recommendations in the areas of Soil Health Restoration, Desirable Cropping Systems, Crop Diversification and Promotion of Multiple Livelihoods and initiation of "Beyond Tsunami" Agricultural Rehabilitation Demonstration programme. Funds for the Demonstration cum Training programme may be provided from the Tsunami Relief Allocation. This will have to be done immediately, if the problems of the tsunami affected farmers are to be solved and their livelihoods revived.

7. Indo-US Collaboration in Agronomic Rehabilitation Strategy - The GreenLine Group, a group of scientists, professional, and technical experts from the US has offered to work closely with scientists in India and seeks a site in Tamil Nadu where they can help to start work on 100 ha of farmland. This can become an important programme to promote sharing of knowledge and technology. The timing of this project is critical to launch at the beginning of the October monsoon season. We suggest that Rs.1 crore be allotted for this collaborative programme from the Prime Minister's Relief Fund

8. We envisage that knowledge connectivity should be a key component of the Bharat Nirman programme designed to provide a New Deal for Rural India. The NCF proposal for **Mission 2007: Every Village a Knowledge Centre** received support in the union budget for 2005-06. We recommend that the Ministries of Rural Development and Panchayati Raj provide Rs. 50 crores each for such training and capacity building activities during 2005-06. The Union Ministry of Agriculture may also provide Rs. 50 crores annually during the next 3 years for content creation and capacity building in the areas of crop and animal husbandry, fisheries, forestry, agro-processing and marketing and for imparting quality trade and genetic literacy.

9. Several farmers' organizations have suggested that the Ministry of Agriculture should be renamed as **Ministry of Agriculture and Farmers' Welfare**. We recommend the serious

consideration of this suggestion since farmers' well-being should be the main goal of the Ministry.

10. We are happy that a NDC Committee on Agriculture has been set-up under the Chairmanship of Shri Sharad Pawar. We request that the suggestions contained in this Report as well as the earlier one may kindly be examined by the NDC Committee so that appropriate action can be taken concurrently at the Central and State levels.

CHAPTER 2 - FOOD FOR ALL

Medium Term Strategy for Food and Nutrition Security with a view to move towards the goal of universal food security over time.

The Mid-term appraisal of the Tenth Plan reveals that we are lagging behind in achieving the Millennium Development Goal of halving hunger by 2015. Under-nutrition and malnutrition are still widespread. Maternal and foetal under-nutrition is resulting in the birth of babies with low birth weight. This has serious consequences for the future intellectual capital of India. Therefore building a sustainable food and nutrition security system is an urgent task.

2. The current trend of a decline in per capita food grain availability and its unequal distribution have serious implications for food security in both rural and urban areas. Going by the Union Planning Commission estimate of the proportions of population below the poverty line, **a total of 260.27 million people in both rural and urban areas put together can be definitely assumed to be unable to buy sufficient food to achieve food and nutrition security.**

3. Detailed analysis of the causes of food insecurity in rural and urban India have revealed that inadequate purchasing power due to lack of job/livelihood opportunities is the primary cause of endemic or chronic hunger in the country. Further, during the 1990s, the PDS has been weakened, both by repeated increases in the issue prices of food grains and by the switch to a system of targeted PDS. We recommend that **people should be able to access grains from PDS whenever they want, wherever they want and in any quantity they want, subject to a few ground rules which will prevent purchase for hoarding and subsequent sale at high prices.**

4. Given the magnitude of the employment problem in urban India, particularly in the small towns, there is a strong case for a National Urban Employment Guarantee Programme on the lines of the proposed National Rural Employment Guarantee Programme. The National Food Guarantee Act we are proposing will address hunger in its totality – both rural and urban.

5. A Six Point Action Plan is outlined below for making India Hunger-Free:

1. Reorganise the delivery of nutrition support programmes on a life-cycle basis with the participation of Panchayats and local bodies.
2. Eliminate micronutrient deficiency induced hidden hunger through an integrated food cum fortification approach.
3. Promote the establishment of Community Food and Water Banks operated by Women Self-help Groups, based on the principle "**Store Grain and Water Everywhere"**.
4. Help small and marginal farmers to improve the productivity and quality of farm enterprises.
5. Introduce support systems to SHGs to make them economically and organizationally sustainable. Establish for this purpose SHG Capacity Building and Mentoring Centres and focus on Livelihood Finance.
6. Formulate a **National Food Guarantee Act** continuing the useful features of the Food for Work and Employment Guarantee programmes and introduce it on 15 August, 2007, which marks the 60th anniversary of our independence. The Food Guarantee Act will be a powerful tool in achieving the goal of a hunger-free India.

CHAPTER 3 - FISH FOR ALL

Fisheries sector has grown at the rate of 4.3 per cent during the Ninth Plan and represents a major opportunity for growth of the Agriculture and allied sectors in particular and the GDP in general, since it already contributes 6.2 per cent of agricultural GDP and 1.4 per cent of GDP and also contributes 21 per cent of national Agricultural Exports. India already occupies fourth position in fisheries and second position in aquaculture globally and fisheries contribute export earnings of Rs.6,800 crores. The strength of the Fisheries sector consists of large under-utilized areas of fresh water tanks/ponds, lakes and derelict bodies, reservoirs, rivers, saline and brackish water resources, Exclusive Economic Zone and a large coastline. India also has a large variety of agro-climatic zones, fish fauna, research infrastructure and processing capacity.

2. Opportunities for employment and export through exploitation of our premium varieties and mariculture /ornamental fish culture/ sewage fish culture/composite fish culture etc. can be exploited provided our weaknesses like siltation/pollution of water bodies, sub-optimal management, inadequate quality control of seed and feed, inadequate exploitation of available species, and weak infrastructure for landing and marketing as well as problems of open access/multi-user conflicts/inappropriate leasing policies could be tackled. Aquarian reforms to permit optimum exploitation at ecologically sustainable levels are needed urgently along with a review of the Marine Fisheries Regulation Act of the States.

3. Inland fisheries which is already 53 per cent of our total production can be substantially boosted through greater attention to aquaculture both in fresh, saline and brackish water. This would involve production and culture of a larger range of available species, particularly for cold-water species like trout and mahseer and air-breathing fish like magur. The large potential of reservoirs can be optimally utilized for production and employment generation through better leasing policies, appropriate stocking and management and pen culture. Capture fisheries can be promoted through control of pollution of river systems, control of weeds in flood plains/wetlands etc. While inland saline soils in over-irrigated areas can be utilized for production of scampi (prawn), brackish water areas can provide substantial additional

employment and export incomes provided aquaculture is treated at par with agriculture and sound leasing policies are adopted along with reduced duties on feed and lower power tariffs. Above all, transparent quality control of feed and seed through certification cells can boost productivity. Aqua shops/Village Knowledge Centres along with pathological laboratories for better fish/shrimp health and easy bank loans/insurance can further promote this sunrise sub-sector. Design and construction of large assembly/auction markets and small hygienic shops in cities and hygienic boxes for fish sellers particularly women are important components of an efficient marketing infrastructure.

4. Marine fisheries too can see substantial growth through proper registration of all boats, demarcation and enforcement of fishing jurisdictions, and eco-friendly fishing gears/practices greater encouragement to fishing in 90-150 m depths, encouragement to pelagic and mid-water trawling and species-specific fishing like purse seining, squid jigging etc. Introduction of mother vessels for support to artesenal fisheries can improve catches and their quality. Insistence on discharge of the catch by deep-sea vessels on Indian shores can lead to optimum utilization of our processing capacity. An ambitious programme of construction of fish landing centers with cold chains and aqua shops can lead to better value realization and fishing efficiency. Regular dredging has to be undertaken to maintain and enhance the utility of existing fish landing centres etc. Promotion of mari1culture, seaweed culture, fish aggregating devices, artificial reefs, mussel culture are some other untapped areas providing employment opportunities provided technology is disseminated and facilitated and user friendly leasing policies in consultation with stakeholders are put in place. Institutionally, the potential of these initiatives can be optimized through setting up of a separate Department of Fisheries under Ministry of Agriculture, a National Fisheries Development Board to provide technical and infrastructural support to fishers, a Central Fisheries Harbour Development Authority and restructuring of Central Institute of Fisheries Education, Mumbai alongwith setting up of Fish for all training centres for capacity building to provide a fillip for human resource development to all the stakeholders in fisheries.

5. Welfare of fishers can be promoted through a substantial hike in their compensation during close season and an Endowment Scheme for fishers more than 60 years of age. Some 3600 fisher villages should be provided better infrastructure of roads, housing, drinking water,

electricity etc. in view of their precarious living conditions and hazardous occupation. Benefits of Prime Minister's Bharat Nirman should flow to these villages on priority.

7. Additional requirements of funds up to the end of 11th Plan

1.	Margin money for ICAR Fisheries Institutions	(Para 3.1.1.20.3)	Rs. 30 crore
2.	Fishermen' Welfare Scheme	(Para 3.1.4.5)	Rs. 350 crore
3.	10 fish hatcheries	(Para 3.1.11.2)	Rs. 15 crore
4.	10 Common Infrastructure Support Units for shrimp States	(Para 3.1.18.18)	Rs. 50 crore
5.	20 composite fish marketing support units	(Para 3.1.24.4.3)	Rs.20 crore
6.	2 mother ships	(Para 3.2.9.3)	Rs.10 crore
7.	20 minor fisheries harbours	(Para 3.2.12.3)	Rs.240 crore
8.	40 fish landing centres	(Para 3.2.12.3)	Rs. 120 crore
9.	3 small sized Dredgers	(Para 3.2.12.4)	Rs. 30 crore
10.	34 Village Knowledge Centres	(Para 3.2.18.3)	Rs. 17 crore
		Sub-total:	Rs. 882 crores

Note: A sum of Rs.3500 crores would be needed for the National Fisheries Development Board, consisting of 50% grant and 50% loan, if the Board is set up.

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

CHAPTER 4.1 - HILL AGRO ECOSYSTEM

The hill agro ecosystem represents the vast reservoir of fresh water, biological diversity and niche resources for hydropower and forests. It, however, suffers from inaccessibility, marginality, fragility and higher costs of services and marketing.. The development, investment and governance paths adopted in the past have often been divorced from ground realities and local communities.

2. **New Policy: Correcting the Big Mistake:** The National Policy on Agriculture should have a specific, yet integrated, policy on hill agriculture so that commensurate strategies, programmes and activities for hills–plains integration and hill agriculture development geared towards socio-economic and agro ecological synergy could be established. The hillside development policies focusing on forest cover through regulations had wrongly excluded local users across a wide range of ecological and socio-economic regimes. **Inter-disciplinary studies should be undertaken to analyse the cause-effect relationships and to test the old and new approaches to guide future efforts based on scientific facts.** Baskets of eco-technological and knowledge-based options are needed to achieve synergistic enhancement of productivity, profitability and sustainability. A **National Hill Coordinating Centre** to integrate all programmes of the Government of India on Hill Agriculture should be established. The Centre may be Chaired by the Union Minister for Agriculture and closely linked with other concerned Ministries as well as with the National Development Council. A **National Hill Agriculture and Livelihood Development Fund** should be created for judicious implementation of the Hill Policy.

3. While the population growth rate should decelerate, off-farm and non-farm employment opportunities should be created to reduce the pressure on land and other natural resources. The issues of synergy amongst all sub-sectors of agriculture, namely, crops, livestock, fisheries and forestry, inclusiveness, rights and aspiration of all hill people should be specifically addressed. The policy should provide for niche-based high-value farming and income generation, diversification, value addition, market reforms, entrepreneurship development and other

institutional supports. Accurate survey and measurement of area and use patterns of hill/mountain lands should be undertaken to ensure knowledge-based and informed allocation and deployment of natural resources.

4. **Food, Nutrition and Income Security:** A **Hill Farmers' Council for Sustainable Food Security** should be established to coordinate and integrate NEGS and FFW and other programmes under the proposed **National Food Guarantee Act**, adopting the whole-life cycle approach. It should promote SHGs to establish and operate **Community Food Banks** (**CFB**) and promote sustainable enhancement of productivity to further increase the productivity and marketable surpluses, specially of small farmers. **The Land Use Boards** should be restructured to be able to proactively advise farmers, based on congruence of agro-climatic capacity with agro-economic-ecological opportunities and market prospects. Fodder and feed availability should be ensured by promoting integrated management of grazing lands, fodder production and stall feeding, creation of **fodder and feed banks** and by establishing **Livestock Food Corporations**. The underexploited potential of fisheries sub-sector should also be harnessed.

5. Towards Jal Swaraj : Hydrological Balance and Water Security: Two complementary approaches are needed: (a) harvesting of rainwater, groundwater recharge and efficient use of water and (b) the hydrological balance in the Himalayas as dictated by the snow and glacier regimes and climate change. As regards the first component, water harvesting structures, including roof-top water harvesting, and improvement and creation of lift irrigation schemes should be ensured by involving water user associations including PRIs, NGOs and local communities. Pressurised micro irrigation (with assured quality of appliances), rehabilitation of hydrological hot-spots and water bodies, establishment of Low Water Parks, promotion of low water requiring high value crops, popularization of low-cost green houses coupled with fertigation, recharging of dead wells, reviving of the "dying wisdom", establishment of water banks, creation of skilled manpower and human resources for managing water at various levels and, above all, fostering water literacy so that water becomes everyone's business, constitute the essential elements of ensuring water security at the household and farm levels.

6. As regards the hydrological balance, a **National Research Centre on Glacierology** should be established for collection, storage and dissemination of information on status of seasonal/perennial snow and ice. The Centre should undertake research on understanding the interaction amongst biological processes, physical environment and the climate change and

develop early, medium and long-term warning systems and advise on trends of water availability and overall hydrological situation in the medium and long-term. Further, an iterative process of **integrated basin management** should be established with clearly defined objectives, planning process, implementation modality and monitoring and evaluation mechanisms, which would help also in accessing the proposed national plan of physically linking all the major rivers of the country.

7. **Soil Health and Bio Diversity Security:** The following sets of actions should be taken towards ensuring soil health and bio diversity security**:** (i) Correct soil micro nutrient deficiency (**hidden hunger**), adopt IPM and IPNS, issue **soil health card** to each farmer and establish atleast one modern soil testing laboratory in each District for micro-nutrient analysis, and launch a **community land care movement**, (ii) digitize inventory of plant, animal, fish and microbial bio diversity, ensure priority collection of endangered species and prepare and **undertake an integrated collection and conservation programme**, including the establishment of gene sanctuaries, and (iii) undertake niche-production of unique local bioresources and intensify **gene literacy** campaign to enhance participatory conservation and equitable sharing of benefits accruing through the use of genetic resources of specific locations (realization of **Farmers' Right**).

8. **Reversing the Technology Fatigue:** Each hill State should formulate/update **State Science Policy** to reorient it to be farmer-centred and geared to pursue knowledge-intensive agriculture. **Ecotechnologies** encompassing genetically improved strains, IPM and **IPNS** should be promoted through **Farmer Participatory Research and Knowledge Management System**. Greater emphasis should be placed on post-harvest management - processing, value-addition, policy and market research, skill development and retooling to strengthen the **production-consumption chain system**. Mandates of the KVKs and ATMAs should be changed to internalize the new developments and priorities in the areas of post harvest management. New extension approaches viz PPP, farmer-to-farmer (**Farm Schools**) etc. should be adopted. Timely and adequate supply of quality seed and other planting materials as well as other inputs should be ensured. **Seed Banks** should be established and preferably operated by SHGs and WSHGs to ensure regular flow of quality materials, particularly under drought and other aberrant weather

conditions. Need-based mechanization of hill agriculture and certification and market-driven and knowledge-based development of **organic farming** should be streamlined. Following the success story in Uttaranchal, **organic villages**, covering large number of farmers, should be organized with clearcut outcome in mind.

9. **Farmer-centric Market and Institutional Support and Gender Mainstreaming**: Planning for marketing should begin with planning for production. Land Use Boards should have the capacity to advise farmers on market opportunity - based production planning. Given the high marketing costs in hills and to protect farmers' income, the use of market infrastructures such as warehouses, storages, transport, etc. should be subsidized for the hill farmers. On the other hand, **MSP and MIS should be expanded and operationalised also for certain catalytic products from hills**. The NHM should give highest priority to value addition, processing, prevention of post-harvest losses and marketing and should adjust its budget allocation accordingly. Separate **Regional Master Plans for Market Development** in NER and NWR should be prepared, integrating them respectively with SE Asian and West Asian markets.

10. As regards institutional support, credit regulations and packages should be aligned with actual settings in the hills - land rights, jhuming and CPR, and the high costs of services and markets. The Government of India should assist banks in covering the undue risk in hill agriculture and sharpen its life-support assistance to the clearly identified targets. All agricultural development programmes should be engendered. Women must be given land rights and should have access to credit, water, education, health, knowledge and insurance. The indigenous and traditional knowledge uniquely possessed by female farmers should be protected and duly rewarded.

Additional resource required for the next seven years:

Item	Amount (Rs. in Crore)
Water conservation tanks with and without distribution attachments	365
Micro-irrigation, repair of degraded irrigation systems, expansion of lift irrigation, machines and implements	300
National Centre on Glacierology	50
Special credit and insurance products, transport subsidy	500
Market infrastructure development	300
Organic farming certification, model organic villages and marketing	250
Capacity building, training, strengthening and mentoring of SHGs, SFEs, etc; Soil Testing Laboratories	500
Total	**2265 Crores**

ENHANCING PRODUCTIVITY, PROFITABILITY, STABLITY AND SUSTAINTABILITY

CHAPTER 4.2 - ARID AGRO ECOSYSTEMS

Arid agro-ecosystems, receiving less than 450 mm annual rainfall with 40-60% coefficient of variability, covering 31.7 million ha in hot arid and 7 million ha in cold arid zones, account for 12 percent of the geographical area of the country. The arid zones are characterized by permanent water scarcity, intense aridity, fragility of natural resources and recurrent droughts.

2. **Policy Actions for Enhancing and Sustaining Livelihood Security:** The arid region should be separated out for an exclusive policy for drought proofing, land management, survival and livelihood security, and not clubbed together with semi arid regions. **Sustainable Land Management (SLM)**, and not Watershed Development, must be the focus in arid zones. Various ongoing and planned Central and State development programmes in arid agro ecosystems should be coordinated by the proposed MoA-hosted **National Authority for Dryland Farming Areas (NADFA). A National Committee on Sustainable Land Management (SLM) in Arid Agro Ecosystem**, under the auspices of the NADFA, with due representation of the cold arid, should be constituted and function as a **multistakeholder consortium**. Arid zone States should constitute State level counterpart Committees.

3. Concerned Ministries and financial institutions should facilitate public-private linkages not only in infrastructure development but also in promotion of rural entrepreneurship and in establishment and strengthening of capacity of PRIs, SHGs, cooperatives, Small Farmers' Estates (SFEs), etc. to facilitate access to quality inputs and to fair markets. The Central Government should create an **Agriculture-Risk Fund** and design a **special insurance product and dispensation mechanism** to insulate farmers from risks. Fifteen percent of the development budget should be allocated to on-farm strategic research to facilitate generation, refinement and adoption of location-specific technologies.

4. **Livestock, Fodder, Feed, Food and Livelihood Security:** Establish **Livestock Food Corporation** in each State. The District LSD Consortia should ensure enhanced and sustained production of fodder and feed crops and adoption of recommended livestock management technologies. **Fodder and feed banks** should be established at strategic points. As regards food security, the adoption of proven technologies and development strategies for enhanced productivity, prevention of post harvest losses, value addition and remunerative marketing should be emphasized. **Food, grain, seed and water banks**, preferably operated by SHGs, should be established. The proposed **National Food Guarantee Act** should be operationalised. Off-farm and non-farm employment should be created for increasing income and economic access to food.

5. **Water Security: Conserving Every Drop of Water:** Water literacy should be increased to make water conservation everyone's business towards more income per drop of water. Rainwater harvesting, restoration of water bodies, reviving of "dying wisdom" and groundwater recharging should be made mandatory to everybody. The various water-related development programmes should be coordinated under one umbrella and synergised at the action site by Panchayats and other grassroot organizations under the direction of the District SLM Consortium. About 10 percent of the total investment in watersheds and soil conservation should be allocated for development and fine-tuning of SLM technologies. Location-specific integrated watershed development programmes and increased water use efficiency particularly through the development and adoption of quality microirrigation, fertigation and low cost greenhouses should be promoted. A **travelling workshop** of experts from India and from the Nile, Jordan and Imperial Valleys should be organized to formulate new strategies for water management.

6. **Soil Health and Technological Security for Sustainability:** Soil-test-based micro nutrient amendments to manage the **hidden hunger** of soil should be widely adopted. Each arid zone district should have at least one well-equipped and suitably staffed advanced soil testing laboratory. Each farmer should be issued a **Soil Health Card**. **The Land Use Boards** should be strengthened to play a proactive role in advising farmers. Selective mechanization should be

supported to enhance precision, timeliness and productivity. **Farm schools** should be established to replicate "bright spots", particularly IPM, IPNS, and integrated crop-livestock-tree and organic farming technologies. Each KVK should be augmented with a post-harvest technology unit.

7. **Conserving Genetic Heritage and Harnessing Unique Niches:** The national bureaus of plant, animal and microbial genetic resources should chronicle and digitise inventories of the bioresources and associated traditional knowledge, and launch gene literacy movements to sensitise all stakeholders. The Suratgarh Farm (Rajasthan) of the Government of India should be developed as an *ex situ* **germplasm repository of arid zone livestock genetic resources**.

Production and commercialisation of off-season as well as high value crops and commodities should be strongly supported and promoted. The ICAR should establish a **cold arid regional sub-station at Ladakh** to generate technologies and develop new strategies for capturing the opportunities of the region and should work closely with the proposed National Centre on Glacierology.

9. **Farmer-centred Marketing:** Arid zone farmers should be insulated from price dips in "good" years with timely and effective implementation of MSP and MIS, especially for the life-line commodities. Based on market research, special arid zone commodity markets/parks/zones and periodic markets should be established. Adopting the NDDB model, farmers' cooperative marketing, fully equipped with grading, sorting, standardization and packaging facilities should be developed. Trade and regulatorypolicies, including SPS, for dairy products, wool and horticultural and other specialty products should be integrated with the development role of these commodities.

10. **Financial Implications:** An additional sum of Rs. 1,275 crore for the next seven years as detailed below, may be provided in the budget to cater to the above mentioned requirements.

- Agriculture-Risk Fund ---- Rs.500 crore (GOI)
- Special Insurance Products and Dispensation --- Rs. 300 crore (GOI)

- Micro-Capital Grant to support drought proofing and to assist and mentor SHGs and SFEs ---Rs. 300 crore (State Governments and GOI)
- Special Market Intervention Scheme ---Rs. 100 crore (GOI)
- Establishment of modern marketing centre --- Rs. 75 crore (GOI)

ENHANCING PRODUCTIVITY, PROFITABILITY, STABLITY AND SUSTAINTABILITY

CHAPTER 4.3 - COASTAL ZONE AGRICULTURE

1. Nearly 25% of India's population lives in coastal areas. Anthropogenic pressures on coastal ecosystems and living aquatic resources are increasing. There is urgent need for sustainable livelihoods and sustained production.

2. We recommend the establishment of **agro-aqua farms** on coastal wastelands under a **National Sea Water Farming for Coastal Area Prosperity Project** in about 50,000 ha in the States of Gujarat (Kutch), Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal, as well as in Andaman and Nicobar and Lakshadweep Islands. **Women's Aquaculture Estates** should also be established along the coast through Women's Development Corporations and financial institutions for the purpose of assisting *dalit* and fisherwomen to take to sustainable and profitable aquaculture. The programme based on sound scientific principles of agro-forestry may be given priority in the livelihood rehabilitation programmes being sponsored under the Prime Minister's Relief Fund in tsunami affected areas.

3. **There is need for a Coastal Systems Research Programme (CSR) on the lines of Farming Systems Research Programme carried out in inland areas.** We recommend that ICAR may initiate an All India Co-ordinated Research Programme on coastal agriculture, jointly with CSIR and State Agricultural / Animal Husbandry / Fisheries Universities.

4. We suggest that a **National Board for Sea Water Farming** be set up under the Chairmanship of Minister for Agriculture and Food. The Board should have the Ministers in charge of Environment and Forests, S & T, Ocean Development, Water Resources and Commerce, and senior representatives from all the Coastal States and Islands, as Members, so that a holistic view on all aspects of seawater use and coastal agriculture management can be taken.

ENHANCING PRODUCTIVITY, PROFITABILITY, STABLITY AND SUSTAINTABILITY

CHAPTER 4.4 - MISSION FOR THE PROSPERITY OF SUGARCANE FARMERS

Sugar industry is the largest agro-based industry in rural India. The industry has enabled the country to be self-reliant in this highly sensitive essential commodity of mass consumption. Inspite of the fact that sugar is probably the most distorted agricultural product in the global market, India exported about 4 million ton of sugar during the last three years. However, the growth rates in cane crushing capacity, quantity of cane crushed and sugar production has outstripped the same in terms of area under sugarcane, its yield rate and total production leading to a general shortage of sugarcane for the sugar factories. The Statutory Minimum Price [SMP] of sugarcane [declared by the Government of India] has been continuously increasing. Between 1999-2000 & 2002-03 while the sugar prices declined from 141.2 [base 1993-94] to 117.1, the sugarcane prices increased from Rs 56.10 per qtl to Rs 64.50 per qtl with 8.5% basic sugar recovery. Incidentally, the sugarcane farmers are a strong force in the major sugarcane producing States. There are practices regarding sugarcane area reservation, pricing, payment for sugarcane, supplying arrangement and the developmental role of the sugar factories, which are peculiar to this industry. With the increase in population and the anticipated increase in per capita consumption of sugar, it is estimated that the demand of sugar would reach about 24.5 million ton by 2010 from about 18 million ton in 2001-02. With the existing level of productivity and quality of sugarcane, it would need an increase in area under sugarcane from the existing 4.4 million hectare to about 5.5 million hectare, which may be extremely difficult due to claims of other crops and large water requirements.

2. The all India yield of sugarcane had been nearly stagnant for quite sometime and during the last five yeas it has continuously declined from 71.2 ton/ha in 1998-99 to 64.6 ton/ ha in 2002-03. The need is to introduce packages of improved technology, services and public policies designed to raise productivity and quality of sugarcane crop. It is suggested that a Technical Mission on Sugarcane [TMS] be established jointly with sugarcane growers' organisations, banks, sugar factories and research organisations on the basis of a 'seed to sugar' approach to improve the All India average sugarcane productivity to at least 80 ton/ha and sugar recovery to

at least 11% in five years. India has the technical know how and do how to achieve this. There are huge gaps in yield potential and actual yield. The productivity in the sub-tropical States, which have nearly 60% of the total area under sugarcane, is substantially lower than that in the tropical States. If the levels indicated above were achieved, there would be enough sugarcane to have 25 million ton sugar per year. The TMS could have three major components: (a) Intensification of sugarcane research (b) Transfer of technology (c) Improving productivity and quality of sugarcane

3. The TMS would have to be placed under the exclusive charge of a senior knowledgeable officer of the Government of India to be declared as Mission Director. In the major sugarcane producing provinces, the State Governments may designate State level 'Mission Director' to act as 'nodal officer'. The initial assessment of the cost of the programme for a five-year time slice is Rs 900 crore. However, this would require to be firmed up on a item wise basis. The additional annual production of sugar with increased productivity and quality of sugarcane would be worth about Rs 7000 crore.

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

CHAPTER 4.5 - CONSERVATION, CULTIVATION AND MARKETING OF MEDICINAL PLANTS

Medicinal and aromatic plants provide a window of opportunity to concurrently strengthen health, food, nutrition, and livelihood security of farm families and agro-ecological security of the environment. Traditional systems of medicine have been used in India over the years to address human, animal and plant health. India as one of the biodiversity rich countries with a rich heritage of traditional medicine has the potential to be a leading player in the sector.

Recommendations

2. Immediate measures are needed in the areas of **Policy, R&D, Input supply, Market, Pricing Support and Information Portal on MAPs. A National Mission on Medicinal and Aromatic Plants** may be organized to ensure that the sector receives the integrated attention it deserves. The recently approved National Horticulture Mission (NHM) includes MAPs, but given the already large number of fruit, vegetable and flower species to be addressed under the NHM, the MAPs may not receive the special attention and leadership it urgently needs. Pending the preparation of a full-fledged Mission, a distinct Mini-Mission may be organized for MAPs under the ongoing NHM. A dynamic leader in the area of medicinal plants and herbal medicine may be appointed as the coordinator of the Mini Mission for MAPs.

3. **The Mission should have a Policy Guidance Committee (PGC), an apex level body comprising the Ministers of Agriculture, Health, Environment & Forests, Commerce and Science & Technology, to give direction. The PGC could guide the restructuring of the National Medicinal Plants Board (NMPB) on the lines of NDDB.**

4. Measures to ensure supply of quality planting material, research on quality, safety and efficacy of products, standardization of products and suitable regulation, proper pricing for harvested and cultivated produce, a market oriented strategy to guide cultivation for the home

and external markets, documenting and recognition of traditional knowledge on medicinal plants, and setting up a single window information portal are the areas needing immediate attention.

5. Promotion of Public-Private Partnerships (PPP), promotion of Contract farming and appropriate codes of conduct, encouraging different Commodity Boards to promote intercropping with plantation crops, forming Medicinal Plant Growers' Association, community-based herbal gardens and enterprises and **Herbal Biovalleys** on the model of the Silicon Valley may be nurtured for providing the infrastructure needed for the conservation and sustainable use of medicinal plants.

6. The TF Report on MP had in 2000, recommended an allocation of Rs.1000crore for development the sector. It is recommended that an equivalent amount be made available to the proposed National Mission on MAPs in order to enable it to launch a dynamic programme in the areas of conservation, cultivation, scientific validation, and marketing under distinct brand names.

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

CHAPTER 4.6 - ORGANIC FARMING

There is a growing interest in organic farming practices in several parts of India, partly due to an expectation of higher prices for organically produced farm commodities. It will be useful to promote organic farming for low volume, high value crops like spices, medicinal plants, fruits and vegetables. Internationally acceptable certification standards and institutional structures are urgently needed. Cost of certification also has to come down.

2. Preparation of **Organic Farming Took Kits, based on IFOAM principles,** to assist farmers on the do's and don'ts relating to the production of organic farm produce, promoting the formation of **Small Farmers' Organic Agriculture Estates and Organic Farmers' Clubs** to confer the power of scale at the production and post-harvest phases of farming to small farmers, organizing a **National Federation of Organic Farmers' Associations** on the pattern of IFOAM, and declaring **Organic Farming Zones** are some of the steps needed to give direction and support.

4. **Organic farming needs even greater research support than chemical farming**. Our National Agricultural Research System will have to develop **bio-organic farming methodologies.**

5. It would be useful to develop a national strategy for organic farming, specifying regions, crops and seasons, ideal for raising crops through organic farming techniques.

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

CHAPTER 4.7- BIOFUELS

Bio-fuels derived from plant-based resources assume importance in the context of the need to develop non-renewable sources of energy. Farmers' organizations need proper extension advice on the advisability of shifting their land use to the cultivation of crops for bio-fuel production. **A well-defined Biofuel policy based on science and economics needs to be developed jointly by the Union Planning Commission, Ministries of Agriculture, Rural Development, Petroleum, Non-Conventional Energy Sources and Science & Technology. ICAR and CSIR will have to be actively associated**. The economic and ecological sustainability of this programme should be the bottom line in decision-making.

2. A **systems approach** is necessary for ensuring that the different components of bio-diesel programme are effectively coordinated and bio-diesel becomes a cost effective alternative. There is need for convergence and synergy in Technology and Public Policy for farmers to undertake farming of crops used in ethanol and other biofuels. Necessary industrial infrastructure should be developed to process the collected biomass for production of ethanol / other biofuels and the by-product industrial wastes so generated, could be used as manure.

3. ICAR and CSIR should jointly undertake to work on developing suitable process development for biofuels from various feedstocks and for developing agronomic practices for growing crops for biofuels in wasteland in cooperation with State Agricultural Universities.

4. It is recommended that a '**National Biofuel Board' headed by the Member in charge of Energy in the Planning Commission,** be set up to develop a roadmap for use of biofuels in petrol and diesel engines in a time bound manner. The Board should be supported with appropriate technical and financial resources and function like the Atomic Energy Commission with specific targets, autonomy and accountability.

CHAPTER 5 - AGRICULTURAL MARKET REFORMS

An efficient marketing system is essential for the development of the agricultural sector, providing incentives to the farmers for commercialisation, increasing production and giving appropriate signals for production planning and research activities. At the time of independence, there was shortage of production against demand and the immediate concern was to save the farmers and the consumers from malpractices of traders and facilitate growth and development of an orderly marketing arrangement. Organized marketing of agricultural produce was promoted though regulated markets. The State Governments and the Union Territories passed the APMC Act and in view of the supply side constraints various other legal enactments were promulgated and orders covering specific products issued. The resultant Government monopoly in setting up agricultural produce markets under the State specific Acts virtually prevented the private sector from taking any important initiative in the development of agricultural marketing infrastructure. There is no doubt that a large network of 7418 wholesale agricultural produce markets under the regulated system has been created and there is improvement in marketed surplus-output ratio, standardization of marketing charges, improvement in quality of market information etc but the lack of basic infrastructure, inadequate development of rural periodic markets, lack of transparency in weighing, auctions, other market related matters, sale of ungraded produce, distress sale immediately after harvest, poor quality of services offered to the farmers and lack of professionalism continue to be some of the constraints.

2. The Ministry of Agriculture is playing a proactive role in bringing about a change in the mindset from trade regulation to trade promotion, establishment of rural godowns, warehouses, cold storages and amending the APMC Act by the State Governments/ Union Territories with a view to primarily enable the private and cooperative sector to establish and operate markets for agricultural commodities and offer the farmers an alternative. However, the response of some of the State Governments is inadequate. With increasing commercialisation of agriculture, market planning needs to begin before the production planning. The restructured State Land Use Boards supported by a team of technical experts/agencies could render much needed advice to the farmers based on meteorological,

marketing and management information. More storage including cold storage and warehouse capacity should be created and warehouse receipt be developed as an effective credit instrument. There is also a need to encourage setting up of farmers' markets, development of farmer's organisations under the banner of the commodity produced by them, develop farmer centric code of conduct for contract farming, improving quality concern among the producers, increasing flow of marketing credit, tightening of the supply chain, minimizing post harvest losses and improving value addition to enhance the farmer's income.

3. The various legal enactments concerning agricultural processing and marketing particularly the Essential Commodity Act need a revisit.

4. The Minimum Support Price [MSP] is the major instrument of agriculture price policy of the Government of India. There is need for much stronger protection of MSP across the country. The MSP system, which has contributed towards diversification and commercialisation of Indian agriculture and also in achieving the present level of production, needs to be continued in near foreseeable future and its implementation should be improved. Price behaviour of sensitive commodities not covered by MSP, needs to be closely monitored particularly during the glut season for need based support under the Market Intervention Scheme.

COMPOSITE FINANCIAL SUMMARY

Chapter 1 : From Crisis to Confidence

1 Beyond Tsunami Agricultural Rehabilitation Demonstration programme

Funds for the Demonstration cum Training programme may be provided from the Tsunami Relief Allocation at the rate of Rs. 20 lakhs per demonstration, each covering an area of 200 ha. In all about 15 such demonstrations may be organized in the affected states and in Andaman and Nicobar Islands at a cost of Rs. 3.00 crore.

Rs. 3.00 Crore

2 Indo-US Collaboration in Agronomic Rehabilitation Strategy: **Rs.1 crore may be allotted for this collaborative programme from the Prime Minister's Relief Fund.**

Rs.1.00 Crore

3 **Mission 2007: Every Village a Knowledge Centre:** We recommend that the Ministries of Rural Development and Panchayati Raj provide Rs. 50 crores each for training and capacity building activities during 2005-06.

Rs.100.00 Crore

4 The Union Ministry of Agriculture may also provide Rs. 50 crores annually during the next 3 years for content creation and capacity building in the areas of crop and animal husbandry, fisheries, forestry, agro-processing and marketing and for imparting quality trade and genetic literacy.

Rs.150.00 Crore

5 A total of about Rs.3000 crores of public investment may be needed during the next 3 years for making the 'Every Village a Knowledge Centre' concept a reality. We suggest that investment in the VKC programme should come from a variety of government sources including the USO fund and the vast resources being set apart for Bharat Nirman.

Sub-total: Rs.254.00 Crore

Chapter 2: Food for All

To be worked out

Chapter 3: Fish for All

Additional requirements of funds upto the end of 11th Plan

11. Margin money for ICAR Fisheries Institutions	(Para 3.1.1.20.3)	Rs. 30 crore
12. Fishermen' Welfare Scheme	(Para 3.1.4.5)	Rs. 350 crore
13. 10 fish hatcheries	(Para 3.1.11.2)	Rs. 15 crore
14. 10 Common Infrastructure Support Units for shrimp States	(Para 3.1.18.18)	Rs. 50 crore
15. 20 composite fish marketing support units	(Para 3.1.24.4.3)	Rs.20 crore
16. 2 mother ships	(Para 3.2.9.3)	Rs.10 crore
17. 20 minor fisheries harbours	(Para 3.2.12.3)	Rs.240 crore
18. 40 fish landing centres	(Para 3.2.12.3)	Rs. 120 crore
19. 3 small sized Dredgers	(Para 3.2.12.4)	Rs. 30 crore
20. 34 Village Knowledge Centres	(Para 3.2.18.3)	Rs. 17 crore
	Sub-total:	**Rs. 882 crores**

Note : A sum of Rs. 3500 crores would be needed for the National Fisheries Development Board, consisting of 50% grant and 50% loan, if the Board is set up.

Enhancing Productivity, Profitability, Stability and Sustainability

Chapter 4.1: Hill Agro-Ecosystem

1.	Water conservation tanks with and without distribution attachments	Rs. 356 crore
2.	Micro-irrigation, repair of degraded irrigation systems, expansion of lift irrigation, machines and implements for agricultural mechanisation	Rs. 300 crore
3.	National Centre on Glacierology	Rs. 50 crore

4.	Special credit and insurance products, transport subsidy	Rs. 500 crore
5.	Market Infrastructure development	Rs. 300 crore
6.	Organic farming certification, model organic villages and marketing	Rs. 250 crore
7.	Capacity building, training, strengthening and mentoring of SHGs, SFEs, etc; Soil Testing Laboratories	Rs. 500 crore
	Sub-total:	**Rs. 2256 crore**

Chapter 4.2 : Arid Agro-Ecosystem

Part A

1.	Agriculture-Risk Fund	Rs.500 crore (GOI)
2.	Special Insurance Products and Dispensation	Rs. 300 crore (GOI)
3.	Micro-Capital Grant to support drought proofing and to assist and mentor SHGs and SFEs	Rs. 300 crore (SG and GOI)*
4.	Special Market Intervention Scheme	Rs. 100 crore (GOI)
5.	Establishment of modern marketing centre	Rs. 75 crore (GOI)
	Sub Total A	***Rs 1275 crore***

* Rs.200 crore by the State Government (SG) and Rs. 100 crore by GOI

Part B

1.	Contingency fund	Rs. 500 crore (GOI)
2.	Strengthening horticulture-led diversification	Rs. 300 crore (NHM)
3.	Livestock *ex situ* germplasm conservation at Suratgarh Farm	Rs. 100 crore (ICAR)
4.	Augmenting water availability by promoting rainwater harvesting, groundwater recharge and water bodies restoration, development and management	Rs. 250 crore
5.	Large scale demonstrations, establishment of fodder, feed and grain banks, Farm Schools	Rs. 300 crore

6.	Soil health care based on soil test, including micronutrients analysis and popularization of agricultural machines and implements	Rs. 200 crore
7.	Commercialization of date palm production, support to micro-irrigation, supply of quality vitroplants and other planting materials	Rs. 120 crore
	Sub-total B	**Rs. 1770 crore****

**A sum of Rs. 1770 crore is to be met through redeployment of resources from existing National Horticulture Mission and other National Missions, Watershed Projects, ATMA, ICAR's KVK and other projects and by using the National Rural Employment Guarantee Scheme and the Food for Work Programme.

Chapter 4.3 : Coastal Zone Agriculture

To be worked out

Chapter 4.4 : Mission for the Prosperity of Sugarcane Farmers

Rough assessment of the outlay for the project [5 year time slice] is about Rs 900 crore as under.

1.	Intensification of research: establishing a sugarcane breeding centre, strengthening of the molecular biology and genetic engineering capacities and other research work.	**Rs.125 to 150 crore**
2	Technology Transfer including the seed multiplication programme and maintenance of nucleus seeds and extension work..	**Rs. 600 crore**
3	Improving productivity of sugarcane: supporting establishment of Soil Testing	

Laboratories, Tissue Culture Laboratories,

Bio-fertilizer units and service charges to NABARD **Rs. 160 crore**

Sub-total: **Rs. 900 crore**

Chapter 4.5 : Conservation, Cultivation and Marketing of Medicinal Plants

1 It is recommended that **Rs.1000crore** be made available to the proposed National Mission on MAPs in order to enable it to launch a dynamic programme in the areas of conservation, cultivation, scientific validation, and marketing under distinct brand names.

Rs. 1000.00 Crore

Sub-total: **Rs. 1000.00 Crore**

Chapter 4.6 : Organic Farming

To be worked out

Chapter 4.7 : Bio-fuels

To be worked out

Chapter 5 : Agricultural Market Reforms

1 No specific recommendation with additional financial implication made. However, the inter-ministerial task force on Agricultural Marketing [May, 2002] has estimated investment requirements for development of marketing, storage, cold-storage infrastructure during the Xth Plan at **Rs. 12,230 crore.**

Grand Total: **Rs.8337.00 Crore**

COMPOSITE ADMINISTRATIVE INITIATIVES

CHAPTER 1: FROM CRISIS TO CONFIDENCE

Immediate Steps needed to prevent farmers' suicides:

1 **Credit supply and reform:**

- There should be a corpus (on the line of calamity funds) for assisting farmers affected by crop losses.
- Rate of interest may be reduced to 4% simple with government support, instead of compound rate of interest for arrears.
- Interest on loans in areas hit by drought and floods and for crops under heavy pest infestation, needs to be waived.
- Introduce a moratorium on debt recovery, including loans from non-institutional sources, till reasonable profit margins are recorded; stagger debt recovery in easy installments
- Crop insurance cover needs to be immediately expanded to cover the entire country and all crops.
- Credit should also be available if the farmer is adopting sustainable farming practices including the upkeep of traditional breeds of cattle. NABARD could develop a suitable project for low external input sustainable agriculture and aquaculture (LEISA).

2 **Irrigation and Cropping Pattern:** Regulate cultivation of water intensive cash crops in "dark and grey zones". Agronomists should present their data not just on the basis of productivity per hectare but on the basis of net income per unit of water.

3 **Inputs:** Introduce appropriate legislation to regulate and deter the sale of spurious seeds and chemicals; promote community-based and managed seed production and marketing units at the village level; promote integrated pest management and integrated plant nutrient management systems.

4 **Agriculture Marketing and Prices:** Implement MSP for coarse cereals and pulses; Create a corpus for stabilizing price fluctuations; Introduce quantitative restrictions on imports of farm commodities which constitute the backbone of the livelihood security system in dry farming areas.

Introduce a **Farmers' Livelihood Security Compact to address the above**

- **State level Farmers' Commission** could be set up for the purpose of ensuring dynamic government response to farmers' problems.
- **Initiate a Census of Suicides** to have a proper understanding, assessment of reasons and count of suicides**.**
- **Debt survey:** An All India Debt Survey should be undertaken, taking into account newer forms of credit and indebtedness and newer forms of bondage.
- **Debt waiver:** The amount that is to be the cut-off point could be worked out in consultation with Panchayats and farmers' representatives in the distress hotspot areas.
- **Insurance revival:** There are provisions in the insurance laws that allow LIC to revive the lapsed policies, which should be done in the distress hotspots.
- **Revising import policies:** Prevent inferior quality pepper from entering the state from Sri Lanka. Re-examine and revise import duty on cotton
- **Market Support:** There is also need for introducing focused **Market Intervention Schemes (MIS)** in the case of life-saving crops such as cumin in arid areas.
- **Extension work:** Agricultural and Animal Sciences Universities could form **Hope Generation Teams** (like NSS) of young male and female students who could stay in the distress villages during vacations and extend both technical and psychological support. The universities must be accountable to the farming community and not to private interests.
- **Basic services:** There is urgent need for both affordable health insurance, as recommended in the first report of NCF and the revitalization of primary health care centres.

- **Knowledge Empowerment:** Village Knowledge Centres (VKCs) should be established in the farmers' distress hotspots. These VKCs could be linked to a Block level Village Resource Centre (VRC) with the help of the Indian Space Research Organisation (ISRO).
- **Enlarging the export of farm commodities:** The Ministry of Agriculture and ICAR should evolve a policy for ensuring that the appellate basmati is used only for traditional fine grain aromatic rices of great antiquity and of a specific geographic origin.
- Initiate Beyond Tsunami Agricultural Rehabilitation Demonstration programme and give approval for the **Indo-US Collaboration in Agronomic Rehabilitation Strategy in Tsunami affected areas**

Mission 2007 – Every Village a Knowledge Centre

Action Point 1: The Government of India should include in the **Bharat Nirman programme** the establishment of Village Knowledge Centres (VKCs) in each of the about 237,000 Panchayats in the country and in the local bodies in the North East region.

Action Point 2: There is need for convergence and synergy among the numerous initiatives of Central and State Governments in the area of ICT for governance and development

Action Point 3: Connectivity and Content: National Digital Gateways: A Connectivity and Content Consortia involving all relevant government, academic and private sector institutions need to be set up in every district of the country.

Action Point 4: Capacity Building: The Jamsetji Tata National Virtual Academy for Rural Prosperity could be developed as the umbrella organization for capacity building. **A Consortium of Capacity Building Institutions** will have to be organized for each language of communication.

Until 2010, the aim should be the knowledge and skill empowerment of rural women and men with public funds.

The process of obtaining the RSP license should be simple and transparent. We recommend that the Ministries of Agriculture, Rural Development, Panchayati Raj, Communication and

Information Technology and Home may jointly develop a simple set of procedures for RSP license.

Change in Mindset with reference to the role of the Ministry of Agriculture, Government of India

Several farmers' organizations have suggested that the Ministry of Agriculture should be renamed as **Ministry of Agriculture and Farmers' Welfare**. We recommend the serious consideration of this suggestion since farmers' well-being should be the main goal of the Ministry. This will also help to link faces with figures.

NDC Committee on Agriculture: We are happy that a NDC Committee on Agriculture has been set-up under the Chairmanship of Shri Sharad Pawar. We request that the suggestions contained in this Report as well as the earlier one may kindly be examined by the NDC Committee so that appropriate action can be taken concurrently at the Central and State levels.

CHAPTER 2 : FOOD FOR ALL

1. **Access to PDS**: People should be able to access grains from PDS whenever they want, wherever they want and in any quantity they want, subject to a few ground rules which will prevent purchase for hoarding and subsequent sale at high prices. That is, flexibility with regard to time of purchase, place of purchase and quantity of purchase needs to be fitted in to the Public Distribution System.

2. Need for National Urban Employment Guarantee Programme on the lines of the National Rural Employment Guarantee Programme. Introduce a **National Food Guarantee Act** combining the two.

3. Set up **50 SHG capacity building and mentoring centers** in every State, to enhance the management and marketing capacities of members of the Self-help Groups (SHGs).

Such centers can be established in existing institutions like Agricultural, Rural and Womens' Universities, IITs, institutions operated by NGOs, etc.

CHAPTER 3 : FISH FOR ALL

1. State Fishery Department should have exclusive control over stocking, management, leasing, exploitation and conservation of fisheries resources in reservoirs in consultation with Irrigation Department and stakeholders. (Para 3.1.4.2)
2. Fishermen' Welfare Scheme needs enlargement particularly in terms of size of assistance through frequent consultations with stakeholders. (Para 3.1.4.5)
3. Wetlands should be developed by adopting appropriate policies for stocking of various species of find and shellfishes. This should be done after removal of weeds etc. through Food and Work/ Employment Guarantee Programme. Village Panchayats may undertake this activity in a time bound manner. (Para 3.1.5.1)
4. Sport fisheries and tourism in the hill areas should be encouraged through large scale seed production and stocking of golden mahseer and rainbow trout. (Para 3.1.7.2)
5. The different species of exotic trout (Rainbow/ Brown/ Brook) and indigenous varieties like snow trout should be stocked in the streams in medium and higher altitudes. In lakes and other static water bodies, mirror carp should be stocked through provision of seed and other assistance in order to provide livelihood opportunities to the people living in the hills. (Para 3.1.7.4)
6. National agency for providing HRD support and training to fishers/ aquaculturists/ entrepreneurs/ corporate sector should be set up by restructuring and revitalizing Central Institute of Fisheries Education, Mumbai. (Para 3.1.9)
7. Integrated fish farming in paddy fields and in conjunction with the piggery/ poultry/ duckery should be encouraged through special incentives and by extension agencies/village knowledge centres, especially in the hilly and tribal areas. (Para 3.1.9.5)
8. A professionally managed National Fisheries Development Board should be set up on the pattern of NDDB. (Para 3.1.11)

9. Exotic species such as arctic char and lake trout should be imported for introduction in upland waters in order to provide income opportunity to people in the higher altitudes. Their impact on native biodiversity will have to be monitored. (Para 3.1.12.2)
10. Air breathing fishes should be stocked in shallow, seasonal and weed choked waters, due to the high medicinal value and consumer preference of these species. Their propagation should be encouraged through provision of good quality brood stock to seed farms and through better extension of the technology for their breeding and rearing. (Para 3.1.13.1)
11. Ornamental fish should be further encouraged in view of their export potential and in view of their amenability for production by women in villages as a Cottage industry. This could be through introduction of highly prized varieties and technology dissemination through Village Knowledge Centres. (Para 3.1.14.1)
12. Fish production as a source of family nutrition should be started as a mass movement through promotion of backyard fish farming involving air breathing species such as magur etc., Village Panchayats, Extension Agencies and Village Knowledge Centres must disseminate the required information. (Para 3.1.15.1)
13. Shrimp farming must be further encouraged for global competition by reducing import duties on feed and feed ingredients, reduction in power tariff to bring it at par with Agriculture for small and marginal farmers etc. Fisheries should be treated at par with Agriculture for the purpose of loan on differential rate interest, loan for tube well, power, water rates and income tax as well as assistance for seed/feed/transport. Above all reasonable rates for insurance must be ensured. (Para 3.1.18.5)
14. There should be a national agency to ensure seed certification to ensure quality seed. There should be a registration of all hatcheries in the States and regular inspection of their brood stock and hatching practices. (Para 3.1.18.7)
15. Aquaculture Service Centres/Aqua shops should be set up with laboratory/ storage/communication. (Para 3.1.18.8)
16. States Govt. should set up common effluent treatment plants, water testing and disease control laboratory and another infrastructure facilities for shrimp farm clusters. (Para 3.1.18.17)

17. Similarly, an accreditation Cell should be set up to control the quality of feed based on various parameters worked out in consultation with stakeholders and scientists. (Para 3.1.21.3)
18. Department of Animal Husbandry, Dairying and Fisheries (DAHDF) should set up a technical group to develop internationally accepted protocols, which are desirable and feasible for encouragement of organic fish farming in consultation with stakeholders (Para 3.1.23.1)
19. Considering the critical importance of small cold chains in a tropical country like India. Ice plants in the private sector should be encouraged through reduce power tariff, easy availability of credit from Banks, and other operational facilities, which would ultimately result in higher value realization by the fishers. (Para 3.1.24.2.1)
20. Large assembly/auction markets should be designed by Central Institute of Fishery Technology/National Institute of Agricultural Marketing and constructed all over the country by the States with Central assistance to reduce spoilage of fish and promote marketing of fish in hygienic environment. This would encourage greater competition and, therefore, higher prices for fishers. Institutional finance should also be attracted for the purpose. (Para 3.1.24.4.3)
21. States must encourage local bodies to set up hygienic retail fish market in all medium and large towns in the interest of the consumers as well as women who generally market the fish. They could be provided specific grants to work as seed money for drawing institutional finance. Meanwhile Municipal Committees must strictly enforce existing laws for hygienic retailing of fish. (Para 3.1.24.4.4 and 3.1.24.4.6)
22. Women and men who market fish should be provided insulated fish boxes fitted on cycles for mobile marketing of fish to reduce spoilage. (Para 3.1.26.8)
23. There is a need for comprehensive and cohesive set of Aquarian Reforms in order to foster a sustainable and equitable use of both Coastal and inland waters for capture and culture fisheries. (Para 3.1.27.1)
24. A Committee may be set up to prepare proposals for Aquarian Reforms on the lines of land reforms. (Para 3.1.27.2)

25. ICAR centres for the North-East in Barapani should undertake a major programme of seed and brood stock production for species suitable for the North-East, particularly ornamental fish. (Para 3.1.28.7)
26. A coordination council consisting of coastal states and Govt. of India should be set up to review issues relating to better exploitation of EEZ. (Para 3.2.3.1)
27. States should be assisted by Govt. of India to amend their Marine Fishing Regulation Act in a time bound manner, in tune with the latest developments in sustainable utilization of marine fisheries resources. (Para 3.2.4.2)
28. Juvenile harvest should be reduced to the maximum possible extent by introduction of appropriate fishing gear including regulation of cod end net size in line with the technology from CIFT. (Para 3.2.4.5)
29. Restriction in area for resource specific fishing, prolonged seasonal closure for conservation, protection of juvenile and spawners during breeding season should be enforced more strictly by the states in consultation with the stakeholders. (Para 3.2.4.8)
30. Small trawlers should be encouraged through incentives to fish further off shore. (Para 3.2.4.10)
31. Pelagic and mid water trawling should be encouraged through incentives. (Para 3.2.4.11)
32. Research and development efforts should be aimed at developing fuel-efficient fishing craft/gear/methods as well as energy efficient hull designs. (Para 3.2.4.12)
33. Remote sensing for dissemination of information on potential fishing grounds should be undertaken more effectively through provision of communication facilities that can provide real-time information to the small-scale fishing sector. (Para 3.2.5.1)
34. Regular stakeholders consultation should be held to discuss new policy initiatives and constrains. (Para 3.2.6.2)
35. Introduction of resource specific vessels for long lining, purse seining and squid jigging should be taken up on top priority. Mechanized vessels below 20 m. length need major improvements in design for longer voyages. (Para 3.2.8.4)
36. Modern fishing vessels of 15-19 m. OAL are needed to exploit areas between 90-150 m. depths. (Para 3.2.8.4)

37. Mother vessels for on board processing and with refrigerated holds should be introduced to permit longer voyages by fishers. (Para 3.2.9.3)
38. A time bound programme should be undertaken to improve the hygiene and infrastructure facilities at the fish landing centres and fishing harbours including establishment of Aqua shops etc. (Para 3.2.12.2)
39. New minor fishery harbours and fish landing centres should be constructed in accordance with the Master Plan to comfortably accommodate the boats in operation and also ensure hygiene standards particularly for exports. (Para 3.2.12.3)
40. A Central Fishery Harbour Development Authority for composite planning and efficient management of all fish harbours and landing centres should be set up. (Para 3.2.12.6)
41. States must liberalize their leasing polices for promoting mariculture. (Para 3.2.13.2)
42. An All India Coordinated Research Project on Mariculture should be set up for transfer of technology and demonstration to tap the eminence opportunity available in the coastal area for mariculture. (Para 3.2.13.3)
43. States must also formulate/liberalize leasing policies to encourage establishment and the use of Artificial Fish Habitats (AHD) for higher yield of oceanic tuna and Artificial Reefs to provide shelter to fish for breeding and feeding etc. (Para 3.2.15.1 and 3.2.15.2)
44. An All India Master Plan for HRD should be prepared and Fish for All training centres on the pattern of KVKs should be set up for capacity building of fishers. (Para 3.2.18.2)
45. A comprehensive legislation to regulate Indian Fishing Vessels in our EEZ should be promulgated. It should prohibit transfer of catch on high seas and provide further catch to be unloaded only on Indian soil where sufficient spare capacity exists for processing. (Para 3.2.19.1)
46. A separate Department of Fisheries under the Ministry of Agriculture should be set up in the Government of India. (Para 3.2.21.1)
47. State wise Fresh Water Aquaculture Development Plan prepared by CIFA, Bhubaneswar under ICAR, should be discussed with concerned states by DAHDF to identify constraints and ensure speedy implementation with appropriate inputs. (Para 3.2.22.1)

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

CHAPTER 4.1 : HILL AGRO-ECOSYSTEM

1. A National Hill Coordinating Centre should be established to integrate all programmes of the Govt. of India on Hill Agriculture. The Centre may be chaired by the Union Minister for Agriculture and closely linked with other concerned Ministries and the National Development Council.
2. A National Hill Agriculture and Livelihood Development Fund should be created for judicious implementation of Hill Policy.
3. The existing North Eastern Council and Western Ghat, Eastern Ghat and Deccan Plateau Development Programmes should be overhauled.
4. A Hill Farmers' Council for Sustainable Food Security should be established to coordinate various ongoing programmes related to food security.
5. The Land Use Boards should be restructured to be able to advise farmers on agro-economical, ecological and market opportunities.
6. A National Research Centre on Glacierology should be established for collection, storage and dissemination of information on status of seasonal/perennial snow and ice and for research leading to systems for early, medium and long term warnings.
7. Implement the recommendations of the Swaminathan Committee recently made for strengthening R&TD and human resources development and deployment in NER.
8. The National Horticulture Mission should allocate adequate funds to hill States to establish mother nurseries and progeny orchards of identified varieties. It should give highest priority to value addition, processing, prevention of post-harvest losses and marketing.
9. Seed Banks should be established and preferably operated by SHGs and WSHGs to ensure regular flow of quality planting material.
10. Separate Regional Master Plans for Market Development in NER and NWR should be prepared.
11. GOI should assist banks to cover undue risk in hill agriculture.

12. All agricultural development programmes should be engendered. The indigenous and traditional knowledge uniquely held by female farmers of the hills not only should be protected but also duly rewarded.

CHAPTER 4.2: ARID AGRO-ECOSYSTEMS

1. **Arid region be separated from semi arid regions of the country for an exclusive policy for drought proofing, land management and livelihood security.**
2. Various ongoing Central and State Plans in the region should be coordinated by the proposed MoA-hosted National Authority for Dryland Farming Areas (NADFA). A National Committee on Sustainable Land Management (SLM) in Arid Agro Ecosystem under NADFA should be constituted to monitor the outcome of various programmes in the region.
3. Arid Zone States should constitute State level Committees, which conjointly with the National Committee should ensure timely flow of the earmarked funds through the District Sustainable Land Management Consortium to Panchayati Raj Institutions.
4. During the next seven years, both Central and State Governments should atleast double their investments in arid zones in particular and fifteen percent of the development budget should be allocated to on-farm strategic research.
5. Fodder, feed, food, grain, seed and water banks should be established at strategic points and preferably operated by SHGs.
6. Various water-related development programmes should be coordinated under one umbrella and synergised under the District SLM Consortium.
7. Each KVK should be augmented with a post-harvest technology unit and may be redesignated as Krishi and Udyog Vigyan Kendra (KUVK).
8. Suratgarh Farm (Rajasthan) should be developed as an *ex situ* arid zone livestock germplasm repository.
9. The ICAR should establish a cold arid regional sub-station at Ladakh to generate technologies and develop new strategies for capturing the opportunities of the region.

CHAPTER 4.3: COASTAL ZONE AGRICULTURE

1. Initiate Programme on "**Sea Water Farming for Coastal Area Prosperity: E**stablishment of **agro-aqua farms** in about 50,000 ha in the States of Gujarat (Kutch), Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal, as well as in Andaman and Nicobar and Lakshadweep Islands. Coastal wastelands could be identified for this purpose.

2. Establish **Women's Aquaculture Estates** along the coast through Women's Development Corporations and financial institutions for the purpose of assisting *dalit* and fisherwomen to take to sustainable and profitable aquaculture.

3. There is need for a **Coastal Systems Research Programme (CSR)** on the lines of Farming Systems Research Programme carried out in inland areas. We recommend that ICAR may initiate an All India Co-ordinated Research Programme on coastal agriculture jointly with CSIR.

4. A **National Board for Sea Water Farming (**agriculture will cover crop and animal husbandry, fisheries, forestry and agro-forestry) may be set up under the Chairmanship of Minister for Agriculture and Food with the Ministers in charge of Environment and Forests, Science & Technology, Ocean Development, Water Resources and Commerce and senior representatives from all the Coastal States and Andaman & Nicobar and Lakshadweep Islands as Members.

CHAPTER 4.4 : MISSION FOR THE PROSPERITY OF SUGARCANE FARMERS

1. A Technology Mission on Sugarcane (TMS) is suggested for 5 years for improving the productivity and quality of sugarcane so as to have enough sugarcane to produce annually 25 million ton of sugar without any increase in the area under the crop.

2. The TMS may be placed under the exclusive charge of a senior officer of the Govt. of India to be designated as 'Mission Director'.
3. In the major sugarcane producing States, the Governments may designate a State level 'Mission Director' to act as 'nodal officer'.
4. A High Level Committee of 15 members with representatives from the Government of India, States Government [on rotational basis] banks [rotational basis] Research Institutions, NABARD, RBI, Industry and Farmers under the Chairmanship of the Hon'ble Union Agriculture Minister to oversee the programme.
5. Similar Committees in the ten major sugarcane producing States be constituted.

CHAPTER 4.5: CONSERVATION, CULTIVATION AND MARKETING OF MEDICINAL PLANTS

1. Set up National Mission on Medicinal and Aromatic Plants. To start with, it maybe a **Mini Mission under the National Horticulture Mission**. The Mission should have a **Policy Guidance Committee (PGC)**, an apex level body comprising the Ministers of Agriculture, Health, Environment & Forests, Commerce and Science & Technology, to give direction. The PGC could guide the restructuring of the National Medicinal Plants Board (NMPB) on the lines of NDDB.

2. **Medicinal Plants Growers' Associations** each covering about 100 ha could be formed on the model of SHGs

3. **Pricing:** The Commission on Agricultural Costs and Prices (CACP) of the Ministry of Agriculture, in close consultation with the Ministry of Environment and Forests, and Department of AYUSH of the Ministry of Health, particularly the NMPB, and Ministry of Commerce, should address the problem of pricing.

4. **Herbal Biovalleys** may be developed on the model of the Silicon Valley for providing the infrastructure needed for the conservation and sustainable use of medicinal plants. A Project Design Team may be immediately constituted with members drawn from the

NMPB, NBDB, NHM, NABARD and APEDA, to prepare a Business Plan for the world's first Herbal Biovalley in Kerala as recommended by the Kerala Commission on WTO Concerns in Agriculture, and at other suitable locations in Western and Eastern Ghats, and western, central, eastern, Himalayas and in the N E Region.

CHAPTER 4.6: ORGANIC FARMING

1. Promote formation of Small Farmers' **Organic Agriculture Estates and Organic Farmers**' Clubs

2. Organize a **National Federation of Organic Farmers' Associations** on the pattern of IFOAM.

3. **Organic Farming Zones** can be promoted under the National Horticulture Mission for fruits, vegetables, tea, spices and medicinal plants, so that certification and quality control become easy.

4. Develop a national strategy for organic farming, specifying regions, crops and seasons, ideal for raising crops through organic farming techniques.

CHAPTER 4.7: BIO-FUELS

1. A well-defined **Biofuel policy** based on science and economics needs to be developed jointly by the Union Planning Commission, Ministries of Agriculture, Rural Development, Petroleum, Non-Conventional Energy Sources and Science & Technology. ICAR and CSIR will have to be actively associated.
2. **Set up a National Biofuel Board.** The Board may have the following composition:

Chairperson	:	An eminent professional in the area of biofuels
Members	:	Member (Agriculture) incharge of feedstock production
		Member (Processing and quality control)
		Member (Marketing, industry-farmer linkages through contract purchase etc.)
		Member (Centre – State coordination, linkages with private sector, global technology watch)

A Board of the above kind may function like the Atomic Energy Commission with specific targets, autonomy and accountability.

CHAPTER 5: AGRICULTURAL MARKET REFORMS

1. The APMC Act in different States/Union Territories needs to be amended on the lines of the draft of the amended. APMC Act circulated by the Government of India. It would encourage private sector investment in development of agricultural marketing.
2. Need for review of the Essential Commodity Act and other Acts/Orders concerning storing, marketing and processing etc of the agricultural commodities.
3. Improve the marketing infrastructure and bring about more transparency in auction and other marketing related matters in the regulated matters.
4. The role of the Agricultural Produce Marketing Committees and the State Agricultural Marketing Boards to change from regulation to development and promotion of markets for the local products and better marketing practices.
5. Restructure the Land Use Boards and provide technical support to then to give pro-active advice to the farmers based on meteorological, marketing and managerial information on matters concerning choice of crops/varieties/timing/marketing etc.
6. Establish commodity based farmer's organisation to develop market orientation among the farmers and articulate farmer's issues on commodity basis.
7. Develop a farmer centric 'Code of Conduct' for contract faming and encourage farmer's groups/organisations to deal with the purchaser/processor.

Reduce the post harvest losses by training, development of appropriate equipments, facilities and also tightening of the supply chain. Encourage farmer's groups/cooperative societies to involve in marketing of agricultural produce.

CHAPTER 1

FROM CRISIS TO CONFIDENCE

1.1.0 The Setting

1.1.1 The first report of the NCF was presented to the Government in December 2004. We are indebted to the Government of India as well as to several State Governments for taking prompt action on some of our recommendations. The Union Planning Commission has made an in-depth appraisal of the progress made in agriculture and allied sectors as part of the Mid-term appraisal of Tenth Five Year Plan (2002-2007). The findings were discussed at the 51st meeting of the National Development Council (NDC) on 27-28 June, 2005. It will be appropriate to begin this second report of NCF with a few quotations from the points made by the Prime Minister, the Union Minister for Agriculture and the Deputy Chairman of the Union Planning Commission at the NDC meeting.

1.2.0 Points made at the NDC meeting

Dr. Manmohan Singh, Prime Minister:

1.2.1 "A particularly disturbing aspect of our performance over the past several years is that agricultural growth has decelerated after the mid-1990's. Agriculture had grown at 3.2% from 1980 to 1996. It decelerated to 2.1% during the Ninth Plan. The cornerstone of the Tenth Plan strategy was a reversal of the declining trend in the growth rate of agriculture and with a target for agricultural growth at 4%. Unfortunately, actual performance of agriculture appears to have deteriorated even further and will possibly not exceed 1.5% during the first 3 years of the Plan…… **Correcting this must be accorded the highest priority……..** We must have the ambition to double our agricultural production in ten years."

1.2.2 Shri. Sharad Pawar, Union Minister of Agriculture, Food & Civil Supplies, Consumer Affairs and Public Distribution:

"The tragic incidents of **farmers' suicides** in some of the States have been a matter of serious concern…… crop losses, consecutive failure of monsoon, recurrent

droughts, mounting debts, monocropping, land tenancy, etc., seem to be some of the main causes…… 76% of the victims were dependant on rainfed agriculture and 78% were small and marginal farmers……. 76% and 82% of the victim households had borrowed from non-institutional sources in 2000-01 and 2002-03 respectively. The interest rates charged on such debts ranged from 24 to 36%, as compared to 9-12% on institutional credit."

1.2.3 "The **livestock sector** is extremely important for providing supplemental income to the farmers. Studies have shown that farmers' suicide is practically non-existent in areas where the farmers have opportunity to earn income by activities like dairying…… But the fact remains that our cattle productivity is one of the lowest in the world."

1.2.4 **"Agriculture sector** is covered in the State List of the Seventh Schedule to the Constitution. Hence, it is the primary responsibility of the State Governments to develop and promote agriculture and increase its production and productivity….. The share of agriculture and allied activities in the total allocation of all State/ UTs taken together is a meagre 6.46% for the Tenth Five Year Plan and 5.62% for the Annual Plan of 2003-04."

1.2.5 **Dr. Montek Singh Ahluwalia, Deputy Chairman, Planning Commission:**

"Agricultural growth has decelerated from 3.2% in the period 1980-81 to 1995-96 to an average of below 2% subsequently….. Employment generation in the economy is not upto expectations. **Organised sector employment has fallen in absolute terms in the last three years……** The situation regarding groundwater use is also very disturbing. There is excessive drawal of groundwater leading to an alarming lowering of the water table in many areas….. Rainfed areas account for two-thirds of the cultivable area at present and it is necessary to develop a coherent strategy for water conservation and management for these areas."

1.2.6 Thus, our agriculture is in a state of crisis. The rate of growth in food production has fallen below population growth rate. To achieve a 4% growth rate in agriculture, we must aim at a 8% growth rate in horticulture and animal husbandry. How are we going to achieve these goals? This calls for a higher investment in irrigation, animal husbandry, fisheries, post-harvest technology, rural energy supply and communication. The investment in agriculture has stagnated at 1.3% of GNP during the last three Five Year Plans.

1.3.0 The Agrarian Crisis: Remedies

1.3.1 The Prime Minister and Minister for Agriculture and Food have both suggested several measures to overcome the agrarian crisis. The Prime Minister has emphasized the need for increasing investments in the entire chain of activities related to agriculture and for promoting water efficient technologies. He has called for a sharper focus on strategic research and extension **for overcoming the current technology fatigue**.

1.3.2 The Agriculture and Food Minister has advocated a greater focus on the development of marketing infrastructure and the introduction of marketing laws conducive to direct marketing and contract farming. He has also pleaded for making the **National Horticulture Mission** which has a Plan outlay of Rs. 2300 crores during the remaining part of the Tenth Plan period, a success.

1.3.3 The agricultural crisis should be viewed not just in terms of growth rates. **If we place faces behind figures, over 400 million children, women and men belonging to families with small and marginal holdings, as well as landless labour families, are in deep distress.** This explains why we are off-track in achieving the UN Millennium Development Goals in the areas of reducing poverty induced hunger or under-nutrition, infant and maternal mortality rates and control of major diseases (*Table - 1*). According to a survey carried out by NSSO, on behalf of the Ministry of Agriculture, 40% of the 51,770 farm households surveyed said that they would quit agriculture, given a chance. No wonder, the mass media have started focusing attention on hunger and farmers' distress hotspots. For example, the July 4, 2005 issue of a national magazine (Outlook) contains a cover page article on "The death of the Indian Farmer", to highlight the fact that "trapped in a vicous cycle of crop failure, high debt and penury, the Indian farmers' future is an endless night."

TABLE - 1

Progress towards achieving the MDGs in India					
Indicator	**Year**	**Value**	**On track Value**	**MDG target value**	**Status**
Proportion of population below poverty line (%)	1999-2000	26.1	30	18.75	On track
Undernourished people as % of total population	1999-2000	53	49.8	31.1	Off track
Proportion of under-nourished children	1998	47	46.1	27.4	Off track
Literacy rate of 15-24 years old	2001	73.3	N.A.	None	N.A
Ratio of girls to boys in primary education	2000	0.77	0.83	1	Off track
Ratio of girls to boys in secondary education	2001	0.68	0.79	1	Off track
Under five mortality rate (per 1000 live births)	2001	93	87	41	Off track
Infant mortality rate (per 1000 live births)	2001	66	56.7	27	Off track
Maternal mortality ratio (per 100,000 live births)	1998	407	332	129	Off track
Population with sustainable access to an improved water source, rural (%)	2000	79	69	80.5	On track
Population with sustainable access to an improved water source, urban (%)	2000	95	90	94	On track
Population with access to sanitation urban (%)	2000	61	55	72	On track
Population with access to sanitation rural (%)	2001	21.91	39.3	72	Off track
Source: Mid-term Appraisal of Tenth Five Year Plan (2002-2007), GoI, Planning Commission, June 2005					

1.4.0 From Crisis to Confidence

1.4.1 How can we once again generate confidence in our agricultural capability? How can we convert despair into hope in farmers' homes? **Several solutions had been**

offered in our first report and it may be appropriate to reiterate their importance and urgency, since they are yet to be implemented. **We cannot afford to relax in the field of agriculture, since apart from its deep human and livelihood implications, agricultural decline will erode national sovereignty in the area of foreign policy.** Accelerated agricultural progress will confer multiple benefits – nutritional, economic, ecological, social and political.

1.4.2 Under WTO regulations, extending essential and life-saving services to resource poor farmers will not be considered trade distorting. **The following steps, recommended in our first report, need to be implemented without further delay:**

i) Water for Agriculture:

Implement a Million Wells Recharge programme, make water harvesting mandatory and restore water bodies.

ii) Soil Health Enhancement:

Establish a **Network of advanced soil testing laboratories** capable of testing large numbers of soil samples for 16 macro and micronutrients and issue a **Soil Health Card** to every farm family. **Remove the hidden hunger of soils** by providing the necessary micro-nutrients. Micro-nutrient deficiencies are widespread in all our soil types and as a single step, the amelioration of soil hunger makes the largest contribution to productivity improvement.

iii) Bridging the widening gap between scientific know-how and field level do-how:

Establish without any further delay about 50,000 Farm Schools for the purpose of farmer-to-farmer learning. The Farm Schools should be established in the fields of **farmer achievers** who are actually enhancing productivity and profitability in their farms through scientific and sustainable agriculture. Priority may be given in the areas of horticulture, crop-livestock, mixed farming, organic farming, agro-forestry and aquaculture for establishing Farm Schools. The establishment of such Farm Schools will add the dimension of **engagement with farm families,** to extension.

iv) Capacity building in post-harvest technology:

This is an urgent task, particularly with the initiation of a National Horticulture Mission. **All existing KVKs should be equipped with facilities for training in post harvest technology as soon as possible.** Capacity building in post harvest technology, and imparting quality literacy (*Codex alimentarius* standards of food safety) are absolutely essential for realizing the goal of enhancing the productivity and quality of horticulture crops.

v) Dryland Farming:

Large scale demonstrations may be initiated with hybrid **Arhar** (*Cajanus Cajan*), to initiate a productivity revolution in pulses. Application of micronutrients, and introduction of new implements are other urgent tasks.

vi) Horticulture:

Organise **Small Holders' Horticulture Estates**, to provide the power of scale to small producers at the production and post-harvest phases of the horticulture enterprises; increase investment on post-harvest technology and quality literacy; organize **horticulture seed villages** to produce and market good quality seeds and planting material and to generate new opportunities for skilled employment for rural women.

vii) Cotton:

Streamline Mission Management and organise Small Holders' Cotton Estates. Replicate Maharashtra's organic cotton experience, wherever feasible. Increase import duty on cotton by 30% as recommended in our first report.

viii) Livestock and Livelihoods:

The Union Minister for Agriculture and Food has rightly emphasized in his address to the NDC the importance of livestock in ensuring minimum income and nutrition security to small farm families. Breed, feed and health management hold the key to enhancing livestock productivity. Breed improvement in a slow process, except in poultry. Improved nutrition will help to increase milk-yield by atleast 50%. Fodder and feed are the major constraints in improving productivity. Hence, a **Livestock Food Corporation of India** may be organized for the purpose of promoting the growth of Fodder and Feed Self-Help Groups (SHGs)

and Fodder and Feed Banks set-up all over the country by local SHGs with financial support through NABARD and financial institutions. The Livestock Food Corporation should not be organized on the lines of FCI, but should be a promotional, facilitating and mentoring organization. If innovative steps for increasing the production of good quality fodder and feed are not taken, farm animal productivity will go down further. To make a significant impact on poverty reduction, our animal husbandry programmes should be pro-poor and pro-women. **Since good grazing lands hardly exist now, we have to rely on stall-fed livestock enterprises.** The proposed Livestock Food Corporation can also promote the fortification of all cellulosic biomass like rice straw. Its major aim should be to ensure fodder and feed security in all parts of the country. **At the same time, all Central and State government farms should be maintained for fodder and feed production under the umbrella of the Livestock Food Corporation of India. They should not be handed over to private parties for non-agricultural uses.**

ix) Harnessing Gram Panchayats and Gram Sabhas for spreading sustainable agricultural practices and quality and trade literacy:

The Eleventh Schedule (Article 243G) of the Constitution 73rd Amendment Act 1992 lists "agriculture, including agricultural extension" as the first among 29 items entrusted to Panchayats for attention and action. There are nearly 240,000 elected Panchayats and local bodies in the country. There are also more than one million elected women members of the Panchayats. If Panchayats are empowered technically, financially and legally to assume these responsibilities, they could become catalysts of accelerated agricultural progress, particularly in the areas of sustainable natural resources management and productivity enhancement. Atleast one male and one female member of each Panchayat could be trained in integrated pest management, integrated nutrient supply and scientific water management, so that they could promote the **group endeavour needed for success among farm families**.

x) Restructuring the management of Technology Missions in order to enable them to respond to farmers' needs in an integrated manner:

a) In our first report, we had recommended that there should be a convergence of appropriate Technology Missions around a Watershed or the command area of an irrigation project. This is essential to derive maximum benefit in terms of yield and income from the available water resources.

b) A Technology Mission is one, which is technology rich, and which is characterized by well defined outcome indicators and monitoring tools. It is also characterized by an end-to-end approach, covering all steps in the cultivation-consumption chain. The Mission Director should be an eminent professional who is likely to occupy the position for atleast 5 years and who will be accountable for the success of the Mission. Unfortunately, the Farm Technology Missions are **tending to become subsidy rich and technology poor**. Accountability is also lacking, with the result that in several important crops like pulses and oilseeds, home production is stagnating and imports are increasing. This is one of the causes for the expanding farmers' distress in dry farming areas. The smaller the farm, the greater is the need for productivity improvement, so that the farm family can have additional marketable surplus.

c) Enhancement of small farm productivity coupled with assured and remunerative marketing opportunities is the most effective means of reducing rural poverty. Fortunately, there is much scope for enhancing productivity even with the technologies currently on the shelf, provided market linkages can be tied up. This is where farmer-centric cooperative group and contract marketing can help. **It should be emphasized that agricultural decline is not just the result of supply side factors related to input use and extension, but also due to a slow growth in demand.** The real per capita food consumption decline is absolute in the case of cereals, pulses and edible oils. Since small and marginal farmers constitute a substantial proportion of India's population, consumption will go up, if such farm families have access to more income.

xi) <u>Credit supply and reform:</u>

At the macro level, in 2004-05, the agriculture credit of Rs 1,15,000 crores made available exceeded the target of Rs. 1,10,000 crores, according to the Banking Division of the Union Ministry of Finance. It is not so much lack of credit availability but the

interest rate at which loans are given to resource poor farmers that is the major problem today. If marketing is also not pro-small farmer, the capacity to repay loans gets diminished. **Hence credit reform should include not only enhancement of the total amount available for farm loans, but also a reduction in interest rates and linkage with market.**

1.5.0 Immediate Steps to avoid the tragedy of farmers' suicides

1.5.1 The following steps have been suggested by experts and farmers' associations working in this area:

i) *Credit and insurance:*

a) Repeal the Public Demand Recovery Act, enacted by the British between 1904 and 1912, under which farmers could be jailed for defaulting the State for a paltry sum.

b) Create a corpus (on the line of calamity funds) for assisting farmers affected by crop losses.

c) Reduce the rate of interest for crop loans to 4% simple, with Government support, instead of compound rate of interest for arrears. Amendments to the Banking Act in the 1980s, has enabled banks to charge compound interest for bank arrears. This multiplies the farmers' outstanding dues thereby driving them to despair, particularly under conditions where pro-small farmer marketing arrangements do not exist.

d) The more the poverty levels, the higher appears to be the rate of interest. In the Kalahandi belt of Orissa, known for endemic hunger and starvation, farmers receive loans from private money-lenders at a stupendous interest rate of 460 per cent. In neighbouring Madhya Pradesh, the rate of interest varies from 160 per cent to 250 per cent and in Jharkand, tribals in Palamau district pay back at a rate of 130 percent. These poverty stricken areas should receive top priority for credit access.

e) Interest on loans in areas hit by drought and floods and for crops under heavy pest infestation, needs to be waived.

f) Ensure transparency at the block level for proper credit disbursal by involving panchayats, farmers' organizations, other civil society organisations and district administration. The credit disbursal system is ridden with corruption; it is reported that in Bihar, the block office often siphons off about 20% from every loan sanctioned – the situation may be somewhat similar in other states also and deserves urgent verification and correction.

g) Reduce crop insurance premium to increase cover. At the same time, crop insurance cover needs to be immediately expanded to cover the entire country and all crops.

h) Announce a moratorium on debt recovery including loans from non-institutional sources in distress hotspots, till reasonable profit margins are recorded; stagger debt recovery in easy installments. For this purpose, liquidity support will have to be provided for localized banks like RRBs and District Central Cooperative Banks

i) At present credit is generally available only for improved technologies like hybrid crops, crossbred cows, etc. **There is a need to de-link the availability of credit from technology**. Credit should also be available if the farmer is adopting sustainable farming practices including the upkeep of traditional breeds of cattle. NABARD could develop a suitable project for low external input sustainable agriculture and aquaculture (LEISA).

ii) *Irrigation and Cropping Pattern:*

a) Regulate cultivation of water intensive cash crops in "dark and grey zones". All new crop varieties being introduced in the country from any source should be assessed for their water requirement.

b) **Agronomists should present their data not just on the basis of productivity per hectare but on the basis of net income per unit of water.**

c) Intensify programmes for the rejuvenation of traditional water harvesting structures and creation of new ones and implement the recommendations contained in the first report of NCF.

d) Introduce measures to prevent further exploitation of groundwater in the dark zone, whether by public or private parties.

iii) *Inputs:*

a) Introduce appropriate legislation to regulate and deter the sale of spurious seeds and chemicals.

b) Marketing of inputs through retail shops may be assigned to registered agricultural graduates. Like the chemist shops, the agri-input shops could also be run exclusively by agriculture graduates. Women agricultural graduates could be encouraged and helped to start such Agri-input shops.

c) Promote community-based and managed seed production and marketing units at the village level and organize seed villages for this purpose.

d) Promote integrated pest management and integrated plant nutrient management systems.

iv) *Agriculture Marketing and Prices:*

a) Implement MSP for coarse cereals and pulses, which are the primary crops in rainfed drylands across the country. MSP as well as procurement need to be strengthened in the suicide hotspot areas of Andhra Pradesh, Karnataka, Kerala and Maharashtra.

b) Create a corpus for stabilizing price fluctuations.

c) Introduce quantitative restrictions on imports of farm commodities which constitute the backbone of the livelihood security system in dry farming areas.

1.5.2 The suicides of farmers are a symptom of a larger process, a reflection of a far wider rural distress. Thousands of households that have not seen suicides are also in the distress zone and hence should receive urgent attention.

1.5.3 Based on the above suggestions, it would be prudent to introduce a **Farmers' Livelihood Security Compact.**

1.5.4 The Farmers' Livelihood Security Compact could consist of the following integrated package of measures:

1.5.4.1 **Farmers' Voices: Farm men and women** have plenty to say. Yet, information from their side hardly seems to be heard with any degree of seriousness by the authorities

who should be listening. If we do not listen to them, the suicides will not stop. There must be regular interaction between relevant authorities and small farmers as a first step. **State level Farmers' Commission** could be set up for the purpose of ensuring dynamic government response to farmers' problems.

1.5.4.2 **Census of Suicides:** It would be prudent to take note of field realities, which force farmers to end their lives. Reliable statistics will help to measure the impact of redressal measures.

1.5.4.3 **Urgent stepping-up of credit:** Inspite of Government pronouncements, credit is, becoming increasingly difficult to access. Indeed, official policies and agencies at all levels are making access to credit more difficult. According to one expert, the Cotton Federation in Vidharbha, which was set up to aid small farmers, ***acts instead as a loan recovery arm of the banks***. So farmers who have had a bad year in 2004 may not go to the Federation with their produce in 2005 even if they have a good harvest. The Federation would cut their bank loan amounts from the meagre payouts. Which means the farmers would turn to private traders and will not be able to access the minimum support price. Many of the Vidharbha suicides were of farmers who had lost hope in the Federation and turned to private traders.

1.5.4.4 If we cannot urgently address the problem of credit, we can forget about even slowing down the suicides, let alone stopping them. **A paradigm shift from microfinance to Livelihood Finance is called for.** So serious is the credit crisis that in a few instances small moneylenders have also taken their lives. This is because their clients have all unavoidably defaulted. There is also an incredible amount of fiddling with what credit for agriculture means. So-called Grameen banks are giving loans not for agricultural activities but for constructing buildings of private hospitals, private colleges, and even company showrooms. This is within their largely rural districts, and can be passed off as rural credit. There is need to check the break-up of the loans given by Grameen banks.

1.5.4.5 **Debt survey**: There is an urgent need for a proper All-India Debt Survey conducted on very different terms. The survey should take into account newer forms of credit and indebtedness and newer forms of bondage.

1.5.4.6 **Debt waiver:** For the smallest and the weakest, a debt waiver would bring some immediate relief. The amount that is to be the cut-off point could be worked out in consultation with Panchayats and farmers' representatives in the distress hotspot areas.

1.5.4.7 **Insurance revival:** Owing to no fault of their own, lakhs of farmers have seen their insurance policies lapse after the initial two payments. There are provisions in the insurance laws that allow LIC to revive the lapsed policies. Indeed, it would be in the interest of LIC to do so. If done, in Andhra alone, this would place Rs. 1,000 crore back in the farmers' accounts and give many a sense of confidence.

1.5.4.8 **Parivar Bima Policy:** The integrated family insurance policy recommended by NCF in its first report deserves to be examined and introduced, to begin with, in dry farming areas. The example of Assam in this respect is worthy of being followed by other states.

1.5.4.9 **Urgent need for employment:** The slow and halting march of the employment guarantee scheme and food-for-work programmes is a matter of utmost concern. Not only is distress mounting in rural households, migrations are increasing. In Kerala, famous for out-migration, Wayanad was the one district that saw little of it and, in fact, had considerable in-migration. All that has changed with the agrarian crisis. From districts like Mahbubnagar in Andhra Pradesh, migrants go in lakhs seeking work in Mumbai and its surrounding regions. Many go to astonishingly far-off places in other parts of the country, driven by hunger and an absence of work. Indeed, the employment guarantee in its present version will not even begin to meet this problem. A radical approach to creating far more days of work is crucial at this point. The proposal to bring an additional 10 million ha under assured irrigation and the other components of the Bharat Nirman programme would help to enlarge employment opportunities in villages.

1.5.4.10 **Policies for Irrigation Water:** Water conservation, equity and fairness and public good will have to be the basis of water policies. Privatization should not work against the interests of small and marginal farmers. In the small town of Hindupur, in AP, residents are spending an estimated Rs. 8 crores a year on drinking water. Farmers meanwhile, pay up to Rs. 12,000 for a single 'wetting' of their water-starved fields. Irrigation policies need to be viewed in a holistic manner and made pro-poor.

1.5.4.11 **Revising import policies:** In the context of the Kerala suicides, there is an urgent need for a revision of existing rules. Inferior quality pepper is entering the state in thousands of tonnes and, after being mixed with Malabar pepper, is then being exported to overseas markets as Indian pepper. This is destroying the market for genuine Malabar pepper - the best (premium quality) in the world. And many suicides are indeed linked to the crash in the prices of pepper and coffee. The government order of December 2004 stopped such imports from most countries except Sri Lanka. This loophole is being systematically exploited ever since. Low-grade pepper from places like Vietnam and Indonesia now first goes to Sri Lanka ***(where it enters with no duties)***. All this then enters India as "Sri Lankan pepper" when it is in fact nothing of the sort. The measures of the Kerala government to meet this crisis involve policing farms in Wayanad, while it is the import policy that needs review.

1.5.4.12 **Addressing the problem of cotton:** Some swift action on import duties is also a must in the case of Vidharbha's poor cotton farmers. Nearly 30 lakh people are dependent on that crop for their livelihoods. With great difficulty, they managed to have the import duty on cotton raised from five per cent to ten per cent. In contrast, the duty in the case of import of sugar is 60%. The cotton growers head the list of farmers who have committed suicide in Maharashtra and hence deserve to be treated on the lines of the sugarcane farmer. The estimated purchase of cotton in Maharashtra during this year is 202 lakh quintals at a cost of Rs. 4600 crores. However, the amount paid was only Rs 750 crores. Since cotton farmers did not get their full payment, they were in distress Monopoly intervention in cotton purchase by State Governments needs careful review. Also, in our first report we had recommended increasing import duty on cotton to 30%. This needs to be implemented immediately.

1.5.4.13 **Ending extortion in tenancy rates:** In Andhra, quick moves need to be made to end extortionist rates of tenancy and lease. Many small farmers, in coastal AP for instance, are crushed by having to part with over 80 per cent of their produce as rent. **There is an urgent need to implement land reform measures. Some of these already exist and need to be enforced.**

1.5.4.14 **Investment in agriculture:** The misery of farmers cannot be halted if urgent steps are not taken to increase investment in agriculture to a far greater level than it is now. The agrarian crisis is a component of a far wider and deeper rural distress. **Even if agriculture's share of GDP has dipped, its centrality to life is such that every section and sector do badly when agriculture does badly.** Suicides of farmers are followed by hunger deaths, for instance, amongst carpenters and weavers as in the case of Andhra Pradesh, who have lost both their market (with the falling purchasing power of their clients) and also their meagre subsidies.

1.5.4.15Access to affordable inputs is crucial: No less important than listening to the farmers is to undo the extraordinary damage that harmful policies have inflicted on them.

i) Input prices have simply shot up and are still escalating. It is possible today that a farmer in Telangana owning eight acres of paddy land may still be below the official poverty line. The government must urgently intervene to ensure that seed and other inputs reach farmers at affordable costs and at the right time and place. Resource poor farm families should not be left to the mercy of input dealers who have emerged as the new moneylenders of the countryside.

ii) Quality control is becoming increasingly important. For example, in the district of Yavatmal in Maharashtra, 1,200 shops have sprung up selling seed and other inputs. There is one quality control inspector to oversee the lot. This is a region where re-sowing has frequently occurred, not merely due to poor rainfall but also due to sub-standard inputs like poor quality seed. The maximum punishment for selling fake seed (except where new laws have been passed) is a meagre Rs. 500.

iii) **Appropriate regulation an urgent must:** Control has also to be exercised over false and exaggerated claims for inputs. It is frightening that desperate farmers are going in for unproven and poorly tested inputs on a large scale in sheer desperation. This being done often will increase credit obtained from moneylenders. Quality control is especially urgent in the case of bio-fertilizers and bio-pesticides.

iv) The setting of standards means the re-introduction of firm regulation where required. Companies have drastically lowered the minimum germination rate they assure farmers. In the case of seed, this has fallen to as low as 60 per cent. This

means a village buying 1000 bags of seed pays for that number, but gets only 600 in effect. Such unscrupulous groups, companies and individuals pushing such practices must be brought to book and accountability must be ensured.

1.5.4.16 **Overhauling farmers' markets:** Swift action is required to overhaul the **ryuthu bazars** or farmers' markets. **Most of these are presently controlled not by farmers but by traders, from whose control they must be released**. Even the "farmers' markets" are now heavily loaded against the small producers. Cartels and trader networks manipulate these and rig prices systematically. Amendments to APMA, as suggested by the Union Agriculture Ministry, need to be carried out by State Governments as soon as possible. Several State Governments have already taken action to reform the agricultural marketing system. There is also need for introducing focused Market Intervention Scheme.

1.5.4.17 **Extension work:** Several states have been systematically withdrawing from extension work. Few things could be more problematic, at a time when the farmer is desperately and urgently in need of sound advice and expertise on a range of issues.

i) The vital role of the Agriculture Extension Officer must be recognised and the system revived and strengthened. At the same time, Farm Schools should be established at the grassroot level.

ii) Quite a few farmers took their lives after crop failures, which in some cases could have been avoided by timely advice and technical assistance. There is also a tendency among some resource poor farmers to take to high cost technology without the capacity to incur losses due to factors beyond their control. In this context, it is also important to re-state the role of Agricultural universities. In some cases, major input dealers sit on the governing bodies of such universities and this often leads to major conflict of interests. Linkages between agricultural universities and farm communities must be completely restructured and strengthened.

iii) Agricultural and Animal Sciences Universities could form **Hope Generation Teams** (like NSS) of young male and female students who could stay in the distress villages during vacations and extend both technical and psychological support. **The universities must be accountable to the farming community and not to private interests**. The needs and demands of the community must be the first priority of such

bodies. The universities must also undertake a serious study of existing and emerging cropping patterns in their regions. The peripatetic hope generation teams could be a timely response to the crisis situation.

1.5.5 **Basic services:** Ultimately, steps to prevent farmers' suicides cannot be divorced from steps to end the larger rural distress. That in turn cannot be de-linked from our overall policy framework. **The distress sweeping rural India flows from the gradual collapse of public services. For instance, almost all the suicide and otherwise crisis-hit households record high health expenditures. Indeed, that is emerging as the second-fastest growing component of rural family debt.** Yet the privatisation of basic services will only worsen this situation. There are documented instances of farmers mortgaging all their land in order to raise private loans to pay off health bills**. There is urgent need for both affordable health insurance, as recommended in the first report of NCF and the revitalization of primary health care centres.**

1.5.6 Likewise, the commercialisation of education is taking its toll on students from poor farm families in even the most educated state of them all - Kerala, particularly in crisis-hit Wayanad district. In rural Andhra, there are school students who have simply stopped going because their parents cannot afford the bus fare. The privatisation of utilities or the massive hikes in rates has also been a factor in farmers' distress. In Andhra, the state shut down the irrigation development corporation in 1997. This was, predictably followed by a huge rush for private borewells. For an overwhelming number of those in distress in Andhra, their crisis was linked with water and borewells. There were years when spending on borewells was the major cause of debt.

1.5.7 **Knowledge Empowerment:** In addition to the above steps, there is need for establishing Village Knowledge Centres (VKCs) in the farmers' distress hotspots. These VKCs could be linked to a Block level Village Resource Centre (VRC) with the help of the Indian Space Research Organisation (ISRO). This will enable tele-conferencing and thereby facilitate immediate attention to distress calls. The VRC-VKC grid could provide dynamic and demand driven information on all aspects of agricultural and non-farm livelihoods. These centres of hope in areas where rural families had lost hope should be operated to the extent feasible, by the wives or children of the farmers who had unfortunately taken their lives. This will help to impart realism and a right sense of

priorities in the creation of content. Training and capacity building in the operation of such centers need to be done in local languages. ISRO has agreed to help in organizing such Knowledge Centres in the distress hotspot areas of Mahbobnagar, Wayanad, Vidharba and Karnataka in association with M S Swaminathan Research Foundation, Chennai.

1.6.0 Enlarging the export of farm commodities:

1.6.1 Safeguarding our position in Basmati rice exports:

In its report on agricultural biotechnology, the Swaminathan Committee had recommended that no genetically modified rice should be released in the name of **basmati**, since many countries including Europe have not approved the sale of genetically modified foodgrains. The Agricultural and Processed Food Products Export Development Authority (APEDA) and the All India Rice Exporters' Association have brought to our attention another serious threat to our basmati rice exports.

While questioning the Rice Tec Patent in the United States, the characteristics of Indian Basmati were defined on the basis of the following three criteria.

a) A set of physical parameters such as length, breadth, elongation ratio and slenderness ratio.
b) Linkage to the original land races that trace back their history to poems of Heer-Ranjha and 18th century documentation.
c) Grown in geographically well-defined areas

1.6.2 Based on the above, the Ministry of Commerce notified Basmati standards under the E1A on 23 January 2001. Inspite of such clarification, several high yielding semi-dwarf stature aromatic rices are being released by research institutions under the name **Basmati. Such a dilution of the pristine properties of traditional Indian Basmati, is now seriously threatening our export earnings from Basmati rices**. Also, the "dwarf basmati" grains are being used for adulteration with traditional basmati varieties.

1.6.3 Research on new aromatic long grains should be encouraged but such varieties should be marketed under appropriate names and should not be called basmati. Basmati is not the only premium rice. Hence, new long grain, aromatic rices can stand on their own in the international markets without be termed basmati. It would

be in the interests of both farmers and the country, that we maintain the Indian basmati varieties, which are valued very highly in the international market, in their pristine purity. Otherwise, **Pakistan basmati will eclipse the numerous strains being marketed from India, carrying the name basmati** in the international market.

1.6.4 Therefore, the Ministry of Agriculture and ICAR should evolve a policy for ensuring that the appellate **basmati** is used only for traditional fine grain aromatic rices of great antiquity and of a specific geographic origin. **The new high yielding fine grain aromatic rices can be given other appropriate names, since they have a good market potential without being called basmati.** They can stand on their own merit, without diluting the historic halo, which surrounds the traditional Indian basmati rice.

1.6.5 We would urge that the following points may be kept in view in the area of nomenclature:

i) The dilution of Basmati definition is not in the interests of either Basmati or the new varieties.
ii) All long grain aromatic strains should not be called basmati.

1.6.6 In our first report, we had emphasized the urgent need for strengthening our infrastructure for sanitary and phytosanitary measures and for launching a trade and quality literacy movement among farm families. APEDA may be enabled to help Agricultural Universities organize a 1 Credit Course (12 lectures) for all Agricultural and Home Science College students on external trade opportunities and on methods of sustaining and expanding our agricultural exports.

1.6.7 There is need to explain the features of *Codex alimentarius* standards of food safety in villages. This can be done through the proposed grid of Village Knowledge Centres. Now that the Doha round of negotiations in agricultural trade are nearing completion, we should lose no further time in helping our farm families to become quality conscious, with reference to both home and external markets. Our agricultural competitiveness in the external market can be improved only if we help farm families to increase both productivity and quality of crops in demand in the global market.

1.7.0 Beyond Tsunami: Agronomic Rehabilitation of Tsunami affected coastal agriculture:

1.7.1 In the first report of NCF, detailed suggestions had been offered for the psychological, ecological and livelihood rehabilitation of tsunami affected coastal areas

in Tamil Nadu, Kerala, Pondicherry and the Andaman and Nicobar Islands. The main instrument for ecological rehabilitation is the establishment of bioshields, while the biovillage model of sustainable on-farm and off-farm livelihoods is the most effective pathway of ensuring work and income security. In several places, the seawater had entered prime agricultural land adjoining the coast, rendering both soil and water saline. About 6,000 ha of farmland are estimated to be affected in Tamil Nadu and Pondicherry. Ad hoc recommendations were being given to the affected farmers by both NGOs and government departments. **In particular, the indiscriminate application of gypsum was being recommended.**

1.7.2 NCF therefore organized a Travelling Workshop by a Team of Scientists drawn from the Central Soil Salinity Research Institute, Karnal, the Central Salt and Marine Chemicals Research Institute, Bhavnagar, the National Institute of Oceanography, Goa, the National Bureau of Soil Survey and Land Use Planning of ICAR, IARI, ICRISAT, the Tamil Nadu Agricultural University and MSSRF, from 16-18 July, 2005. Based on their advice, the following recommendations are made for the use of extension and research workers engaged in helping farmers in tsunami-affected areas to restore the health and productivity of their soils. **It is recommended that these recommendations based on the best possible technical expertise available in the country may be communicated to the concerned State Governments and the Andaman and Nicobar Islands administration by Secretary, Agriculture.**

1.7.3 Recommendations of the Travelling Workshop

1.7.3.1 Tsunami waves caused extensive damage to the basic agricultural resources like soil and water as well as to standing crops like paddy, groundnut, etc in some of the regions of Tamil Nadu and Pondicherry. Across the affected areas, the intensity as well as type of the damage vary. Since the devastating incident took place, the Department of Agriculture, Tamil Nadu along with concerned research institutes and NGOs have been involved in rehabilitating the affected farmland.

1.7.3.2 To understand the multi-dimensional nature of the problem and to develop science-based soil health rehabilitation packages. The participants of the workshop visited around nine villages (spot measurements for pH and EC were conducted and

discussions with farmers were held) in Nagapattinam and Cuddalore districts on 16th and 17th July 2005. On 18th the team met at Chennai, discussed their field observations and arrived at the following recommendations:

1.7.3.3 Soil Health Restoration

Tsunami waves caused three kinds of damages to soil. These are:

a) Deposition of slushy grayish brown clay,
b) Deposition of sand, and
c) Sea water intrusion, which receded (within 3 hrs to one week from the field) leaving salts in the field

a) Deposition of slushy grayish brown clay deposit

This kind of damage was noticed exclusively in the southern parts of Nagapattinam district where the clay deposit thickness varied from 5 cm to 30 cms height. After drying it was 2mm to 50mm thick. The chemical analysis of the deposited material showed that it is rich in organic matter (0.6 – 1.2%), having good water holding capacity and cation exchange capacity with an Exchangeable Sodium Percentage of 55%. During the field visit (16th July 2005), the pH and Electrical Conductivity (EC) of the sediments, which were scrapped and heaped in the field were found to be nearly 8.6 and 12.7 ds m^{-1} respectively.

Problems caused by clay surface deposits: Crust formation leading to physical barrier for aeration and germination; High amount of salts leading to the development of salinity; Danger of toxic material (heavy metals)

Management of clay deposits: The deposit can be mixed with soil by ploughing and it will improve soil texture, especially of the surface soil, water holding capacity and soil fertility. The incorporation of deposited material will not act as physical barrier since it cracks on drying and after mixing. The higher amount of salts will get leached down after the rainy season and thus it will not be a permanent source of salts, which could affect adversely the root growth. The deposit was scrapped and kept by some farmers in the field itself as heaps. It should be spread and incorporated into the soil to avoid the development of acute localized salinity.

b) Management of soils with sand deposition

This kind of damage was noticed in the mid and northern villages of Nagapattinam districts and southern regions of Cuddalore district. The thickness of the deposit varied from 2 – 5 cms. The deposit was scrapped and heaped in the field itself by some farmers. The analysis on 16th and 17th July 2005 showed a pH of nearly 6.5 and an EC of 8.3 ds M^{+1}.

Management of Sandy soils: The sand deposit need not be scrapped, but may be ploughed back in the field itself. Wherever the material has been collected and left in the field as small heaps, it should be spread again in the field and mixed with the soil. Leaving the deposits as heaps in the field will aggravate local salinity.

c) Seawater inundation

This kind of damage was noticed in a few areas of Nagapattinam and Cuddalore districts. The seawater entered the field directly as well as through backwater canals. The water receded within a few hours (quickly) in some areas, and after five to seven days (slowly) in some other farms. Soil analysis shows that the soils have become salinised and not sodic and the soluble salts are dominated by Cl and SO_4 and not by CO_3 and bicarbonates. Hence, during leaching the pH will not go up, ESP and EC will decrease simultaneously during the reclamation process. Different soil depth analyses indicate that the top 0-2 cm depth soil has an EC of 25-120 ds m^{-1} with a pH of 7.2 - 8.2.Hence leaching with sufficient amount of canal water or rainfall will help to overcome the problem. Normally, rainfall should be heavy in this region during the Northeast Monsoon season (October-December).

Use of gypsum: A blanket application of gypsum for reclamation in the entire affected areas should be avoided. Gypsum application should be location specific i.e. where the pH is >8.5, ESP>15 and in cases where during reclamation the pH increases. It should be followed purely on the basis of soil test results.

The gypsum already supplied to the farmers at the rate of 500 kg per hectare could be used as a fertilizer to meet the calcium and sulpur nutrition needs of oil seed

crops like gingelly (seasame) and groundnut. In such cases the recommended dose would be around 100 to 200 kg/ ha.

Use of Organic Manure: The soils are sandy in texture, and have low amounts of organic carbon. Farmers should be encouraged to go in for green manuring in addition to the judicious application of FYM, compost and biofertilizers.

Restoration of water ponds inundated with seawater and deposits: Most of the small water ponds located in the fields which are the source of irrigation for the second and third crop, were severely affected and at present the water is saline.

1.7.3.4 Agricultural Departments and farmers should be advised to take the following measures:

i) Physical removal of contaminated water through tankers and connected pipelines thus paving way to receive monsoon rains
ii) Surface leaching through rainfall and canal water
iii) Promoting rain water harvesting in household and farm ponds
iv) Desilting and interlinking drainage channels to facilitate the easy flow of water.

1.7.3.5 Desirable Cropping Systems:

The following crops and varieties are suggested for the forthcoming season in Tamil Nadu and Pondicherry:

a) Salt-tolerant crops/varieties have to be grown in the first year and the first crop should be preferably rice
b) Rice – TRY 1, TRY (R) 2, CO 47, ADT 43 and ADT 36
c) Ragi – TRY 1, Sunflower – CO4, Groundnut – VRI 2
d) Green gram (K 851, Pusa bold)
e) Brinjal (PLR 1, AU 1), Cluster bean (Pusa Now bahar)
f) Jack fruit (Palur 1), Pomegranate (Ganesh), Sapota (PKM 1)
g) Cashew (VRI 2 & 3), Amla (BSR 1) and Tamarind (PKM 1)

1.7.3.6 Specific agronomic practices for Rice

a) Aged seedlings (one week more than normal age) may be planted
b) Higher number (4-6 Nos.) of seedlings per hill may be planted
c) 25% extra N as basal dose may be added

d) Higher dose (40 kg/ha) of zinc sulphate has to be applied
e) At panicle initiation and 15 days after, foliar spraying of DAP 2% along with 1% urea and 1% potash may be done for increasing the yield
f) Soil testing based P application or apply 15 kg P/ha as maintainer dose
g) Sowing sprouted seeds (3 days) under delayed canal water availability or excess rainfall

1.7.3.7 **Application of FYM and Micro nutrients:** 12.5 t/ha may be applied for all the crops

1.7.3.8 **Promote integrated farming systems** involving crop-animal combination with suitable animal breeds and allied enterprises

1.7.3.9 **Crop diversification:** Promotion of horticulture and tree crops and value addition to the produce will help to increase income and employment. It would be in the interest of farmers to accord high priority to horticulture.

1.7.3.10 **Multiple Livelihoods:** There is a need to promote additional on-farm and non-farm enterprises like the preparation of coconut based value added products, apiculture, dairying, small growers poultry estates, cashew processing, production of bio-fertilizers and bio-pesticides. This would promote multiple employment opportunities not only to the majority of small and marginal farmers but also to the landless labourers who form a sizable part of the local population and who have lost their livelihood opportunities.

1.7.3.11 **Demonstrations of Agronomic Rehabilitation Practices**: It is suggested that a special demonstration cum field verification programme may be organised in tsunami affected agricultural areas based on an integrated crop-livestock farming system. The demonstrations may cover about 200 ha each and address the following major problems:

i) Fields affected by clay deposits
ii) Fields affected by sand deposits
iii) Areas affected by seawater inundation

There could be a combination of the above 3 forms of soil health hazards in some areas.

1.7.3.12 **The "Beyond Tsunami" Agricultural Rehabilitation Demonstration programme may include the following components:**

i) *Soil health restoration*

ii) *Water management and sea water replacement*

iii) *Crop and varietal choice*

iv) *Introduction of livestock farming for supplementary nutrition and income*

v) *Producer-oriented marketing*

vi) *Training and capacity building*

vii) *Monitoring at benchmark sites of the impact of the rehabilitation measures*

1.7.3.13 The Tamil Nadu Agricultural University and the State Department of Agriculture could initiate these demonstration cum training programmes with technical help from CSSRI, Karnal, CSMCRI, Bhavnagar, NBSSLUP, Bangalore and ICRISAT, Hyderabad. **Funds for the Demonstration cum Training programme may be provided from the Tsunami Relief Allocation at the rate of Rs. 20 Lakhs per demonstration, each covering an area of 200 ha. In all about 15 such demonstrations may be organized in the affected states and in Andaman and Nicobar Islands at a cost of Rs. 3.00 crores.** This will have to be done immediately, if the problems of the tsunami affected farmers are to be solved and their livelihoods revived.

1.8.0 Indo-US Collaboration in Agronomic Rehabilitation Strategy:

1.8.1 Earlier this year in the USA, a group of scientists, professional, and technical experts came together to address the contaminated areas that had little hope of recovery. This group of professionals became the **GreenLine Group**. The group includes experts in sodium remediation, composting, organic farming, water treatment and other measures to restore the muddy rice fields and river delta areas in India that have very high levels of contamination from sea water.

1.8.2 **GreenLine Group** has offered to work closely with scientists in India and seeks a site in Tamil Nadu where they can help to start the first phase programme on 100 hectare of farm land. This first phase will be used to adjust the practices and procedures to the region and establish a teaching center which will be used for education and training to scale up the programme to other areas and regions.

1.8.3 This programme will utilize many proven technologies used throughout the United States. Plans are in place to restore the damaged lands and soil, but also to improve the soil quality, water quality, and increase farm and aquaculture production in

these areas. Additionally, several key universities, including Texas A&M, Pennsylvania State, and Texas Tech, will contribute scientists and graduate students to this first phase two year programme. This can become an important programme to promote sharing of knowledge and technology.

1.8.4 The impact of this programme on the farmers of this region can be realized in as little as six months, by restoring farming activity. The timing of this project is critical to launch at the beginning of the October monsoon season. The US Team will meet its own expenses. We suggest that Rs.1 crore may be allotted for this collaborative programme from the Prime Minister's Relief Fund, which will be implemented by MSSRF, ICRISAT and the GreenLine Group.

1.9.0 Mission 2007 – Every Village a Knowledge Centre

1.9.1 In its first report, NCF stressed the need for knowledge connectivity in rural India, since for enhancing our agricultural efficiency and competitiveness, farm families need urgently the right information at the right place and at the right time. We envisaged that knowledge connectivity should be a key component of **Bharat Nirman** designed to provide a New Deal for Rural India. The NCF proposal received support in the union budget for 2005-06.

1.9.2 Shri P Chidambaram, Union Finance Minister, made the following announcement concerning Mission 2007 in his budget speech on 28 February 2005 *"The National Commission on Farmers has recommended the establishment of Rural Knowledge Centres all over the country using modern information and communication technology (ICT). Mission 2007 is a national initiative launched by an alliance comprising nearly 80 organisations including civil society organizations. Their goal is to set up a Knowledge Centre in every village by the 60th anniversary of Independence Day.* ***Government supports the goal, and I am glad to announce that Government has decided to join the alliance and route its support through NABARD.*** *I propose to allow NABARD to provide Rs. 100 crore out of RIDF (i.e. Rural Infrastructure Development Fund)."*

1.9.3 In order to impart the needed momentum to the rural knowledge revolution, NCF organized in collaboration with NABARD a discussion in Mumbai in April 2005 to prepare a road map for organizing ICT-SHGs (Self Help Groups), to begin with in 10

states, where the infrastructure for the rural ICT revolution exists. NABARD will provide Rs. 1 lakh each to 10,000 ICT-SHGs during 2005-06.

1.9.4 NCF also helped to organize the second convention of the National Alliance for Mission 2007: Every Village a Knowledge Centre at New Delhi on 11-12 July 2005. The convention was addressed by the President of India, Union Ministers for Finance and Panchayat Raj and the Chief Ministers of Rajasthan and Delhi, in addition to leading experts.

1.9.5 Based on the discussions held at the National Convention, NCF recommends for the consideration of the Government of India the following 5 action points.

Action Point 1: The Government of India should include in the **Bharat Nirman programme** the establishment of Village Knowledge Centres (VKCs) in each of the about 237,000 Panchayats in the country. VKCs also need to be established in the local bodies in the North East region. Apart from providing generic and dynamic information in areas relevant to rural livelihoods and agricultural marketing the VKCs can help to provide meaning and content to the **Right to Information Act 2005.**

Action Point 2: Convergence and Synergy among public and private sector initiatives: There is need for convergence and synergy among the numerous initiatives of Central and State Governments in the area of ICT for governance and development. The following are some of the major initiatives.

i) National e-governance plan (NeGP) announced in October 2004 and the technical and financial support proposed to be extended to the State Wide Area Network (SWAN). Additional Central assistance is proposed to be extended to all the states for initiating NeGP.

ii) A well articulated Broadband Policy announced in December 2004, followed by a notification on 28 January 2005 on de-licensing of the use of wireless equipment in band 2.4 GHz to 2.4835 GHz between 1 and 4 watt power.

iii) Notification on de-licensing of indoor use of low powered wireless equipment including Radio Local Area Networks in the frequency band 5.150 to 5.875 GHz with the maximum effective isotropic radiated power, using the built-in or indoor antenna.

iv) Commitment of the Government of India to set up 100,000 VKCs by 2007 through the Ministry of Communication and Information Technology.

v) Announcement of financial support for content development to the Northeastern states for the creation and operation of 487 Community Information Centres (CICs)

vi) Decision of the Union Planning Commission to re-establish the DISNIC – PLAN project, with institutional linkages to grassroot organizations and covering all the districts indentified for Employment Guarantee through NIC.

vii) Commitment of the Ministry for Panchayati Raj for providing facilities to house VKCs

viii) Enactment of the Right to Information Act 2005

ix) Setting up of a National Knowledge Commission under the chairmanship of Dr Sam Pitroda

x) Numerous initiatives in the private NGO and public sectors such as e-chaupal of ITC, VKCs and Village Resource Centres of MSSRF and ISRO, and Unlimited Potential Capacity building programme of Microsoft.

The National Alliance for Mission 2007 could help in promoting interaction and synergy among all these important initiatives in the public and private sectors.

Action Point 3: Connectivity and Content: National Digital Gateways: A Connectivity and Content Consortia involving all relevant government, academic and private sector institutions need to be set up in every district of the country. They can be organized under atleast 4 National Digital Gateways relating to fields such as agriculture and agribusiness, education, health and livelihoods. These national gateways should focus and respond to the needs of the rural families, by collecting, processing, packaging and disseminating demand driven information in **multi-lingual and multi-media formats**. This will help to overcome language and literacy barriers.

Scientists from ICRISAT, IIT Kanpur and MSSRF have proposed that standard thesaurus such as AGROVOC of the FAO should be considered the basis for design of agricultural information portals in India in multiple Indian languages. The AGROVOC also permits addition of new terms that are specific to local cultural practices. Using semantic web technology, context specific searches can be carried out. A standards-based

contents design process can then emerge. Conversion of AGROVOC into a number of Indian languages will make the proposed national gateway for online agricultural information in India a reality. Other agricultural research institutions should get involved in the exercise to hasten the process of conversion into different languages.

1.10.7 The National e-governance Plan (NeGP) envisages the setting up of over 100,000 Community Service Centres. This will help to ensure that all the Central and State e-governance services are available on the Internet and through VKCs.

Action Point 4: Capacity Building: The rural families should have a sense of ownership of VKCs. The Gram Sabhas could provide guidance on priorities in information needs. Ultimately, atleast 1 woman and 1 man will have to be trained in each village as Master Trainers. The Jamsetji Tata National Virtual Academy for Rural Prosperity could be developed as the umbrella organization for capacity building. The rural women and men elected as Fellows of NVA could help to manage VKCs and in providing the needed information at the right time. They will also train other rural women and men in computer techniques and in adding value to information so as to convert generic into location specific information.

A Consortium of Capacity Building Institutions will have to be organized for each language of communication. We recommend that the Ministries of Rural Development and Panchayati Raj provide Rs. 50 crores each for such training and capacity building activities during 2005-06. Members of the Capacity Building Consortia could also undertake mentoring services until the time the VKCs become self-reliant. **The Union Ministry of Agriculture may also provide Rs. 50 crores annually during the next 3 years for content creation and capacity building in the areas of crop and animal husbandry, fisheries, forestry, agro-processing and marketing and for imparting quality trade and genetic literacy.** The various Farm Technology Missions could work with VKCs in spreading information relevant to the improvement of productivity and profitability.

Action Point 5: Organisation and Management: This is a crucial component of Mission 2007. The greatest challenge will be in the area of organization and management. Organisation of VKCs can be undertaken by multiple agencies such as the following:

i) **Gram Panchayat Centred VKCs** under the Bharat Nirman programme, with guidance and oversight from Gram Sabhas.

ii) Community Centred and managed VKCs through ICT-SHGs with support through NABARD.

iii) Commercial ICT-Kiosk models promoted by business and industry, NGOs and academic institutions.

1.9.6 All methods of organization should be based on the principles of gender sensitivity, social inclusion and antyodaya, so that the rural digital divide does not become one more factor in enlarging the rich-poor and gender divides.

1.9.7 The Village Knowledge Centre will be an important step in Government's plan to reach out to 200 million subscribers with connectivity and providing over 4000 community radio stations. We also recommend that a single window, time-bound licensing policy be implemented for providing one ham radio per Panchayat in all the 237,000 local bodies in the country.

1.9.8 The frequencies that are foreseen internationally for new technologies such as Wi Max should be vacated at an early date, so that there could be massive savings in communication costs. Also, we recommend that Government should remove the service tax (10.2%) currently levied on Internet Bandwidth in villages. As a single step, this will help to remove an important barrier in extending ICT services to rural areas

1.9.9 Synergising the Common Service Centres (CSC) of Department of Information Technology (DIT) with Mission 2007: The recently announced DIT scheme for setting up 100, 000 CSCs in rural areas emphasises entrepreneurship and revenue generation as its prime objectives. As per the guidelines, the DIT scheme appears to preclude a number of professional and non-governmental organizations and community-based SHGs who may not have so far implemented Knowledge Centres but would do so given an opportunity. The CSCs to succeed, should be inclusive, pro-poor and pro-women and should provide the necessary forward and backward linkages to the farmers, especially to the poor farmers, with value-added, locale-specific knowledge. It is important to ensure that farming communities run the CSCs with support from their Panchayats. The NCF recommends that the DIT scheme for Common Service Centres is brought under the umbrella of Mission 2007 and implemented as a part of Bharat Nirman. A monitoring

agency with strong civil society participation may be set up to ensure that the CSC scheme attains the national objectives.

1.9.10 Finance and Policy Support: NCF urges Government to make knowledge connectivity the backbone of other forms of rural connectivity. **We have an uncommon opportunity to take the digital revolution to rural India. What we need is a coherent and interactive package of public policies, and not too many fragmented and isolated initiatives and policies.** Since farm families constitute the vast majority of the rural population, we urge the Ministry of Agriculture to facilitate a Rural and Agricultural Knowledge Revolution through a coordinated action plan.

1.9.11 The Telecom Regulatory Authority of India (TRAI) has proposed the concept of **Rural Service Provider (RSP).** The BSNL/ MTNL's fibre optic network covers over 600,000 kms and nearly 97% of the optic fibre remains unlit dark fibre. **This is a huge unused national resource of inestimable value for Bharat Nirman.**

1.9.12 The RSP license should allow for the provision of telephone, internet and radio services exclusively for the rural areas with no license fee levied until 2010. The RSPs should be allowed to use any technology that may be appropriate to provide the rural families with the needed services. They may be allowed to connect with the **Taluka** headquarters through any national network on the revenue sharing bands. Long distance connectivity may also be provided free of cost to RSPs until 2010. As recommended by TRAI, the costs could be met from the USO fund. Wherever feasible, unused optic fibre bandwidth may be procured from this purpose, supplemented by bandwidth from VSAT and DTH service providers to cater to the needs of data broadcasting and reaching the unreached.

1.9.13 The process of obtaining the RSP license should be simple and transparent. We recommend that the Ministries of Agriculture, Rural Development, Panchayati Raj, Communication and Information Technology and Home may jointly develop a simple set of procedures.

1.9.14 A total of about Rs.3000 crores of public investment may be needed during the next 3 years for making the 'Every Village a Knowledge Centre' concept a reality. We suggest that investment in the VKC programme should come from a variety of

government sources including the USO fund and the vast resources being set apart for Bharat Nirman. **Until 2010, the aim should be the knowledge and skill empowerment of rural women and men with public funds.** We are confident that the rural knowledge managers (ICT- SHGs) and the Fellows of the Jamsetji Tata National Virtual Academy will develop during the next 5 years the capacity to earn adequate funds, through facilitating the outsourcing of appropriate government and private sector activities from the urban to rural areas.

1.10. 0 Producer Oriented Assured and Remunerative Marketing: Role of Commodity Futures Markets

1.10.1 Opportunities for assured and remunerative marketing hold the key to sustaining farmers' interest in increasing productivity. As already emphasized, we should increase rural non-farm income, so that the purchasing power of the rural poor goes up. Only then will home consumption show improvement. In early 2003, the Government of India liberalized procedures for the establishment of commodity future markets. As a result, this market is expanding at a fast pace. The trade turnover in the commodity exchanges touched Rs. 5,70,000 crores during 2004-05. The time has come to ensure the healthy and regulated growth of this market and make small farmers benefit from the development of this market. If spot and futures prices of farm commodities are available to farmers as well as to the agro-and food processing industries through VKCs, agriculture as a whole will benefit. We should make available to farmers dependable data on market prices, so as to enable them to take decision on the crops to be sown and on post-harvest sale of commodities. The APMC yards across the country are now being networked electronically by the Multi-Commodity Exchange of India (MCX), Mumbai. The National Commodities and Derivative Exchange (NCDEX), operates online trading through nearly 6000 terminals covering 33 agricultural commodities. 430 cities and towns across the country were covered be the exchange in Dec 2004. **It will be very useful if the Village Knowledge Centres are linked to NCDEX and MCX so that they can disseminate spot and futures price data among farmers.** It is also now possible to transmit such data on cell phones. We recommend that the Ministry of Agriculture may take speedy steps to bring this about.

1.11.0 Change in Mindset with reference to the role of the Ministry of Agriculture, Government of India

1.11.1 Several farmers' organizations have suggested that the Ministry of Agriculture should be renamed as **Ministry of Agriculture and Farmers' Welfare**.

1.11.2 We recommend the serious consideration of this suggestion since farmers' well-being should be the main goal of the Ministry. This will also help to link faces with figures.

1.12.0 NDC Committee on Agriculture

1.12.1 We are happy that a NDC Committee on Agriculture has been set-up under the Chairmanship of Shri Sharad Pawar. We request that the suggestions contained in this Report as well as the earlier one may kindly be examined by the NDC Committee so that appropriate action can be taken concurrently at the Central and State levels.

1.12.2 The NDC Committee on Agriculture could also give consideration to the following

i) Mobilising financial resources from -

a) Central Government
b) State Governments
c) Financial institutions
d) Bilateral and Multilateral donor institutions

1.12.3 The order of additional investment needed for infrastructure development (production and post-harvest), capacity building and research and extension as well as the order of additional resources needed for doubling food production by 2010 will have to be calculated

ii) Indo-US Collaboration

Some of the priority areas should be -

a) Proactive land use advice based on reliable weather forecasts
b) Assessment of soil micro-nutrient requirements using nano-technology
c) Precision agriculture, to reduce cost of production and enhance income

CHAPTER 2

FOOD FOR ALL

2.1.0 Medium Term Strategy for Food and Nutrition Security with a view to move towards the goal of universal food security over time

2.1.1 The Mid-term appraisal of the Tenth Plan reveals that we are lagging behind in achieving the Millennium Development Goal of halving hunger by 2015. Under-nutrition and mal-nutrition are still widespread. Maternal and foetal under-nutrition is resulting in the birth of babies with low birth weight. This has serious consequences for the future intellectual capital of India. Therefore building a sustainable food and nutrition security system is an urgent task.

2.2.0 Food and Nutrition Security

2.2.1 The concept of food and nutrition security implies that -

i) every individual has the *physical, economic, social and environmental access* to a balanced diet that includes the necessary macro- and micro-nutrients, safe drinking water, sanitation, environmental hygiene, primary health care and education so as to lead a healthy and productive life.

ii) food originates from efficient and *environmentally benign production technologies* that conserve and enhance the natural resource base of crops, farm animals, forestry, inland and marine fisheries.

(Science Academies Summit, MSSRF, 1996)

2.2.2 This comprehensive definition of food and nutrition security provides guidelines for developing an effective operational strategy for achieving the goal of freedom from hunger.

2.2.3 Hunger has three major dimensions:

i). Chronic or endemic hunger resulting from poverty-induced undernutrition.

ii). Hidden hunger arising from micro-nutrient malnutrition, caused by the deficiencies of iron, iodine, zinc and Vitamins in the diet.

iii). Transient hunger caused by seasonal fluctuations in food availability and disruptions in communication and transport arising from **natural or man-made disasters**.

2.2.4 A sustainable national nutrition security system should cover all these three categories of hunger. It must also address the three issues of availability, access and absorption.

i. *Availability* of food at the household level depends upon (a) food production, changes in existing food grain stocks and / or imports.

ii. *Access* to food depends on livelihoods / purchasing power.

iii. *Absorption* of food is influenced by access to clean drinking water, environmental hygiene and primary health care.

In recent years, there is cause for concern on all the three counts of food availability, food access and food absorption.

2.2.5 Food Availability

2.2.5.1 In the nineties, food grain growth rate has slowed down drastically to 1.7 % and has fallen below the population growth rate of 1.9 %, so that per head annual net food grains output has fallen by about 3.5 kg from a peak of 180 kg. in the three years ending in 1994-95 to, 176.5 kg. by the three-year period ending in 2000-01. (Utsa Patnaik, www.macroscan.org. August, 2002)

2.2.5.2 The decline in per capita food grain availability and its unequal distribution have serious implications for food security in both rural and urban areas.

2.2.5.3 In 1999-00, the average calorie consumption of a consumption unit in urban areas was 2637 kcal/day and this is not much higher than the norm of 2100 kcal/day, set for an urban adult. It is also important to note that while there are visible signs of an enormous increase in conspicuous consumption by the urban rich, there are also signs of increasing inequality in urban areas: in 1999-00, the bottom 10 percent of urban population obtained on the average only 1890 kcal/ day. That is, nearly 28 million people in our urban areas have unacceptably low levels of calorie consumption. (Food Insecurity Atlas of Urban India, MSSRF-WFP, 2002)

2.2.5.4 Similarly, going by the official Planning Commission estimate of the proportion of population below the poverty line of 27.09 percent in rural areas and 23.62 percent in

urban areas, a total of 260.27 million people in both rural and urban areas put together can be definitely assumed to be unable to buy sufficient food to achieve food and nutrition security. These estimates have been contested and can best be taken as the lower bounds of the estimated poor population in the country. The problem at hand is therefore of enormous dimensions. Besides, there are regional variations as well in the incidence of poverty. Across the nation, the poorest states are Orissa, followed by Bihar, Madhya Pradesh and Assam.

2.2.5.5 Though official data on poverty suggest a reduction in the percentages of population below the poverty line, there is reason for presuming that the incidence of hunger is increasing. Data on nutritional intakes suggest that income poverty is increasingly divorced from the calorie norm of 2400 kcal per consumption unit per day underlying the original official definition of poverty line. The data show that the percentage of population consuming diets providing less than 2400 kcal per capita per day is much higher now than the percentage below poverty line as estimated by the Planning Commission. Recent work by Professor V S Vyas suggests that in as many as eight major states, the proportion of the rural population accessing less than 1800 kcal/day (the level below which malnutrition can cause irreversible damage) exceeds 30 per cent. This is indeed cause for concern.

2.2.6 Food Access

2.2.6.1 Access to food grains is related to the purchasing power of the population and the nature of public distribution system that is prevalent. Purchasing power of large sections of the rural population has been weakened in recent years by the crisis in agriculture and rural livelihoods. In urban areas, the weakening of the PDS has exacerbated the problem of food insecurity.

(i) Rural Food Insecurity

Several studies have shown that the poverty is concentrated and food deprivation is acute in predominantly agricultural and rural areas with limited resources. Rain-fed agriculture is one of them. Agricultural labour and migrant labour are susceptible to hunger. In India of the 310.7 million rural workers, 103.12 million are agricultural labourers. Of these, about 48.37 million are females. Female agricultural labourers are

especially vulnerable to food insecurity on account of lower wages as well as the effects of migration.

One third of the rural work force is dependent on casual employment. This segment faces uncertainties of wage and work and is highly susceptible to food deprivation.

About 40.14 percent of the rural workers are cultivators. Of the total 124.68 million cultivators, about 40.64 million cultivators are women with inadequate resources and credit facilities. In hilly areas and rain-fed back ward areas, often there are more female cultivators than male cultivators. Besides rural labourers, both agricultural and non-agricultural, small and marginal farmers also face food insecurity. Not only do they not get remunerative prices for their produce, they are also affected by the rise in retail/PDS food grain prices, being net buyers of grain.

ii) Urban Food Insecurity

It is often presumed that, since urban areas are covered by the PDS, food security is not a major issue in urban areas. This is not true. During the 1990s, the PDS has been weakened, both by repeated increases in the issue prices of food grains and by the switch to a system of targeted PDS. Besides, studies show that the bottom 10 percent of the urban population is not really helped by the prevalent system of PDS for accessing food grains. In 1999-00, average cereal consumption of bottom 10 percent of urban population was 9.55 kg/month in urban India. Of this, less than one kg/month was accessed from PDS (Food Insecurity Atlas of Urban India, MSSRF-WFP 2002).

This brings out the need to have a system of PDS that is flexible so as to ensure larger coverage. **People should be able to access grains from PDS whenever they want, wherever they want and in any quantity they want subject to a few ground rules to prevent purchase for hoarding and subsequent sale at high prices.** That is, flexibility with regard to time of purchase, place of purchase and quantity of purchase needs to be fitted in to the Public Distribution System. Accessing subsidized food grains is absolutely essential not only for the settled urban poor but also for the migrant population from villages.

As for purchasing power, the quality and quantum of employment of the population determine their income earning ability and therefore their ability to purchase food grains in the market. Casual employment normally fetches an income that is low and irregular; regular employment on a decent wage ensures a relatively better access to food. In 1999-00, in urban India only 4 out of every 10 workers belonged to the regular wage category; among the bottom 10 percent of urban population, nearly 4 out of 10 persons are casual labourers. The nature of the employment problem varies across different size classes of towns. Proportion of casual labour among males as well as females is much higher in small towns compared to the metropolitan cities or big towns. Similarly, the proportion of workers in regular employment is much lower in small towns compared to bigger towns. (Food Insecurity Atlas of Urban India, MSSRF-WFP, 2002)

Given the magnitude of the employment problem in urban India, particularly in the small towns, there is a strong case for a National Urban Employment Guarantee Programme.

2.2.7 Food Absorption

2.2.7.1 Biological absorption of food in the body is related to the consumption of clean drinking water as well as environmental hygiene.

The situation on this front is serious in India. For instance, in urban areas -

a) Slums that have inadequate facilities of sanitation and drinking water, provide shelter to nearly 22 % of urban population in the country. In the early nineties, one third of slums did not have any drinking water facility and nearly half the slums did not have toilet facilities.
b) Access to basic amenities - safe drinking water, toilets, electricity, are much lower for households living in small towns.
c) In 1998-99, 15.4 % of children were severely stunted and 11.6 % were severely underweight.
d) While there are wide variations in the nature and extent of the problem of food insecurity across urban areas, small towns are especially vulnerable.

2.2.8.2.1 A National Food Security System should therefore give concurrent attention to the landless poor in villages and to casual and migrant labour families in urban areas, particularly in small towns.

2.3.0 Hunger-Free India: Components of Action Plan

A six-point Action Plan is suggested below for achieving the goal of Hunger-Free India.

2.3.1 Reform of the Delivery System: Restructure the delivery systems relating to all nutrition support programmes on **a life cycle basis**, starting with pregnant women and 0-2 infants and ending with old and infirm persons. An illustrative list of the programmes, which will benefit from a life-cycle based delivery system is given in Table 1. Elected Panchayats and local bodies should be involved in restructuring the delivery system.

Table 1: Current Status of Interventions

S.No	Stage of Life Cycle	Intervention / Action
1.	Pregnant Mothers	Food for Nutrition to avoid maternal and foetal mal- and under- nutrition resulting in LBW children
2.	Nursing Mothers	Support needed for breast feeding, for at least six months
3.	Infants (0-2 years)	Not being reached by ICDS
4.	Pre-School Children (2-6 years)	Integrated Child Development Services
5.	Youth going to School (6-18 years)	Noon Meal Programme
6.	Youth out of School	Not being attended to
7.	Adults (18-60 years)	Food for Eco-Development (Sampoorn Gramin Rozgar Yojana), PDS, TPDS, Antyodaya Anna Yojana
8.	Old & Infirm Persons	Annapoorna and Food for Nutrition Programmes
9.	Emergencies	Food during natural calamities

2.3.2 **Community food security systems:** Promote the establishment of **Community Grain and Water Banks**, involving Panchayats and local bodies. This programme should be based on the principle "**store grain and water everywhere**".

2.3.2.1 The Community Grain / Food Bank system will help to widen the food security base by including a wide range of millets, grain legumes and tubers. **While these can be operated by the nearly 240,000 Panchayats and Urban Local Bodies in the country, using flexible implementation mechanisms suited to local needs, the programme**

should financially supported and regulated by the state to ensure social inclusion and sustainability.

2.3.2.2 The Community Foodgrain Bank (CFB) is a decentralized system of storage and management of food at the village level by the community to address the problems of difficulty in physical access to food due to natural calamities, seasonal imbalances and lack of purchasing power.

2.3.2.3 Steps Involved in Setting up CFBs:

i) Foodgrain Corpus: The calculation of amount of foodgrain required to be stocked is as follows:

The Indian Council of Medical Research (ICMR) norm of per capita per day cereal requirement by an adult is 420 grams. A family of 5 will therefore require 2100 gms per day, say 2 kg/day (assuming children in the household whose requirement will be slightly less). Extrapolating, the monthly requirement for a family is 60 kg and for a village with 100 households, the monthly requirement of foodgrains is 6 tons.

The ICMR norm for pulses is 40 gms per capita per day. For a family of five, this amounts to 200 gms per day and 6 kg per month. The monthly requirement of pulses for a village with 100 households is 600 kg.

The amount to be stocked has to be calculated on the basis of population needing assistance and period for which it is to be provided.

ii) Storage Structure: Storage is an important aspect needing attention. The storage space / structure will be determined by the amount to be stocked. It should be all weather resistant, located in a common place and accessible to all. The extant Community Grain Bank scheme of the Government of India unfortunately does not pay much attention to storage.

The requisite expertise for building the infrastructure for grain storage is available with the Indian Grain Storage and Management Research Institute of the Department of Food, as well as with Tata Steel Rural Development Society (TSRDS). The TSRDS has developed steel silos made of pre-fabricated steel that can be placed in the open and can withstand all weather conditions. These range in capacity from 1 m.t to 13 m.t. With guidance, they can be built locally by local self-help groups thereby generating employment.

iii) Operation and Management:

The initial corpus of foodgrains (rice and pulses to start with) is to be given free, based on the requirement. Subsequently, the mechanism should evolve into a community-managed bank wherein the members can borrow the cereals/pulses and develop a system of repayment in kind after a specified period at a pre-decided rate of interest, also in kind.

The system works like this:

a. Those in need of foodgrain can borrow foodgrain from the CFB. The eligible quantity will be determined with the ICMR benchmark as the norm.
b. The management of the CFB should be by the community. A food bank management committee of five to seven members, with at least 3 - 4 women, should be formed to monitor the operations. The village Panchayat will also be represented.
c. The period of loan, rate of interest all have to be decided by the committee in consultation with the entire village
d. Registers to be maintained: Stock Register, Lending and Repayment (Principal + Interest) Register, Individual Passbooks of Grain Borrowed and Repaid

2.3.2.4 Capacity building of the community to manage the CFB is very crucial. Sustainability of the mechanism hinges on ensuring livelihood security of the people.

2.3.2.5 Promote the growth of **community water security systems** based on a 5-pronged strategy consisting of:

i. Augment supplies through mandatory water harvesting and conservation
ii. Give attention to demand management by eliminating all sources of unsustainable use of water and promoting "more crop per drop" methodologies of crop cultivation
iii. Harness new technologies relating to improving domestic water use efficiency, de-salination of sea water, breeding of drought and salinity tolerant crop varieties, bioremediation, etc.

iv. To begin with, each district in the country could develop a sustainable water security system. Community action should however start at the village level.

v. Promote seawater farming through integrated agro-forestry and aquaculture production systems in coastal areas.

vi. Pay attention to water quality. The quality of drinking water is deteriorating due to pesticide and bacterial contamination in ground water. Equal attention should be paid to the improvement of drinking water quality and the augmentation of water supplies. Bioremediation techniques will have to be used for removing arsenic and heavy metals from tube well water.

Box 1

Community Food Banks in Orissa: A Success Story

Community Food Banks, set up as models by the M S Swaminathan Research Foundation (MSSRF) with support from the World Food Programme (WFP), are in operation in eight tribal villages in the Koraput-Kalahandi region of Orissa. These villages vary in size from a hamlet with 9 households and a population of 54, chosen because of its difficult access, and a village of 127 households with a population of 529. Starting in 2002, the foodgrain corpus in all the project villages has increased by over 100 percent through repayments and voluntary addition to the stock by the community. There is no default. The Food Banks are managed by Food Bank Management Committees of 5 – 7 members. 50 percent of members are women. The Committee decides on the terms of repayment, interest etc. Community Seed Banks are also in operation in all the villages.

The functioning of the community food banks has led to several other positive outcomes. Besides a decline in food scarcity and insecurity, there has been a decline in the extent of migration in search of work, dependence on moneylenders, consumption of seed during crisis, and distress sales of produce. The old, infirm and destitute in the community are receiving greater attention and care now than was the case earlier.

Self Help Groups formed in the project villages have undertaken income generation activities like mushroom cultivation, vegetable, vermicomposting, poultry and fishery. As on March 2005, total savings in the bank of the SHGs was Rs.1,09,000. The SHG members had cumulatively availed loans to the extent of Rs.2,41,000 for income generation activities. Village development committees have also been formed in all the villages. Community development activities such as promoting health and sanitation awareness, maintaining a medicinal plants garden and micro-watershed development have been taken up in some of the villages.

The Orissa experience of MSSRF-WFP initiative shows that while an universal PDS, funded and managed by the State is absolutely essential to food security, it needs to be supplemented with locally managed food security systems in areas difficult to access. It must also be mentioned that a key factor underlying the success of the Orissa initiative is the cohesive nature of the tribal societies involved with the project.

2.3.3 **Eradicate hidden hunger** caused by micronutrient deficiencies based on natural food cum food fortification approaches. For example, salt fortified with iron, iodine, minerals and vitamins, coupled with the consumption of beta-carotene rich sweet potato

or vegetables will be very helpful to fight hidden hunger. Local SHGS can be trained to make nutritious biscuits as an income earning activity. Nutritional literacy should be promoted at the school level. High priority should go to the elimination of iron deficiency anaemia among pregnant women.

2.3.4 New Deal for the Self-employed

2.3.4.1 The unemployment rate on current daily status was about 9.21 percent (34.85 million) in 2001-02 in rural areas. Unemployment among rural youth increased from 9 percent in 1993-94 to 11.10 percent among males and 10.60 percent among females in 1999-2000.

2.3.4.2 Rural employment grew at 0.67% and agricultural employment at 0.02% during 1999-2000. According to the 55th round of survey of NSSO the share of self-employed in 1999-2000 was about 53%. The share of self-employed in total employment, 58% (133 to 134 million) was in the primary sector, i.e., agriculture and allied activities.

2.3.4.3 Detailed analysis of the causes of food insecurity in rural and urban India have revealed that inadequate purchasing power due to lack of job/livelihood opportunities is now the primary cause of endemic or chronic hunger in the country. Since opportunities for employment in the organized sector are dwindling, we have to create a policy environment that enlarges opportunities for remunerative self-employment in rural India in order to avoid an era of jobless economic growth.

2.3.4.4 Agriculture, comprising crop and animal husbandry, fisheries, forestry and agro-forestry and agro-processing, is the largest private sector industry in India, providing livelihood opportunities for over 600 million women and men. There is need to intensify efforts to create more opportunities for gainful livelihood opportunities in both the farm and non-farm sectors. According to FAO, malnutrition is high in areas where a very high percentage of population depends solely on agriculture for their livelihood. One reason for the high prevalence of hunger in villages is inadequate growth in opportunities for remunerative non-farm employment.

2.3.4.5 The menu of income earning opportunities for the self-employed needs to be enlarged. This calls for a paradigm shift from **micro finance to livelihood finance.** NCF had recommended in its first report that all the existing Krishi Vigyan Kendras (KVKs)

should be provided with a post-harvest technology wing. In addition, there is an urgent need for atleast **50 SHG capacity building and mentoring centers** in every State, to enhance the management and marketing capacities of Members of the SHGs. Such centers can be established in existing institutions like Agricultural, Rural and Womens' Universities, IITs, institutions operated by NGOs, etc. Village Knowledge Centres can provide SHGs with e-commerce facilities. Accounting software will have to be introduced. SHGs will be sustainable in the longer term only if they have backward linkages with technology and credit, and forward linkages with management and marketing. Sustainable Self-help Groups (SSHGs) will emerge only if we build the capacity of the key members (both women and men of SHGs). **The SHG Capacity Building and Mentoring Centres** may be financially supported by the Union Ministry for Rural Development. This should be an essential component of the New Deal for the Self-employed.

2.3.5 Enhancing the Productivity and Profitability of Small Holdings:

2.3.5.1 Nearly 80% of the land holdings in India are below 2 ha in size. Unlike in industrialized countries where only 2 to 4% of the population depends upon farming for their work and income security, agriculture is the backbone of the livelihood security system for 2/3 of India's population. **Therefore, farmers constitute the largest proportion of consumers**. The smaller the farm, the greater is the need for marketable surplus in order to get cash income. **Hence, improving small farm productivity, as a single development strategy, can make the greatest contribution to the elimination of hunger and poverty**.

2.3.5.2 Indian soils are both hungry and thirsty. Hence, soil health enhancement and irrigation water supply and management hold the key to the enhancement of small farm productivity. The following steps are urgently needed.

i. National network of advanced **soil testing laboratories** with facilities for the detection of micronutrient deficiencies. **As a single agronomic intervention, supply of the needed micronutrients in the soil has the greatest impact on increasing yield.** Hidden hunger is as widespread in soils, as in human beings. In fact, the two have causal relationships.

ii. Million Wells Recharge Programme
iii. Restoring Water bodies and promoting mandatory water harvesting.
iv. Establishment of 50,000 Farm Schools to promote farmer-to-farmer learning.
v. Organisation of Small Farmers' Horticulture, Cotton, Poultry, aquaculture and other Estates, to promote group farming and to confer the power of scale to small producers both at the production and post-harvest phases of farming.

2.3.5.3 Farming is becoming a gamble both in the monsoon and the market and hence small farmers urgently need **proactive advice** on land and water use. Land use decisions are also water use decisions. The Every Village a Knowledge Centre Movement can help to give farmers dynamic advice on meteorological and marketing conditions.

2.3.5.4 **In addition to dynamic advice, farmers also need proactive advice** on land and water use. For this purpose, State Land Use Boards should be restructured, retooled and reactivated on the lines indicated in Fig 1. This is a task of the utmost priority.

2.3.5.5 We suggest that under the recently concluded agreement for cooperation with the United States in the field of agriculture, the following areas may receive priority.

i. Short and Medium term weather forecasting, in order to assist Land Use Boards to give proactive advice to farmers on crop and varietal choice.
ii. Rapid and low cost soil testing technologies based on nanotechnology. This will enable the application of need based macro- and micro- nutrients. Factor productivity in relation to fertilizer application is low now and this enhances the cost of production. The average fertilizer response of food grain output to NPK utilization works out to 7.8 kg. grain per kg NPK. This is a very low return.

2.3.5.6 Unless factor productivity is increased, small farm agriculture will become un-remunerative. This is one of the causes for a high percentage of farmers wanting to quit farming. We must recognize the need for increasing the productivity and profitability of small and marginal farms, in order to eliminate endemic and hidden hunger in the families such farmers

2.3.6 Designing and introducing a Food Guarantee Act:

2.3.6.1 We have over a century of experience in organizing relief work, under the provisions of the Famine Code in the colonial period, and Food for Work programmes in the post-independence period. It is clear that our agriculture has reached a stage when

farmers will grow more only if we can consume more. Hence, a **National Food Guarantee Act**, combining the features of the Food for Work and Employment Guarantee Programmes, will represent a win-win situation both for producers and consumers. Women, in particular, prefer a combination of grains and cash as wage, provided the food grains are of good quality.

2.3.6.2 A National Food Guarantee Act should lead to a decentralized network of grain storage structures and thereby help to prevent panic purchase of food grains during periods of drought or flood. They will also help to prevent distress sales by producers at the time of harvest. In addition, it will help to enlarge the composition of the food security basket.

2.3.6.3 Brazil, Kenya and a few other countries have announced, "Zero Hunger" programmes. **India can take the lead to give meaning and content to the zero hunger concept by developing a National Food Guarantee Act.**

2.3.6.4 The major features of a National Food Guarantee Act were discussed at a Consultation held at MSSRF on 19 June 2005. The participants made the following suggestions:

1. The main aim of the proposed legislation should be to integrate the features of Employment Guarantee Acts (National and Maharashtra) and Food for Work Programmes, in order to ensure that every child, woman and man has physical, economic, social and environmental access to balanced diet, clean drinking water and primary health care. This is fundamental to providing every individual in the country an opportunity for a healthy and productive life. Rural and urban populations as well as migratory labour families will have to be covered. Social inclusion should be the bottom line.
2. The National Food Guarantee Act should be gender sensitive. The concept of "work" should be enlarged to cover also skilled work related to human and social development, as for example, establishing and running crèches, balwadis, preparing noon meals, etc.
3. Payment of a part of the wage in the form of food grains has the double advantage of helping farmers in the area of marketing, and consumers in the form of obtaining their basic caloric requirements in the form of good quality food grains

at a reasonable price. This will also help to enlarge the composition of the food security basket.

4. Food guarantee can become a reality only if there is an implementation mechanism characterized by low transaction cost, transparency and freedom from corruption. The Gram Panchayats / elected local bodies may be able to provide such a mechanism. The Gram Panchayat / Local Body can form in the respective villages a Consortium of Agencies like SHGs, Mahila Mandals, Farmers' Clubs etc, to provide oversight to the implementation of the integrated food for work and employment guarantee approach to the elimination of hunger and poverty. **The Panchayat can thus provide a platform for partnership at the grass root level.** However Panchayats will need the necessary legal, financial and technical empowerment. There are a large number of tasks, which are assigned by Constitution Amendment 73 to Panchayats, but they have no capacity to discharge these responsibilities since they have not been legally or financially empowered to do so. Capacity building of women and men Panchayat members in undertaking such tasks has to proceed concurrently with financial empowerment.
5. Information empowerment on entitlements is vital for success. Household entitlement cards can be distributed and full use could be made of Mission 2007: Every Village a Knowledge Centre Programme. The recently enacted Right to Information Act will also facilitate the process of empowering the rural poor (often illiterate) in understanding their entitlements under various pro-poor schemes of Central and State Governments.
6. Training and Capacity Building of all concerned with the implementation of the programme is extremely important. Suitable institutions will have to be identified for imparting training to administrators, Panchayat leaders, SHGs and others who will be involved in implementing the Food Guarantee Act.
7. The Act should provide scope for including feasible land reform measures like providing dalits and the poor with space for a homestead garden where the needed vegetables and fruits can be grown. SHGs can also be given space on lease in common property land for raising nutrition gardens and fodder for farm animals.

8. Integration with primary health care is exceedingly important. For example, de-worming should be made compulsory atleast once in two months. Multiple fortified salts could be used in noon meal programmes in order to attack the problem of hidden hunger caused by micro nutrient malnutrition.
9. The Act could stimulate a movement for storing grain and water everywhere through community food and water banks. A national network of community food banks could be established.
10. Nutrition and education are fundamental to enabling every individual to experience a productive and healthy life. Therefore the enactment of a Food Guarantee Bill will be the best method of ensuring that we are able to accomplish the UN Millennium Development Goals.
11. Thanks to the extensive work done both within the country and outside on issues relating to "Right to Food", there is considerable legal and technical expertise available for preparing a framework for Food Guarantee. We should therefore proceed with this initiative.
12. It will be appropriate to operationalise the Food Guarantee Act on August 15, 2007, which marks the 60th anniversary of India's independence.

2.4.0 Road Map for Eliminating Hunger

2.4.1 In summary, the six-point action plan recognizes that the problem of food security is both multidimensional and cuts across the rural-urban divide. Since urban food insecurity and deprivation are closely related to rural deprivation, a comprehensive rather than a sectoral approach is required.

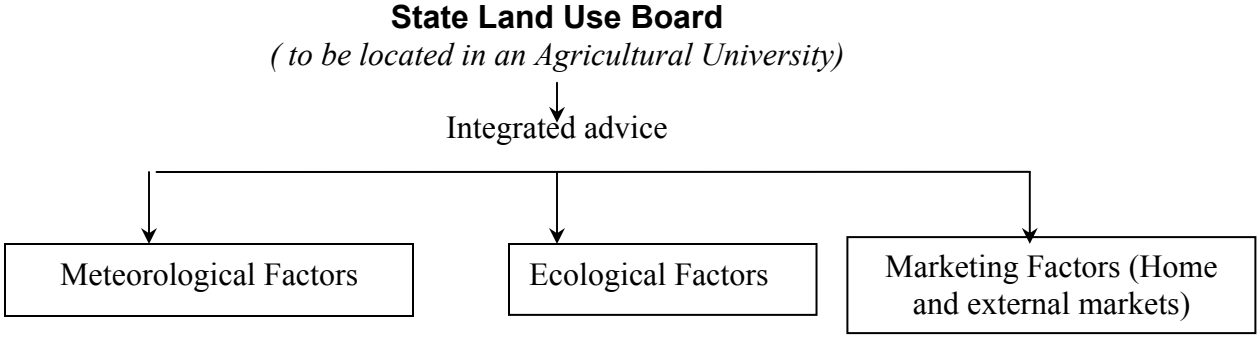
The six points in brief are:

1. Reorganise the delivery of nutrition support programmes on a life-cycle basis with the participation of Panchayats and local bodies.
2. Eliminate micronutrient deficiency induced hidden hunger through an integrated food cum fortification approach.

3. Promote the establishment of Community Food and Water Banks operated by Women Self-help Groups, based on the principle "**Store Grain and Water Everywhere"**.
4. Help small and marginal farmers to improve the productivity and quality of farm enterprises.
5. Introduce support systems to SHGs to make them economically and organizationally sustainable. Establish for this purpose SHG Capacity Building and Mentoring Centres and focus on Livelihood Finance.
6. Formulate a **National Food Guarantee Act** continuing the useful features of the Food for Work and Employment Guarantee programmes and introduce it on 15 August, 2007, which marks the 60th anniversary of our independence. The Food Guarantee Act will be a powerful tool in achieving the goal of a hunger-free India. By increasing demand for food grains as a result of increased consumption by the poor, the economic conditions essential for further agricultural progress can be created.

Proactive Advice on Land use

(Land use decisions are also Water use decisions)



The Land Use Board through a virtual college should give proactive advice on the choice of crops and farming systems, so as to achieve a match between demand and supply in farm commodities and to ensure that the most efficient crops are grown in different agro-climatic and agro-ecological regions.

CHAPTER 3

FISH FOR ALL

3.1 The Terms of Reference of the National Commission on Farmers (NCF), *inter-alia* provide; "Suggest measures to attract and retain educated youth in farming and recommend for this purpose; methods of technological upgrading of crop husbandry, Horticulture, Animal Husbandry; **Fisheries (Inland and Marine)**, Agro Forestry, Agro processing and associated marketing infrastructure" etc.

3.2 Chapter V of the First Report of the NCF has already dealt with the subject of Horticulture and the subject of Marketing has been discussed in Chapter V of this Report. The subject of Fisheries (Inland and Marine) is discussed in the following paragraphs.

3.3 Fisheries, both inland and marine offer great scope for income generation and nutritional security for the people and export opportunity for the country. More than seven million fishers directly and an extremely large number of people indirectly are dependent on Fisheries for their livelihood.

3.4 The Tenth Five Year Plan had targeted GDP growth in agriculture and allied sectors at 4 per cent per annum. The actual growth during the first three years of the Tenth Plan is only 1 per cent per annum. In contrast, the growth rate in fisheries sector had been sustained at 4.3% during the Ninth Plan, because of the untapped potential being exploited particularly through aquaculture. It is felt that the greater attention to fisheries through higher investment proposed in this Chapter would help to further increase the growth rate of fisheries sector. A growth of 8% in the fisheries sector would be needed to help in the achievement of a 4% growth in agriculture.

3.5. The Tenth Five Year Plan envisages increasing fish production from 62 lakh tonnes in 2002-03 to 82 lakh tonnes in 2006-2007, with a financial outlay of Rs.740 crores in the Central and Rs.1324 crores in the State plans. This requires a focus on sustaining gains already made in production; protecting the productivity of inland and marine fisheries, increasing production through expansion of area and new technical breakthroughs; adding value to the produce and ensuring quality; and creating increased livelihood avenues through remunerative and assured marketing opportunity.

3.6. India's strategy for attaining the objective of "**FISH FOR ALL"** is:

- **Enhancing** productivity in all inland ponds and achieving sustained high production per cubic volume of water in them; giving integrated attention to capture and culture fisheries both in inland ponds and in coastal areas.
- **Ensuring** the adoption of responsible and sustainable fishery practices in the area of marine fisheries and introducing a code of conduct for this purpose.
- **Establishing** agro-aqua farms, involving the cultivation of mangroves and *Salicornia, casuarinas*, cashewnut, coconut and other appropriate tree species and the culture of prawns and shrimps.
- **Spreading** quality literacy among fisher families with reference to sanitary and phytosanitary measures and codex alimentarius food safety standards.
- **Improving** facilities for fish landing, storage, transportation, processing and marketing.
- **Developing** social marketing techniques, which can help to ensure the availability of good quality aquatic products to resource-poor consumers.
- **Introducing Aquarian Reforms** to help in the spread of fish enterprises based on the principle of environmental sustainability, economic viability, social, general equity, nutritive quality and food safety. Aquarian Reforms should aim to promote harmony between artesenal and mechanised fishers and Agriculture and Aquaculture and cover both Indian and coastal water resources.
- **Organising Fish for All** training centres for fisher families based on the principle of learning by doing, to impart latest technical skills ranging from capture or culture to consumption. Helping both resource poor producers and resource poor consumers through sustainable self-help groups is a major objective of the "Fish for All" programme.

Box -1

A Summit was organized by M.S.Swaminathan Research Foundation with World Fish Centre (ICLARM), Government of India and Government of West Bengal in Kolkata on December 18-19, 2003 for the National launch of "Fish for All". The objective was to ensure "Fish for All and Forever" and the Summit sought to develop a road-map for achieving this goal by 15th August, 2007 which marks the 60th anniversary of India's independence. To achieve the objectives, the Action Plan "Agenda 2007" was formulated as under:

I. Public Policy and Action

- Through **Aquarian Reforms** ensure productivity, sustainability, profitability, gender and social equity in capture fisheries (marine and inland), aquaculture and non-food fisheries (e.g. sea weeds);
- Set up a separate **Ministry/Department of Fisheries** in the Union Government and bring aquaculture and fisheries on par with agriculture especially in the provision of basic infrastructure needed for the sector;
- Formulate a National Fisheries Policy for sustainable development taking in to account the needs of the fisheries and aquaculture sectors as well as opportunities for domestic and international trade;
- Strengthen existing fisheries legislation both at center and the states; and formulate new legislation where necessary in order to help in realizing the full potential of the sector to improve nutrition and provide more jobs and income;
- Policy on water allocation for freshwater fish culture on par with irrigated agriculture; allocation of specific areas for women enterprises;
- Reduce post-harvest losses and increase value by launching intensive Quality and Scientific Literacy Movement through use of modern ICT technology, sanitary and phytosanitary measures and globally accepted standards on hygiene and sanitation;
- Legislation on introduction and control of exotic species.

II. Implementation of Programs for Sustainable Development

- Regulate and limit access through implementation of monitoring, control and surveillance of fisheries;
- Conserve and sustainably exploit marine resources through harmonized seasonal ban on fishing across maritime states; elimination of destructive fishing; declaration of closed areas and setting up of sanctuaries;
- Deploy effort in less exploited areas (e.g. harnessing offshore marine resources, sea weed culture, etc.)
- Set up small-fisher aquaculture estates to bring in social equity. Estates to have backward linkages with R&D institutions and forward linkages with assured and remunerative markets;
- Organise National Pilot Projects for demonstration of new technologies such as sea water farming for prosperity of coastal areas; setting up of bio-villages for providing sustainable livelihood opportunities; low external input sustainable integrated farming practices, culture of ornamental fishes, etc;
- Implement national level programs for reduction of post-harvest losses and popularisation of low-cost value addition technologies;
- Develop strong domestic marketing infrastructure.

III. Strengthening of Institutional Mechanisms and Capacity Building

- Set up a professional–managed **National Fisheries Development Board (NFDB)** for overall fisheries and aquaculture development;
- Strengthen existing institutional mechanisms and census information for implementation of developmental programs;
- Strengthen existing fisheries education institutions and set up a national facility on the model of the Indian Institute of Technology for harnessing the opportunities provided by space, information and communication technologies as well as biotechnology and renewable energy technologies.

IV. Public Awareness

- Implement programs for bringing awareness among public and policy makers on the need for conservation and development of aquatic resources, sustainable and responsible fisheries and aquaculture, including adoption of good management practices;
- Create awareness on safety issues among small-scale fishermen;
- Create awareness on the contributions of fish to nutritional security.

V. Partnerships

- Develop bilateral, regional and international collaborations to strengthen the functioning of research and development institutions in the country.

3.7 There have been several major positive developments over the years, which have the potential to develop Fisheries to the optimum level. The Government of India have already formulated a Marine Fishing Policy in 2004. They have also adopted the FAO's Code of Conduct of Responsible Fisheries and have very recently enacted Coastal Aquaculture Act, 2005. India is also a Member and host for Bay of Bengal Programme inter-governmental Organisation (BOBP-IGO) whose work for safety, responsible fisheries and small fisher marketing as well as simple post harvest technology have been commendable.

3.8.0 SWOT Analysis for the Fisheries Sector in India

3.8.1 It would be useful to conduct a SWOT analysis in order to appreciate the potential for employment, income generation and nutritional security for the people, while making Indian fisheries globally competitive.

3.8.2 Strengths

i. India has vast inland and marine water resources. We have 2.3 million hectares of fresh water tanks and ponds, 1.3 million hectares of oxbow lakes and derelict waters and reservoirs with water spread of 3.1 million hectares.

ii. Further, we have 1,91,024 km of rivers and canals system. Besides we have 1.2 million hectares of brackish water resources.

iii. India has an Exclusive Economic Zone (EEZ) of over 2.02 million sq. m with the continental shelf of about 0.51 million sq. km and a coastline of 8118 kms (3600 fishing villages) besides, our large coastline has substantial area under estuaries, lagoons and backwater, which harbour a variety of fin and shellfish resources.

iv. Further, India is blessed with a large variety of agro climatic zones extending from the very cold regions in the Himalayas to the temperate regions in the South for inland fisheries. Both saline water as well as fresh water resources are available.

v. India has also one of the richest and well-diversified fish fauna in the world.

vi. Since India is largely located in tropical and sub-tropical zones, the biological productivity of its aquatic resources is also very high. This could be utilized to have a broad based fisheries sector for the diverse conditions in the country.

vii. India has a well-established system of fisheries research and education through ICAR institutions focused on specific fisheries sub-sectors: Central Institute of Fresh Water Aquaculture, Bhubaneswar, Central Inland Fisheries Research Institute, Barrackpore and Central Institute of Brackish Water Aquaculture, Chennai, focus on inland fisheries. Central Marine Fisheries Research Institute, Kochi; Fisheries Survey of India, Mumbai, Central Institute of Coastal Engineering for Fisheries, Bangalore and Central Institute of Fisheries and Nautical Engineering and Training, Kochi, focus on other specific sub-sectors while Central Institute of Fisheries Education, Mumbai concentrates on Human Resource Development for Fisheries. In addition, there is a National Research Centre on Cold Water Fisheries, Bhimtal and National Bureau of Fish Genetic Resource, Lucknow. These are being supplemented by the large number of Agricultural Universities with Colleges of Fisheries. This research and training infrastructure must provide technological backup to fishers for more productive and sustainable fisheries through optimum utilization of available water resources. Marketing and export promotion is further assisted by Marine Products Export Development Authority (MPEDA) and National Cooperative Development Corporation (NCDC)

viii. Fisheries is a well-established activity in many parts of the country and the traditional knowledge and the expertise of the fishers has the potential to be utilized for bigger and more sustainable harvest through proper training and technological support.

ix. India has one of the best fish-processing infrastructures in the world, which is currently under utilized due to shortage of raw material.

3.8.3 Weaknesses

i. Through years of neglect, the water bodies particularly river systems in the country have faced massive pollution level arising out of increased and unrestrained industrial activity. This has recently affected the fisheries resources particularly in the rivers. Similarly, marine resources have suffered due to pollution arising out of unsustainable activities in the coastal regions and

inadequate attention to pollution due to off shore oil exploration and shipping. There has been inadequate awareness generation and insufficient technology dissemination.

ii. Due to unsustainable activities particularly in the Himalayas, there has been substantial soil denudation leading to heavy silting of the rivers system leading to shrinkage of water bodies.

iii. There has been inadequate attention to maintenance of water bodies like ponds, floodplain lakes (beels) etc., and even recently constructed reservoirs and ponds/tanks have reduced capacity for stocking of fish due to growth of water hyacinth etc.

iv. Quality control for fish seed as well as fish feed is virtually non-existent leading to malpractices and exploitation of the fishers. Further, there is reliance only on a few species. This has dangerous repercussions.

v. Post harvest losses in the marine sector are as high as 30 per cent due to constraints of fishing fleet bed on shore handling and poor marketing facilities.

vi. Open access regime due to population pressure both for inland and marine fisheries leads to reduced catches per unit effort and uncompetitive production.

vii. Multi-user conflicts and excess extraction of water for multifarious uses lead to depletion of fish stocks.

viii. Neglect of reservoirs at the pre-impoundment and impoundment stages leads to inefficient exploitation of this vast resource.

ix. Unsustainable and unscientific leasing policy leads to poor utilization of resources.

x. Database on resources as well as production/yield levels creates difficulties for policy formulation.

3.8.4 Opportunities

i. Fisheries are an excellent source for nutrition particularly for protein. White meat particularly fish is preferred by the health conscious people over red meat globally. There is thus an adequate market for higher quantities/varieties of fish both nationally and globally.

ii. Considering India's huge population, the size of the domestic market itself offers great incentive for higher production and technologies are available both nationally and internationally for optimum utilization of aquaculture, both fresh water and brackish water, for enhancing production sustainably. Approximately 60% of our population is fish eating.

iii. Many countries have over-fished their marine resources and now offer a large market for produce from India.

iv. Developed countries take up 85% of total imports of fishery products. Global trade is of the order of US $ 56 billion.

v. India has produced and is exporting Tiger shrimp (*P.monodon*), which enjoys a premium market abroad in view of its size and taste. In marine fisheries, India alongwith Maldives produces yellow fin tuna, which is a premium variety internationally.

vi. Indian rivers particularly in the Himalayas and Cauveri in the South have excellent game fisheries of Mahseer. Through appropriate stocking of Mahseer and Rainbow trout, sport fisheries provide an excellent means of promoting tourism.

vii. Entire Himalayan region, which is relatively unpolluted eco-system, is under exploited in terms of cold water fisheries.

3.8.5 Threats

i. India's neighbours, particularly China, have gone in for large-scale production of *P.vannamei* through domesticated brood stock. Compared to this, India's Tiger shrimp production is still dependent on wild brood stock. Requirement of protein for *P.vannamei* is also less, making it cheaper to produce. China and other South Eastern countries produce large quantities of *P.vannamei,* and offer stiff competition for Tiger shrimp in the market abroad.

ii. There is an absence of well-equipped fish health laboratories and competent extension centres, to advise aquaculture fishers about, fish health and treatment.

iii. The infrastructure, particularly for marketing, is poor and the facilities for maintenance of hygiene and good value realization in the fish markets are deficient.

iv. The infrastructure for marine capture fisheries is also inadequate going by the size of the fishing fleet. The harbours and fish landing centres suffer from inadequate facilities for hygienic landings, cold storage and cold chains availability and poor handling. All these constraints lead to poor value realization by the fisher and also may create problems for exports in view of sanitary requirements.

v. The technology for processing at fisher level is still not widely used. This leads to large-scale spoilage and the fishers are denied the benefit of value addition.

vi. People all over the country have not yet developed the taste for processed marine fish and, therefore, there is inadequate domestic market for processed marine fish.

All told, the strengths of the fisheries sector coupled with opportunities have a great scope of promoting livelihood and providing nutrition. India has the capability of taking care of the weaknesses and the threats to improve its position as the fourth largest fish producer, and second largest producer in Aquaculture globally. We have to proceed in the directions of greater productivity, better diversification, sustainable practices, hygienic handling at all stages comprehensive infrastructure and above all skill upgradation and human resource development.

3.1.0 Inland Fisheries

3.1.0 An overview

3.1.1 The vast and varied inland waters (viz. lakes, reservoirs, wetlands, rivers, streams, ponds and tanks) constitute an important fisheries resource of the country. In recent years, the fish production from these open and confined waters has increased considerably reaching to a current level of 3.4 million tonnes- accounting for 53.12% of the country's fish basket. Notwithstanding this marked achievement, the traditional fishers have gained little in stature and income out of the fisheries development and concerns on the economic condition of fishers persist. These concerns become more important in the context of rising environmental degradation, depressed prices world

over, emerging new economic order following WTO and signing of several multilateral agreements. Further, despite generation of considerable baseline information and technologies by the national institutions/universities, the country's cumulative fish production is hardly commensurate with the nation's water resources and decidedly far below the inland fish production of China which is about ten times more than India.

3.1.2 Inland water resources harbour the original germplasm of one of the richest and most diversified fish fauna of the world, comprising 930 fish species belonging to 326 genera. The resources provide full time vocation to 1.2 million inland fishers, and yield 3.4 million tonnes of annual fish production. India is the second largest producer of inland fish in the world and the sector plays a great role in nutritional security and employment potential. Besides being a source of income and livelihood to poor fishers, it also engages the rural population in ancillary jobs such as marketing, retailing, transportation etc. The sector achieved a growth rate of 12.7% during 2002-03. However, the sector still remains largely unorganised even today mainly due to the scattered and diffused nature of activities.

3.1.3 During the past two decades, a shift has been observed from marine fisheries to inland fisheries. Fish farming of carps and crustaceans is likely to witness manifold increase in the coming years in view of its profitability. This would be possible only through diversification of cultural practices and enlarging the cultivable *ecotypes* including new species as well as cultural practices like fish-cum-pig culture, fish-cum-poultry, and paddy cum fish culture etc. The new unexploited areas also include rainbow trout farming, ornamental fisheries, fresh water pearl farming, farming in inland saline waters, backyard fish culture, air breathing fish culture, flow thru fish culture, algae culture etc. There are a few other challenges viz. multiple use of water leading to scarcity of water in future affecting aquaculture activities, large scale diversion and abstraction of water in view of emergence of new river valley projects, risks from diseases making bio-security a critical issue, availability of quality seed and fish feed etc. In particular, care should be taken by the State authorities in the interest of the ecology to discourage brick kilns from coming up near village ponds/water bodies, which harbour fish biodiversity/natural fish breeding.

3.1.4 The above challenges highlight the need for accelerating productivity through genetic improvement of brood stock, sustainability of production, better health management, water control/management, code of conduct for responsible fisheries, feed management, processing and value addition, fishery credit, legislation and strengthening of marketing infrastructure and extension machinery.

3.1.5 Though fisheries has been recognized as a thrust area in the country's successive five-years plans, a clear-cut comprehensive fisheries policy is yet to be finalized.

3.1.6 In recognition of the increasing role of inland fisheries in overall fish production, the GOI is implementing several schemes including support to Fish Farmers Development Agencies (FFDAs)/ Brakishwater Fish Farmers Development Agencies (BFDAs) programme for fish seed development, cold water fish culture, strengthening of inland marketing etc. A network of 429 FFDAs and 39 BFDAs cover all potential districts of the country. The fresh water area brought under fish culture till date is 6.5 lakh hectares benefiting 11.3 lakh farmers. Over 7.6 lakh unemployed youths have been trained in improved fishing practices. Additionally, about 0.14 million ha area has been covered under shrimp culture. Under the national programme for fish seed production, over 1070 (300 shrimps) fish seed hatcheries have been commissioned producing 20,000 million fish fry in the country during 1999-2000. However, out of the country's resources only 16% of fresh water area and 10% of brackish water area is reportedly being utilized for fish culture. More comprehensive use of the untapped resource should be planned.

3.1.7 While the country has achieved record fish and seed production levels the variety and quality are still an area of concern. Over 80% of fish seed produced in the country belongs to three species of Indian major carp viz. Rohu, Catla and Mrigal or to some extent Silver Carp, Grass Carp or Common Carp, even though there are 46 species of fish and shell fish amenable to culture in the country. Barring a few trials undertaken by the ICAR institutes, standard large-scale seed production technologies of mahseer, hilsa, large catfishes, air breathing fishes, snow trout etc. are still elusive. The varied type of water resources and country's agro-climatic conditions necessitate the availability of seed of these hitherto neglected fish species and bring them into culture arena.

3.1.8 There is an overall need to actively involve Panchayati Raj Institutions, Cooperatives, private sector, NGOs and Self Help Groups (SHGs), in the extension and

promotion programme. Instruments like seed, feed, credit, extension, R&D and database are critical. Certification of seed as well as feed by Goverment recognized agencies warrant priority attention.

3.1.9 A separate National level Agency coordinating with Research Institutions and providing requisite support to aquaculturists / entrepreneurs/ corporate bodies is urgently needed and should be set up by restructuring the Central Institute of Fisheries Education, Mumbai.

3.1.10 Aquaculture is not treated at par with agriculture or industry. This is not only unjust but also a big impediment to the growth of fisheries. During mid 1990s, a decision to put fisheries at par with agriculture was taken in the Central Board of Fisheries meeting held under the Chairmanship of Union Agriculture Minister but later the decision was not implemented. It is high time that final decision to place aquaculture and artesenal fisheries at par with agriculture is taken. Fisheries rightly deserve parity with agriculture in view of several commonalities. In view of the dwindling catches in the rivers system and in the coastal fisheries due to various constraints, fisher folk can be weaned away into aquaculture sector very conveniently which would provide them sustainable employment and income and also relieve pressure on riverine and coastal fish resources. Since aquaculture offers immense scope for employment generation and export opportunities, it would be in the interest of the Government to encourage this activity by exempting small-scale aquaculturists and artisnal fishers from income tax by treating this activity as agriculture. Similarly they could lower the cost of production if they are offered credit at differential rate of interest, loan facility for tubewell, supply of water/canal water at concessional rates, supply of seed and feed at subsidized rates, supply of fertilizers at subsidized rates and subsidy on transport and acquisition of means of transport. Persons involved in agriculture enjoy these facilities and fishers who face similar risks and constraints should also get these benefits. It should be possible for the Department of Agriculture and Cooperation to work out the costs and benefits for extending these facilities to fishers by treating aquaculturist and artesenal fisheries activities as agriculture.

3.1.11 During the series of consultations held with the stakeholders/administrators and field workers, it emanated that many of the problems of fisheries, especially aquaculture,

could be solved and the sector can grow fast if an autonomous **National Fisheries Development Board (NFDB)** on the lines of National Dairy Development Board (NDDB) is set up in the country. The status of an autonomous body would provide much needed working freedom and momentum to the various programmes to benefit fisheries sector in general and fishers in particular. It should be a body with technical experts/professionals from different segments of the fisheries sector. The Board should do the hand holding for the fishers from the production to the marketing stage, particularly for small fishers and be the friend, philosopher and guide for them. Above all the Board must adopt a single window approach so that the multiplicity of agencies/regulatory bodies/Ministries could be avoided. This is particularly necessary in the interest of the State Governments implementing various programmes and the fishers who are often unable to benefit from such programmes due to plethora of rules/ agencies. It would also avoid duplication and ensure flow of funds more effectively. While the Board should have representation at a very senior level from the various ministries/stakeholders, it should be supervised by an Advisory Committee headed by the Union Agriculture Minister. Needless to add, it is critical to have representative of the fisheries sector drawn from the inland and marine sector, women fisher folk, feed and seed producers, traders, exporters, vessel owners, processors and banks. The Board could also serve as an umbrella organization for a host of training institutions, which exist today but suffer from lack of cohesion and composite direction. It is however stressed that the Board should never degenerate into a body delivering subsidies only but must cover all activities relating to planning and implementation in collaboration with the States/Research institutions and the stakeholders. The Commission would be very happy to assist in the formulation of the scope of the Board. Since the Board has to be provided a very large and effective mandate, it must be provided adequate funds to serve as margin money so that it could also draw institutional finance for its revenue generating activities.

It is felt that a sum of Rs. 3500 crores up to the end of Eleventh Five Year Plan should be provided to the Board with 50 % as grant and the remaining as interest free, long-term loan. Considering that the Government has decided to step up public investment in agriculture, funds of this magnitude should not be difficult to find, especially in view of

commendable growth rate in fisheries sector vis-à-vis agriculture and the great opportunity for income from export.

3.1.2.0 Capture Fisheries

3.1.2.1 The capture fisheries resources of the country comprise of rivers, canals, estuaries, flood plains, wetlands, lagoons and reservoirs. The riverine systems comprise 14 major and 44 medium rivers, innumerable tributaries and branches. With a combined length of 45,000 kms and 20,000 sq. kms of catchment area, the country's riverine resources provide one of the richest fish germplasm of the world. The flood plains are primarily continuum of rivers and exist in the form of oxbow lakes especially in the states of Bihar, West Bengal, Assam, Manipur and eastern Uttar Pradesh. Reservoirs constitute the single largest inland fishery resources both in terms of resource size and productive potential. As per FAO, the country has 19,370 medium and large reservoirs with water spread of 3.15 m ha.

Table 1 : Number and area covered under different sizes of reservoirs

	Small (<1000 ha)	**Medium (1000-5000 ha)**	**Large (>5000 ha)**	**Total**
Number	19134	180	56	19370
Area (ha.)	14,85,557	5,27,541	11,40,268	31,53,366

3.1.2.2 Seven major rivers contribute to the estuarine resource of the country. Besides, a large number of smaller rivers on both the coasts also end up in estuaries. The largest and richest estuarine system in the country encompassing the Sundarbans, a complex of several estuaries is Hooghly-Matlah followed by Mahanadi, Narmada**,** Tapti and other peninsular estuaries.

3.1.2.3 The major river systems of India on the basis of drainage are divided broadly into two: (i) Himalayan River System (Ganga, Indus and Brahmputra) and (ii) Peninsular river system (east coast and west coast river system). The flood plains of *Ganga* and *Brahmputra* have the distinction of nurturing some of the finest wetlands of the country. The country has an estimated 2.0 m ha of flood plains lakes where fish and fisheries remain a traditional economic activity with tremendous socio-economic impact in the rural sector. The cold water fisheries resources of the country are comprised of rivers,

streams, lakes, reservoirs with combined riverine length of 8,310 kms and 43,770 ha of lakes and reservoirs. Besides, there are vast sheets of inland saline water located in different states of the country and largely unexploited.

3.1.2.4 After independence and ushering in of an era of industrialization, pressure on the water intensified and need for power, irrigation, flood control and waste disposal led to progressive destruction and shrinking of river water, their siltation and pollution with chemical and domestic discharges.

Table 2: Profile of river systems of India

S. No.	River system	Names of main rivers	App. length (Km.)	States
A. Himalayan or Extra-Peninsular rivers				
.	1. Ganga	Ganga	2525	Uttar Pradesh, Bihar, West Bengal
		Ramganga	569	Uttar Pradesh
		Gomti	940	Uttar Pradesh, Bihar
		Ghaghra	1080	Uttar Pradesh Bihar
		Gandak	300	Bihar
		Kosi	492	Bihar
		Yamuna	1376	Panjab, Haryana, Delhi, Uttar Pradesh
		Chambal	1080	Madhya Pradesh, Uttar Pradesh, Rajasthan
		Tons	264	Uttar Pradesh
		Son	784	Uttar Pradesh
		Ken	360	Madhya Pradesh
	2. Brahmaputtra	Brahmaputtra, Dibang, Siang, Lohit, Manas, Buri, Dihang, Dhansri, Koppili	4000	Arunachal Pradesh, Assam, Nagaland, Sikkim, Manipur
	3. Indus	Jhelum	400	Jammu and Kashmir
		Chenab	330	Jammu and Kashmir, Himachal Pradesh
		Beas, Satluj, Ravi	400	Himachal Pradesh, Punjab, Himachal Pradesh, Punjab, Jammu and Kashmir, Punjab
B	**Peninsular rivers**			
	4. East Coast	Mahanadi	851	Orissa, Madhya Pradesh
		Godavari	1465	Maharashtra, Andhra Pradesh
		Krishna	1401	Maharashtra, Andhra Pradesh, Karnataka
		Cauvery	800	Karnataka, Tamil Nadu
		Bhima	861	Karnataka
	5. West Coast	Narmada	1322	Maharashtra, Gujarat, Madhya Pradesh
		Tapti	720	Gujarat, Madhya Pradesh
		Mahi	583	Gujarat

3.1.2.5 Despite the 'Clean the Ganga' programme the river Ganga is highly contaminated from Hardwar down to Diamond Harbour. The average fish yield has gone down from 27 kg/ha during 1958-61 to 3 kg/ha during 1999-2000. There is a significant change in the

catch spectrum coupled with reduction in size distribution of fish. The tributaries of the Ganga too are highly polluted and impacting its fisheries. Water abstraction owing to construction of dams has resulted in reduced flow affecting the migratory run of fishes. The increased pollution and silt load have further aggravated the problem of water quality and fish carrying capacities. Yamuna is perhaps much more polluted due to discharge of effluents. The fish catches have dwindled drastically and coarse, hardy, trash fishes have taken over the place once occupied by the commercially important Indian carps. Similarly the Brahmputra with 20 tributaries on its northern bank and 13 on its south, is carrying more silt than water during its flow resulting in the rise of its bed and loss of breeding grounds. Mahseer, snow trout and minor carps dominate the catches. As for Mahanadi, catfishes, carps and mahseer/prawn dominate three different regions of the river. In view of emergence of number of impoundments, the Godavari has been reduced to the status of a trickling stream. The barrages built across the river have restricted Hilsa runs while the transplanted Indian major carp failed to develop into commercial significance.

3.1.2.6 Cauveri is a biodiversity hot spot in having a unique fauna of exotic and Indian carps, catfishes and minor carp. Flowing along the foothills of Himalayas, the rivers Ravi, Satluj, Beas and Chenab harbour precious varieties of cold water fishes viz. trout, mahseer, snow trout and other hill stream fishes. These upland rivers and streams are basically the cradles of cold water fishes and serve as nurseries and rearing grounds for commercially important fish species. Changes in riverine ecology due to water abstraction, dam construction effluents and domestic discharges have adversely affected the breeding, feeding and rearing grounds of the fishes. Rapid industrialization has further added the woe of pollution and sediment concentration.

3.1.3.0 Fisheries management

3.1.3.1 In view of fast ecological degradation, the scientific management of riverine fisheries has not been made possible. The Central Inland Fisheries Research Institute, Barrackpore, has monitored the catches at a few selected centers on the Ganga, Yamuna, Brahmpaputra, Narmada and Godavari. With the construction of series of dams and resultant ecological changes in the riverine habitat, the catches are declining markedly

and posing a vocational threat to the traditional river fisher folk. This threat gets further compounded with the release of noxious industrial effluents and pesticides in these water bodies. The situation warrants immediate measures by taking active conservation programmes such as habitat restoration of select stretches of streams. Further, basin-wide approach with legal and institutional mechanism is imperative for reducing adverse interaction and conflicts between fisher and hydro power/industrial sector. Undertaking of Environment Impact Assessment Studies (EIA) for ascertaining project's adverse impact of projects on fisheries needs to be made mandatory, prior to signing of new hydropower project agreements. Compensatory capture/culture fishing activities should be provided for those who lose livelihoods. This would be on the principle of compensatory afforestation. In areas where industrial pollution threatens local fisheries, the cost for controlling of chemicals or sediments for mitigating fish losses requires compensation. The States' Fisheries Acts need suitable revision with a provision under which polluters must pay the damage cost.

3.1.4.0 Reservoirs

3.1.4.1 Besides being keystones of development, reservoirs formed due to damming of rivers are a veritable source of fish production. They have requisite ingredients for fishers, anglers, bird watchers, tourists and naturilists etc. Presently, the area under reservoirs is 3.15 m ha. It is expected to reach 4.0 m ha by the end of the next decade. At present level of utilization, they yield on an average 20 kg/ha, which hardly matches with their potential.

Box-2

Reservoir Fisheries (Gobindsagar, Himachal Pradesh) – a successful story

Gobindsagar reservoir is located in Bilaspur district of Himachal Pradesh. The reservoir is formed on the river Sutlej and covers an area of about 10 000 ha at effective storage level. The water spread at full storage level encompasses 16 000 ha. Gobindagar is one of the best-managed reservoirs in the country from the fisheries point of view. The average fish production from the reservoir during the last five years was about 1 000 tonnes per annum or 100 kg/ ha/ yr. The maximum yield obtained from Gobindsagar has been to the tune of 122kg/ ha/ yr, which is the highest in the country for a large reservoir.

The reservoir has a predominant fauna of the exotic Silver carp (about 60 –65 % of the total catch) followed by Indian major carps (20 – 25 %), Mahseer species (8-10 %) and Minor carps (8 – 10 %). The Indian major carps are dominated by *Catla catla*. The **Department of Fisheries**, Government of Himachal Pradesh implements several welfare and production oriented schemes for the benefit of the reservoir fishermen. These Centrally Sponsored Schemes include, Saving-cum-Relief Scheme, Group Insurance Scheme for Active Fishermen and the Housing Scheme. The Schemes implemented under the State Plan include Risk Fund Scheme and a Calamity Relief Scheme.

Besides closed season, which is implemented in the reservoir for 2 months (1st June through 31st July) every year, areas suitable for natural breeding in the reservoir are also protected to allow the fishes to breed and thereby help in auto stocking of the reservoir. To maintain species balance, supplementary stocking is done from time to time.

About 3000 registered fishermen inhabit the periphery of the reservoir of which about 1900 are active. These fishermen are grouped into 16 co-operative societies, which are then grouped into an apex body called the Bilaspur Fisheries Marketing and Supply Federation. The Federation assists the fishermen in sale and marketing of fish (including retail marketing, if necessary) and its assets include a cold storage, an ice plant and refrigerated vans. The Gobindsagar fish is marketed in major towns/ cities in Punjab, Jammu and Kashmir and Delhi and also the bordering areas in Uttar Pradesh and Haryana.

Gobindsagar is an excellent example of a well-managed large reservoir and the practices adopted need to be replicated in other large and medium reservoirs of the country.

Management of a reservoir is in fact governance of a water body, which includes a variety of issues ranging from property rights, involvement of stakeholders, strict regulation, good research and appropriate choice of policy. A three-pronged strategy comprising selection of appropriate mesh size, increased stocking support and fishing efforts can however substantially catapult the fish catches of reservoirs. In case of small reservoirs, stocking alone could be more effective in improving the yield as success in the management of small reservoirs depends solely on recapturing the stocked fish. The main management principles suggested in the management of small reservoirs are: i) determination of ideal stocking density derived on the basis of hydro-biological

parameters; ii) selection of right species derived on the basis of fish food resources and iii) proper stocking and harvesting schedule.

3.1.4.2 The fisheries potential of large reservoirs is largely under utilized as evidenced by low production, low income and poor inventory building exercises. The management policy in large reservoir needs to have twin objectives of development and conservation. Further, the poor marketing infrastructure has also depleted the incentive and returns of the fishermen. There is a need to evolve a package approach comprising stocking, monitoring, equitable and just royalty arrangements, market intervention through cooperatives/corporations and quick transport/distribution channels etc. Fisheries Department must be consulted by the Irrigation Departments of States while managing the water resources, since single-minded attention to irrigation can work to the serious detriment of the fisheries resources. Water allocation policies should be in tune with the biological threshold levels for fisheries so that both the water resources and fish resources could be optimally utilized. In fact even while the Irrigation Department could continue to manage the headworks and the canals, the management of the water resource for fisheries in terms of stocking, exploitation, conservation, fishing rights etc., must be under the exclusive control of State Fisheries Department, if the production and productivity of fisheries in reservoirs is to be raised.

3.1.4.3 Indian reservoirs are distributed under divergent geoclimatic and environmental conditions and classified as small (< 1000 ha), medium (1000-5000 ha) and large (> 5000 ha). Fish catches from these reservoirs is exceedingly low - an average 12 kg/ha in case of large and medium and 50 kg/ha from small reservoirs; Notwithstanding the low levels of yields, there are a few reservoirs in the country where good management practices have resulted in increased catches, comparable to the world's best reservoirs. Gobindsagar (H.P.) is one such example where management/scientific intervention has yielded positive results and an annual production level of 120 kg/ha has been achieved. Poor management and inadequate stocking are the main reasons for low fish production. It is recommended that:

a) All small reservoirs comprising 98 % of the total reservoirs of the country be developed as pure culture fisheries units;

b) Medium and small reservoirs be developed by proper conservation, added stocking efforts and involvement of fishermen.

3.1.4.4 Some other measures for raising fish production from manmade impoundments are strict enforcement of management rules, observance of close season, provide training and fishing tools to fishers and last but not least, observing ethics of responsible fisheries. The recommended stocking rates for different types of reservoirs are:

Table 3: Stocking rate and expected fish production of different sizes of reservoirs base

Reservoir base	Stocking rate	Expected fish production
1000-2000 ha	1000 (100-125 m)	500 kg/ha
2001-5000 ha	750 (100-125 m)	125 kg/ha
5001-10,000 ha	500 (125-150 m)	810 kg/ha
Over 10,000 ha	300 (125-150m)	50 kg/ha

3.1.4.5 The cumulative fish seed requirement for the development of fisheries in exploited reservoirs would be around 350 million fingerlings and the country's hatcheries are very well in position to meet this demand. The stocking of the reservoirs will have to be continued regularly for a period ranging from 5-10 years. The present system of auctioning and leasing is highly detrimental on long term basis and needs to be replaced by cooperative, SHG system; management of reservoirs by fishermen cooperatives needs to be promoted in order to increase the efficiency and production levels; since fishermen have been proved the best managers, involvement of fishermen residing around the reservoirs is highly important. Observance of close season, mesh size regulation are highly important in conserving the stock. Besides training, Fishermen' Welfare Schemes such as providing subsidized fishing nets/boats/tents, close-season assistance, premium free insurance, calamity assistance and establishment of fisheries villages need strengthening in terms of level of benefits. In fact, atleast Rs. 1500 per month for the non-fishing months should be available instead of the present level of Rs. 300 per month, in view of the increased costs of living. An additional allocation of Rs. 50 crores per annum adding to Rs. 350 crores upto the end of the 11th Plan should be provided for this purpose from the Government of India.

3.1.4.6 With the launching of ICAR funded All India Co-ordinated Research Projects on five large reservoirs located in different agro climatic regions of the country, considerable baseline information on the limnology and fishery of major reservoirs has been generated and management norms evolved. Under these norms, following select management measures on large, medium and small reservoirs could yield production levels of 100, 75 and 50 kg/ha respectively. Taking these production levels into consideration the country's reservoir fish production could be raised from 94,000 tonnes to 2,45,000 tonnes, constituting an increase of 160%.

Table 4: Current yield vis-à-vis potential from different categories of reservoirs

(In tonnes)

Category	Total area ha.	Present		Potential	
		Av. Production	Total production	Av. Production	Total production
Small	14,85,557	49.90	74,129	100.00	1,48556
Medium	5,27,541	12.30	6,486	75.00	39,565
Large	11,40,268	11.43	13,033	50.00	57,013
Total	31,53,386	29.70	93,650	77.00	2,45,134

3.1.5.0 Development of fisheries in flood plains/ wetlands

3.1.5.1 Freshwater wetlands are extensively spread particularly in Assam, U.P., Bihar and West Bengal and estimated to cover 20 million ha of water in the country. The wetlands are ecosystems where water and land meet. In view of their nutrient status, largely due to predominance of aquatic plants (including weeds), fish production from these water bodies ranges from 100-150 kg/ha, though in view of their organically rich characteristics they have the potential of yielding 1000 kg/ha. The general strategy for development of these wetlands should be to clear them from weed infestation and undertake stocking of fingerlings of grass carp, common carp, *L. rohita and C. carpio. and C. batrachus* in the ratio of 10:10:20:30:30. National Rural Employment Guarantee Programme or Food for Work Programme should be used for clearance of weed infestation and the weed could also function as green manure.

3.1.6.0 Estuaries / Coastal waters

3.1.6.1 Estuaries or coastal waters of the country having potential for brackish water fish farming are of the order of 1.23 m ha. These are the most productive estuaries system in the world with average yield varying from 45-75 kg/ha. Out of the total area, 80% is under traditional farming system and the remaining is under extensive or semi-extensive shrimp farming. The activities of shrimp farming on commercial scale have been taken up in the States of Andhra Pradesh and Tamil Nadu while traditional farming is practised in West Bengal and Kerala.

3.1.6.2 The flood plains of Ganga and Brahmputra rivers have the distinction of nurturing some of the finest wetlands of the country which perform a variety of social functions. These natural ecosystems have intimate relationship with mankind since their inception both directly (fishery, irrigation, industry, recreation) as well as indirectly (recharging of ground water, climate regulation, soil protection, aesthetic valuesetc.). An estimated 2.0 m.ha of flood plain lakes is available in the country where fish and fisheries remains a traditional economic activity with tremendous socio-economic impact on the rural sector.

3.1.7.0 Cold Water Fisheries

3.1.7.1 The cold water fisheries resources comprise high and mid altitude lakes, rivers, streams, tributaries and reservoirs fed by such rivers. These resources are poorly developed primarily due to lack of scientific and development efforts. The waters maintain fairly low temperature, which obviously support scanty primary and secondary productivity leading to slow growth of fishes. However, while cold water fisheries constitute a small part of the total fish economy, its importance in the larger context of the environmental quality of the river system should not be underestimated.

3.1.7.2 The common cultivable species in the hill States are Mahseer (*T. spp., A hexagonolepis*), Snow trout (*Schizothorax spp*.), Mirror carp (*C. specularis*) and the introduced trouts (Brown and Rainbow trout). In view of its prolific breeding propensity, hardy nature, quick growth and consumer's preference, mirror carp is the most common fish in stagnant waters. However, due to repeated inbreeding, the species has of late been showing syndromes of genetic fatigue reflected in the form of poor health and slow growth as well as low survival rates.Among the indigenous species, snow trout

(*Schizothorax*) is the most important in rivers and streams but its stock is declining. Mahseer is a highly important fish of the cold water both as a commercial and sport fish. Though successful attempts have been made for the breeding and seed raising of mahseer, large scale seed availability of seed of golden mahseer (*T. putitora*) is still a constraint.

3.1.7.3 The most important aspect of cold water fisheries is that they provide excellent sport. Trout and mahseer are world known game fishes providing ecstatic pleasures to anglers. Kashmir, Himachal Pradesh, Uttaranchal, North Bengal, Nilgiri, Kodai hills and Munnar High range offer excellent game fishery to anglers. The approximate resources of cold water States in India is given in the table:

Table 5: Area-wise list of different kinds of natural water bodies in the Indian uplands

#	Particulars of water body	Stream length/Area
I	Himalayan and Deccan Plateau river systems	8310 km
II	1. Brackish water lakes (above 3000 msl)	2390 ha
	2. Fresh water natural lakes (1500-2000 msl)	18150 ha
	3. Kashmir high mountain lakes (above 3000 msl)	400 ha
	4. Valley wetland ecosystems	3000 ha
	5. Shivalik Himalayan lakes	74 ha
III	Central Himalaya 1. Fresh water lakes of Kumaon	 355 ha
IV	Himalayan manmade lakes and reservoirs	43770 ha
V.	Peninsular zone 1. Natural lakes 2. Manmade lakes and reservoirs	 85 ha 4400 ha

3.1.7.4 Successful rainbow trout farming has been achieved in J & K and H.P. Private farming units in the form of battery of raceways have also been set up in HP and the trout production from these two States alone has gone up to 150t/yr annually. It is important to consolidate success both in strength and scale. The issues being confronted in further

boosting the production are marketing, largescale availability of trout feed, crop insurance etc. and require early solution. The Country's cold water States have the potential of producing a minimum of 2000 tonnes of trout within a short spell of time. Stock of brown trout (*Salmo trutta fario)* – anglers' favourite, is fast declining both from the farms and streams of cold water States underlying an imperative need to build up the stock of this world famous sport fish either by importing the new strains or intensification of efforts in our farms.

3.1.7.5 The cold water rivers/streams are under growing pressure. In addition to the degradation of water quality, a more serious problem is the disruption of flow pattern with impact on the quality of waters. Besides obstruction of migratory path of major cold water fishes like trout and mahseer, dam construction or channelisation or diversion of water are instrumental in vitiating the natural biological production cycle.

3.1.8.0 Future Challenges

3.1.8.1 The future challenge for open-water fishery is very demanding. Not only have we to make efforts to sustain the existing contribution to inland production basket but also find ways and means to raise this productivity. This has to be achieved in spite of deterioration of open-waters in quality and likely reduction in quantity as well as ever increasing demand for other sectors. Water is critical for fish; it has non-consumptive use in fishery sector. It also acts as substrate for its growth and sustenance. Therefore, any water management issue affects fishery directly. The emerging freshwater scarcity needs to be recognized as an issue of utmost importance. There is a growing awareness that increased water use by humans not only reduces the amount of water available for future industrial and agricultural development but also has a profound effect on aquatic ecosystems and their dependent aquatic life including fishes. Balancing the needs of the aquatic environment and other uses is becoming critical in many of the river systems in the country as population and associated water demands increase. In this context, what is often lacking is the understanding that planning environmental water allocation means striking the right balance between allocations of water for direct human use and indirect human use.

3.1.8.2 A recent assessment of the status of freshwater ecosystems showed that their capacity to provide the full range of such goods and services appears to be drastically degraded. Many freshwater species are facing rapid population decline or are threatened, and yields from many open-water fishery resources have dwindled as a result of interrupted water flow, habitat degradation and pollution. In order to sustain the ability of freshwater dependent ecosystems to support food production and biodiversity, environmental flows especially of rivers and streams must be established scientifically, made legitimate and maintained.

3.1.9.0 Culture fisheries

3.1.9.1 Aquaculture accounts for 70% of the total inland fish production of the country. Besides the exploitation of traditional resource of ponds/tanks, the available technologies have made it possible to utilize small reservoirs and canals too for aquaculture. As per rough estimate only 65% of the pond culture resources had been brought under fish culture mainly through FFDA with average yield of 2,200 kg/ha by 2001-02. There is thus considerable scope for enlarging the coverage and bringing the remaining ponds/tanks/small reservoirs under fish farming.

3.1.9.2 Aquaculture has shown continuous expansion since 1980 and has maintained its position as one of the fastest growing food production activities in the country. The average growth rate of 12.4 % during 1990-96 verily shows the potential of the sector. Aquaculture has been recognized as a major economic activity among the agrarian population and is gaining popularity especially among the rural unemployed youths.

3.1.9.3 The freshwater culture resources in the country comprise 2.25 million ha of ponds and tanks; 1.3 million ha of beels and wetlands; 2.09 million ha of lakes and reservoirs, 0.12 million km of irrigation canals and channels and even paddy fields.

Table 6: Fresh water aquaculture at a Glance:

1. Water area available under pond/tanks	23,58,634 ha
2. Present Annual fish production	22,42,170 t
3. Fish production aquaculture	15,12,000 t
4. Area still to be brought under fish culture	11,99,500 ha
5. Projected cumulative fish production	33,12,800 t
6. Mean projected unit area production	2.672 kg/ha/yr.
7. Requirement of fry	15362 m
8. Requirement of feed	52,04,500 t

3.1.9.4 India is basically a carp country with 84% of our fresh water production being contributed by carps alone. Research investigations undertaken in the country's fisheries institutions resulted in the development of over two dozen high yielding technologies including composite fish culture involving combination of indigenous (*C. catla, L. rohita and C. mirgala*) and exotic carps (*H. molitrix, C. idella and C. carpio*). By extension of this technology through FFDA, it would be possible to boost the aquaculture programme. Later a few other eco-friendly technologies based on utilization of farm's wastes and other byproducts that do away with the cost on feed and fertilization, can be passed on as alternate choices to farmers.

3.1.9.5 The possibilities of integration of fisheries with agriculture and livestock viz. paddy, pigs, poultry and ducks, have opened new possibilities for enhanced income and more ecologically suitable practices. Cattle dung when used as a fertilizer ensures fish production rate of 3-6 t/ha. Use of biogas slurry and aquatic weeds has also been tried successfully. The excreta of pigs, poultry and ducks form valuable feed, especially for organic fish farming. The fish in turn feed the ducks. Similarly, large areas growing paddy can support fisheries, which in turn add to the paddy yield. Extension machinery in agriculture should more actively encourage the adoption of these practices for which the technologies are available in the country. China in particular has benefited substantially from these practices.

Box - 3

Success of Carp Farming in Andhra Pradesh, Haryana and Punjab

Andhra Pradesh, Haryana and Punjab have emerged as the most progressive States with respect to the development of freshwater fish farming in the country. While Andhra Pradesh was to some extent a traditional fish farming State, Haryana and Punjab are non-traditional States and fish farming started only during the early seventies. Today, fresh water fish from Andhra Pradesh is marketed in about a dozen other States (all the States in the NE region, West Bengal, Orissa, Bihar and eastern Uttar Pradesh) and also in the neighbouring countries - Bhutan and Nepal. Similarly, fish produced in Punjab and Haryana is marketed in the neighbouring States after meeting their own requirements.

In Andhra Pradesh, the Kolleru Lake area is the hub of freshwater fish farming. Besides, Indian major carps (IMC) such as catla and rohu, farmers also raise catfishes like African *magur* (*Clarias gariepinnus*) and *Pangasius sutchi*. The average productivity from the farms in Kolleru Lake area is around 5-6 tonnes per ha and scientific methods of farming are deployed to maximise the returns from the ponds. The seed and feed inputs are well organised in the area, which is a big support to the fish farmers. Similarly, the marketing infrastructure is also well knit that takes care of the fish transportation by refrigerated vans to far-flung areas of the country. Per hectare production in Haryana and Punjab is close to 4000 kg and besides Indian major carps, the farmers are also raising freshwater prawn. In these two States, the markets are close to the production centres and, therefore, the per kilogram realisation to the fish farmer is much higher as compared to what the farmers get in Andhra Pradesh.

Freshwater carp farming in the above-referred States exemplifies the innovations and ingenuities of the small-scale fish farmer in optimising per hectare yield from the fishponds and are worth replication in the other carp farming areas of the country.

3.1.9.6 Air breathing catfish culture (*C. batrachus and H. fossilis*) known for their medicinal properties are in great demand. Though hatchery technologies for their seed production have been developed, large-scale seed availability is still a far cry. Presently, the seed is collected from the wild for stocking the ponds. The culture of these fishes is highly suitable in shallow, seasonal and weed-choked ponds along with trapa (*Trapa. bisponsa*) and makhana (*Eurale. ferox*) as practised in north Bihar and eastern Madhya Pradesh.

3.1.10.0 Trout farming: Advancement and scope

3.1.10.1 The farming of rainbow trout (*Oncorhynchus mykiss)* on a commercial scale has been made possible in the hill States of the country. All impediments pertaining to breeding, farm husbandry, production of high conversion feed have been circumvented and the sole irritant, viz. disease infestation in the farms, has also been taken care of to a large extent by establishment of a national pathological laboratory at Indo-Norwegian Trout farm Patlikuhl. This laboratory is in a position to cater to the need not only of

Himachal Pradesh trout growers but also the farmers of J&K and Uttaranchal as well as other parts of the country. A team of departmental workers has been trained from National Veterinary Institute, Oslo, Norway and these personnel have attained sufficient expertise in tackling trout pathological aspects. Regular surveillance and monitoring is being maintained of the trout stock of all the trout growers of the State. Marketing, being a very important issue, a national level marketing study has been conducted through Tata Consultancy Services (TCS), which incorporates assessments regarding domestic and export potential of the trout. Production levels are being upgraded and a vision plan has been prepared by the State of Himachal Pradesh envisaging a trout production level of 500 tonnes within three to five years. Similar production multiplication programmes have been made by the States of J&K and Uttaranchal. The programme is receiving a big boost with the release of financial packages to hill States (viz. J&K, HP, Uttaranchal and Sikkim) by Government of India for construction of hatcheries, establishing feed mill, liberal subsidy to trout growers, inventory survey of fisheries resources, habitat restoration etc.

3.1.10.2 All the country's hill States now have modern trout hatcheries, battery of raceways, feed mill plants and other farm infrastructure. The development in trout fisheries has generated tremendous enthusiasm among the local hill inhabitants in taking up trout farming as full time vocation. A number of trout farming units have already been set up in the state of Himachal Pradesh, Uttaranchal and Sikkim and are adding to the income and prosperity of growers.

Box - 4

Successful Trout Farming in private sector in the state of Himachal Pradesh/J&K

The successful implementation of two foreign aided projects (supported by EEC and NORAD) in the field of rainbow trout farming in the States of Jammu and Kashmir and Himachal Pradesh have brought new hopes and prospects in the development of cold water fisheries resources of the country. The farming of rainbow trout (*Oncorhynchus*) *mykiss* on commercial scale has been made possible in the hill States of the country. The farming system demonstrated in the State run farms have generated tremendous enthusiasm among the local unemployed youth to take up farming of trout fish as a means of livelihood. With the support, motivation and knowhow by the extension wings of State Government better farming units have come up even in the remote hill pockets of the States of Himachal Pradesh, Uttaranchal and Sikkim.

The main reasons attributed to the upfront acceptance of the technology success by the growers are :

i) Import of quick growing European/Swedish strains of rainbow trout.

ii) Modernisation of trout hatcheries vis-à-vis easy and adequate availability of trout lings to private trout growers.

iii) Evolvement of compounded palletized feed for all the stages of trout with high FCR, appetence value and stability factor.

iv) The bulk quantities of farm- reared trout seed and its transplantation in rivers and streams has contributed significantly in the revival of sport fisheries in the states.

Country's trout farming programmes need strengthening both in strength and scale. Against the current production of 150 tonnes farm-reared rainbow trout annually the production could be raised ten fold within a short period. The success achieved in the states of Himachal Pradesh and J&K in trout farming is worth emulating by other states for generating employment and raising proteinous food for hill inhabitants.

3.1.10.3 The current production level of trout of 150 tonnes annually can easily be raised manifold among the hill youths. Entrepreneurs are also evincing keen interest in establishing large farms and entering the export market. The only action required is simplification of rules in the acquisition of land for these investors.

3.1.10.4 The high altitude snow bound lakes located all around the mid-Himalayas could be developed as Angler's paradise. The only requirement is the ranching of fry/fingerlings of game fishes viz. lake trout (*Salvelinus namycush*) and Arctic char (*Salmo Salar*) - all excellent game fishes and stocked world over in high altitude waters.

3.1.11.0 Species diversification

3.1.11.1 As per FAO, India utilizes only three bio-categories and 15 species in contrast to 29 by China, highlighting the need to diversify aquaculture and ensure

sustainability and increase in farm production. The thrust as in diversified production must cover both technological and non-technological aspects such as consumer preference, the economics of production and marketability of the selected species. It is time that the available technologies for nationally and internationally breeding and culture of murrels, minor carps and large catfishes, are utilized by scientific institutions/State departments and industry more comprehensively. Though hatchery seed of mullets, mahseer, snow trout, catfishes air breathing fishes are not available in required quantities, yet considering their high price, these would be welcome addition to the fresh water aquaculture system.

3.1.11.2 Yet another critical infrastructure gap relates to setting up of model large scale hatcheries particularly for targeting the hitherto under-utilised species like trout, mahseer, Sea-bass and Sea-bream, etc. These hatcheries would have to be in the public sector for supplying brooders to recognized private sector hatcheries and to provide seed directly to fishers. It is proposed to set up 10 such hatcheries in different States at a cost of Rs. 1.5 crores per hatchery.

Table 7: Species wise aquaculture production in India in the year 2000.

Species	**Production (mt (%))**
Freshwater*	
Cyprinus carpio	86400 (4.12)
Labeo rohita	567433 (27.1)
Cirrhinus mrigala	516900 (24.7)
Catla catla	546200 ()26.1
Ctenopharyngodon idellus	151100 (7.2)
Hypophthalmichthys molitrix	16489 (0.79)
Clarias spp.	10235 (0.49)
Anabas testudineus	65000 (3.1)
Channa spp.	21920 (1.05)
Others	59371 (2.83)
Marine:	
Penaeus monodon	52471 (2.50)
Penaeus indicus	300 (0.01)
Crassostrea madrasensis	14 (0.001)
Pema viridis	609 (0.03)
Paphia gallus	630 (0.03)
Total	**20,96,072**

3.1.12.0 Introduction of new species

3.1.12.1 There has been a continuous debate on the subject of the introduction of new species in the country. With the setting up of National Committee on Introduction of Exotic species in the country by Govt. of India, a very restrictive view or a blanket ban may not be in the long run interest of the country and introduction proposals must be considered on merit and with a forward looking view. The role played by some of the exotic fishes viz. trouts, silver carp, grass carp, mirror carp in raising country's overall fish production cannot be overlooked. Many countries in our neighbourhood have benefited from the exploitation of exotic species. The scientific development and

emerging technologies, monosex populations etc., would be able to offset the adverse impacts, if any, of these introductions. It may not be desirable to legalise entry or allow introduction of such species like African carp (*Clarias garriepinus),* which could play havoc with the country's aquaculture programme in view of its voracious carnivore feeding regime. However, some other species deserve introduction for enrichment of stock and tapping of opportunities which have hitherto remained unexploited.

3.1.12.2 The high attitude lakes dotted all along the foothills of Himalayas, though important potentially for development of sport and food fisheries, are currently lying severely under-utilized. Both rainbow and brown trout have failed to establish themselves in view of extremely low high altitude water temperature during a major part of the year. Suitable species for such arctic, lentic, glacier-laden waters are Arctic Char (*Salmo salar*) and lake trout (*S. fontinalis*). It is recommended that eyed-ova of these species may be imported as establishment of these species in these upland waters would not only provide protein and livelihood to hill inhabitants which have little income opportunities but also promote sport fisheries in these far flung pockets.

3.1.12.3 Another exotic fresh water species on the horizon is *Tilapia niloticus*. Highly popular as a food fish in neighbouring countries, this *easy to breed -quick to grow* fish has high consumer's performance in international markets although it has its defects too. Some stakeholders felt that it could be useful for India since it could reduce our over-dependence on *P.monodon* for export and also allow participation of fresh water fisheries in the export arena. However, since there is some controversy about its suitability for Indian conditions, its performance in water bodies where it has already been grown, through the backdoor should be studied in a time bound manner by a small group of experts and industry. The Departmetn of Animal Husbandry, Dairying and Fisheries (DAHDF) should set up this group.

3.1.13.0 Culture of Air breathing fishes

3.1.13.1 In view of consumer's preference and medicinal values, the air breathing fishes viz. *Clarias batrachus, Anabas testudineus, Heterophenstes fossilis* command high price in fish markets. These fishes have an advantage of growing in shallow, seasonal, muddy, weed-choked ponds, scattered in the villages of UP, MP, West Bengal, Assam,

Orissa and northeastern states. These fishes are also easy to transport, requiring less water and are quite hardy for long transportation route. Presently, the seed of these fishes is collected from the wild as large-scale seed availability of both *Magur* and Koi is not there.

3.1.13.2 In Thailand, *Clarias maculates* is being bred by specialized breeding techniques and rearing is done on a large scale. Production rate as high as 30-60 tonnes/hectare have been reported. The Thai *Magur* also grows 3-4 times more than Indian *Magur* and attains size of 600-800 grams in one year. Considering the potential of promoting air-breathing fish culture programme in the country, research institutions should go in for large-scale brooder seed production of both *Magur* and *Singhi*. Some stakeholders have also felt that Thai *Magur* (*C. maculatus*) should also be introduced on a large scale. However, there is some controversy about its suitability for Indian conditions and its performance too should be studied by a group consisting of experts and industry to be set up by DAHDF.

3.1.13.3 Similarly, large catfishes, especially *Mystus seenghala* and *Wallago attu*, are in great demand among the consumers in north Indian states. While no technology on breeding and raising large-scale production of these catfishes is available in the country, great strides have been made in America and other European countries on intensive monoculture of Channel catfish (*Ictalurus punctatus*). The import of technology of Channel catfish farming under a bilateral project, would perhaps be a step of great economic importance and also meet country's consumers' demand of highly sought after catfishes.

3.1.14.0 Ornamental fish culture

3.1.14.1 World trade in ornamental fishes has touched a record figure of over US$1 billion and is growing @ 10% per year. Despite vast potential, India's share in export of ornamental fishes is negligible. A large number of ornamental fishes that abound in the country's freshwaters viz. *Danio rasbora, Trichogaster spp, Gara spp, Botia spp, Carasius a*uratus etc. are known world over. Ornamental fish culture has grown as a cottage industry in several Asian countries with substantial employment potential. Besides being a foreign exchange earner, it has a great domestic market. There is a need

to expand the activities both in mini farms and mega units. Several private farms have sprung up in eastern and southern parts of the country. The ornamental fisheries if developed on commercial scale have the potential of creating large-scale employment for the fisherfolk rendered jobless consequent to depletion of fish catches in the rivers and streams in the country.

Box - 5

Ornamental Fish Culture and Trade (Chennai, Tamil Nadu) - a Success Story

Kolathur village on the outskirts of Chennai is famous for ornamental fish cultivation by small-scale producers. There are about 600 families earning their livelihood through ornamental fish cultivation in Kolathur and on an average each household in the village earns over Rs 5000 per month through ornamental fish farming. About 45 kms from Kolathur, Gummidipoondi village is another hub of ornamental fish production where women SHGs have successfully taken up breeding and raising of ornamental fish to earn their livelihood.

On the commercial front, the ornamental fish trade is a growing business with Chennai and Kolkata turning out to be the major production and export centres. The domestic trade is a mix of medium and small ornamental fish farmers. In Chennai, many farmers grow fish in their backyards and sell the stock to bigger companies, which are engaged in the export business. The State Government undertaking Tamil Nadu Fisheries Development Corporation (TNFDC) joined the field in 2000. It rears popular varieties like goldfish, angelfish, mollies and fighters in its farm near Coimbatore. The ornamentals are sold in the local markets.

The global trade in the ornamental fish is estimated at Rs 5000 crores, of which India has a minuscule Rs 2.0 crore. This is despite the country's tropical climate, varied freshwater sources, and 8 000 plus-km coastline. However, the growing demand for ornamental fisheries and the growing interest in aquarium may change all this very soon.

Singapore and other South East Asian countries account for 80 per cent of the global trade. The main markets are the US, the UK, Belgium, Italy, Japan, China, Australia and South Africa. According to industry estimates, India's domestic annual turnover is about Rs 15 crores, but the global market is much bigger. With its tropical climate, India can become a key player. Many Indian species like catfish, dwarf and giant gouramis, and barbs are popular abroad and fetch good prices.

To popularise ornamental fish production and trade, Kolathur is an excellent example to emulate. It provides a good mix of both domestic as well as commercial-scale production, which largely cater to the export market.

3.1.14.2 There is a need to recognize ornamental fisheries as a potential sector under fish farming; impart scientific orientation to the activity by involving geneticists and pathologists in the programme; activating the role of Govt. of India/ICAR / MPEDA in the promotion of ornamental fish culture in the country and training of riverine

fishermen in the culture and breeding of ornamental fishes/ construction of Aquarium and other configuration are some other issues for consideration and implementation.

3.1.15.0 Backyard aquaculture

3.1.15.1 With an aim to promote small-scale fish farming in urban areas, the concept of backyard fish culture or kitchen ponds is getting increasingly popular, especially in South East Asian countries. Common carp and air breathing fishes are most suitable under the backyard fisheries. Being omnivore with wide range of feeding regime, any type of trash food/kitchen refuse could be served to these fishes and converted into fish flesh. India also has several other species, which fits the concept of backyard fish culture viz. magur (*Clarias)*, grass carp, *Seenghi Heteroprenstes* etc. All these fishes except grass carp have an additional trait of thriving in shallow, muddy waters. A small pond of 50-100 sq meters can easily meet a family's demand of fish without involving any recurring cost except the one time purchase of fish seed. Depending upon the inclination and interest of the pond owner, these backyard units could also be used for breeding and raising ornamental fishes and contribute to the family's income. The concept of backyard fish farming is well accepted in the country and is already prevalent in limited scale in the States of West Bengal and Assam. The present need is to expand it into other states of the country through extension and mass awareness programmes. Both scientific institutions and development departments should come out with pre-packed information and ideal size of backyard ponds, species stocking and growth details etc.

3.1.16.0 Sewage fed fisheries

3.1.16.1 Biological amelioration of sewage is a viable option to overcome the problem of large-scale generation and accumulation of organically rich sediment/material. In recent years, sewage fish culture after proper treatment is increasingly being used for production of fish. The fish production levels in the system are quite high while cost of fish culture is greatly reduced in the absence of component of feed and its expenditure. A number of sewage fed fish farming units have been set up in the country especially in West Bengal. Sewage fish culture is also ecologically beneficial and can convert such disadvantaged areas into Bio Parks for leisure activities as in

Mudialy (W.B.) States must launch programmes to encourage municipalities and other local bodies to set up aquaculture based sewage treatment units, which would produce fish and treat the sewage in an ecologically friendly manner. It is estimated that one acre of such a treatment pond would be needed for treatment of one million litres per day of sewage

3.1.16.2 Gambusia (*Gambusia affinis*) has been recommended for mosquito control in stagnant water due to its preference for mosquito larvae. It is a live bearer and is easy to keep and breed. Care should be taken however, as it cannot survive in highly polluted waters and in community tanks or ponds with other fish since it eats up the larvae of other fish and even its own young. They have been used extensively in USA and also in India in clean wells, small tanks with stagnant water etc. However, fathead minnows, which are hardier and less nasty, are also recommended.

Box - 6

Mudialy Fishermen's Cooperative Society, Kolkata (West Bengal)

The Society, registered in 1961, obtained 70 ha.of waterlogged wasteland-cum-garbage dump from Calcutta Port Trust and 10 ha. from the State Government. The Society has since engaged in production of fish in the sewage water and has also set up a Nature Park involving growth of an eco-tourism centre and extensive plantations of fodder plants, dust absorbing plants, canopy trees and agri horticultural plants. In the process, the Society has not only been successful in treating 25 million litres of waste water through biological means for pisci-culture, but has also provided various facilities to its members like daily-wage medical and educational assistance, funeral aid, marriage aid and housing advance. The integrated and mutually beneficial nature of these activities has converted a stinking, disadvantaged area into an ecologically friendly expanse of greenery. The Society has successfully cultured Indian major carps as well as many exotic carps and successfully demonstrated the technology for sewage water fisheries. The work of the Society has won it the National Productivity Award twice as well as Indira Priyadarshini Brikshamitra Award, Award for overall performance in Pisci-culture and Award for Overall Excellence from NCDC. The "Mudialy Model" has successfully demonstrated the feasibility of production of fish and establishment of an eco-friendly facility even while utilising industrial wastewater and disadvantaged wetland.

3.1.17.0 Pen Culture

3.1.17.1 Raising fish seed in pens (fabricated enclosures of bamboos and nylon nets) erected around the marginal areas of beels, chaurs, lakes or even reservoirs is gaining wide acceptance among the fish culturists of Bihar, West Bengal, Assam and some other states of the country. This seed raising system helps in utilisation of organic

matter, especially decayed matter and detritus etc., piled up in the shallower areas of these nutrient water bodies.

3.1.17.2 Taking in view the country's wide constraints of rearing space in fish farms vis-a-vis high cost entailed in construction of new fish farms, pen culture offers great promise and scope in enhancement fish seed production of the country. It is one such system where seed could be grown in plenty up to fingerling stage for meeting the huge seed requirement of large water bodies including reservoirs without incurring extra cost on feeding the fish seed. Special schemes need to be formulated by State and Central Govt. bodies with an aim to encourage pen culture programme in the country.

3.1.18.0 Brackish water fish culture

3.1.18.1 Since 1980, development of brackish water fish culture has been one of the most outstanding features of the aquaculture sector in the country. It has brought substantial economic gains to fish farmers.

3.1.18.2 In India an area of about 1.2 million ha has been estimated as amenable for brackish water aquaculture in the coastal areas of the country out of which 0.14 million ha has been brought under farming. The infrastructure facilities established over the years include hatcheries, both in private and public sector, feed mills in private sector and processing units. Over 0.03 million persons are reportedly engaged as direct employees in shrimp farming and double of this number i.e. 0.06 million are employed in ancillary activities.

3.1.18.3 The Ministry of Agriculture has established BFDAs in the coastal states of the country. Under the BFDA an area of about 1000 ha had been developed for shrimp culture by the agency till 1999-2000. There has been a steady increase in cumulative shrimp production over the years and the production level during 1990-91 was 83,000 tonnes. However, the white spot virus disease outbreak during 1995-96 reduced the production. The production subsequently increased and is presently stagnating at the 1995-96 level. Though a traditional activity, shrimp farming has grown as a commercial enterprise not only among small and marginal farmers but also in the corporate sector. This has improved the rural economy, increased employment, living standards of coastal population and has led to foreign exchange earnings. At the same time, due to

unregulated growth and poor farm hygiene, there have been losses and socio economic problems. Brackish water fish culture deserves expansion after taking the entire ecological aspects into considerations.

3.1.18.4 Production of freshwater prawn, popularly known as Scampi (*Macrobrachium rosenbergii*) in saline waters particularly in inland areas represents yet another opportunity for employment generation and income. Large areas in the country have suffered from the problem of salinity due to excessive irrigation and inappropriate water management. While these soils have been treated with gypsum to control the salinity, which is costly, a more profitable utilisation of such saline soils can be through culture of Scampi. The technology is indigenously available and the States using the saline soils/water for production of scampi should launch special extension efforts and incentives to popularise freshwater prawn farming.

Box - 7

Farmers' Associations or Aqua clubs (Thanjavur, Bhimavaram)

(a) Thambikottai-Vadakadu Shrimp Farmers Association in Thanjavur district, Tamil Nadu.

In Tamil Nadu, shrimp farmers in Thanjavur district have formed village level associations and organise regular meetings to follow good management practices for achieving eco-friendly and sustainable shrimp farming. One of the best examples of this association is the "Thambikottai-Vadakadu Shrimp Farmers Association". The members of this Association consult themselves before initiating pond preparation, introducing water in their ponds, selection and stocking of seed, feed management, shrimp health management, prevention of disease, formation of separate channels for draining out waste water, time for harvest of the crop, fixing of price, etc.

The Association members also inspect the shrimp hatcheries located at Chennai and Marakanam areas and collect seed samples for testing in at least three PCR laboratories to ascertain the presence/ absence of pathogens. The tested seed is purchased in bulk, which is then divided amongst the members of the Association as per their requirement. If a viral disease affects any farmer's crop, all precautionary measures are taken to prevent the spread of the disease to the other ponds. The Association also suitably compensates the affected farmer's loss. The Association takes the responsibility of road laying and providing other infrastructure like drainage canal and street lamps to the villages adjacent to shrimp farm cluster. The Association organises meeting of the members on fortnightly basis and discusses and solves their problems with mutual consent.

(b) Sri Subrahmanyeshwara Aqua Club in West Godavari district, Andhra Pradesh

To promote cooperative approach in management of shrimp farming activities and other common issues that commonly arise in cluster-based shrimp farms, aqua clubs have been set up in Andhra Pradesh. A total of 128 aqua clubs with a membership of 3 367 farmers is now existing in the State. However, one of the best initiative of this kind is the Sri Subrahmanyeshwara (SS) Aqua Club in Mogalthur village is West Godavari district of Andhra Pradesh. The SS Aqua Club comprises 58 farmers with 108 ponds spread over 58 ha and the farmers involved are mostly small-scale, practicing improved traditional farming with low investments. Based on the technical inputs provided by the Network of Aquaculture Centres in Asia –Pacific (NACA), Bangkok and the Marine Products Export Development Authority, Kochi, the farm level 'better management practices' or the BMPs were demonstrated in the shrimp ponds of the SS Aqua Club with great success.

The above two initiatives by the shrimp farmers in the Tamil Nadu and Andhra Pradesh need to be replicated in the other coastal states also where shrimp is fast developing on commercial-scales.

3.1.18.5 In India, coastal aquaculture is synonymous with farming of tiger shrimp (*Penaeus monodon*). With the availability of hatchery and grow-out technologies, shrimp

farming picked up momentum during the late eighties, which continued until 1996 when the Supreme Court placed restrictions on intensive scales of technologies, which had adverse impact on the ecology and the environment. However, with the setting up of Aquaculture Authority in February 1997 and regulation of farming activities, the practices have gradually became sustainable. With the enactment of the Coastal Aquaculture Bill by the Parliament in May 2005, shrimp farming activities are likely to get a further boost in the near future. Therefore, it is essential that all future developments in shrimp farming are geared towards practices which are sustainable and do not have any adverse impact on the environment. In this regard, the following recommendations are suggested:

3.1.18.6 To make shrimp farming globally competitive and provide a level-playing field to the Indian growers, it is essential that import duties and taxes on feed and feed ingredients should be reduced. Similarly, reductions in power tariff to bring it on par with agriculture will provide great relief to the shrimp farmers. Presently, industrial rates in power tariff are levied on shrimp farming, which places a heavy burden on the farmers with small holdings.

3.1.18.7 Domestic marketing of shrimp and other seafood should be developed to reduce the total dependence on export market. Development of domestic markets would also necessitate extensive publicity and promotion, which should be undertaken at the national level by utilizing the print and electronic media. .

3.1.18.8 Domestication of shrimp brood stock should be initiated through a private-public partnership so that the hatcheries get specific pathogen free and ultimately specific pathogen resistant brood stock for supplying quality seed to the shrimp growers in the country. Central agencies like Aquaculture Authority should also initiate seed certification program to enable the farmers to receive quality seed for raising in their farms. This work could be taken up by the NFDB when set up. There should be a registration of all hatcheries in the States and regular inspection of their brood stock and hatching practices. Air freight for transportation of shrimp brood stock and nauplii should be revised to bring it on par with the rates levied for fish seeds.

3.1.18.9 Shrimp farmers face considerable difficulties in terms of pond water quality and animal health management. Many farmers face heavy losses due to want of timely and reliable advice. It is, therefore, suggested that Aquaculture Service Centres should be set up with the active involvement of the farmers in different production areas. These Centres should be equipped with a laboratory, storage facilities for inputs and with communication facilities. The Centres should be run by trained and capable managers who are available to the farmers to provide reliable technical advice, arrange for procurement of quality seed, feed, probiotics, etc. They should also provide information on the market and price fluctuations to the farmers. The centres should be provided with the initial seed money and should subsequently be self-financing.

3.1.18.10 The coastal States should formulate a sound leasing policy to allot Government land to small and medium farmers, entrepreneurs and corporate houses engaged in shrimp farming. The Coastal Zone Management Plans should allocate lands in the coastal areas for shrimp farming and also permit conversion of unproductive agricultural land for aquaculture if adequate precautions are taken to prevent salt water incursion to the neighbouring agriculture land or groundwater sources.

3.1.18.11 The Banks should provide loans to farmers to undertake shrimp aquaculture. Similarly, crop insurance should also be initiated to protect the farmers from the risk of viral and bacterial diseases and natural calamities such as cyclone, tsunami, floods and droughts. Premium should be fixed at reasonable rates, especially for weaker section/ self-help groups.

3.1.18.12 Shrimp farming is presently cenered on a single species *i.e. P. monodon.* To make the farming practices sustainable, diversification is necessary and new candidate species of shrimp and fin fishes should be encouraged for which technology is either indigenously available or needs to be sourced from other countries. The role of the Government in this regard is paramount and it should catalyse the entry of new candidates into the farming systems.

3.1.18.13 Potential lands for coastal aquaculture have been given on long-term lease to private entrepreneurs for salt production. Such lands in many parts of the country are not being used profitably due to various reasons. The Government should review this lease policy and permit shrimp and fish culture in salt land and salt affected areas.

3.1.18.14 All shrimp farms and shrimp hatcheries should be registered with the Aquaculture Authority. However, the registration process should be simple and easy to comply with. Each registered farmer and hatchery operator should be given an identity card and the period of registration should match the repayment period of bank loan.

3.1.18.15 The coastal States/Union Territories should formulate Integrated Coastal Zone Management Plans, which should include areas suitable for development of shrimp farming. Fresh micro level survey to identify potential land for coastal aquaculture should be conducted to arrive at the correct estimate. Larger areas should only be taken up after environment impact assessment studies are conducted. Permission should be given for water intake through forest land wherever necessary.

3.1.18.16 Considerable communication gaps exist between scientists and farmers. The Fisheries Research Institutes under the ICAR system should provide technical support to the Aquaculture Service Centres on a day-to-day basis and *inter-alia* assist them in water and soil quality and aquatic animal health management. The concerned ICAR Research Institute should also undertake surveys on wild brood stock of important aquatic species, prioritise research programs on domestication of *P monodon* and establish laboratory facilities to test antibiotic residues at appropriate places.

3.1.18.17 Shrimp farms draw water from the creeks and estuaries, which also receive pollutants from point and non-point sources of pollution. There, it is essential to regularly monitor the pollution levels so that they do not adversely impact the development of shrimp farming. Similarly, the waste water from the shrimp farms needs to be monitored and adequately treated before it is released into the open waters. The use of mangroves, mussels and oysters, seaweeds and sea grasses should be encouraged to reduce the levels of organic matter in the wastewater.

3.1.18.18 Shrimp farming provides livelihood support to about 1.0 million people in the coastal areas, besides making substantial contributions to the foreign exchange earnings of the country. To ensure sustainable growth of shrimp farming in the country, the government should assist in setting up of infrastructure such as common effluents treatment plants for cluster-based farms, domestication of shrimp brood stock, opening of bar mouths and dredging of channels and creeks for flushing at regular intervals.

3.1.18.19 In view of the importance of shrimp in the fisheries basket especially for exports and its contribution to export earnings and looking to its vast employment potential using the brackish water resources of the country, it is proposed to identify a cluster of shrimp farms and shrimp estates where common infrastructure consisting of intake/settling reservoirs and effluent treatment etc. would be provided in the public sector, even through user charges could be levied on the fishers. It is to be noted that the Government does invest substantially for such common infrastructure for export oriented activities like Export Promotion Industrial Parks, Export Promotion Zones etc. It is proposed to set up 10 such clusters in the relevant States @ Rs. 5 crores per cluster.

Box - 8

Success achieved in raising Shrimp and Scampi Seed Production in Chennai/ Pondicherry

Presently, about 237 shrimp hatcheries have been set up in the coastal states with an installed capacity of about 12 billion seed per annum. Of these as many as 110 have been set up in Andhra Pradesh, 67 in Tamil Nadu and 21 in Kerala. In Orissa, 13 shrimp hatcheries exist.

Practically, all hatcheries were set up to breed tiger shrimp, *Penaeus monodon*, with some also breeding *P. indicus*. However, during the last 4-5 years, may of these hatcheries have also started breeding freshwater prawn, *Macrobrachium rosenbergii* (scampi).

Most of the modern and state-of-art hatcheries are located either in Kakinada area in Andhra Pradesh or in the Chennai – Marakanam belt in Tamil Nadu. These hatcheries are an excellent example of the efforts that have gone towards the development of commercial-scale shrimp and scampi farming in the country and any further development envisaged in this sector has to keep in mind the hatchery infrastructure set up so far. It may be noted that scampi production is quite spread unlike shrimp production, which is in clusters. Scampi, which represents a major strength for Indian fisheries, since it can be grown profitably in inland areas even in the North India in slightly saline conditions, is especially amenable to contract farming.

3.1.18.20 Economics of Aquaculture

ICAR has estimated the economics of various categories of Aquaculture as under:

I. Carp polyculture

Particulars	Production t /ha/ year)	Returns (Rs. /ha/year)	B:C Ratio
Low input	2.5	75,000/-	1.8
Medium	6.0	1,80,000/-	1.5
High	10.0	3,00,000/-	1.3

180 man-days per ha per year can be employed.

II. Integrated Fish Farming

Particulars	Returns (Rs./ha/year)	B:C ratio
Ducks	1,10,000/-	1.8
Poultry	1,50,000/-	1.4
Pigs	1,20,000/-	1.6

240 man-days per ha per year can be employed.

III. Other Culture Fisheries

Particulars	Production (t /ha/ year)	Returns (Rs. /ha/year)	B:C Ratio
Prawn farming	1.5	2,25,000/-	1.5
Carp-prawn farming	3.0 & 300 kg	1,35,000/-	1.6
Catfish culture	3.0	1,80,000/-	1.5

IV Economics of Shrimp Farming

Particulars	Production (t /ha/ year)	Returns (Rs. /ha/year)	B:C Ratio
Extensive	1.0	2,50,000/-	1.7
Improved extensive	2.0	5,00,000/-	1.4
Semi-intensive	4.0	10,00,000/-	1.3

300 man-days per ha per year can be employed.

3.1.19.0 Running Water Fish Culture

3.1.19.1 Hills have more water than land. Schemes such as running water fish culture offer great scope and promise in the expansion of aquaculture in cold water states. The system is highly remunerative as richly oxygenated water - the critical component is available in abundance in hills enabling the culturist to undertake 5-10 times stocking densities. A crude type of running water fish culture system (RFS) called Johra fishery is being practised in the hilly pockets of Tripura and West Bengal. An improvised version is found in Himachal Pradesh. The RFS system is totally feed based and the cultured fish species are common carp and silver carp. Production rates as high as 54 tonnes/ha. have been reported by the Central Institute of Fresh Water Aquaculture (CIFA), Bhubaneswar. There is a need to enlarge the number of fish species for culture under RFS and standardize rearing protocols.

3.1.20.0 Quality control in seed

3.1.20.1 With the evolvement of technology of induced breeding by the ICAR institutes in the country and its later transference to State departments and various entrepreneurs, a large number of hatcheries have been set up in both private and public sector in different parts of the country. As per information, as of today, there are 911 carp hatcheries in the country. The nursery area available in government fish farms is around 2,893 hectares. In terms of fry, the production currently is around 18,500 million, with West Bengal, alone producing over 50% of the country's total seed production followed by Assam. In the uplands, there are 23 rainbow trout hatcheries, in the States of Himachal Pradesh, J&K and Uttaranchal.

3.1.20.2 The mushrooming of seed production hatcheries has given a much needed thrust to the fish/prawn farming programme in the country but on the other hand, it has promoted sale of substandard and suspect quality seed. There is now a need for establishment of a **National Agency and Protocol of Seed Certification** in the country. A solution lies in the registration of all hatcheries by the State departments, followed by regular inspections of the brood stock and seed produced by a team of officers with representatives of research institution/SAUs and State fisheries department. The parameters for examination may include health status of brooders, hygienic standard of farms and condition of produced seed. Based on the inspection, the hatcheries may be approved for supply of seed to farmers and issuance of Accreditation Certificate. Further, each seed consignment packed for sale may be labelled indicating quality, quantity, batch number of species of fish and other relevant details. The state Accreditation Committee may keep surveillance and periodically check the hatcheries stocks. The seed supply would invariably carry stamp of the hatchery on the consignment meant for transportation. In case of any breach of rules by the hatchery operators, the accreditation committee would have the right to blacklist the firm and even cancel the registration of the firm. Such a measure is necessary for ensuring production of quality seed in the country and put a check on sale of substandard and dubious quality seed. The action is vital to protect the genuine seed suppliers and lend credibility to fish seed trade in the country.

3.1.20.3 Even while the ICAR system has an array of specific institutions concentrating on various segments in the fisheries sector, their contribution can be further enhanced if they move strongly into domestication of globally available technologies, consultancy to fishers and corporate sector, large scale production of brooders for recognized private sector seed producers, sale of good quality seed, especially for hitherto under-utilized species etc. These institutions could be encouraged to link their outlays to outcomes for meeting the felt needs of the fishers and to prepare a bankable project in this regard through Special Purpose Vehicles (SPVs) for undertaking commercially viable activities for production of brooders/seeds/other items of use for fishers. They could be provided margin money assistance of Rs. 30 crores for attracting institutional finance.

3.1.21.0 Quality control in feed

3.1.21.1 Nutritious feed and oxygenated water are key to good health of fish. The nutritional requirement of warm and cold water fishes ensuring high conversion ratio are well known. Formulated feed of carps and fresh water prawn with locally available ingredients have been prepared and marketed by CIFA. Use of probiotics and supplementation with vitamin A and vitamin E has also been worked out for preparing cheap diets.

3.1.21.2 While low quality unstandardized feed is available in the market, certified high quality feed at reasonable rates is still not available. There is a great demand for duly certified fish feed for carps, catfishes, trout and fresh water prawns. The problem is more acute in case of fishmeal, a major feed constituent for raising carnivore fishes viz. trout**,** mahseer catfishes and murrels. Fishmeal interspersed with sand, prawn meal, rotten blood meal, urea etc. when used as a feed ingredient creates hosts of problem ranging from poor growth to manifestation of diseases.

3.1.21.3 The country's research institutes have to take a lead in solving this problem. Again, an accreditation cell needs to be set up under an appropriate authority to check and inspect the formulated feed on the basis of proximate analysis, stability ratio, appetence value and above all, Feed Conversion Ratio and subsequent issuance of accreditation certificate to feed manufactures. This would ensure availability of quality

feed to the fish growers and build their confidence on the purchased product and boost profitability of operations.

3.1.21.4 Feed production farms both for fresh water fish and shrimp should be in small size units located near the consumer and aqua estates and suitably dispersed, in order to generate small-scale employment and reduce costs since local material could be used more efficiently.

3.1.22.0 Bio-security from diseases

3.1.22.1 Quite often, a number of diseases are posing a potential threat to aquaculture as well as to wild stock of aquatic life. The emergence of such diseases in countries known to be free from such diseases or even in countries with established control system and eradication programme often result in significant losses. The recent disease epidemic of UDS (Ulcerative Disease Syndrome) or white spot or viral infection *irrido virus* in trout took a heavy toll of fatalities in fish farms. Disease monitoring system in the country is decidedly very weak with disease investigation centers located only in few national fisheries institutes. In view of poor sanitation of farms and non-observance of standard hygienic norms the hatcheries in majority of farms usually become hotbed of disease resulting in poor survival rate and slow growth.

3.1.22.2 Fish health, farm's hygiene, surveillance of bio-stock are crucial to raise productivity in seed or fish producing centers as well as ensuring bio-security to the stock. Risk factors often posed by the disease in carps, trout and shrimp could be minimized by establishing pathological laboratories equipped with trained staff. Regular surveillance and requisite help to the stakeholders could be provided through these fish pathological laboratories. The need is for the fish grower to accord due priority to fish health and condition of farm's. Further, we must set up the necessary legal provisions for the implementation of contingency plans. Such legal powers must include provisions for declaring a list of serious diseases for which action is needed, reporting measures for abetting or controlling these diseases and other legal provisions. A list of the crises centers/laboratory information, which has the necessary facilities to control or treat the diseases, should be made widely known to the stakeholders.

3.1.23.0 Organic Fish Farming

3.1.23.1 Based on the principles of protecting the environment, minimising soil and water degradation and optimising biological diversity as well as consumer demand, the concept of organic fish farming has a lot of potential.The system calls for intensive monitoring of environmental impact namely: i) integration of natural plant communities in farm management ii) processing according to organic principles iii) natural breeding protocols iv) use of certified feed and fertilizers v) non use of medicine and synthetic pesticides etc. Demand for organic aquaculture products *viz* trout, carp and mussel is increasing each year in international markets. There is a tremendous scope in the country to step up organic fish farming in order to fetch better price and profits as well as promote pollution-free fish culture practices. There is a growing awareness about the health hazards that may result due to the consumption of fish grown in polluted environments. DAHDF should set up a small technical group consisting of ICAR, industry representatives and small fisher organizations to work out protocols for organic fish farming which should be feasible, affordable and acceptable to international buyers.

3.1.24.0 Post- harvest Fisheries

3.1.24.0.1 The post-harvest fisheries consist of different type of functionaries working at different levels. The important stakeholders in the post-harvest sector along with their respective roles are as under:

Table 8: Stakeholder groups in Indian post-harvest fisheries

Player	Role
Fishermen's assistants	Mainly the wives of the fishermen are involved in helping the fishers in collecting the catches from the nets for sale after landing. No payment is involved.
Head loaders	Carry fish from the landing centers to the auctioning site, from auction site to godowns or transport systems. Some of them come from non-fishing communities.
Poor people collecting fish	Extremely poor people, collect fish from fishers either for free or in a barter system involving sweetmeats, etc. and either sell the fish for money or use for domestic consumption.
Money lenders	Lend money for business and personal purposes to the fishers and traders. Some moneylenders are involved only in money-lending activities, while others are involved in fish trade also.
Auctioneers	Auction catches which are landed. In traditional fish landing centers, in places like Chennai, it is exclusively women who act as auctioneers; in some others, it is only men. Some auctioneers are also moneylenders.
Boat owners	Own different size boats, possibly driver-cum-owner. Operat major mechanized centers.
Companies/Exporters	Buyers of fresh fish from the port/landing center for export or sale within the country > 100km.
Agents	Act on behalf of buyers of fresh/dry fish. Accumulate economic lots to be sent elsewhere. Some agents buy in bulk and retail to cycle/moped traders on credit.
Tricycle and auto rickshaw owners and operators	Hired by the fishers for transporting fish to the wholesale and retail markets.
Cycle/moped traders	Buy from the landing center and sell in markets in and around the site (upto 50 km); Generally not from the fishing caste.
Petty traders (head load)	Buy and sell fish (fresh and dry) within 30 km of the site, mostly women, the fishing caste.
Fish collectors	Appointed by the commission agents, they are paid employees for taking care of collection, storage and transport of the catches from the village too difficult for the agent to access on a regular basis. Could be men or women, almost all of them from non-fishing communities.

3.1.24.1 Fish processing

3.1.24.1.1 Short or long term processing of fish to retain its desired quality is necessary to prevent wastage through spoilage of a valuable product. Domestic markets in India require mainly fresh fish. Indian processors of frozen fish have generally, used different types of indigenously fabricated air blast freezers or horizontal blast freezers, some of which are imported while others are fabricated domestically.

3.1.24.1.2 Cold chain concept calls for provisions of integrated facilities to retain the quality of refrigerated or frozen fish from the term of harvesting till it reaches the consumers. The cold chain system requires following facilities:

a) Adequate supply of ice for holding fresh fish before processing
b) Containers for holding fresh fish in ice, cold storage at landing centers
c) Intermediate points on the transit route
d) Processing, marketing and distribution centers
e) Facilities at retail markets.

3.1.24.2 Ice plants and production

3.1.24.2.1 There is no authentic study available on the requirement of ice meeting the need of inland fisheries. Ice often has to be transported, over long distance to the landings centers/villages and ponds at considerable cost. The availability of the ice to the producer especially during non-summer months becomes a serious concern. The ice producers, in view of their important role in helping fisheries industry deserve incentive and support. Some of the issues retarding the growth of this important item of infrastructure are constant increase in power tariff on ice plant factories; differential charges on ice plant factories vis-à-vis cold storage; hefty security deposit on quarterly basis charged by the Electricity Department; refusal of banks to advance loan to ice plant factories on viability grounds; high surcharge rate on ice plants even though it is a risk industry. These issues need to be given sympathetic consideration by State Governments since fisheries benefit the poor fishers and the sector can and does contribute to the State revenues.

3.1.24.2.2 Basket made of split bamboos with suitable lining inside are mainly used as containers for fish transportation in the country. Such baskets cause bruise on the fish skin because of rubbing against the rough and tough surface of the baskets. Other types of

containers such as tea chests, old plywood boxes are also used. Cheap containers with proper insulation have been developed but have lacked acceptance. It is important to develop/fabricate better plastic containers at affordable prices.

3.1.24.2.3 The inland sector, although characterized by highly displaced landings, has an advantage in having production sites close to the consumption centers. However, the reservoir fisheries are an exception to this and necessitate strengthening of infrastructure. There is a growing realization that closer ties between primary producers and manufactures would be mutually rewarding, the former being assured of a ready market for his produce at a reasonable price and the later being assured of an uninterrupted supply of raw market for his production line.

3.1.24.2.4 Aiming to create facilities for ensuring remunerative price to fishers and to make available fresh fish to consumers, avoiding slew of intermediaries, the Ministry of Agriculture launched a centrally sponsored scheme with 100% assistance viz. 'Strengthening of infrastructure for inland fish production in the country' during 1992-93. Under the scheme, 33 units were sanctioned to 18 States envisaging assistance of Rs. 200 million for creating infrastructure facilities in the form of fish handling sheds, ice plants, cold storage, retail outlets, insulated vans etc. During 2004-05, Ministry of Agriculture sanctioned another scheme viz. 'Strengthening of post-harvesting infrastructure' with an objective to reinforce post-harvesting network. The goals laid down under the scheme include developing fish preservation and storage infrastructure; developing marketing network such as retail vending, kiosk, aqua shops, insulated/ refrigerated vehicles, mini trucks, auto-rickshaw with ice box, moped bicycle/bicycle with ice box, fish display cabinets; weighing scales, computer units and allied components. The scheme is being implemented through self-help groups of fisher women, NGOs, cooperatives, joint ventures, Govt. undertaking, co-operatives in a location specific manner. The Government of India, Ministry of Food Processing Industries has also a number of subsidy-oriented schemes for NGOs/ cooperatives, private sector, joint venture etc. The schemes have been designed to provide incentive for setting up value addition projects on fisheries. Subsidy up to 75% is envisaged for providing beneficiaries for setting up unit in remote areas while 50% for other for projects involving cost up to Rs. 10 lakhs. The

assistance is provided ranging from Rs.40-100 lakhs to different categories from private sector to Govt. undertaking.

3.1.24.3 Economics of Inland Fish Trade

3.1.24.3.1 Select families in each market, both at wholesale and retail levels control inland fish marketing as a business. The margin of profit is generally kept high to cover the risk factors. The operation of inland fish is normally restricted in the districts, the inter-districts or inter-state movement is only during the high catch or glut seasons. The price spread and cost of marketing are quite high. The retail price of locally sold fish doubles when compared to the price received by the fisher. The cost of transport, ice, packing, handing, losses and other fixed costs together at wholesaling and retailing hardly ranges 8-12/- kg. Thus there is wide scope of reducing the price spread and increasing the producer share in the consumer rupee.

3.1.24.4 Marketing

3.1.24.4.1 Fish being highly perishable and difficult to handle, the streamlining of fish marketing requires much greater attention and effort. As a first step, the fish collection/ auction and distribution centres should be separate from the retailing centres. Hygiene and cleanliness are important in the fish markets. There should be slit-wooden/plastic platforms and plastic sheets for stacking the saleable fish, preferably with provision of water nozzles for maintaining humidity, especially in bulk markets. Movement of fish stacks especially in large auction markets should be in plastic containers in order to avoid damage in crude baskets/bags.

3.1.24.4.2 Fish marketing involves functions from catching of fish to reaching the consumer. Post-harvest fisheries activities including processing, production, development, transport and marketing provide greater employment to labour than the harvesting sector. It is generally felt that post-harvest infrastructure is grossly inadequate in fisheries sector. The retail markets are unhygienic and lack basic facilities. Mostly the whole fish is sold in the market and there is negligible processing/ value addition in fresh water fish marketing. Further the marketing, transportation and storage being handled by

the private sector lack hygiene as well as price norms. This core activity has witnessed a slow growth, lagging far behind the production trends.

3.1.24.4.3 Physcial infrastructure for marketing is important. It is proposed to provide composite fish marketing support to the States by setting up 20 units spread over various States for a period of seven years culminating in the end of the Eleventh Plan. The support would consist of assembly and auction market yards, small cold chains through cold storages, refrigerated and insulated vans and mobile retailing. The States could be permitted to have a suitable mix of these elements depending on local requirements. It is estimated that a sum of Rs.1 crore per unit would be needed.

3.1.24.4.4 Mandi/marketing Committee must take the responsibilities of renovation of fish marketing with requisite hygienic standards. A proper layout and design for small and large modern state of art fish markets should be developed by Cultural Institute of Fisheries Technology/National Institute of Agricultural Marketing, Jaipur, according to the conditions and needs of different regions of the country. A scheme should be formulated for development of large and medium fish markets, by tapping institutional finance. It should be realized that improper/unscientific handling in marketing centres can substantially lower the price realization, besides proving to be a health hazard. Foreign buyers too are getting increasingly conscious about the hygienic conditions in the landing centres and markets.

3.1.24.4.5 In particular, Kolkata wholesale fish market being the second largest fish market in the world needs a substantial overhaul. The market must be redesigned with proper layout, auction facility, hygienic, handling of fish and efficient drainage commensurate with the varieties and the volume of fish handled here. The layout would have to take into account the multifarious role of this market for assembly, auction, storage, export and even retail sale of fish. The State Government should prepare a bankable plan in consultation with the stakeholders with margin money from the Central Government.

3.1.24.4.6 It is imperative to ensure proper hygiene in large and small consumers market for fish. Municipal Committees must enforce the laws more strictly in the interest of public health.

3.1.24.4.7 It is further recommended that the present status of Fish Farmers Cooperative Federation should be carefully studied and specific steps should be identified and implemented to rejuvenate this important institution on a sustainable basis, in the interest of the fishers.

3.1.25.0 Socio- Economic Status of Fisher Folk

3.1. 25.1 An overview of various studies relating to socio-economic aspects of small-scale fishers usually overemphasise on economic and technical factors rather than social parameters. It is said that, to date, fisheries management lacks the human element i.e. missing of social parameters in decision-making processes.

3.1. 25.2 During the last fifty years of continuous development programmes, despite introduction of new technologies in fisheries and aquaculture and progressive increase in budget allocations; the status of today's average fisherfolk in terms of access to the benefits of development has not changed much. In the Ninth Plan, the Union Govt. allocated around Rs. 207 million to fisheries, 400 times more than its allocation in the First five year plan. In the same period, inland fish production witnessed a growth of 12% and stood at 3.2 million tonnes during 2000-01. However, their socio-economic status has not improved in a commensurate manner. The situation is worse in case of riverine fisher folk, with rivers and streams turning into aquatic deserts. An integral part of the civilization and one of the oldest communities, the traditional riverine fishermen have even fallen below the poverty line. Even the Census of India refuses to acknowledge them as a separate community. We do not seem to have a clear category of riverine fisher folk.

3.1. 25.3 Though no official figures are available on the number of riverine fishers. Their population is estimated to be around 0.45 million. A large chunk of the 387 communities of the fisherfolk, identified by Anthropological Survey of India are involved in inland fishing. These fishers are dependent on the 191,024 km of rivers, canals, etc.

3.1.25.4 The traditional fisher folk share an intricate relationship with rivers and they cannot afford to play with it. Non-fishing communities, however, go for maximum extraction. One of the factors quoted for destructive/over fishing is the short duration of lease. The leaseholders want to extract as much fish as possible from the rivers with each passing day of the lease period. Another problem is the use of restricted and destructive

fishing gears. While the traditional fisher's gear are designed to catch legal-sized fishes, the lessees deploy massive, small meshed mahajal, which virtually sweep entire stretches of rivers without even sparing a fingerling or insect larvae. Further, with the dwindling fish population, locals have resorted to devious methods for catching fish. Poisoning,and electrocuting have become rampant and norms are flouted with impunity. The list is endless. If traditional fishers have to survive, they need help from the authorities.

3.1.26.0 Welfare of fishers

3.1.26.1 Welfare of the under-privileged poor fisher has always remained the core objective of Central and State assisted schemes initiated during the successive five year plans. These include subsidized supply of fishing tools viz. nets/boats/tents, premium free insurance, model fishermen village scheme, risk fund scheme of providing financial assistance in the events of floods/calamities, close season periodicity.

3.1.26.2 However, due to poor literacy levelamong fisherfolk, the effect of some of the welfare schemes have failed to percolate down to the targeted fishers. There is a need to undertake investigative studies to assess the impact of these schemes on the economic status of the fisher to generate benchmark data and initiate new schemes or improvise the existing ones. Since fishable waters are common property resource, competition among fishers often leads to conflicts. Fishing villages all along the riparian areas of rivers reflect backwardness and under-development. Exploitation by contractors who hire them, after seeking fishing rights of reservoirs or other water bodies is rampant. The entire system is disorganized and exploitive. Most of the studies on socio-economic profile of traditional fishers present disturbing trends.

3.1.26.3 There is a need for paying special attention on the subject. The first step is to organize them and bring them under cooperatives or self help groups. A complete registration of fisher population, followed by imparting to them training on latest techniques in fisheries viz. pond fish farming, seed production / integrated farming etc., and providing them fishing tools at subsidized rates and demarcation of riverine, and reservoir stretches etc is needed. Fishing nets and country boats are the two main requirements of traditional fisher which need to be made available to fishers at subsidized

cost by the Central/State agencies. Basic amenities such as schools, banks, primary health centres, drinking water taps and other infrastructure facilities also require strengthening.

3.1.26.4 The fisherfolk should be provided access to institutional credit at low rates of interest.

3.1.26.5 With an aim to provide one-time financial help to the country's aged and poor fishers over 60 year age, an **Endowment scheme** is recommended for implementation jointly by State and Central Governments, through LIC or any other insurance agency like Agriculture Insurance Company. The Central Government, State Government and fisherman in accordance with a reasonable cost-sharing formula could pay the premium on an annual basis. The scheme could operate through Cooperatives/Self Help Groups for better administration. Financial assistance would be provided to select number of fishermen on the basis of seniority of age, membership period and fixed quota of each state.

3.1.26.6 The Government of India as well as National Centre for Agricultural Economics and Policy Research has suggested certain schemes with an aim of uplifting economic status of poor fishers but in view of poor literacy level and sheer ignorance of the community, the benefits of these schemes have failed to percolate sufficiently to the fishers. Gujarat and some other states have got studies conducted which have shown that the marine fishermen have been benefited when organized under the cooperative fold or self help group scheme.

3.1.26.7 Women have traditionally played a crucial role in the production and marketing of fish. The areas like propagation and seed raising of ornamental fishes, seed raising and farming of trout, which are relatively indoor activities, are highly suitable for adoption as a vocation by women.

3.1.26.8 Retailing/ marketing of fish has for long been done by womenin different parts of the country. The present day need is to upgrade their skill in fish marketing, sanitary and hygiene standards of sale shops, upkeep and maintenance of fish texture, quality with an ultimate aim of enhancing profitability in profession. The programme ensuring supply of insulated fish boxes, low cost drying rakes, initiated by Bay of Bengal Programme in the country has shown encouraging results and such efforts need

fortification both horizontally and vertically at state and national level by government and NGOs.

3.1.26.9 Although women contribute a large measure in fish marketing, they do not receive adequate share of the fish income or employment opportunities. The poor self-employed women have a triple disadvantage of being poor, self-employed and being women. They face problems related to posture of work (continuous sitting), their work environment (sitting on the road side for sale of fish) and physical endurance (loading fish containers on her head), besides the repetitive nature of movement from catching centers to markets. Currently, Bay of Bengal Programme is playing a laudatory role in improving the status of fisherwomen, focusing on training, awareness, saving and credit schemes and promotion of alternative income generating schemes. The programme needs expansion and wider coverage.

3.1.27.0 Aquarian Reforms

3.1.27.1 There is a need for a comprehensive set of **Aquarian Reforms** in order to foster the sustainable and equitable use of both coastal and inland waters for capture and culture fisheries. Introduction of Aquarian Reforms to help the fishers and the spread of fish enterprises based on the principle of gender and social equity as well as ecology are long overdue, even though concerns have been voiced in various fora over time. These reforms would *inter-alia* consist of leasing policy for major inland water resources like ponds, reservoirs and river system etc, as well as coastal areas for aquaculture, water tariff at concessional rate at par with agriculture, power tariff again at par with agriculture for small and marginal fishers, insurance against accidents/livelihood threatening events, enforcement of close season to permit sustainable fisheries in river system, the reservoirs and ponds. Further, since feed is a major component of the expense on aquaculture and in pond and reservoir fisheries, the taxes and custom duties should be minimum in order to sustain poor fishers who are suffering from dwindling catches. In addition, the open access system in marine fisheries has also caused severe stress on sustainability of fisheries resources and this must be regulated in a sustainable way so that the implementation is not coercive but consensual. It is essential to foster harmony in the use of living aquatic resources by artesenal fishermen operating catamarans and commercial

families operating mechanised fishing boats and trawlers. The major aim of the Aquarian policy should be the conservation of living aquatic resources, sustainable use, equitable sharing of benefits and harmony between artesenal and mechnised fishing.

3.1.27.2 While the elements of **Aquarian Reforms** are fairly obvious, their implementation over the years has been less than satisfactory for various reasons. It is suggested that the DAHDF should set up a small Committee, which should go into these elements keeping the requirements of gender and social equity and ecology in view and give its recommendations on the lines of land reforms, for adoption by the states after consultation with all stakeholders.

3.1.28.0 Fisheries in North Eastern States

3.1.28.1 Fisheries resources of the seven landlocked North Eastern States viz. Arunachal Pradesh, Assam, Meghalya, Mizoram, Manipur, Tripura and Nagaland are broadly of four types:

i) Rivers and streams; (18,968 km)

ii) Reservoirs (42,782 km);

iii) Beels/lakes (1,43,491); and

iv) Ponds (42,782 ha).

3.1.28.2 The average fish catches in these states from riverine resources range between 26-80 kg/ha, in case of ponds, it is 400-1300 kg/ha and in case of beels it is 30-180kg/ha. There is a quantum rise in fish seed production in these states. Production of table size fish has shown only a nominal increase. In view of widespread and extensive waters in the form of rivers, lakes, beels, these states have tremendous potential for raising fish production. Besides the 19,000 km run of river Brahmputra, the most important resource in the region is lakes/beels. Arunachal Pradesh offers immense scope for production of trout culture, running water fish culture, integrated fish farming, and ornamental fisheries. The priority areas for Assam are undertaking programme on integrated farming, exploitation of fisheries potential of beels, enhancement of fish production in ponds, freshwater prawn culture.

3.1.28.3 In case of Meghalaya and Nagaland, the scope exists for production of cold water fishes, development of lakes/ reservoirs/ beels and integrated fish farming.

Tripura has all type of water resources viz. rivers, beels, reservoirs etc. and a tradition of fisheries and the activities relating to integrated farming and ornamental fishery could be intensified for employment generation and higher production.

3.1.28.4 There is tremendous potential for development of mahseer and trout fisheries in the States of Meghalaya, Arunachal Pradesh and Nagaland. Hatcheries on the lines of J&K and HP could be constructed and rainbow trout farming could be promoted in the government. as well as private sector.

3.1.28.5 Lakes and beels having water spread of over 1.46 lakhs hectares constitute a major resource for fisheries exploitation. In view of their productive potential, with little efforts on management practices coupled with stocking, the average fish production in lakes and beels could be given a quantum raise. The scope for integration of fisheries with pig, poultry and duckery is immense in the region. 15-20% of paddy cultivation is being done in the region in low-lying area and in which deep water paddy is grown without pesticides. Such areas are ideal for paddy cum fish culture. The upland pockets of Meghalaya and Arunachal Pradesh are highly suitable for establishing running water fish culture units with cultivable species like trout and mirror carps.

3.1.28.6 Extension/ training activities require strengthening in all the North Eastern states. There is a need to raise teams of trained officials for providing support to extension.

3.1.28.7 ICAR centers for the North-East in Barapani should undertake a major programme of seed and brood stock production for species suitable for the North-East, particularly ornamental fish, at affordable rates.

3.2.0 Marine Fisheries

3.2.1 An Overview

3.2.1.1 The fishery wealth of India has enormous potential to provide livelihood and nutritional security to the large population of the country. Sustainable development of marine fisheries requires a sound combination of good management practices and conservation measures. These *inter alia* include sustainable harvesting of resources following eco-friendly fishing methods, enhancement of over-exploited resources through closed season and closed areas, rationalization of the existing fishing effort,

improved infrastructure for landing and berthing of fishing vessels, monitoring, control and surveillance, promotion of resource-specific fishing in the deep sea and a safety and security net for the small-scale fishermen. While agriculture provides food security, fisheries provide nutritional security to the country and both of them should be treated at par with each other in all development programmes.

3.2.1.2 The marine fisheries resources of the country comprise a long coastline of 8118 kms and an equally large area under estuaries, backwaters, lagoons, etc highly amenable for developing capture as well as culture fisheries. After declaration of the EEZ in 1977, the area available to India is estimated at 2.02 million sq. km, comprising 0.86 million sq. km on the west coast, 0.56 million sq. km on the east coast and 0.60 million sq. km. around the Andaman and Nicobar Islands. With the absolute right on the EEZ, India has also acquired the responsibility to conserve, develop and optimally exploit the marine living resources within this area.

3.2.1.3 The harvestable potential of marine fishery resources in the EEZ has been estimated at about 3.921[1] million tonnes. An estimation of the depth-wise potential shows that about 58.0 per cent of the resources are available in 0-50 meter depth, 35 per cent in 50-200 meter depth and 7.0 per cent in depths beyond 200 meter (Table 9)

Table 9: Summary of marine fishery resources potential in the Indian Exclusive Economic Zone (in million tonnes)

Depth Zone/Resources	0-50 m	50-200 m	200-500 m	Oceanic	Total
Demersal	1.280	0.625	0.028	-	1.933
Pelagic	1.000	0.742	-	-	1.742
Oceanic	-	-	-	0.246	0.246
Total	2.280 (58 %)	1.367 (35 %)	0.028 (0.7 %)	0.246 (6.3 %)	3.921

3.2.1.4 The marine fishing fleet comprises about 0.281 million traditional craft (including about 44 578 motorized traditional craft), 53 684 mechanised craft and about 170 large fishing vessels of 2l meter overall length (OAL) and more. As seen by the number of traditional craft and small-mechanised vessels, the major fishing activities are still concentrated in the areas within the 0 to 70-80 meter depth zone. As compared to the west coast, concentration of traditional craft (including motorized) is more on the east

[1] ***The potential has been revalidated to 3.934 million tonnes in year 2000.***

coast (about 57 percent of the total). In the case of mechanized vessels, the trend is reverse. The scale of mechanization is also reflected in the total fish landings of the two coasts.

3.2.2 Fish Production and Trend

3.2.2.1 It has been generally recognised that the Indian Ocean has the best-developed fisheries, but coastal resources in this ocean are under stress in many areas and require effective management, even though the potential for expansion may exist offshore. In India, while inshore waters have been almost exploited to the sustainable levels, the contribution from deep sea has been insignificant. The current (2003-2004) annual fish production has been estimated at 6.4 million tonnes (mt) – 3.0 mt from the marine sector against a potential of 3.9 mt and 3.4 mt from the inland sector against a potential of 4.5 mt (Table 10).

Table 10. Fish production

In million tonnes

Year	Marine	Inland	**Total**
1991-92	2.447	1.710	4.157
1992-93	2.576	1.789	4.157
1993-94	2.649	1.995	4.644
1994-95	2.692	2.097	4.789
1995-96	2.707	2.242	4.949
1996-97	2.967	2.381	5.348
1997-98	2.950	2.438	5.388
1998-99	2.700	2.566	5.262
1999-2000	2.834	2.823	5.657
2000 – 2001	2.811	2.845	5.656
2001 – 2002	2.930	3.126	5.956
2002 – 2003	2.981	3.205	6.186
2003 - 2004	2.940	3.460	6.400

Source: Ministry of Agriculture, Government of India

3.2.2.2 The growth in marine fisheries production over the recent years has been rather slow (an average of 2.19 per cent during the period 1991-1992 to 1999-2000) as compared to the inland fisheries (average of 6.55 per cent during the corresponding period). Gujarat continues to be the leading producer of marine fish followed by Kerala, Maharashtra and Tamil Nadu. Penaeid shrimps, which dominate the export front, are at

their optimum exploitation levels, whereas tuna and cephalopods are the two least exploited fisheries owing to limited operational range of the majority of the present fishing fleets and also the lack of suitable technology. Several other species in the continental shelf are exploited only up to 70 - 80 m depths.

3.2.2.3 The export of marine products in terms of value registered a level of Rs. 60,920 million in 2003-04 against Rs. 17 674 million during 1992-1993. Frozen shrimp continued to be the largest item in terms of value. Shrimp contributed 31.50% in volume and 65.88% in value of the total export of marine products from India. USA continued to be the single largest market for Indian marine products in value terms, with Japan in the second position. Export to South East Asian markets have shown an increase over the years and several minor markets like South Africa, Tunisia, Poland, Ukraine and Hungary have emerged, showing a positive growth.

3.2.2.4 The growth rate in total fish production has been around 4.12 per cent per annum during the nineties. The inland sector has witnessed a much higher growth rate of 6.55 per cent as against 2.19 per cent in the marine sector during the corresponding period. Keeping in view the slow growth rate achieved in the marine sector and stagnation in the near-shore waters, a growth rate of 2.5 per cent has been proposed during the Tenth Plan. To even achieve this growth rate, it will be necessary to implement sound programmes for exploitation of the deep-sea resources.

3.2.3 Issues and Approach to Development

3.2.3.1Entry 57 of List 1 of Seventh Schedule of the Constitution specifies Fishing and Fisheries beyond Territorial Waters as a Union subject, whereas Entry 21 of List II speaks of Fisheries as a state subject. Reading both the Entries together, it follows that control and regulation of fishing and fisheries within territorial waters is in the jurisdiction of the state, whereas beyond the territorial waters, it is the exclusive domain of the Union. Therefore, management of fishery exploitation in the EEZ requires close coordination between the centre and the states.

3.2.4 Coastal Marine Fisheries

3.2.4.1 India's EEZ comprises different depth zones: 0-50 metres extending to 0.18 million sq. kms; 50-200 metres extending to 0.27 million sq. kms; and 200 metres and beyond extending up to the limits of the zone, 1.57 million sq. kms. Presently, 25 per cent of the present production is by the artesenal sector and 74 per cent is from small-motorized boats. Only about one per cent is from the deep-sea fishing vessels in operation. Fish production has increased over the years with the motorization of traditional craft and introduction of mechanized boats in the traditional sector, as well as by the diversification of fishing effort beyond 50 meters depth.

3.2.4.2 Fishing effort is currently concentrated in the 0 to 80-90 m depth zone. Approximately 99 per cent of the landings are obtained from this zone. While inshore waters have been almost exploited to the sustainable levels, the contribution from the deep sea has been insignificant. The fish production from near-shore waters (up to about 90 meter) has reached its optimum yield levels and has been stagnant for some years leading to pressure on the coastal fin and shellfish resources and regular conflicts between traditional and mechanised sectors. Although the Marine Fishing Regulation Act (MFRA) promulgated by the coastal states and the union territory of Lakshadweep provides zones for different categories and sizes of fishing vessels to operate in demarcated areas, this seldom takes place due to inherent weaknesses in the Act. Central Government should assist states to rectify these weaknesses.

3.2.4.3 India faces considerable difficulties in the development and management of its marine fishery resources for a host of reasons. The Indian subcontinent covers a vast region with long coastlines and different ecosystems, both on land and in the sea. The fishery resources are diverse, as are the fishery technologies and systems. Artesenal and small-scale fishermen operate from thousands of landing places dispersed along the coast and live within socially and culturally disparate communities. Responsibilities and programmes for fisheries management and development are split between the Union government and state/ union territory governments, which differ in their policies, programmes and approaches. Central Board of Fisheries should meet atleast twice a year to sort out these difficulties in the interests of all concerned.

3.2.4.4 A sizable population of the marine fisher folk living in the 3600 fishing villages are socio-economically backward due to poor literacy, total dependence on fishing, unstable income, extravagant spending on alcohol, health hazards and risky life in the sea without adequate insurance cover for family. They are also victims of cyclone, tsunami and other natural calamities. Several welfare schemes of the Government have helped only a small percentage of the population. Therefore, the programme of poverty alleviation of the families of nearly seven million fishers has to get top priority in the fisheries development programme.

3.2.4.5 Recent trends in both artesenal and small-scale fisheries in the country have been disturbing and indicate the need for implementation of sound management programmes. Several fish stocks are being over-fished. The loss in terms of harvest of juveniles is very substantial. Trawlers and Ring seiners cause maximum destruction of juvenile population followed by mini trawlers and purse seiners. In fact, such management for the coastal marine fisheries is long overdue. The catches and earnings of fisher folk have been declining. Resource scarcity and the dearth of new income opportunities have combined to make life difficult for small-scale fisher folk. The Government should take all steps to reduce juvenile harvest through introduction of appropriate fishing gears as developed by CIFT. Considering the large-scale exploitation of juveniles and discards by the trawlers, the cod end mesh size of trawl with square shape should be increased to 30 mm.

3.2.4.6 Introduction of mechanized boats and motorization of traditional boats have caused extended fishing operations. This has also increased the fishing pressure beyond recovery of certain standing stocks and depletion of resources is noticed in many fisheries. Therefore, restriction and regulation in the operation of mechanized/ motorized fishing vessel is required in a phased manner to curb the excess fishing effort. Further, mechanized fishermen and traditional/non-mechanized fishermen should have clearly demarcated zones for fishing to avoid clashes.

3.2.4.7 The open access nature of marine capture fisheries is one of the major reasons for depletion, economic waste and conflict among user groups. Without adequate control over access, these consequences will become increasingly sever and further impede the sustainable management of fishery and the resource. With an open access, no catch limits have been set on effort or the catch.

3.2.4.8 The restriction of fishing effort could be in the form of restriction in the number of vessels, number of days or hours at sea, engine power, size of the fishing gear, fish holding capacity, etc. Fishing pressure on over exploited fishery resources such as shrimp in the inshore waters has to be drastically reduced. Restriction in areas for resources specific fishing, prolonged seasonal closure to allow recovery of over-fished species, prevention of fishing juveniles and spawners during breeding/ spawning season should be introduced. Since the monsoons trigger breeding and spawning and monsoon effects vary from place to place and year to year, a close monitoring of resources is vitally required to make a regular fisheries forecast. Until such fisheries forecast system is introduced, the present uniform closure of fishing in all maritime states and UTs could continue.

3.2.4.9 To optimise the fishing fleet size, a National-Level Review Committee was constituted in 1997 to study the size of the present marine fishing fleet in India *vis-à-vis* the harvestable potential and gives recommendations on the fishing effort that need to be deployed. The Committee concluded, after discussion with experts and with coastal states and the union territories that the mechanizeed fishing fleet, in the size range of 8.0 to 15.0 m over-all length (OAL), has attained optimum strength and no fresh entry should be allowed. However, 700 new-generation resource-specific vessels, about 18m OAL, including trawlers and gillnetters-cum-longliners, could be added to the fleet to tap resources in the EEZ beyond the 50 m depth zone. This step also vindicates the recommendation of the Committee on Deep Sea Fishing set up by the Union Government in mid-nineties. The recommendations of the Review Committee on Optimization of Fishing Fleet need to be implemented at the earliest to sustain the coastal fisheries.

3.2.4.10 At present, the mechanized fishing vessels alone are licensed. The system of licensing needs to be extended to motorized and non-motorized craft as well. Licensing will be helpful to maintain an inventory of all categories of fishing vessels. Another management option that has been considered for this area is to encourage small trawlers to diversify into fishing activities that can be practised further offshore, in order to reduce overcrowding in inshore waters and reduce the pressure on the fish stocks. However, few fishermen are equipped for such ventures, and there is a need to provide support to this category as also technical information on the availability of resources or the best fishing methods with which to target them. Assistance from the Food and

Agriculture Organisation can be sought to obtain suitable technology for the Indian conditions.

3.2.4.11 Gear employed for exploitation of demersal resources, particularly the bottom trawl, is being used excessively. The trawlable biomass appears to be overexploited and a reduction in the trawl effort is necessary to sustain the demersal fishery. On the other hand, the gear employed for the exploitation of pelagic resources is either underused or not used at all. Considering the biomass abundance of plankton feeders, such as the small pelagic species along the southwest coast, pelagic and mid-water trawling should be encouraged.

3.2.4.12 On a fair estimate, 70 per cent of the operational cost of a mechanized fishing vessel is accounted for by fuel cost alone. Therefore, one of the prime requirements of the fishing industry is development, demonstration and popularization of fuel saving designs of fishing craft, fishing gear and methods. Studies on the energy efficient hull designs for fishing vessels for reduced power requirements and their effect on vessel motions and manoeuvrability at sea, are required on a continuous basis. Development of deep-sea hull designs in FRP and aluminium for fishing vessels is also essential keeping in view the scarcity of timber.

3.2.4.13 The existing regulatory policies restrict fishing season, fishing areas and the mesh size of gear. However, there is no monitoring and surveillance system available with the concerned implementing organizations. Voluntary compliance by the fishermen to operate in the areas allotted to them is totally absent and encroachment by the larger mechanized vessels in the areas demarcated for the artesenal craft continues. The Central Government has now proposed to introduce a Vessel Monitoring System (VMS), which is expected to resolve the problem. Implementation of a sound monitoring, control and surveillance system including the VMS should be implemented at the earliest. The demarcation of the areas reserved for the small-scale sector also needs to be done on a priority basis. Similarly, the Central Government should also consider providing a fresh model bill to the states/ union territories to enable them to revive their MFRAs on the basis of their present requirements and also global initiatives to which India is a signatory.

3.2.4.14 In the wake of the Tsunami disaster, substantial support both financial and

infrastructural, has come to the affected fishers and their villages in the form of fiberglass boats and huts etc. The fear has been expressed in some fora that the number of artesenal boats in the affected coastal areas would in fact go up since some fishers may even use the damaged boats after repair in addition to the new boats received by them. This would further increase the fishing intensity and may result in still lower catches and unsustainable stock. States must therefore immediately embark on a programme of registration of all boats in the coastal areas, in order to assess the situation and adopt suitable policies in consultation with all stakeholders to ensure a sustainable fishing fleet commensurate with availability of landing and berthing facilities.

Box - 9

Self-Help Groups in Fisheries (Tamil Nadu)

The Southern Districts of Tamil Nadu have witnessed significant increase in the number of fisherwomen Self Help Groups (SHGs). Punnakkayal village has the largest number of SHGs in an Indian village with over 50 groups consisting exclusively of fisherwomen.

Today, there are several examples of successful fisherwomen SHGs in the region and their experiences need to be promoted in the other states also. Examples: The fish market at Neelankarai is managed by fisherwomen belonging to 12 SHGs. The management practices established by this group demonstrate their efficiency and unity. Similarly, the SHGs formed by fisherwomen in Vellapatty village in Tuticorin has enabled its members to conduct individual business involving a wide range of activities, including fattening of crabs for sale in the local market. These SHGs also have good linkages with the NGOs who have helped them in the promotion of their business.

3.2.5 Potential Fishing Zones (PFZs)

3.2.5.1 Remote sensing can play a significant role in dissemination of information on potential fishing grounds and also assist in judicious exploitation, conservation and management of marine resources. The imageries received by the National Remote Sensing Agency (NRSA) at Hyderabad are used to derive the sea surface temperatures and interpreted to identify the PFZs. These identified PFZs are informed to the fishermen on a day-to-day basis. Ground truth surveys have indicated substantially higher fish catch rates in the PFZ areas than in the non-PFZ areas, especially for small pelagics. Encouraging and supporting development of local facilities for receiving, processing and broadcasting the PFZ data will be of great help to the small-scale fishermen.

3.2.6 Co-management of fisheries and stakeholder consultations

3.2.6.1 Fisheries cannot be managed effectively without the cooperation of fishermen. The delegation of fisheries management to the local fishing committees will be more effective than the direct management by the Government. Once the community is involved in the formulation and implementation of management measures, better acceptability and compliance can be expected. Co-management makes maximum use of indigenous knowledge and expertise to provide information on the resource base and to complement scientific information for management. The potential advantages of a co-management include effectiveness and equity. It can be more economical in terms of administration and enforcement than the present centralized systems. It provides a sense of ownership over the resource, which makes the community more responsible for long-term sustainability of resources.

3.2.6.2 The vital interest of artesenal fishing sector should be protected. Stakeholder consultations should be held at regular intervals to bring them into the management process and ensure a balance in exploiting fishery resources for long-term sustainability. Such consultations should include discussions on new policy formulations, amendments to the existing policies and other important issues as considered necessary.

3.2.6.3 We are already in the new millennium and at a very crucial juncture of marine fisheries development. Many landmark decisions have been taken in the near past (*e.g.* closed season during monsoon months, optimization of the fishing fleet, revalidation of the harvestable potential) and their implementation is likely to bring radical changes. Restricted access to marine fisheries is being talked about more loudly than in the past. In April, 2005 the Government of India has also conducted a census of craft, gear and other attributes of economic significance for the entire coastline (including the two groups of Islands). This exercise is also seen as a benchmark for the millennium and would be valuable for planning and development of the marine fisheries sector in the country. This should be utilized effectively.

3.2.7 Protection of coastal fishery resources (near shore and estuaries) for a sustainable fish production

3.2.7.1 Coastal zone is the vital bridge between terrestrial and marine aquatic ecosystem. It is considered as the most productive ecosystem on earth in terms of biological

production since it accommodates rich biodiversity in estuaries, lagoons, inter tidal zone, coral reefs, mangroves and wet lands which are acting as breeding and spawning grounds. Since the coastal fishery resources depend heavily on the coastal zone ecosystem, their protection is of paramount importance, through involvement of local communities.

Box – 10

Appropriate coastal zone management and development of the ecosystem in a holistic manner is critical for the sustainable management for the fisheries and livelihood of fishers particularly the traditional fishers and other stakeholders. The M S Swaminathan Committee to review Coastal Regulation Zones Notification 1991 has submitted its report in February, 2005 and has developed the following 12 tasks guiding principles which should govern future decision on Coastal Zones Management:

1. Ecological and cultural security, livelihood security and national security should the cornerstones of an integrated coastal management policy.
2. The coastal zone is including an area from 12 nautical miles including sea-bed and inland tidal water bodies etc., should be taken up for an integrated, cohesive, multi-disciplinary and multi sectoral coastal area management and regulatory system.
3. Regulation, education and social mobilization should be the three major components of a participatory and a sustainable Coastal Zone Management Strategy and Panchayati Raj institutions in coastal area should be fully involved in the educational and social mobilization programme.
4. The protection and sustainable development of the marine and coastal environment and its resources should be in conformity with international law. Every effort should be made towards ensuring an Integrated Marine and Coastal Area Management as prescribed in the 1995 Jakarata Mandate under the 1992 Convention on Biological Diversity.
5. Coastal regulation needs to be based on sound, scientific and ecological principles and should safeguard natural and cultural heritage. Heritage sites need particular care. Birds sanctuaries and parks and breeding ground of migratory birds should be protected.
6. The precautionary approach should be used where there are potential threats of serious or irreversible damage to ecologically fragile critical coastal systems and to living aquatic system.
7. Significant or irreversible risks and harm to human health and life, critical coastal systems and resources including cultural and architectural heritage would be considered unacceptable.
8. Ecological economics should underpin economic activities.
9. Coastal policy and regulations should be guided by the principles of gender and social equity as well as intra-generational and inter-generational equity. All stakeholders should be involved in decision making. Precious biological wealth coming under Marine Biosphere Reserves should be managed by Trusteeship mode.
10. Coastal protection and bio-resources conservation policy should be guided by techno economic efficiency, the precautionary approach, "polluter-pays" principle and "public trust doctrine"
11. Those engaged in hazardous dangerous coastal activities should bear the liability to compensate the victims of marine pollution and fish contamination and should also bear the cost of restoring the coastal environmental degradation. The onus should be on them for demonstrating that their developmental activities are environmentally benign. The principles contained in Biodiversity Act (2002) should be applied to coastal bio-resources management involving concurrent attention to conservation, sustainable use and equitable sharing of benefits.
12. The regeneration of mangrove wetlands, coral reefs and sea grass beds as well as promotion of coastal forestry and agro-forestry will confer both short and long term ecological and livelihood benefits. National coastal bio-shield movement along the coasts of the mainland of India and islands should be initiated as a priority task under National Rural Employment Guarantee and Food for Work programmes. Short term commercial interests should not be allowed to undermine the ecological security of our coastal areas.

Thus, coastal zones management requires cohesive, multi-disciplinary approaches as well as multi-dimensional vision. Sustainable human security in all its dimensions - ecological, economic, ethical cultural and human well being, in terms of the health and happiness both for men and nature should be the goals of an enlightened Coastal Zone Management Policy.

3.2.8 Deep Sea Fisheries

3.2.8.1Besides shrimp aquaculture, fishing rights and responsibilities in the deep sea fishing sector have been the most debated issue since the mid-nineties and various user groups have different opinion on the modalities of harnessing the marine fisheries wealth, especially from the deeper waters. At the outset let us recognise the fact that traditionally India has had no entrepreneurship in the deep-sea fishing. Historically, the coastal communities have fished in the near-shore waters, using artesenal methods, most of which are still in vogue today. In order to develop entrepreneurship and promote investment for greater exploitation of the marine fisheries, the Government has provided policy supports for the development of the industry from time to time. The Shipping Development Fund Committee (SDFC) was entrusted with the task of extending soft loans to the deep-sea fishing sector. Loans were provided to the extent of 95 per cent of the cost of the vessel and the debt equity ratio was 6:1. A number of Indian companies acquired deep-sea fishing vessels since 1975, but almost all of them were shrimp trawlers, which operated on the east coast in limited areas from Visakhapatnam. Less than half the numbers of these shrimp trawlers are in operation at present. Acquisition of deep sea fishing vessels was financed by SDFC till 1986. In a few cases consortium of nationalised banks also came forward to finance deep sea fishing vessels. Later on SDFC was wound up and SCICI took over its activities.

3.2.8.2Another policy initiative taken by the Government of India was to introduce the charter policies of 1981 and 1986. Subsequently, for obtaining requisite technology for exploiting the deep-sea resources and exposing the Indian entrepreneurs to the latest developments in the field, the New Deep Sea Fishing Policy was initiated during 1991. The accent of the policy was on increasing fish production and acquisition of deep sea fishing vessels by the entrepreneurs through joint ventures, leasing and test fishing for technology transfer, since other nations had the requisite technology and the appropriate vessels for this purpose. The 1991 policy also came to an abrupt end after the Government accepted the recommendations of the Deep Sea Committee in September, 1995.

3.2.8.3 In retrospect, it could be said that of the many flaws these policies had, one major flaw was that they were restricted to the deep-sea sector. Policies of such exclusive nature created chasm between the small- scale sector (small mechanised & traditional vessels) and those licensed to fish in the deep sea. The growing fear of complete domination by the big brother gradually led to agitation, which ultimately culminated in rescinding the New Deep Sea Policy of 1991. Subsequently, the Government of India has approved a Comprehensive Marine Fishery Policy in November 2004, which includes important elements for the Deep Sea Fisheries. These must be implemented in a time bound manner and in full collaboration with the States. It is important to stress that the States must also be consulted and kept in the picture while licensing Deep Sea ventures for better control and harmony in the seas.

3.2.8.4Of the many options to harness the deep-sea fishery resources, diversification of the existing deep sea fishing fleet and introduction of resource specific vessels for long lining, purse seining and squid jigging is absolutely necessary in the present circumstances. Mechanised vessels below 20m OAL necessitate major inputs in their design to not only increase their voyage but also facilitate bringing back the catch in as good condition as possible. The design of the boat, engine power, winch capacity, gears and cold storage facilities on board may have to be checked to equip them properly for offshore fishing. However, countries like Sri Lanka have successfully promoted the use of intermediate range of fishing vessels to fish in the deeper waters and thereby reducing pressure on coastal stocks. Introduction of modern fishing vessels in the intermediate range (15-19 m OAL) is also essential to exploit areas between 90 to about 150 m depth to harness both demersal and pelagic resources.

3.2.9 Empowering small-scale fishers for offshore fishing

3.2.9.1Participation of small-scale fishers in offshore fishing is limited due to heavy capital investment and recurring expenditure. In this regard the fisher cooperatives/ associations/ groups should be assisted through bank loan and subsidy to enable them to take up offshore fishing. Assistance should be provided to engage carrier cum supply vessels to a group of fishers so that they can fish longer in the sea and the catch could be brought back in good quality at regular intervals through carrier vessels.

3.2.9.2 Our fishing effort around Andaman & Nicobar Islands and Lakshadweep Islands is negligible. Though these two groups of islands in the Bay of Bengal and Arabian Sea are located strategically to exploit oceanic pelagic fishery resources, no serious attempt has been made so far to develop a strong base for oceanic fishing. The resource potential of these islands in the Indian EEZ is estimated at 250000 metric tonnes and the present harvest is about 40 000 metric tonnes. Special cells should be set up in Lakshadweep and Andaman & Nicobar Islands, to exploit tuna and other oceanic pelagics. These fishing bases should be developed as in Maldives with mother fishing operation to harvest tuna and squid resources in the EEZ and beyond in the international waters. Oceanic tuna fishing should be the main focus for which all infrastructure facilities should be developed with adequate incentive for the Island fisherman cooperatives. Commercial fisheries development should be encouraged to allow private entrepreneurs to invest in Island fisheries.

3.2.9.3 Since mother ships are costly, the Govt. should position one mother ship in A&N Islands and other in Lakshdweep Islands, which could collect the catch of smaller boats and process them on boat for value addition/store the catch in refrigerated holds and thereby allow fishing boats to operate for longer periods without spoilage of fish. It is recommended that Rs. 10 crores should be earmarked for purchase of two mother ships.

3.2.9.4 Taking into account the harvestable potential for deep-sea resources, the first step is to fix the fleet size for different category of resource- specific fishing vessels. Once an optimum fleet size is fixed, the second step would be to arrive at a policy for acquisition and deployment of such vessels. In the absence of indigenous capabilities to construct resource- specific vessels and the activity also being capital- intensive, equity participation with sound guidelines may have to be considered. Coupled with this, adequate support through post- harvest infrastructure and marketing would also be necessary. Some of these aspects are discussed in greater details in the following paragraphs.

Box - 11

Fishermen Cooperatives (SIFFS, Trivandrum)

The South Indian Federation of Fishermen Societies (SIFFS) originated through the intervention of NGOs in the artesenal fishing sector during 1970s and 1980s. Starting as an apex body of societies of Trivandrum district, SIFFS in its present form comprises a three-tier structure. The three core activities of SIFFS include (i) marketing of fish caught by members, (ii) providing credit for renewal of fishing equipment and (iii) promoting savings. Some of the major interventions of SIFFS include:

Boat Building

SIFFS pioneered the introduction of marine plywood boats in 1982. Since then, it has been playing a major role in the promotion of marine plywood boats in three districts on Southwest coast of South India. The activities under this programme include (i) setting up boatyards to manufacture different models of boats and undertake repair works, (ii) conducting research and development on designs of boat models and materials for boat building and (iii) providing training in boat building and maintenance. Today, SIFFS is a leading player and a leader in plywood boat building market in South-West Coast of India.

Outboard Motors

SIFFS recognises the link between OBMs and plywood boats and, therefore imports outboard motors and spare parts for distribution to the beneficiaries at affordable prices. Today, SIFFS is the country dealer for Suzuki marine products, and a leading importer of OBMs and spares in South India. Over the years, SIFFS has also kept pace with rapid increase and spread of motorised craft through setting up of OBM service centres and spares parts outlets for sale and maintenance works.

Fish Marketing & Ice Plants

Fish marketing has been one of the major areas of intervention of SIFFS and has been exploring new areas for marketing of both fresh and processed fish through trials and experiments in export market. Quality improvement programme is an area of priority for SIFFS now. SIFFS has also initiated marketing of fish in the domestic sector through a retail shop in Trivandrum. The shop aims to serve as a channel to sell the surplus fish procured for the export purpose.

SIFFS is an excellent example of cooperative endeavour coupled with modern marketing enterprise, which can be replicated in other states also.

3.2.10 Post-harvest Infrastructure and Marketing

3.2.10.1 In India, approximately 67 per cent of the total fish production is consumed in fresh form as per the available data. Nearly 6 per cent is used for reduction into fishmeal. Altogether 23 per cent is consumed in processed and preserved form that includes 16 per cent used for drying, 7 per cent for freezing and less than one-half per cent for canning- almost all of these under medium and small- scale sectors. As spoilage of fish starts right from the time it is caught, the proper storage, preservation and prompt disposal or transport services are essential. Various studies have from time to time

pointed to the high levels of wastage in the fishery due to spoilage. This is particularly acute during the monsoon, when up to 30 per cent of the catch could be lost. This is a vital area to be addressed, and may result in increased economic returns to those dependent on the fishery without any increase in fishing effort. Therefore, strengthening of post- harvest infrastructure such as storage facilities, ice plants, cold chains, roads and transportation, etc., as well as effective marketing system in identified areas are the key requirements for the development of this sector. This would ensure higher profit margins to the producers enabling faster fisheries development.

3.2.10.2 Since fish is subject to rapid deterioration in quality in view of the generally hot climate in India and the inadequate cold chain, it is necessary to ensure **quality literacy** amongst fishers in order to ensure appropriate value realization for them and also to protect the health of the consumers. This could be achieved by regular programmes of awareness generation/knowledge dissemination on the pattern of the good work done by National Egg Coordination Committee.

Box - 12

Corporate Sector in Aquaculture and Seafood Processing
(The Waterbase Ltd, Nellore, Andhra Pradesh)

The Waterbase Limited (TWL) is the largest and the only integrated aquaculture unit in India located in the heart of shrimp country at Nellore, Andhra Pradesh. The Company began operations in 1993 and is today a US$18 million company (Rs. 1 billion) with facilities that comprise a shrimp hatchery, feed plant, grow-out farms, and an ultra-modern process plant. Black Tiger (*P. monodon*), White (*P. +indicus*) and Scampi (*M. rosenbergii*) are raised in the farms of the Company. The Company sells shrimps in various forms such as cooked, beheaded, deveined, etc depending on the customer requirements. Apart from its own stock of shrimp, the Company also sources it from other farmers to meet orders. The Company follows HACCP guidelines and is among the few Indian companies that have FDA approval for export of marine products to USA.

The Company exports shrimp in different forms to the quality-conscious markets of Japan, USA, and Europe. It has a 50: 50 joint venture with Handy and Son of US. This JV is exporting pasteurized crabmeat that is considered a delicacy in the West. The Company has also made a retail foray with a specialty seafood restaurant in Bangalore called Tiger Bay and proposes to take this concept to other cities soon. The Company has recently entered into an R&D alliance with INVE of Belgium.

The Government of India has recently permitted the Company to import *P. monodon* broodstock from Myanmar waters for breeding and also for initiating a long-term programme on domestication of tiger shrimp. The Company is also in the process of perfecting the technology for breeding and raising of mud crabs (*Scylla serrata*), which have a lucrative domestic and export market.

M/s Waterbase Ltd is today the only corporate sector player in shrimp farming and its integrated unit in Nellore is an excellent example of corporate sector's contributions to the development of seafood industry in general and shrimp farming in particular.

3.2.11 Assistance to women fish vendors

3.2.11.1 Women fish vendors largely do retail marketing in the marine sector. Over the years, the supply of fish to women vendors is on the decline and they face several other hardships in selling fish, which is a highly perishable commodity. Schemes to promote retail marketing of fish in hygienic conditions should aim at providing assistance to women fish vendors, especially with regard to containers for carrying fish, transportation facilities, etc. Self-help Groups comprising women fish vendors should also be assisted in setting up of hygienic retail outlets with facilities for keeping the product in chilled/ refrigerated conditions. Such schemes will be helpful in sustaining their livelihoods and ensuring quality fish to the consumers.

Box – 13

Hygienic Marketing of Fish in the Domestic Sector (Chennai, Kochi)

Hygienic marketing of fish and fish products in the domestic sector has been a neglected area. Despite several attempts by the Central and State Governments, no tangible results could be achieved. However, in recent years retail marketing of fish and fish products (mainly marine fish) by the private sector has been successful and retail shops have been set up in Chennai, Kochi, Bangalore and Hyderabad. While some of these retail outlets are linked to processing units, others have been set up by enterprising youth. A visit to some of the retail shops in Chennai or Kochi will show the difference it makes to the quality of the product.

This is a significant development and there is a need to promote this initiative, especially through the private sector in the other states also.

3.2.11.2 In the marine fisheries sector, the Central Government has been implementing a central sector scheme and a centrally sponsored scheme since 1964 to provide infrastructure facilities for landing and berthing of mechanised fishing vessels (MFVs), traditional and motorised fishing craft and deep sea fishing vessels. At the end of the First Five-Year Plan, there were 863 mechanised fishing vessels operating along the Indian coast. Presently, there are about 54,000 Mechanised Fishing Vessels and 44,578 motorised fishing crafts. The landing and berthing facilities commissioned so far can only meet the needs of a quarter of the total fishing fleet, resulting in over-crowding and a host of other accompanying problems. Therefore, there is an imperative need to develop more fishing harbours and landing centres to meet the requirements of the existing fishing fleet.

3.2.12 Upgradation of fishing harbours and fish landing centres

3.2.12.1Most fishing harbours in the country are not properly maintained, due to lack of management and inadequate revenue collections. After the harbours are commissioned, the responsibility of maintenance and management is vested with the user agencies/cooperatives/SHGs. The income should be ploughed back for management and maintenance of the centres. However, adequate revenue is being collected regularly in only a few fishing harbours. In some, the revenue collected is too meager for proper management and maintenance. Perhaps, more Aqua shops for catering to the

requirements of the fisher folk in terms of fishing gears/boats etc. alongwith repair shops for these could be setup to increase revenues. NABARD already has a scheme for assisting technical graduates for setting up Agri-Business Clinics and the scheme could be utilized by fisheries graduates also to set up Aqua shops. Qualified professionals are required to set up these shops due to stringent hygienic requirements under HACCP.

3.2.12.2 The hygiene and sanitation conditions in most of the harbours and fish landing centres are below the normal specifications. This is partly due to inadequacies in the design and construction of the facilities and partly due to poor maintenance. The user groups are largely responsible for the poor state of hygiene and sanitation. Accepted standards of hygiene and handling of fish demand that these facilities be maintained strictly, and that contamination of fish be kept down to a minimum. The fishing harbours in India need to be modernised to meet minimum international standards necessary for fish quality assurance[2]. Special design approaches need to be adopted to meet the requirements of standards laid down by Hazard Analysis and Critical Control Points (HACCP) and ISO 9000. If these requirements are not met in the immediate future, the marine products exports may face trade restrictions, since most of the importing countries have stringent hygiene and sanitary conditions. Further, a greater awareness is necessary for the fisher folk on the importance of hygienic handling and preservation of fish as also personnel hygiene in improving the quality of landed fish and prevention of loss and wastages.

3.2.12.3 It is necessary to undertake an ambitious programme to construct minor harbours and fish landing centres which would directly benefit the marine fishers through better handling of fish and safer landing leading to better value realization besides improving the prospects of exports through compliance with the requirements of importing countries. This should be in the central sector considering that the present scheme has had limited success because of its insistence on state share. It is estimated that over the seven-year period culminating in the end of the Eleventh Plan, a total of 20

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[2] ***For modernisation of the existing facilities, the Ministry of Agriculture has allocated budget in the Ninth Five Year Plan @ Rs. 4.0 million for a minor fishing harbour and Rs.2.0 million for a fish-landing centre. This would be a one-time assistance to the states/ union territories.***

minor harbours each costing Rs. 12 crores and 40 fish landing centres each costing Rs. 3 crores would be required, on a conservative estimate.

3.2.12.4 In addition, greater attention would have to be paid to the existing minor fishery harbours and fish lending centres, which have been constructed over the years and are now becoming difficult to use because of the heavy siltation. It is estimated that atleast 50 existing fishing harbours/landing centres need maintenance dredging. Dredging operations can go long way for improving the capacity and utility of these centres. These centres because of their smaller size require special Dredgers; a small Dredger was received as a gift from the Government of Japan a few years back and has been in operation on the Kerala coast with good result. However, the country still needs three more Dredgers, two for the Eastern coast and one more for the Western coast. One method could be to acquire these through normal tenders and operations through a Central agency. Other solution could be to outsource the work of Dredging to private operators with grants from the Govt. of India of Rs. 20 crores for a limited period of five years to the states so that they could afford the Dredging operations. This would save capital costs and operation and maintenance expenses. Since the private sector does not seem to have such small sized Dredgers presently, it may be more practical to acquire these three Dredgers at a cost of approx. Rs. 30 crores.

3.2.12.5 The development of deep-sea fishery industry is of concern to the entire marine fishery sector because it would have considerable impact on the management of near-shore fisheries, shore-based infrastructure utilisation and post-harvest activities, both for domestic marketing and export. Selected fishing harbours should also be equipped with storage facilities for sashimi grade tuna. To avoid over-capitalisation and to ensure a cautious growth of the infrastructure as well as the investments, a rationalised approach will be essential in determining the number and size of fishing vessels, their resource-specific gear and operational equipment as well as technology to be made available either indigenously or through foreign collaborations. The Master Plan must be updated after due consultation with states keeping factors like potential, fishing fleet and export earnings in mind.

3.2.12.6 Lastly, it would be desirable to set up a **Central Fishery Harbour Development Authority**, which could comprehensively manage the Minor Fishery

Harbours and Fish Landing Centres in terms of construction, management, maintenance and dredging etc., in consultation with the States and the stakeholders. DAHDF should prepare a proposal for a law on the subject after consulting the States etc. so that harbours and fish landing centres could be managed more professionally.

Box - 14

Marine Mussel Farming (Kerala)

Marine mussels form one of the must dominant cultivable species all over the world. In India, two species of marine mussels (green mussel - *Perna viridis* and brown mussel – *P. indica*) support a traditional sustenance fishery. However, in recent years, the increasing demand for mussels (especially in northern Kerala) has enabled farmers in north and central Kerala to adopt commercial-scale technologies for mussel farming. More than 450 families in Kasargod, Kannur, Kozhikode, Thrissur and Malappuram are now proud owners of mussel farms.

The technologies for mussel farming have been developed by the Central Marine Fisheries Research Institute, Kochi and include rack, long line and raft methods.

The Malabar Coast of Kerala has now become the centre of mussel farming in India producing about 4 000 tonnes during 2004-05. On an average the mussel farmer is earning about Rs. 6 800 per season. Based on the success of this activity, women SHGs have adopted mussel farming in the back waters adjacent to there houses and the Banks are providing loans ranging between Rs. 8 000 – 9 000 per member of the SHGs. The Government of Kerala also provides financial support through DWCRA and IRDP to promote mussel farming.

3.2.13 Mariculture/ Sea Farming

3.2.13.1 Mariculture provides immense opportunities for significantly increasing food production, employment, income and foreign exchange. Given the wide spectrum of cultivable species and technologies available, the long coastline and the favourable climate, mariculture is likely to generate considerable interest amongst the coastal population in the country. At a time when we speak of over-exploitation in the near-shore waters, limited access to capture fisheries and the need for diversification, mariculture can be one of the most appropriate alternatives. Technologies for a couple of species are presently available in the country and there is an urgent need for developing package of practices for many more commercially important species (e.g. sea bass, sea bream)

3.2.13.2 However, with a possible scenario of large-scale mariculture activities taking place in the near future, it is likely that a situation akin to shrimp farming can be created where unplanned and a fast growth resulted in social conflicts and challenges to

the sustainability of the coastal environment. To avoid repeating the shrimp history, a systematic macro and micro-level survey of the entire coastline would be necessary, to prepare a comprehensive status on the area-wise suitability of the available mariculture technologies, carrying capacity of the ecosystem, social, legal and environmental implications, research and policy support, credit availability and other forward and backward linkages. A status report of this nature would essentially be a SWOT analysis and keep us in preparedness if mariculture activities were to be adopted on a larger-scale during the Eleventh Fiver-Year Plan. Meanwhile the States should have a liberal leasing policy for marine resources to encourage mariculture and avoid conflicts.

3.2.13.3 It may also be worthwhile to develop an All India Coordinated Research Project on Mariculture for transferring the technologies developed so far. Pilot-scale programmes are essential for standardisation and also to enable the end-users to familiarise with the technology, which has been tried successfully abroad.

3.2.13.4 Integrated capture and culture fisheries through seawater farming also offers an opportunity for fisher families particularly women. They can take to rearing of prawns and suitable salt tolerant fish species in canals along the sea coast, using low external input sustainable aquaculture (LEISA) techniques. Agro-aqua farms involving the concurrent cultivation of tree species and rearing of fish and prawn can be promoted to enhance income and employment and opportunities.

3.2.14 Seaweed culture

3.2.14.1 Seaweed cultivation is a profitable activity in the coastal areas and should be initiated as a poverty alleviation programme. Since these activities are new to fishers, demonstration with proper hand on training is necessary. Seaweed training programme, started in Ramnad, Kanyakumari and Tuticorin districts of Tamil Nadu for self-help women groups has given rewarding results. The banks have also come forward for financing seaweed cultivation with a guaranteed buy-back arrangement from companies making products from the seaweeds. Awareness creation, technology dissemination through training and assured marketing through Corporate Sector has created a momentum, which should be continued.

Box - 15

Seaweed Farming (Tuticorin, Tamil Nadu)

Seaweeds grow in the shallow coastal waters of the seas and are vital as a habitat for a variety of marine organisms. Seaweeds provide a valuable source of raw material for manufacture of health food, medicines, food additives, pharmaceuticals, etc. Some of the important products of seaweeds include agar, algin and carrageenan. The most common seaweeds in India available for farming include species of the Genius *Gracilaria, Gelidiella* and *Eucheuma*/ *Kappaphycus*.

In Tamil Nadu seaweed cultivation is common in Rameshwaram, Pamban, Mandapam, Vedalai and Kilakarai areas, where cultivation is now being promoted through the SHGs. M/S PepsiCo India Holding (p) Ltd is also supporting the enterprise through buy-back arrangements.

Seaweed farming is a viable livelihood option for fisher-communities and has considerable potential in other states also. It is environment-friendly and has no adverse impact on the coastal ecology. The experience of the SHGs and other fisher groups in Tamil Nadu can be considered as a successful example for replication elsewhere in the country.

3.2.15 Artificial Fish Habitats and Artificial Reefs

3.2.15.1 It has been widely recognized that installation of Artificial Fish Habitats (AFH) and Fish Aggregating Devices (FADs) are helpful in increasing fish production. The AFHs and FADs allow congregation of fishes as they provide a congenial micro-clime in the ocean for shelter, food and nursery sites. Both AFH and FADs have been used extensively in Japan and Philippines. Large floating rafts called payaous are being used in some countries for exploiting tunas in the distant waters. Modern payaous are equipped with radar, reflectors and solar powered lights and are anchored in deep waters. Such rafts are now also becoming popular among the fishermen of Tamil Nadu and floating rafts installed about 100 km off Nagapattinam have helped fishermen in increasing their catch of oceanic tunas. Such practices need encouragement through liberalised leasing policies and with funding assistance from the Government.

3.2.15.2 Artificial Reef (AR) is entirely different from Fish Aggregating Device (FAD). FADs are either natural or man-made structures that are used to congregate fish for harvest. The purpose of the artificial reef, however, is to establish a new habitat for fish and other marine organisms to feed and breed. Artificial reef are man-made structures, which are deployed in the sea and targeted to increase coastal productivity in

the long run by providing hard-bottom habitat for growth of sessile organisms and establishing food chains. It increases the chance of post larval settlement of many invertebrates and fish larvae and also the survival of juveniles. The holds, crevices, vertical relief and ledges of the artificial reef structures increase habitat space for marine organisms. AR are generally created to provide habitat or shelter for fish and other marine organisms, serve as a nesting, feeding, breeding, spawning and nursery ground, act as a deterrent to bottom- trawling and other destructive gears, help create fishing grounds and create recreational fishing area. About 45 countries are at present engaged in establishing artificial reefs in their coastal waters. In the past, scrap materials, wooden and bamboo structures, used tyres, broken ships etc were used in the fabrication of artificial reefs. However, due to environmental pollution from some of these material such as tyres and less durability of some other materials such as wooden and bamboo structures many countries now use concrete with steel and high-density polythene materials for the construction of artificial reefs. Artificial reefs too should be strongly encouraged through liberalised leasing policies and financial assistance by the coastal states and with the involvement of fisher community.

Box – 16

Artificial Reefs: M S Swaminathan Research Foundation Experience

In Gulf of Mannar, fish production is declining fast because of over-exploitation and habitat degradation. Bottom trawling, exploitation of berried females and juveniles, coral mining and pollution are the major reasons for the degradation of fish habitats. This resulted in reduced catch/effort ratio. Now fishermen have to put more efforts and inputs to catch the same quantity of fish they caught in the past. As a result, income of the fishermen has reduced substantially. Secondly, catch per unit head of fishers has also decreased drastically. In order to reverse this situation there is need to increase the fishery productivity of the Gulf of Mannar. Fishery productivity of the marine waters can be enhanced by two methods: i) sea ranching and ii) artificial reef. In the present attempt role of artificial reef in increasing fish productivity by providing fish habitat is being demonstrated on an experimental basis. With this background, an artificial reef with four different modules, each 30 in number, was deployed about 14 km offshore from Therespuram village. Fishing community of the Therespuram participates in the development, deployment, monitoring and management of this artificial reef.

Monitoring of the artificial reef using underwater photography showed that most of the modules were covered with a variety of different kinds of seaweeds as well as sessile organisms including soft corals. Apart from this, adults of various species were found taking shelter in the reefs, particularly grouper fish were found in large number within the reef. In addition, local community has also noticed the presence of large shoal juvenile fish of different species in the reef region. All these clearly indicate that this artificial reef is gradually becoming breeding and feeding place of fish, which otherwise indicates that artificial reef can be used as a tool to enhance fishery resources. The Therespuram Artificial Reef Society manages the reef without much problem in collaboration other fisher societies, district administration and Fisheries Department.

Replication of the present artificial reef module has already been started by the Tamil Nadu Fisheries Department. It deployed an artificial reef about 25 km north of Kombuthurai coast near Tuticorin. The Fisheries Development Mission of the Tamil Nadu Fisheries Department provided financial support and MSSRF provided technical expertise in the development of this artificial reef. This reef has three modules, each 35 in numbers. The Gulf of Mannar Biosphere Trust has also allotted funds for the establishment of artificial reef.

3.2.16 Monitoring Changes in Fisheries Environment due to Pollution, Global Warming and Sea Level Rising

3.2.16.1 Global warming and sea level rise are now a reality. Warming and displacement of ocean currents, flooding, sea erosion, upwellings, changes in fish habitats, impact on breeding and spawning of fish species, changes in biogeochemical cycles, species migration, inundation of coastal lands, loss of wetlands and mangroves, increased salinity of rivers, bays and aquifers, increased nutrients are some of the visible consequences of these changes. Therefore, regular and systematic monitoring of changes in the living resources and the ecosystem due to global warming and their impact on marine fishery should be encouraged.

32.16.2 Environmental concerns, fish health and food safety are integral part of sustainable fisheries. However, the burgeoning population, rapid industrialization, increasing urbanization and intensification of agricultural activities are together causing irreparable damage to the marine fisheries resources. Point and non-point sources of pollution are degrading the environment. It should be however borne in mind that while education place an important role in addressing point pollution, the non-point pollution needs more comprehensive measures. To check this damage, regular investigations are necessary, especially in all the "hot spots" of pollution along the coastline.

3.2.17 Ecosystem-Based Fisheries Management

3.2.17.1 The living aquatic resources are an integral part of their ecosystem and management of the ecosystem is a prerequisite for the well being of fisheries resources. In the Ecosystem-based Fisheries Management (EBFM), fisheries management is not seen in isolation from the wider management of the marine environment and it is integrated with other sectors of marine management. In the EBFM, there could be a close connection between the Integrated Coastal Zone Management (ICZM) programmes and the management options. It is a major conceptual advancement and there are pragmatic ways to begin implementation with interactions of institutions and societies. The following steps are proposed for moving towards EBFM:

- Identification of relevant ecosystems, their boundaries and characteristics;
- Agreement of management objectives for each ecosystem by encompassing wider ecosystem factors and all stakeholders;
- Development of long-term and immediate objectives for each ecosystem;
- Establishment of sustainability indicators such as reference points, targets and limits;
- A decentralized approach enabling management measures to be taken that are appropriate to biologically distinct areas; and
- An effective management capability.

3.2.17.2 In consultation with the stakeholders and other interest groups, short-term and long-term objectives must be agreed upon for each ecosystem. One of the best ways to conserve the marine living resources is to establish networks of fully protected marine reserves of no-fishing zones. The potential biological benefits of Marine Protected Area

(MPA) are increase in spawning stock biomass, healthier fish stocks, strong age/size composition, more yield per recruit, restoration of healthy tropic levels and spill over effects to non-protected areas. All these benefits lead to and enhance the long-term sustainability of the fishery. A carefully planned protocol and implementation of EBFM within a logistic timeframe would be necessary to contribute to the protection of marine biodiversity and fisheries.

3.2.18 Human Resource Development and Welfare Measures

3.2.18.1 To sustain Indian fisheries in the third millennium, the quality, technical skills and management of fisheries manpower will have to improve in consonance with the rapidly changing needs of our society, both nationally and internationally. Human Resource Development (HRD) for raising a cadre of experts at various levels to support research and vindicate a sustained development of the fishery sector is critically important to India. Moreover, to maintain the pace of growth witnessed by the fisheries sector in the recent past, the efforts may have to be probably larger and faster by several times more than made earlier.

3.2.18.2 For the overall good of the sector, there should be an All-India Master Plan for HRD and social security in the fisheries sector. Fishers, women and men have so far relied on their traditional skill both for catching and marketing fish. However, they must benefit from the advancement of technology in both these segments. State Governments must undertake regular programmes for training and capacity building for them in collaboration with ICAR/other institutions and this must form an integral component of the Master Plan for HRD in the fisheries sector. Fish for All training centres on the model of the Krishi Vigyan Kendras (KVKs) should be organized for the capacity building of fisher women and men in the technical aspects of all the steps in the capture/culture to consumption chain. In the HRD at the organised level where formal education in given, there is need for more sector-oriented education and greater linkage between the formally educated and the industry. There is need for the HRD of the labouring sections who are responsible for giving value to the resource by catching, processing and marketing it. Given the continued poverty of the fishing communities and the extreme risk in the occupation, more promotional and protective social security

measures at the national level need to be conceived. There is need for greater emphasis on the role of women in the sector and greater care and attention to the health and welfare of the children in the communities. Measures for ensuring the safety of those fishing at sea need to be given greater priority both during the normal operations and during times of unpredictable weather. Further, the traditional skill of fishers should be preserved and protected and the younger generation should be encouraged to continue fishing through education, training and incentives. A well-planned educational programme at grass roots level should be initiated to implement conservation measures through community-based initiatives. Further, the infrastructure in the 3600 fisher villages must also be upgraded on priority to improve the quality of life of fishers through provision of better road connectivity, appropriate housing, commensurate with the harsh conditions near the coast, clean drinking water, electricity and telephone connections etc. The components and financial resources of the Prime Minister's Bharat Nirman should be utilised to benefit these fisher villages on priority, considering that the artesenal and traditional fishers represent some of the poorest section of our population and they undertake fairly hazardous work.

Box - 17

Bharat Nirman

Prime Minister has approved an outlay of Rs. 1,74,000 crores for "Bharat Nirman" which would bring an additional one crore hectare under assured irrigation, connect all villages that have a population of 1000 (or 500 in hilly/tribal areas) with a road, construct 60 lakh additional houses for the poor, provide drinking water to the remaining 74,000 habitations that are uncovered, reach electricity to the remaining 1,25,000 villages and offer electricity connection to 2.3 crores households and give telephone connectivity to the remaining 66,822 villages.

3.2.18.3 **Village Knowledge Centers** should be set up to create awareness and direct access to information on various issues including technology, quality awareness, finance, marketing, processing etc. These centres could provide technology dissemination as well as skill upgradation and could tap the R&D resources provided by the various ICAR institutions. These Village Knowledge Centres could be supported by the State Fisheries Departments and it is proposed to set up one such centre in each State/Union Territory to

give a fillip to fisheries as a source of livelihood and nutrition. 34 such Village Knowledge Centres could be set up at a cost of Rs.50 lakh per centre.

Box - 18

State Institute of Fisheries Technology (Kakinada, Andhra Pradesh)

The State Institute of Fisheries Technology (SIFT) at Kakinada provides an excellent example of state-level institutional support to the fisheries sector. From the original mandate of imparting practical training to marine fishermen in handling mechanised fishing boats with imported gear, SIFT now handles a variety of activities. These activities broadly include training and awareness programmes; induction and refresher courses for officials of the Fisheries Department of the State Government and testing of diseases in fin and shell fishes, antibiotic residue testing, soil and water analysis and testing of other inputs such as feed used in aquaculture.

The SIFT has an attached hostel for outstation trainees, a good library, a state-of-art laboratory for detection of shrimp diseases and testing of antibiotics and other necessary infrastructures. The Institute also generates its own revenue through the fee levied on analysis of animal tissue /soil/water samples and PCR testing of shrimp larvae and adults. SIFT provides a good support to the fisheries sector in the State by meeting the requirements of training, skill upgradation, awareness and other technical advice to the fish farmers and the Department of Fisheries.

3.2.19 Fisheries Legislation

3.2.19.1 For sustainable development of the marine resources the Indian Parliament enacted the Territorial Sea, Continental Shelf, Exclusive Economic Zone and other Maritime Zones Acts in 1976 which led to the establishment of a 200 nautical mile EEZ with effect from January 15, 1997. Since then, India has also enacted a number of other laws and regulations, including the Coast Guard Act, 1978, the Maritime Zones of India (Regulation of Fishing by Foreign Vessels), Act, 1981 and the related Rules of August, 1982. However, we still do not have a legislation to regulate fishing in the Indian EEZ by wholly Indian owned fishing vessels. This aspect needs priority attention of the Government and a comprehensive legislation to regulate the Indian fishing vessels in the EEZ needs to be promulgated. It should prohibit transfer of catch on high seas and provide for the catch to be unloaded only on Indian soil where sufficient spare capacity exists for processing.

3.2.20 Participation in Regional Fisheries Management Bodies and Ratification of International Instruments

3.2.20.1 The 1990s have witnessed many other international agreements and accords relating to the intentions of the international community to achieve sustainable fisheries and to which India has been a party. These agreements represent milestones in international efforts over many years and include Chapter 17 of Agenda 21 of the UN Programme of action which includes programme areas relating to coastal areas and the oceans; the 1992 International Conference on Responsible Fishing (held in Cancun, Mexico) and the 1993 Agreement to promote compliance with International Conservation and Management Measures by fishing vessels on the high seas.

3.2.20.2 India needs to adopt all international fishery and related conventions and agreements. (e.g. Compliance Agreement). In fact, being the largest maritime country in the region we need to set the example. It is also in our strategic interest to do so first. Because of the straddling and migratory nature of valuable stocks like tuna, it is also important to take the lead to strengthen regional fisheries bodies like the Bay of Bengal Programme, which will help to collaborate with the countries in the region, effectively harvest the shared stocks and also widen the use of our national research and technical expertise in the region.

3.2.20.3 The Plans for the Fisheries Sector in the country have so far focused on an integrated approach to optimise production and productivity, augment export of marine products, generate employment, improve socio-economic conditions of the fishermen and fish farmers, conserve aquatic resources and genetic diversity and increase per capita availability and consumption of fish. This focus shows that so far there has been emphasis on development; in other words, more and more exploitation of the resources. However, management, which is often perceived as a response to development, has not received the desired attention. The Code of Conduct for Responsible Fisheries provides an excellent opportunity to integrate management with development and should be implemented with all earnestness.

3.2.21 Separate Department for Fisheries

3.2.21.1 Fisheries, being multidisciplinary in nature, is handled by various Ministries/ Departments in both the Central and the State Governments. This has resulted in problems of coordination since various elements of fisheries are handled not only in the DAHDF but also in Department of Ocean Development, Department of Biotechnology, Ministry of Food Processing Industry etc. Many countries smaller than us have separate Departments of Fisheries in view of the importance of the sector. Many States also have separate Departments of Fisheries. Therefore, it is suggested that a separate Department for Fisheries should be set up by the Government of India as a part of the Ministry of Agriculture. This will ensure appropriate focus and thrust to the sector, which has enormous potential of employment generation, food and nutritional security and foreign exchange earnings.

3.2.22 State Road-Maps

3.2.22.1 ICAR has produced state-wise road maps for Fresh Water Aquaculture Development for each State based on its resources and potentiality. DAHDF should hold discussions individually with these States in collaboration with ICAR to identify the road blocks in implementation of these road maps and identify specific inputs needed to implement the road map in a time bound manner.

3.2.22.2 Fisheries offer immense scope for employment generation and production in A&N Islands and Lakshadweep Islands. Fisheries in these islands has not grown adequately due to absence of infrastructure and problems brought about by destruction of coral life by coral lime manufacturing. The potential of these islands has now been recognised by the Central Govt and it is heartening that series of initiatives have been listed in the Comprehensive Marine Fishing Policy, adopted by the government in November 2004. The recommendations are well founded and reasonable and must be implemented in a time bound manner to benefit the economy of these Islands in general and the livelihood of fishers in particular.

3.2.23 Projections

Subject to a reasonable implementation of the provisions of the recent policies/legislation in the fisheries sector and the implementation of the recommendations made in this Chapter, it should be possible to achieve the following levels by the year 2010:

(i) Increase in fish production from the current level of six million tonnes to about eight million tonnes (approximately 3.2 million tonnes from the marine sector and 4.8 million tonnes from the inland sector, mainly from aquaculture and reservoir fisheries).

(ii) Increase in landing and berthing facilities for fishing vessels from the current level of about 25% to about 50%, which would result in reduction of post-harvest losses (from the present level of about 20% to about 10%) and better return on investment for the marine fishermen.

(iii) Perceptible improvements in hygiene and sanitary conditions of landing and berthing facilities.

(iv) Significant improvements in marketing, packaging and transport infrastructure for domestic marketing. This will reduce the role of middlemen and ensure remunerative price for the fishermen.

(v) Productive utilisation of water bodies such as reservoirs, rivers, inland saline/alkaline lands, and waterlogged areas like beels, oxbow lakes and derelict water bodies. (At least 75% of the water spread area to be brought under aquaculture in place of the present level of about 40%).

(vi) Increase in export earnings from fish and shell fish exports from the current level of Rs. 7,000 crore to about Rs. 14,000 crore.

(vii) Creation of additional employment/self-employment opportunities for about one million people.

3.3.0 Conclusion

3.3.1. Effective exploitation of the estimated harvestable resource of 3.934 million tonnes from India's EEZ would entail extending activities beyond the limits of the area of present exploitation, which is mostly within shore range. Future marine fishing policy needs to be formulated by keeping in mind past experience, the capacity of the present

fishing fleet and the availability of funding for the acquisition of resource-specific vessels. Simultaneously, the emergence of a new world order in global fishery must also be kept in mind. Exclusive access rights have replaced freedom of the seas. This exclusive right is now accompanied by responsibility and sustainable development (Code of Conduct for Responsible Fishing). India must formulate and strictly implement a national Code of Conduct for Responsible Fisheries based on the FAO's code. UNCED's Rio Declaration states that the right to fish is conditional and accompanied by the duty to manage and conserve resources for present and future generations. It has therefore to be ensured, that all stakeholders in the marine sector adopt the path of sustainability. Programmes which aim to develop marine fishery must have in-built components of responsible, sustainable and environment-friendly practices.

3.2.24.2 **Additional** requirements of funds for the period till the end of the Eleventh Plan, over and above the existing levels of budgetary funding, for some of the major recommendations of this Chapter are summarised in the Chapter on "Composite Financial Summary".

3.3.0 Acknowledgement

3.3.1 The Commission organised stakeholders' consultations involving State Govts., scientists, experts, bankers, associations and fishers in Kolkata for inland fisheries, in collaboration with Govt. of West Bengal and in Vizag for marine fisheries in collaboration with BOBP-IGO and Govt. of Andhra Pradesh. Aquaculture Authority of the Govt. of India also organised a consultation in Chennai on the request of NCF, on Brackish Water Aquaculture. The Commission also benefited from the inputs from Consultants/Experts. Their contributions are gratefully acknowledged.

CHAPTER - 4.1

ENHANCING PRODUCTIVITY, PROFITIBILITY, STABILITY AND SUSTAINABILITY

HILL AGRO ECOSYSTEM

4.1.1.0 The State of Hill Agro Ecosystem and Hill Farmers

An Overview of the Strengths, Weaknesses and Opportunities

4.1.1.1 Hills and mountains in India are distributed all over the country with major areas located in Himalayas extending 2,500 km in length and 250 to 400 km in breadth. Himalayas in India are composed of north-western and north-eastern flanks. The Western Ghats, Eastern Ghats, Vindhyas and Deccan Plateau constitute the other major hill agro-ecosystems in the country. **These systems cover nearly 50 percent of the total national geographic area and occur in almost all the agro-ecological zones of the country.**

4.1.1.2 The perennial presence of snow and glaciers in the Himalayan Region provide vast natural reservoirs of fresh water resources and form the **tallest water tower of our planet**, dynamically impacting the weather and climate both spatially and temporally-influencing local, regional and global air circulations. Further, the hills and mountains in the country represent extremely diverse agro-ecological settings, providing scope for producing almost any crop, commodity, livestock or fish of the World, whether tropical, sub-tropical, sub-temperate or temperate.

4.1.1.3 The Hills and mountains **are the richest repository of biological and agrobiological diversity**, and the snow and glacier fields act as reservoirs for terrestrial and aquatic species and snow micro-organisms. Pashmina goats, yak, aromatic rices, landraces of sorghum, veritable fruits and vegetables, multicob maize, saffron, orchids, bamboos, cold water fishes and the like constitute unique germplasm treasures of the hills and mountains. Several rare genes have been used from Himalayas and Western and Eastern Ghats for enriching our major crop species.

4.1.1.4 Besides the major niche resource for hydropower and other productive options, the rich natural resource endowments of the hills and mountains include the bulk of the country's forest resources/reserves, timber and non-timber forest products, besides possessing rich reservoirs of minerals and medicinal and aromatic plants and tremendous opportunities for various kinds of tourism, including agro-ecotourism.

4.1.1.5 The hills have their weaknesses also. The two most important problems in hill and mountain agro ecosystems are: **ecological degradation and high level of poverty**. This unholy alliance between poverty and ecological degradation has not been critically studied and analyzed. Economic deprivation and ecological degradation are not unrelated. For integrating the ecological health with economic growth, an understanding of the poverty-ecological degradation nexus is absolutely essential.

4.1.1.6 As regards opportunities, **the hills' unique biological wealth could be converted into economic wealth** and can confer livelihood security on a sustainable basis. The bio-treasure provides multiple viable options for diversification. But most of the indigenous variability of different species have not been exploited fully. Niche production of high value crops and commodities, including selected livestock species, cold fishes, high quality seeds, organic farming, production of medicinal and aromatic plants are other opportunities.

4.1.1.7 Yet, most of the hill States have high concentration of hunger and their poverty and agricultural progress has not been upto the mark. Given the inherent agro-ecological and economic interdependence of the hills and plains, the hills–plains divide should not only be halted but also urgently bridged. This paper critically analyses the current situation of hill agriculture and of hill farmers, identifies the issues, challenges and opportunities of the agro-ecosystem and finally suggests pathways to congruently achieve enhanced and sustained productivity, ecological security, economic viability, employment security and social justice.

The Himalayan Agro Ecosystem

4.1.1.8 **A highly diverse system**: The North West Himalayan Region (NWR), comprising the States of Jammu and Kashmir, Himachal Pradesh and Uttaranchal, covering 331392 sq km, accounts for 10.08 percent and the North East Himalayan Region (NER), comprising eight States, namely, Anunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura, covering 262179 sq km, accounts for about 8 percent of the country's total area **(Table 1)**. Ranging from tarai plains to low, mid and high hills, upto the snowline traversing through valleys, river basins, sub-tropical to temperate, from cold arid to warm and humid, the Himalayan hills have been classified into five diverse agro-ecological zones.

Table 1. Selected indicators of demography and agriculture in the Hill Agro Ecosystem

Region	Geographical Area (Sq.Km)	Agricultural Land Area ('000 ha)	Total Population ('000 No.)	Total Rural Population ('000 No)	Net Cropped Area Per Rural Person (ha)	Area Under Forest ('000 ha)
North West Himalayas	331392 (10.08)	2072 (1.47)	24,711 (2.40)	19,420 (2.61)	0.11	7183 (10.41)
North East Himalayas	262179 (7.98)	3971 (2.81)	39,078 (3.80)	32,987 (4.44)	0.12	11961 (17.33)
Western Ghats	187144 (5.69)	9249 (6.55)	58137 (5.65)	4100 (0.55)	2.26	4969 (7.20)
Eastern Ghats	184744 (5.62)	5069 (3.59)	33492 (3.26)	2866 (0.39)	1.77	2702 (3.91)
Deccan Plateau	644910 (19.62)	36585 (25.90)	150961 (14.67)	94882 (12.78)	0.39	9493 (13.75)
Hill Agro Ecosystem	**1610369 (48.99)**	**56946 (40.32)**	**306379 (29.78)**	**154255 (20.77)**	**0.37**	**36308 (52.60)**
India	3,287,240 (100)	141231 (100)	1028,831 (100)	742,707 (100)	0.19	69024 (100)

* Figures in brackets are percentage of the country total
Source: Statistical Abstract of India, NBSSLUP

4.1.1.9 **High demographic pressure on the land and other natural resources**: The Himalayan region of India is home to 63.8 million people, 6.2 percent of the country's population. While the population density in the Himalayas ranged from one-fourth to one-half of the national average in the NWR and NER respectively, the net cropped area per rural person in the NWR, NER and the country as a whole, was 0.11 ha, 0.12 ha. and 0.19 ha, respectively, the wide intra-and inter-State differences notwithstanding **(Table 1)**. For instance, the highlands, rising upto snowline, are sparsely populated and constitute the alpine pastures and grazing lands and the economy is based primarily on livestock, whereas the valleys are densely populated with high cropping intensity.

4.1.1.10 Given the continued high dependence on agriculture for employment and the population increase on the one hand and the decline in net cropped area, the agricultural land availability will further shrink. In order to support relatively larger population per unit area of cultivated land, higher cropping intensities were recorded in the hill and mountainous States, 160 in the NWR and 145 in the NER as compared to the national figure of 134.Forests are the major land use and account for nearly 59 percent of the total area of the Indian Himalayas. However, illegal felling and timber extraction for commercial purpose have caused large-scale deforestation.

4.1.1.11 **Low yields**: Hill agriculture in India has so far remained neglected and the Green Revolution has failed to climb the Himalayan heights. The average cereal and oilseeds yields in the hills are about two-thirds of that of the national average **(Table 2)**, although there are considerable inter State differences. Consequently, self-sufficiency in foodgrains could not be attained so far in the hills. Sugarcane yields in the hills are highly depressed. As regards fruits, vegetables and potato, despite the high agro-ecological congeniality of the hills for these crops, the yields were half to two-third of those of the national averages, exception being Tripura which has recorded consistently higher yields for rice, potato, fruits and vegetables as compared with the yields in other hill States as well as with the national average yields. As regards individual fruits and vegetables, the yield gaps between the national averages and NER averages are quite

large, especially for papaya, citrus, banana, apple and onion. Average yields of livestock and fisheries in the hills are also depressed.

Table 2. Yield of important crops (Kg/ha)

Particulars	North Western Hills		North Eastern Hills		India	
	TE* 1991	TE 2003	TE 1991	TE 2003	TE 1991	TE 2003
Rice	1887	1799	1328	1532	1745	1996
Maize	1459	1592	1179	1278	1509	1909
Wheat	1550	1605	1336	1274	2265	2700
Pulses	513	626	453	544	554	565
Oilseeds	628	484	580	605	664	724
Sugarcane	59225	40141	39185	38451	65699	63451
Potato	13792	12005	7352	8513	15955	18346
Vegetable	2174	12391	7038	10956	4153	15037
Fruits	3443	3347	7646	8828	9961	11823

Source: CMIE Agriculture; Agricultural Research Data Book 2003
*TE: triennium ending

4.1.1.12 **Foodgrain crops continue to predominate the agriculture sector despite slight drop in area due to diversification towards horticultural crops:** About 75 percent of the gross cropped area of entire Himalayan region, 77.4 percent in the NW and 64.4 percent in the NE, is under staple food grain crops (**Table 3**). The analysis shows that, the production of food grains has not declined in the Himalayas as much as is often thought of and the per caput production in the hills, especially in the NW, is almost as high as in the rest of the country **(Table 4).** In the Western Himalayan region, wheat is the main crop and rice, maize, millets, barely and buckwheat, pulses and oil seeds are also widely grown. However, Uttaranchal is unique in the sense that it has more area under millets and pulses. In addition, potatoes and variety of vegetables, off season vegetables, spices, and fruits are also widely grown in the Himalayas. In the North East, rice is the staple food crop occupying about 81% of the cropland area under food crops. In non-rice fields, often diverse mixture of 8 to 10 crops is grown in a mixed farming system by the NE farmers. Crop survey assessments have shown that, although

continuing to be the most preferred crops in certain areas, the area under paddy and maize is declining in the Himalayas as a whole but area under wheat remains unchanged.

Table 3. Changes in the percentage share of major crop groups in total area in various hill States/regions

States	Foodgrains		Fruits		Vegetables	
	1990-91	2003-04	1990-91	2003-04	1990-91	2003-04
Western Hill						
Himachal Pradesh	80.27	75.81	14.42	20.29	3.55	3.15
Jammu &Kashmir	83.37	79.00	11.17	12.75	3.88	4.56
Uttaranchal	79.82	77.39	11.93	14.84	4.52	7.05
Total	**81.07**	**77.40**	**12.49**	**15.87**	**4.01**	**5.06**
Eastern Hill						
Arunachal Pradesh	76.19	68.71	8.18	15.82	6.92	7.91
Assam	71.30	65.61	1.90	2.73	5.83	5.84
Manipur	81.00	55.74	9.40	8.10	5.90	34.75
Meghalaya	55.46	49.70	10.08	9.06	10.79	13.42
Mizoram	78.35	75.27	11.77	17.27	7.59	6.18
Nagaland	83.14	66.97	2.48	7.96	3.90	8.38
Sikkim	64.54	60.32	5.07	9.76	5.00	11.27
Tripura	65.54	62.24	10.11	5.44	6.82	7.31
Total	**71.08**	**64.41**	**3.76**	**4.78**	**6.12**	**8.14**
India	**68.82**	**65.94**	**1.55**	**2.14**	**3.01**	**3.29**

Source: CMIE Agriculture; National Horticulture Board, Agricultural Statistics at a Glance

4.1.1.13 The reduction in area under foodgrains is largely because of shift towards cash crops like fruits and vegetables. As seen from **Table 3,** between 1990-91 and 2003-04, area under fruits in the hill States increased by about 28 percent and under vegetables the increase was 26 percent in the North West and 33 percent in the North East.

4.1.1.14 **High livestock density:** Indian Himalayas support about 50 million domestic animals (six animals/ha net sown area); cattle (47.5%), goats (15.8%), buffaloes (12.3%) and sheep (10.4%). The livestock density per 100 ha net sown area in the NW Himalayas is 916 and in the NE Himalayas is 499 against 341 for the country as a whole **(Table 4)**. Per caput milk production and availability in the NWR is particularly high, in Jammu & Kashmir the availability is over 300 ml/day. The mountains have a niche for

livestock based livelihoods that one finds in the large areas under rangelands and highland pastures. A large proportion of livestock species is raised under mixed cropping systems. The land holdings are small and livestock substantially supplement the family income and livelihood security. Further, livestock are major source of fuel energy and manure (animal dung and bedding material) or else the number of wood (fuel) headloads carried everyday for heating the pot would increase considerably. An integrated crop-livestock-forest farming system thus holds the key for sustained development of the hill agro-ecosystem.

Table 4. Socio-economic indicators

Indicators	North Western Hills	North Eastern Hills	India
Agricultural workers as % of all workers (2001)	59.29	57.95	58.41
Share of Agri. in NSDP at 1993-94 prices (2001)	25.89	22.18	22.10
Per capita income (Rs.) (at 1993-94 prices)	9263	9735	10964
Percent irrigation of NSA (2002-03)	37.97	20.37	38.75
Foodgrain prod/capita (kg)	158	152	169
Milk prod/capita (kg)	118	27	82
Fruits prod/capita (kg)	66	67	42
Vegetable prod/ capita (kg)	85	105	84
Fertilizer use (2002-03)	64.76	25.27	88.93
Institutional credit (Rs. per person) (2002-03)	283	158	374
% of operational holding up to 1 ha (1995-96)	72.62	58.60	61.58
Av. size of holdings (ha)	0.97	1.92	1.41
Livestock/'00 ha NSA	916	499	341

NSDP= Net State Domestic Product; NSA= Net Sown Area; Source: Statistical Abstract of India; Agricultural Statistics at a Glance; NSSO (1996), CSO, CMIE Agriculture; Livestock Census

4.1.1.15 Over the past one decade, the number of cattle has started declining while the buffalo population is increasing. Similarly, the number of sheeps is declining but the number of goats is increasing. Many reports have been indicating a declining trend in the livestock holding per household but because of increased families overall numbers may not have changed much. The indicators have therefore an important message – the

recognition by hill farmers that maintaining larger livestock holding is no longer profitable. When herd size is reduced there also has been simultaneous shift from local breeds to hybrid cattle and other animals, which induced widespread stall feeding.

4.1.1.16 **Fish potential largely underexploited:** Fish and fisheries, representing more than 100 species and various water body systems such as reservoirs, rivers and lakes and aquaculture involving air breathing fishes are important sources of proteinaceous food, employment and additional income in the hills. However, these resources have remained highly under exploited and there is atleast 4-5 times gap between the potential and the realized yield. For each group of fisheries, specific strategies for enhanced productivity and income should be developed .For instance, the development of open water fisheries involving ranching of hatchery produced seed of Golden Mahseer, Snow trout and Brown trout in the potential stretches of river and the development of lakes of these fishes at mid to high hill altitudes would constitute an important agro-economic activity.

4.1.1.17 A four-fold strategy involving preservation of existing fish stocks, promotion of natural propagation, artificial propagation of selected fish and promotion of fisheries cooperatives would greatly improve development of open water fisheries. Further, integrated fish-cum-livestock farming can yield up to 4-5 tons/ha/year of fish, thus constituting a substantial supplementary food and income. Special areas of interest in hill fisheries should include culture of Exotic trouts, culture of Snow trout and Mahseer, seed production of Mahseer, Snow trout and Rainbow trout, running water culture of common carp, ranching of seed of Mahseer, Snow trout and Exotic trouts in natural waters, Sport fisheries, Ornamental fisheries, high density culture in cages and pens in reservoirs and conservation of important fishes in lakes and rivers. Attention has to be paid to proper seed and feed production, as well as to the efficient management of cubic volumes of water.

4.1.1.18 **Poverty and Undernutrition still high in NER and in Uttaranchal:** Among the 25 million people that inhabit the North Western Himalayas, a large percentage are hill, mountain and highland farming communities. They sustain largely on subsistence farming which they practice on marginal rainfed and some irrigated farmlands occupying 14.5 percent of the total area of the North West Himalayas. Rest of the Himalayan landscape, includes rangelands, pastures, wasteland, the so called bush land - the grazing areas and the forests; all these account for nearly 70 percent of the North West Himalayan area. Another about 15 percent is under permanent snow cover and rocky mountains and serves as perennial source of clean water to the hill people as well as to the rest of the nation.

4.1.1.19 Agriculture accounts for about 26 percent of NSDP in the NW Region (**Table 4)**. Nearly 60 percent of the people in the NWR are dependent on agriculture for their employment. Average land holding in Himachal Pradesh is about 1.2 ha, followed by 1.0 ha in Uttaranchal and 0.8 ha in Jammu and Kashmir.

4.1.1.20 The North Eastern Region (NER) has average land holding of 1.92 ha **(Table 4),** ranging from 0.6 ha in Tripura to 4.82 ha in Nagaland, against the national average of 1.41 ha. The NER has remained underdeveloped and inspite of interventions at the national level, speedy socio-economic development has not taken place. About 65% of the NER is covered with hills and basins, 22% by Brahmaputra valley and 13% by Meghalaya plateau. The Region has a total population of over 39 million, with Assam accounting for 70 percent of the Region's population. Nearly 58 percent of the total workforce is in agriculture and the sector accounts for 22.2 percent of the NSDP (**Table 4)**, analogous to the corresponding national averages. A large proportion of the population in the NER is tribal and depends on agriculture and land-based activities.

4.1.1.21 Although per capita income in the hills was only slightly lower than in the rest of the country, there were significant differences between the two regions in poverty and hunger levels. While for the country as a whole, the poverty level dropped from

about 36 percent in 1993 to 26 percent in 1999/2000, in the Jammu and Kashmir and Himachal Pradesh it dropped sharply by about 22 and 21 percentage points, but remained stubbornly high in the NER, dropping only by about 5 percentage points and exceeded 33 percent in 6 of the 8 NER States as also in Uttaranchal. **The level of hunger (% of undernourished populations) followed the poverty pattern (Table 5), in being particularly high in the NE States.**

Table 5. Economy of India's Hill States/Regions

State/region	% of population below poverty line		Change	Undernourished Population (%) 1996
	1993	1999/2000	1993-1999/2000	
Western Hill				
Himachal Pradesh	28.44	7.63	-20.81	24
Jammu &Kashmir	25.17	3.48	-21.69	10
Uttaranchal Hills		36.00		31*
Total				
North Eastern Hill				
Arunachal Pradesh	39.35	33.47	-5.88	52
Assam	40.86	36.09	-4.77	47
Manipur	33.78	28.54	-5.24	30
Meghalaya	37.92	33.87	-4.05	51
Mizoram	25.66	19.47	-6.19	41
Nagaland	37.92	32.67	-5.25	28
Sikkim	41.43	36.55	-4.88	57
Tripura	39.01	34.44	-4.57	50
Total				
India	**35.97**	**26.10**	**-9.87**	**35.0**

Source: Statistical Abstract of India; Agricultural Statistics at a Glance; NSSO (1996), CSO, CMIE Agriculture, *World Food Programme, Uttaranchal, 2000

4.1.1.22 **The potential of agriculture in the NER remains largely unrealized**. The agricultural production system is predominantly rainfed, mono-cropped at subsistence level. Shifting cultivation (Jhum) is practiced in all the States, except Sikkim, in steep hill slopes with a shifting cycle of 2-3 years. Crop production practices fall under two broad categories viz. (a) settled farming in the plains, valleys and terraced slopes and

(b) shifting cultivation in unterraced hill slopes with "slash & burn" method. Modernization of agriculture has escaped as evidenced from the poor adoption of modern technologies, low consumption of fertilizers and other indicators. In addition to sluggish growth in agriculture, resource degradation and environmental safety issues have also become major concerns of the planners and policy makers. Out of the constraints to agriculture development, the following are unique to the region:

- Primitive agro-economic system in hilly terrain under shifting cultivation leading to land degradation. Limited exploitable water balance in the plains and low ground water potential in the hills have resulted in low level of irrigation. The management of land and water resources, therefore, assumes enormous importance in improving the agricultural economy in the region.

- Inappropriate land tenure (community land for Jhum) and private property rights system in the hilly areas discourage investment and private sector participation in agriculture development. High cost of infrastructure development and relatively low return delays modernization. Such concerns are essentially linked with policies on land reforms, institutional reform, banking and credit and effective governance.

4.1.1.23 In the NER, shifting cultivation or "jhum" accounts for 85 percent of the cultivated area and supports over 2.2 million people, largely tribal communities. The tribal families once food self sufficient, are now barely able to produce enough food for the whole year. The swidden farming is a response to the ecological limitations of humid tropical region and it exhibits a successful human adaptation mechanism to farming in the humid tropics. The swiddeners have developed an agroecosystem that is diverse and is able to respond successfully to the microclimatic diversities and climatic uncertainties. **Despite advocacy and promotion of Jhum substitution technology packages, the system continues. The ecological prudence of Jhum farming families should be combined with techniques which could help enhance the productivity and sustainability of the system.**

Western Ghat Development Programme

4.1.1.24 The Western Ghat Development Programmes (WGDP) have been in operation from the Fifth Five Year Plan in designated hill areas/ Western Ghat talukas. Under these programmes, Special Central Assistance (SCA) is given to the designated areas in order to supplement the efforts of the State Governments in the development of these ecologically fragile areas. The 161 Ghat talukas - 62 in Maharashtra, 40 in Karnatka, 31 in Kerala, 25 in Tamil Nadu, and 3 in Goa (**Table 6**), covering an area of 187,144 sq. km., account for 5.7 percent of the country's total geographical area.

Table 6. Salient features of the Western Ghat area

State	No. of Talukas	Total area (sq. kms.)	In terms of State area (%)	Population (Lakh)	Population density (per sq. kms.)
Goa	3	1721	47	1.72	100
Karnataka	40	46029	24	87.99	191
Kerala	31	27981	72	158.00	565
Maharashtra	62	58400	18	124.20	213
Tamil Nadu	25	26000	20	75.83	292
Total	161	160131		447.74	280

4.1.1.25 The approach and strategy of the programme have evolved through the Plans. During the Fifth Five Year Plan, the emphasis of the programme was on the economic well being of the population in hill areas and exploitation of resources of the hilly region. During the Sixth Plan the emphasis was shifted to eco-development. Apart from the shift in the emphasis from beneficiary oriented schemes to eco-conservation and eco-development, a notable step initiated by the Planning Commission was the involvement of universities and research institutions located in the Western Ghats region in the programme.

4.1.1.26 During the Eight Five Year Plan, the programme focused on involvement of the people and meeting their basic needs through improved management of their land and water resources. **Presently, the WGDP operates on the following principles**:

- **Maintenance of ecological balance,**
- **Preservation of genetic diversity,**
- **Restoration of ecological damage caused by human interaction, and**
- **Creation of awareness among the people about ecological degradation and securing their active participation for the eco-development schemes.**

The programmes and activities undertaken over the years are summarised below.

4.1.1.27 **Development of cultivable wasteland**: One of the main objectives of this scheme is to develop cultivable wastelands in the Western Ghats Region, which are lying unused and when reclaimed will be brought under cultivation of horticultural/plantation crops. The development of land under this sector will be confined to the lower region where scarce wild vegetation exists, without disturbing the ecology in the region, so that immediate benefit could be derived by farming community from land development and plantation of horticultural crops. The following schemes are under implementation: (i) land improvement for soil and water conservation, (ii) assistance for promotion of horticulture crops, (iii) stone wall fencing, (iv) dryland horticulture, and (v) homestead gardens.

4.1.1.28 **Conservation activities***:* Soil conservation aspects on watershed basis receive maximum attention. Maharashtra has initiated the process of implementing the Western Ghat Development Programme on the basis of integrated development of watersheds from 1983-84, which include: (i) land development activities, (ii) water harvesting and erosion control structures, (iii) soil conservation, (iv) water conservation, (v) drainage line treatment, and (vi) plantation.

4.1.1.29 **Animal husbandry**: The role of the animal husbandry sector in the overall development of the Western Ghats is to complement the eco-conservation and eco-restoration efforts and also to open new avenues of self-employment generation through improved animal husbandry practices. The various programmes which are being undertaken under this sector are: (i) incentives to dairy farmers for renovation of cattle

sheds, (ii) incentives for green fodder cultivation, (iii) supply of fodder mini kits, (iv) animal health cover and breeding, (v) training facilities to dairy farmers, (vi) financial assistance for purchase of milch animals in the watershed area, (vii) opening of artificial insemination centres, (viii) poultry (establishment of backyard poultry), piggery and rabbit development, and (ix) artificial insemination for upgrading cattle and distribution of cross bred bulls and cows.

4.1.1.30 **Fisheries:** The Western Ghats with their innumerable water bodies, small and large, offer good scope for inland fisheries including riverine fishery. Development of fisheries in reservoirs and big and minor tanks and renovation of ponds are some of the important programmes included under fisheries sector. The programmes implemented are: (i) construction of fish ponds, (ii) subsidy to new ponds construction, (iii) development of fisheries in reservoirs, tanks, (iv) renovation of ponds, (v) riverine fishery development, (vi) assistance to fish cooperatives, and (vii) developing infrastructure etc.

4.1.1.31 **Horticulture***:* Horticulture assumes greater importance in view of the limited water availability, and also from the viewpoint of economic development and protection of the environment. Under WGDP, the objective of horticulture development activities is to bring the vast stretch of drylands under perennial crops thereby developing the eco-system and upliftment of the socio-economic status of the poor farmers. Various horticulture programmes are being implemented, depending upon the needs and demands in the local areas. The important programmes are: (i) supply of horticultural plants, (ii) training of farmers in horticulture, (iii) establishment of school gardens and community gardens, and (iv) mushroom production and spices project.

4.1.1.32 **Forestry***:* Denudation of the thick forests in Western Ghats has been a serious problem. Construction of huge irrigation / hydro-electric projects and expansion of agriculture without commensurate afforestation has adversely affected the ecology in that area. Therefore, the accent of the forestry programmes has been on afforestation in forest lands as well as on private lands. The main programmes under forestry sector are: (i) eco preservation of forests, (ii) heterogeneous forest vegetation by profuse mixed

seedlings, (iii) conservation and protection of degraded forests, (iv) medicinal plant conservation, and (v) wild life management.

4.1.1.33 **Minor irrigation:** The objective of this programme is to ensure proper and regular supply of water for irrigation so as to raise living standards and economic condition of the people by helping to increase their agricultural productivity and production. There is ample scope for developing minor irrigation sources in this region. Constructions of pickups, vented dams etc. can create irrigation potential and consequently bring more area under irrigation. Creation of Openwells, Borewells / Tubewells and Lift Irrigation schemes are the main works.

4.1.1.34 **Infrastructure development:** With a difficult terrain compounded by high rainfall, many places in the Western Ghats become inaccessible due to swellen rivers, land slides, slushy mud roads etc. during the rainy season. The main demand of the population in the area is for all weather roads and foot bridges. The lack of communicational facilities obviously hampers timely attendance of health and educational services. The movement of local produce and other consumer items to these villages is also hampered. Construction of bridges and construction and improvement of rural roads have been the major programmes.

4.1.1.35 **Sericulture***:* Sericulture was included as a scheme in the Western Ghats Development Programme during the Sixth Five Year Plan. Limited infrastructure facilities like basic seed farms, industrial silkworm seed grainage, establishment of chawkie rearing centres, pilot extension-cum-training centres and demonstration-cum-training centres have been created. Although still inadequate, these facilities have generated awareness about the Sericulture programme in the rural areas resulting in a larger number of farmers enthusiastically adopting sericulture activities.

4.1.1.36 **Village and Small industries:** In order to generate employment opportunities for the people in the Western Ghats, various schemes are being undertaken through different NGOs. Some of the schemes include employment generation activities

for rural women, establishment of small and micro enterprises in the foot hill regions, dairy, poultry, bee-keeping, curry powder units, vegetable cultivation and tailoring etc.

4.1.1.37 **Non-conventional sources of energy:** This programme was taken up in 1993-94 with a view to promoting non-conventional sources of energy in the Western Ghats as this would to some extent relieve the pressure on forests for fire wood. Devices like solar water heater, solar lanterns, installation of bio-gas plants, wind mills, smokeless choolhas, improved kerosene stove etc. are being promoted under this programme.

Eastern Ghats Development Programme (EGDP)

4.1.1.38 The Eastern Ghats region is a part of the Peninsular Plateau comprising the Western Ghats, Eastern Ghats, North Deccan Plateau, South Deccan Plateau and Eastern Plateau. The region is a broken chain of hills that extends from Orissa to Tamil Nadu. The Tamil Nadu part of Eastern Ghats is divided into three physiographic areas: coastal, central and southern spanning three districts in coastal Eastern Ghats, 9 districts in central Eastern Ghats and four districts in southern Eastern Ghats. The major hills in Eastern Ghats are: a) Javadhi hills (Vellore district), b) Pachaimalais (Trichy & Salem districts), c) Kollimalais, Servarayans and Bodamalais (Salem district), d) Kalrayanhills (Salem and Villupuram district), Chitteris and Melagiris (Dharmapuri).

4.1.1.39 The Eastern Ghats cut through by the four major rivers of southern India, the Godavari, Mahanadi, Krishna, and Cauveri. The Ponnaiyar and Palar rivers flow from headwaters on the Kolar Plateau eastward through gaps in the Ghats. The Eastern Ghats is prone to very strong rainfall in the NE monsoon. **Traditional water harvesting structures to conserve the rainwater abound in the Eastern Ghats**. One such example is the Korambu, temporary dam stretching across the mouth of channels, made of brushwood, mud and grass. It is constructed to raise the water level in the canal and to divert the water into field channels for irrigation.

4.1.1.40 The Eastern Ghat is highly significant in terms of its bio-diversity. Extensive field and literature survey of trees in Eastern Ghats yielded 528 tree taxa under 271 genera belonging to 75 families out of the total 2500 species of flowering plants. Medicinal plant diversity is also very high. Out of the total flora of Andhra Pradesh, 1800 are estimated to be medicinal plants, 685 of which are located in certain areas which have been earmarked as Medicinal Plant Conservation Areas. There is also rich diversity in landraces of several food crops. The Eastern Ghat districts of Khammam and West-Godavari in Andhra Pradesh are rich in sorghum diversity, particularly landraces. The Eastern Ghats are rich also in mineral resources, but intensive mining is destroying large parts of the agricultural land. Various economic activities should be balanced to ensure sustainabilities.

4.1.1.41 Because the hills and the surrounding plains are densely populated, accessibility to the forests is rather easy. **The forests in the Eastern Ghats are the most affected, compared to the Western Ghats and Himalayas, as they are experiencing heavy demographic pressure**. A study featuring the forest degradation in Kolli hills which is a part of the Eastern Ghats revealed an observed loss of about 25 ha in dry evergreen forest; and about 35 and 1306 ha loss was observed in the semi-evergreen and dry deciduous forests, respectively. About 69% of the present forest area is under low risk category, 25% is under medium risk category and about 2% (581 ha) is under the high-risk category. **Severe fuel-wood extraction, illegal felling and intensive grazing are the main reasons for this change.**

4.1.1.42 An ethnobotanical study was carried out during 1995-2001 in the Eastern Ghats region of Andhra Pradesh covering the districts of Chittoor, Cuddapah, East and West Godavari, Guntur, Khammam, Krishna, Kurnool and Visakhapatnam. The study revealed the tribal populations of Chenchus, Erukalas, Koyas, Konda Reddis, Lambadas (Sugalis), Naikpods, Nukadoras, Valmikis and Yanadis. The tribal communities are associated with cultivation and use of several endemic species and have discovered the ethnic uses of 9 epiphytic and 11 terrestrial orchids. A total of 29 accessions of local landraces of Sorghum were collected most of which was used for food. **Identifying and**

conserving the useful flora can be done only with the close cooperation of these tribal communities.

The Deccan Plateau Development Programme (DPDP)

4.1.1.43 Deccan Plateau covering 644910 sq. km, about 20 percent of the country's total area, stretches across Andhra Pradesh, Karnataka, Southern Maharashtra, Southern MP and TN. About 70 per cent of the population work in agriculture. Nearly half of these are small farmers cultivating as little as two acres. The other half work as hired agricultural labourers for larger farmers. Poor soils and low and erratic rainfall have resulted in poor productivity in the region.

4.1.1.44 In the Deccan plateau, the areas that fall in the rain shadow regions of both the Western and the Eastern Ghats, ensuring adequate availability and quality of water is a major priority. Rainfall is lesser than many other areas of the country, coming to as low as 500mm a year; its pattern fluctuates widely and its spread is also very erratic.

4.1.1.45 However, to survive the erratic water availability, the traditional communities have developed a network of water harvesting structures and intricate irrigation networks. For instance, the Kohlis, who are a small group of cultivators residing in the district of Bhandara, Maharashtra, built some 43,381 water tanks over several centuries. which formed the backbone of successful irrigation in the area. So is the community managed Phad Irrigation system that existed in Maharashtra.

4.1.1.46 There is also considerable diversity in crops and crop sequences where traditional crops such as millets and cumbu met the nutritional as well as cultural requirements of the local communities. However, they are being replaced steadily by cash crops to meet the market requirements. **Replacement of cultures and traditions has replaced local and adapted agro biodiversity as well.**

4.11.47 The following development programmes deserve high priority both for Eastern Ghats and Deccan Plateau:

a) **Judicious water management of surface water and groundwater and re-vitalisation of traditional water harvesting structures and water saving measures have to be identified and upscaled**. Irrigation measures to supplement rainfall are very important for crop production stability. Watershed development needs to be more holistic and should integrate should biodiversity conservation. Floods and droughts occur frequently in the Eastern Ghats, which should be managed with adequate knowledge through early warning systems and flood mitigation measures.

b) **Soil conservation** should be followed encompassing (i) adequate soil cover to prevent exposure to direct sun, rain and wind, (ii) mixed farming, (iii) rainwater conservation and (iv) adequate regenerative capacity of the soil so that it could manure itself.

c) Instead of focusing only on hydroelectric power, **alternate measures of energy development** – wind, sunlight, need to be identified and upscaled. The development and use of **biofuels** generating crops as part of wasteland development is highly recommended.

d) The shift away from crops such as sorghum and millets which are ideal for the dry parts of the Deccan and which used to be a part of the consumption pattern of the residing population needs to be rectified. The increased emphasis on rice and wheat (brought about by the wide scale availability through the PDS) must be corrected by **diversifying the PDS through the inclusion of locally-produced grains.** Adequate market access is essential to revitalize crops such as the millets which are disappearing from the food basket.

e) **Agro-biodiversity exploration, conservation and enhancement are a top priority** both in the Deccan and the Eastern Ghats. This has to be set in the context of local cultures and traditions.

f) **Involve the local people and local governance mechanisms**, particularly the Panchayats, for conservation through community action by the formation of cooperatives and groups and for realization of the Farmers' Rights provisions.

4.1.2.0 Horticulture-led Transformation of Hill Agriculture

4.1.2.1 As seen from **Table 3,** between 1990-91 and 2003-04, percentage areas under fruits and vegetables in the NW Himalayas increased from 12.5 to 15.9 and from 4.01 to 5.06, respectively. In the NE Himalayas, the corresponding area percentage increases for fruits were from 3.8 to 4.8 and for vegetables from 6.12 to 8.14. These increases in relative terms were much higher in the hills than in the plains. As seen from **Table 4**, per caput production of fruits in the Himalayas is thus now about 60 percent higher than that in the rest of the country. Likewise, per caput vegetable production in the NER is about 25 percent higher than that in the country as a whole.

4.1.2.2 **The entire Himalayan range is a favourable agro-ecosystem for growing a wide range of fruits, vegetables, medicinal and aromatic plants and other cash crops**. Small areas with their own micro climatic conditions provide suitable sites for growing particular crops, such as apples, citrus fruits, walnuts, plums, peaches, bananas, mangoes and pineapples; vegetables such as tomatoes, radish, potatoes, cabbage, cauliflower and several local and introduced temperate vegetables, other cash crops like ginger, chillies, cardamom and saffron; and flowers such as orchids, gladioli, marigolds and chrysanthemums. The fruits and vegetables cover around 16% of the crop land. **The present trends towards rapid expansion of horticultural crops will have positive implications for improving food and economic security of hill farmers.**

4.1.2.3 In some of the States, in Himachal Pradesh for instance, apple accounts for 76 percent of the State's total fruit production, horticulture will lead the future agricultural and economic growth**.** The fruit based production system has helped alleviate poverty of many hill farmers of Himachal. Over 86% of the population is now literate and there is almost 100% literacy below 14 years. From the viewpoint of employment and income generation, fruit and vegetable farming are high quality options for hill farmers. The high quality of production options is also evident from the backward and forward linkages generated by them. Fruit crops farming in Himachal has helped convert the non-viable subsistent farming into viable farming through harnessing of appropriate niche potentials of marginal mountain lands. **However, the overdependence on apple may not be desirable.**

4.1.2.4 With the diversification of farming in the hills, however, **many second generation issues of unsustainability, ecological compatibility and social, gender, ethnicity and equity sensitivity are emerging**. The landmark study " Warning signals from the apple valleys", analyses one such problem of pollination failures making a dent on productivity of apples in Himachal. But, this has also brightened the prospect of installing honeybee hives in and around the orchards, not only increasing pollination and fruit set in apples, but also generating substantial additional income, employment and nutrition through enhanced honey production thus converting challenges into opportunities. In fact, honey production in Himachal Pradesh has increased to about 1,200 tonnes annually and it has become an important source of income and employment also in Jammu & Kashmir and in Uttaranchal.

4.1.2.5 Among plantation crops, the development of smallholder tea cultivation in Assam spread over 40 thousand ha is an emerging phenomenon in the NE region, which has potential for converting to '**Organic Tea'. Large cardamom** farming as an under storey crop in hill slopes of Sikkim is a unique traditional production system conferring high ecological stability. As a high value cash crop in Sikkim, it generates employment for 80-100 days per ha **(Box 1).** Popularisation of **seabuckthorn** in cold arid Himalayas and in China is yet another success story **(Box 2).** These success stories are quite replicable and

detailed location-specific plans and activities for their replication, involving various stakeholders, should be formulated and implemented.

4.1.2.6 Loose skin mandarin orange is a unique high value crop in the NER. Broadly named as 'Khasi orange', it grows well both in Assam valley as well as in the hill slopes. The fruit quality is excellent, and unlike Nagpur orange which is entirely on budded plants, the plantations in the NER are raised from seedlings only. Due to neglect, the orange trees are suffering from malnutrition and disease and insect infestations, resulting to severe decline. Still in certain pockets trees are highly productive, and if due care is taken, orange industry can revive back with a real boost to the agricultural economy of the region. Under the Horticulture Technology Mission, considerable expansion of passion fruit area (3885 ha) has taken place, particularly in Mizoram, Sikkim and Nagaland. Processed passion fruit has a good export market and a few processing units have also been established.

Box 1

Forest Floor Farming of Cardamom in the forests of Sikkim

The subsistence dry land farming on sloping crop lands of north Sikkim should be presenting the poverty cum resource degradation scenario for farmers. However, ethnic mountain farming communities of Sikkim had chosen a wild high value spice –cardamom for barter and cash income source. The farmers started farming it under the forest floor like any perennial crop. For decades now, cardmomis their high value cash crop grown under the shade of natural forests as well as underalder afforestation.

Almost 75%farmers of north Sikkim have replaced the food grain agriculture on their farmlands with cardamom and alder tree plantations. Cardamom-alder forestry plantation provided permanent green cover to thousands of hectares i.e. 23% of farmland. The contribution of cardamom farming to livelihoods ranges between 40-88%. Four key factors which make cardamom farming on marginal sloping lands useful are:

- It is ecologically adapted to farming on sloping lands and forestry system and the plants maintainpermanent green cover on forest floor.
- Cardamom farming ensures ecological stability to fragile mountain slopes by requiring farmers to maintain a good forest cover of nitrogen fixing alder trees.
- Cardamom is farmer domesticated, low volume-high value cash crop and it generates employment for minimum of 80-100 days per hectare.
- Globally almost 90% of cardamom is produced in Sikkim and its neighbouring valleys of Nepal and Bhutan alone, therefore, the region is the

4.1.2.7 Apple was introduced in rain shadow belts of Arunachal Pradesh, mainly in Kameng district where annual rainfall is around 900 mm. It is reported that about 5000 ha was brought under apple and quality of fruits was excellent. Unfortunately, there was no after care and science-based back stopping, resulting in poor performance. Under high rainfall condition even at 6000 to 7000 ft altitude of NEH (upper Shillong in Meghalaya, Phutsero of Nagaland etc) apple was not a successful crop and therefore the niche found in Arunachal Pradesh needs to be nurtured to meet the demand of local market. Apple industry in Bhutan with a new set of varieties is showing promise. Snow clad dry hills of Sikkim are also suitable for apple production.

Box 2

Forest as an orchard

Seabuckthorn provided a breakthrough in combining strategic desert conservation needs of China with local economic needs in north and northwest China. Seabuckthorn plantations and R &D in post harvest processing of wild fruit into variety of valuable products including medicines, have made marvellous impact on both the household and regional economy. China has now well managed seabuckthorn forests covering more than one million hectares and by the end of 2004,seabuckthorn agroenterprise was a multi billion agroenterprise in China.

Seabuckthorn success story is one of the outstanding examples of development approaches for hills which combine horticulture and forestry to promote an economically and ecologically productive hill farm economy. A forest of wild seabuckthorn bushes represents characteristics of a good forest on the sloping lands and river valleys, as well as economically productive features of a fruit orchard. Local farmers of the areas have strong economic interest in maintaining the seabuckthorn forests and government institutions have long term strategic (ecological) interests in promoting it.

LEH BERRY brand name in India, is a result of replication of the Chinese success story. Ten years of efforts of international agencies and encouraging private investment has led to the establishment of RS 100 crore LEH BERRY brand agro-enterprise in India since the year 2001, benefiting farmers of Ladakh (Nubra valley)in J&K and tribal districts of Himachal Pradesh.

4.1.2.8 It is very essential to plan for development of those crops only which are easy to grow and are well adapted in the prevailing agro-climate. An analysis of productivity of major fruit crops in different States and other comparative advantages in terms of market accessibility and demand should be taken as the basis/criteria while formulating the area expansion programmes. For example, crops like banana, pineapple and orange are grown in all the North East States. But the productivity of these crops vary vastly in different areas. **Perusal of yield data and other parameters like net income per ha, market demand, peak season of arrivals and price trend in major markets should be kept in mind to regulate the production-marketing chain.**

4.1.2.9 Ginger is already a well established cash crop in Meghalaya and Mizoram and the crop received developmental support to possible extent. Large-scale seed production of improved varieties like Nadia in Meghalaya, and marketing support in Mizoram encouraged ginger cultivation. There is still a good scope for improving the productivity in ginger and some processing support (dehydrated ginger of low fibre containing variety) may boost the crop further. Ginger should be encouraged in Assam and Arunachal Pradesh, where productivity is quite good and ample scope for its improvement remains. Sikkim has come up well with ginger production in more recent years. APEDA report shows that ginger export from NER has already started and during 2001-02 about 1640 mt were exported. **Export-led growth of ginger deserves focused joint attention** of the concerned State Governments, SPS and quality assurance authorities, private sector and NABARD and other banking institutions to particularly promote WSHG activities.

4.1.2.10 Out of all vegetables, potato is the most important one. Potato yield is quite high in Tripura and the State has already achieved the distinction of commercially producing TPS. In the plains, potato is harvested in winter months (Dec.-Jan.), but in the hills of Meghalaya harvesting takes place in the months of July-September. Price trend in Kolkata market clearly shows that although maximum arrival takes place in November-December, maximum price is realized during the period of June to November. The yield of potato in Assam is about 8 t/ha, against about 26 t/ha in West Bengal. But the advantage of off-season harvest needs to be exploited to the maximum extent and potato

cultivation should be encouraged in mid-high hills of NER.A good number of improved varieties and suitable management practices have already been worked out by the CPRI Station in Meghalaya and NEC support has been provided for seed multiplication locally. Potato is an important cash crop in the hill districts. It shows positive growth throughout the period and the yield has doubled during the last 30 years and the trend needs to be accelerated through improved extension, irrigation expansion and input and market supports.

4.1.2.11 In case of vegetable crops, improved production should be possible much faster. Unlike in the case of fruits, in vegetables research information and farmers' rich experiences are available in case of most of the vegetable crops. Intensive vegetable cultivation in Nowgang district of Assam, growing of climbing beans in mixed stand with maize in hills, raising locally good quality seeds of radish and cauliflower, are some of the examples which show farmers' interest and skill in vegetable cultivation in the hills. New improved varieties and hybrids should cover larger areas in flat and valley lands in the hills. Vegetable production has improved considerably Horticulture Technology Mission claims to have brought 9000 ha additional area under different vegetable crops, especially in paddy fallows as the second crop.

4.1.2.12 **Vegetable farming has particularly helped small and marginal hill farmers come out of poverty trap**. The often quoted off season vegetable farming in the hills signifies intensive use of small landholdings of hill farmers using their family labour most productively (generating better employment for the family on farm). It has already transformed livelihoods of millions of families across the Himalayas. **The concerns of such families today is sustainability of the option and not the alternative**. Indeed, vegetable farming is most promising option for small farming families, but it is ecologically highly unsustainable; the cost of cultivation keeps rising year after year. The need for excessive use of fertilizers and pesticides is a continuing concern both for the farmers as well as the consumers. The private companies and market forces have replaced the role of research and technology institutions as sources of new varieties and inputs for vegetable farming. Therefore, the public institutions, ICAR system including the agriculture universities need to reform and strengthen themselves for new roles as

technological innovators and back up supporters for hill resources management and profitability of hill farmers through a participatory mode. The KVKs and ATMAs can play an important role in this direction by undertaking **location-specific activities** rather than dumping on the hill farmers the technologies developed in distant plains of India and elsewhere.

4.1.2.13 In flowers, **orchids**, particularly the temperate orchid Cymbidium, is the specialty of the NE region. Although sporadic attempts have been made to commercialise orchid cultivation in Sikkim, Darjeeling district of West Bengal and Arunachal Pradesh with Cymbidium, full potentiality is yet to be exploited. Of late, big units with protected cultivation structures are coming up mainly in Sikkim. M/s India Carbon Ltd., Guwahati, took to commercial production of tropical orchids, but only with limited success. Cluster of small farmers / SHGs may approach M/s Indian Carbon Ltd., Guwahati, M/s Nagami Nursery, Dimapur, NRC for Orchids, Pakyong, Sikkim, and the like, for sourcing quality planting materials and for possible tie up for marketing arrangement, including appropriate contract farming arrangements, as common in Thailand and other South East Asian countries.

4.1.2.14 **Anthurium**, another crop of cut flower value, is also coming up well in some of the hill States. Commercial scale production from Mizoram is reported and some marketing arrangements have also been established. Private initiatives to develop contract growing for orchids and Anthurium, organizing training on floriculture, setting up tissue culture hardening facility and others are in the pipeline. The Government of Assam has targeted Kamrup district as a floriculture district of Assam. Among Medicinal and Aromatic Plants, *Citronella* grass cultivation for aromatic oil was extended to a reasonably large area, including in the unutilized lands of tea gardens. RRL, Jorhat of the CSIR has identified suitable strains and assisted in establishing distillation units. Due to good rainfall and rich soil, the vegetative growth of aromatic grasses is luxurious, particularly in the valley lands. But, **the potential remains highly underexploited and the necessary synergistic push of the stakeholders is missing.**

4.1.2.15 Patchouli (*Pogostemon cablin*) has been identified as a suitable essential oil bearing aromatic plant with immense export potential. Patchouli oil production could be a rural based, labour intensive, low cost agro based cottage industry in the NER. Due to active support of NEDFi (North Eastern Development Finance Corporation Ltd) for production of patchouli oil on commercial basis under a buy back guarantee, already about 1800 acres have been covered under Patchouli. Patchouli cultivation is being promoted also in the plains of Assam, while another essential oil bearing 'Geranium' is considered for the hills. **NEDFi micro-finance scheme is aiming to support NGOs / SHGs for promotion of medicinal and aromatic plants, which definitely enjoy a niche in the NER.**

4.1.3.0 Issues and Challenges of Hill Agriculture and Concerns of Hill Farmers

4.1.3.1 **Lack of fact-based rational understanding and of knowledge-led development approaches have been the main reasons for the poor state of hill agriculture and deprivation of the hill people.** Hill area development in India has been based on the perceptions of **Land Degradation Theory** that was so widely dramatized in 1970s through the book "**the Himalayan Dilemma: Land Degradation and Human Poverty**" by Ives and Messerli. The vicious cycle of poverty-land degradation-food insecurity-poverty was coined during that period. It blamed hill farmers for the forest denudation and land degradation problems leading to downstream floods, siltation and desert like situation. It predicted dooms day for the Himalayan farmers by the end of 2000.The fundamentals of the theory were that Himalayan farmers are causing large scale soil erosion and land degradation in the Himalayas and their farming cultures are the root cause of floods in Bangladesh, large scale forest denudation and land degradation and siltation of dams, rivers and even the Bay of Bengal. The theory linked their poor livelihoods to all these evil processes. **Without verification, every one accepted the theory**. More data was generated by other agencies in further support of these observations. The aid agencies, both multilateral and bilateral, the World Bank and Asian Development Bank and others, made countries of the region think and act accordingly. Several government programmes such as stricter forest policing and forest laws for

conservation with little concern for livelihood security of people in and around forests, were outcome of this process. The muddiness of the current debate on the rights of the tribal people could, to a certain extent, be ascribed to the Ives-Messerli theory.

4.1.3.2 After about four decades, we have a situation where the hill farmers, the villains of the theory and real victims of the counter measures, are in crisis. **New evidence is now available to explain that the Himalayan degradation theory was a mis-judgement of nature's processes and that Himalayan farmers have suffered over the decades because of the international and national initiatives on pro conservation policies and investments**. The world over unrest in the mountains, that emerged during this period, has been attributed to policies and interventions made during this period, which denied or restricted rights and access of hill people to their livelihood resources, be it the tribals of NE India, the tribals of northern Thailand, Myanmar, Bangladesh or the Andean Indians of Latin America, or be it the sheeps of the Valley of Flowers in India. The new findings observe that, unfortunately, today the Governments and institutions in the affected countries are not ready to listen to the new findings. There is so much of vested interest within these national systems (conservation lobby) that **new findings are being fiercely resisted** and dubbed wrong **(Box 3).**

4.1.3.3 These findings have great implications for shaping the course of events for the hill farmers. It calls for unloading the soil erosion and degradation loaded mind sets of researchers and development thinkers and seeks revisit of the whole issue in the light of new knowledge and information to verify the situation and make necessary changes at whatever level they will be needed - policy, development programmes, research and even academia. **The new findings highlight the need for pro hill people policies rather than putting priority on conservation of resources over people**. **New *mantra* is** – "**Given the opportunity and supportive conditions hill people are masters in conserving resources." Governments only need to create an enabling environment, in place of whole range of restrictive regimes which have alienated hill farmers from their own environment making them refugees in their own surroundings.**

4.1.3.4 Another major knowledge gap exists for reliable estimates of total forest area and areas under different forest categories. The geographic areas of hill States have

been calculated long ago using available means and these tools had limitation of not being able to calculate the area under verticality of hills and mountains. This means that official geographic area of all hill States is as if they are plain, and it does not include area created due to verticality factor. The new tools i.e. GIS based digital elevation models and other tools now help us calculate the area correctly. For example, the official area of Himachal Pradesh is 55,000 sq.km but when new tools were used the actual area turned out to be 88,000 sq.km. A difference of 33,000 sq km is huge indeed. This extra land holds the key to solving many problems of hill farmers. This extra land is not crop land, because crop land is measured and recorded in the revenue records. Then it may be the forest land, and if that is true, it should facilitate major policy decisions about need for land use adjustments.

4.1.3.5 **Besides the main issue discussed above, hill agriculture has some inherent challenges of remoteness and inaccessibility, lack of connectivity of production areas with all weather link roads, marginality, and fragility in terms of moisture stress, depleting soil fertility and the poor soil conditions and a short growing season. Added to these are socio-economic constraints such as small and fragmented holdings, poor productivity, labour shortages, poor post production management, poor marketing and networks (lack of market development) and lack of entrepreneurship. All these have led to underutilization of resource bases in the hills and the limited generation of surpluses and low returns to the farmers.**

4.1.3.6 **With few exceptions, constraints to improved agricultural production in the Himalayas include poor management practices, inferior quality and inadequate quantity of planting material, seeds, and other inputs, little access to extension services and marketing. Crop damage due to unpredictable weather as well as from wild and astray animals is a major deterrent. Across the Himalayan region, farmers face problems in accessing market information, post harvest processing and value adding skills and opportunities. Because of the lack of regular markets and reliable marketing and due to the high marketing costs, hill farmers in many areas are finding it too risky to diversify into more lucrative high value crops.**

4.1.3.7 Shortage of fodder and feed is rampant in the hills. **"Livestock fodder problem is more acute than human food problem in the hills**". The rangelands and grasslands are operating at one fourth of their productive potential. **Most of the fodder and grazing areas have been infested by non-palatable invasive species,** such as lantana, eupatorium and congress grass. As an estimate, about 40-60% shortage of fodder is being faced by the Himalayan farmers.

Box 3

Forests and Floods
Drowning in fiction or thriving on facts?

Flood processes in Asia are highly complex. Only integrated approaches take this complexity sufficiently into account and lead to adaptive and effective flood management. An improved approach to watershed and floodplain management integrates land management in the uplands with land-use planning, engineering solutions, flood preparedness and emergency management in the lowlands. This requires good understanding of all the physical processes involved, as well as the social behaviour and culture of local residents. Furthermore, this approach should draw upon the best available scientific knowledge about the environmental, social and economic impacts of floods and the environmental, social and economic effects of interventions.

The myths and misperceptions about the causes of flooding that have misguided decision-makers, planners and managers alike need to be replaced by rational understanding based on facts. Too many local, national and international agencies have used 'conventional wisdom' and unsupported claims to advance their own institutional interests and because it has been politically advantageous to channel aid funds to upland reforestation and conservation projects. The media has unfortunately perpetuated many of the myths regarding forests and floods out of a well-intentioned, but ill-informed, desire to protect the environment, especially the forests of upper watersheds.

It should be clear that large-scale reforestation programmes, the adoption of soil and water conservation technologies in agriculture, logging bans and the resettlement of upland people to lowland areas will ***not*** significantly reduce the incidence or severity of catastrophic floods. Positive environmental impacts from these interventions will be of a local nature, while the negative social and economic impacts are likely to be more widespread.

Importantly, the habit of blaming upland inhabitants for catastrophic floods of whole river basins must be abandoned. Instead, practical solutions are needed to redress watershed degradation caused by unsustainable land-management practices, including poor logging practices and inappropriate infrastructure development. While refraining from exaggerating the negative impacts that mountain people have on the environment, we should also not overstate the positive impacts of their participation in watershed management programmes, as is happening with some recent attempts to develop markets for the environmental services that forests may provide. Moreover, policy-makers and development agencies have a moral and ethical responsibility to ensure that regulatory and project approaches are based on the best available scientific knowledge and do not unnecessarily place upland communities at risk of further impoverishment.

While the ability of forests to prevent catastrophic floods is limited, watershed management should definitely not be abandoned. Forests provide a variety of environmental services, which need to be protected and nurtured for the benefit of today's and tomorrow's upland and lowland populations. Watershed management needs to consider the needs and interests of local populations, but should also account for the needs of the wider society. The most effective approaches to reducing damage caused by catastrophic floods require a strong focus on downstream areas and flood plains. People in these areas need to 'learn to live with rivers', as the UK Institution of Civil Engineers entitled its 2001 report on flood mitigation measures. At the same time, politicians and policymakers need to abandon their belief in quick fixes for flood-related problems. While the high costs of floods in the lowlands of Asia are evident, it is important that the beneficial aspects of floods are also acknowledged. It is only by promoting and supporting comprehensive integrated watershed and flood plain management that the needs and aspirations of all residents — uplanders and lowlanders — can be adequately addressed.

FAO, 2005

4.1.3.8 Livelihoods of majority of the population in the Himalayan region revolve around agriculture, land being the nucleus of all socio-economic activities. For majority of the small and marginal farmers, their wealth and poverty is associated with the ownership of the size of land holdings. **The great majority of the farming households are marginal (below 0.5 ha) and small (0.5 to 1.0 ha) landholders**. The situation is particularly unsatisfactory in the North West and in Tripura**.** For instance, by 2010, nearly 90 percent of the holdings in Himachal Pradesh, and over 96 percent in Jammu and Kashmir will be less than 2.0 ha in size. Sometimes, land ceiling laws prohibit bigger holdings, which may need to be reviewed while promoting contract farming.

4.1.3.9 **Shrinking cropland holdings is a key concern for managing food and livelihoods**. Rural development efforts across the Himalayan region face a serious challenge of finding a solution to this problem. The per capita available cropland in hilly areas across Indian Himalayan states is already too little to sustain livelihoods. The consequences of this situation to sustaining livelihoods and management of land resources are serious indeed. The Himalayan cropland which is about 4.3 percent of the country's cropland has to support livelihoods of disproportionately large number of mountain people, who account for 6.2 percent of the nation's population. Moreover, the hill and mountain cropland is divided into a range of flat and sloping land types. While 37% of the cropland is sloping land of various degrees, the Himalayan farmers are cropping sloping lands even beyond 25 and 30 degrees. Down in the valleys, new human settlements, urbanisation, industrialisation and government infrastructure development activities, all are competing for converting the valley crop land into non farm use. For instance, in Himachal Pradesh, net cropped area decreased from 5.82 lakh ha in 1990-91 to 5.49 lakh ha in 2001-02.

4.1.3.10 Implications of cropland scarcity in hills are manifold in the form of indicators of unsustainability of hill agriculture in respect of land resources, production and livelihood **(Table 7)**. The unsustainability indicators are in fact hidden responses of farmers to the lack of access to cropland of adequate size and quality. The state of croplands in the hill region and its impact on the food insecurity and continuing poverty paint a grim picture for sustainable hill agriculture. The key issues that emerge are,

shrinking size of land holdings, erosion from sloping farmlands and decline in soil fertility and, above all, strengthening of the nexus cycle of inadequate food production-food insecurity-poverty-resource degradation. **It highlights the fact that unless solution is found to cropland scarcity, agriculture as a source of sustenance for the small and marginal farmers may loose its significance.**

4.1.3.11 All across the Himalayas, declining size of landholdings has seen virtual invasion of farming communities on the non-farm CPR land, wasteland, rangeland, forest areas etc. for conversion into cropland. Many areas, particularly Uttaranchal, are witnessing **increasing out-migration of males**. It has created a unique situation in which sizable percentage of women are today heading farming households and economy of these households is at best known as **money order economy. Thus, the already leading role of women in hill agriculture is further enhanced.** Further, the outmigration of males beyond a certain proportion may be detrimental to hill agricultural economy in the long run and should be checked by creating *in situ* employment opportunities for them.

4.1.3.12 Several hill States present success stories of agricultural diversification through fruit and vegetable farming which have helped improve the livelihoods of small and marginal farmers. The diversification is, however, already facing second generation problems and the challenge of

sustaining and widening benefits of hill agricultural diversification is beset with range of new problems such as:

- Large proportion of marginal farmers are yet to benefit from agricultural diversification
- Cash crop farming is facing pricing, marketing and sustainability problems
- New generation of farmers, the educated unemployed youths, are keen to explore entrepreneurship opportunities, but not with much success. (Millions of educated unemployed youth across the Himalayan States, mostly from the farming families are waiting for jobs. Even though many of these educated unemployed youth have acquired traditional knowledge of farming from their families, they need to be equipped with necessary knowledge and skill in farming, entrepreneurship and agribusiness).

- Unexplored comparative advantages of hill agriculture
- Constrained livelihoods because of biological degradation of support lands – the waste lands
- The hill and mountain farmers lack appreciation of climate change, and
- Weak mountain agricultural research and extension support services.

Table 7:Indicators of unsustainability of hill farming and livelihoods
(Time Frame 1954-1991 = 37 Years Approx.)

Indicators Reflecting Problems Relating to Resource Base / Production Flow and Resource Management	Range of Changes
3. Soil Erosion Rates on Sloping Lands	+20 to 30 %
4. Abandonment of Agricultural Land due to decline in soil fertility	+3 to 11%
5. Appearance of Stones / Rocks on Cultivated Land	+130 to 100 %
6. Size of Livestock Holding per Family (LSU)	-20 to 55%
7. Area of Farmland per Household	-30 to 10%
8. Forest Area	-15 to 85%
9. Pasture/ Grazing Area	-25 to 90%
10. Good Vegetative Cover on Common Property Land	-25 to 30 %
11. Fragmentation of Household Farmland (in number of parcels)	+20 to 30%
12. Size of Land Parcels of Families	-20 to 30 %
13. Distance between Farmland Parcel and Home	+25 to 60%
. Food grain Production and Self- Sufficiency	-30 to 60%
15. Permanent Out migration of Families	None to 5%
16. Seasonal Migration	High to High
17. Conversion of Irrigated Land into dry land farming due to water scarcity	+7 to 15 %
18. Average Crop Yields on Sloping Lands a. Maize and Wheat b. Millets	 -9 to 15% -10 to 72%
19. New Land Under Cultivation	+5 to 15%
20. Human Population	+60 to 65%
21. Application of Compost (organic manure)	-25 to 35%
22. Labour Demand for Falling Productivity	+35 to 40%
23. Forestry Farming Linkages	Weak to Weak
24. Food grain Purchases from Shops	+30 to 50 %
25. External Inputs' needs for Crop Production	High to Medium
26. Fuel wood Fodder Scarcity in terms of time spent in collection	+45 to 200%
27. Fodder Supply from a. Common Land b. Private Land	 -60 to 85% +130 to 150%
28. Emphasis on Monocropping	High to High
29. Steep Slope Cultivation (above 30 %)	+10 to 15%
30. Weed and Crop Herbaceous Products' used as Fuel wood	+200 to 230 %
31. Conversion of Marginal Land into Cultivation	+15 to 40%
32. Fallow Periods	From 6 to 3 months

Note: A positive sign (+) means increase and negative sign (-) means decline/ decrease
Source:Shrestha, 1992.

4.1.4.0 Opportunities in Hill Agriculture: Transforming the Vast Marginal Hill Lands into the Lands of Opportunities

4.1.4.1 Hill agriculture and the Himalayan areas have specific advantages that can be harnessed to good effect, in particular the wide diversity and the presence of niches particularly suited to certain crops e.g. apples in Himachal and saffron in Soppore Valley of Kashmir, pashmina goats and yak in the highlands of Ladakh or mithun in Arunachal Pradesh. It offers hope to develop these comparative advantages, promote investment in such niche areas as part of the efforts to improve farm economy in sustainable ways.

4.1.4.2 Apple farming on marginal farmlands in Himachal Pradesh, cardamom plantations in the forests as well as conversion of sloping farmlands into forests for planting cardamom, and afforestation of barren land with seabuckthorn in Ladakh and China, constitute the technological options which reflect better understanding of niche perspective — the real niches consider use of local biodiversity as priority. In these examples, marginal land was adopted as a given condition and agricultural development options were searched accordingly. The commonalities among these examples are productive use of marginal farmlands, support for land, soil and water management and harnessing of specific niches.

4.1.4.3 The three examples convey a message that marginal lands are not constraints to productivity if appropriate technological choices are made. **Marginal lands have specific niches(comparative advantages)**. A proper understanding of the niches can provide clue to the potentials of marginal lands under given agro ecological environment. The three production systems use perennial plantations of different types with equal advantage - be it modern varieties of apples or a farmer domesticated perennial spice cardamom or a wild thorny shrub - seabuckthorn. All the three production systems aim at **combining economic sustainability with ecological stability** of the landscape and local environment.

4.1.4.4 Cardamom farming highlights two points, one is that local biodiversity can be a good source of niche based crops for marginal lands. The perspective behind the marginal

land crops is that these are the plant resources adapted to edaphic and climatic conditions of marginal lands. These may not be the crops coming from experimental stations of research institutions but local plants whose economic potentials have been determined by the market or industry. Seabuckthorn story provides insights to technological scope for combining soil and water conservation efforts on marginal and fragile land with food security and poverty alleviation. Seabuckthorn case is a unique example, which explains that forestry systems can be designed in such a way that while serving the purpose of good forests they can also provide benefits of horticulture plantation to local people. Seabuckthorn initiative also explains how forests can be made to serve as fruit tree farm in terms of offering livelihood opportunities.

4.1.4.5 The experiences described above add a new dimension to the thinking process about linking marginal land management to improving livelihoods. The trends unfolded by these case examples define a role for biodiversity/agro biodiversity in enhancing use value of marginal lands for sustainable hill development strategies. The core message of the three technological successes is that **a change in the development thinking from "considering marginal hill lands as constraints to livelihood opportunities and poverty alleviation to that of lands of opportunities" is bound to synergise ecological and economic gains in hill agriculture leading to sustained livelihood security of the hill people**.

4.1.4.6 A few other promising trends have emerged in recent years which should be consolidated to achieve the ultimate goal of happy hill farming families. For instance, in the NER, out of the total area of 2.2 million ha of Jhum lands, about 17.5% is cultivated at any one point of time, involving about 4.5 lakh Jhumia families. Of late, with increasing awareness of disadvantages of shifting cultivation, the farmers in certain areas have started adopting settled cultivation. Some of the pilot projects like (a) Permanent settlement of Jhum cultivation through development of plantation crops in Karbi Anglong and N.C.Hills of Assam, (b) Providing 2.0 ha of terraced land to Jhumia families along with inputs and financial help for settled cultivation in Meghalaya, (c) Land reclamation and provision of production inputs for horticulture and cash crops in Mizoram, and (d)

Encouragement for terrace cultivation in Nagaland and others are already showing some positive impact towards settled cultivation.

4.1.4.7 Also, emergence of a trend of land concentration in the hands of a few and privatisation of land holdings have been reported from some areas. In the name of tribals, **some 'smart' tribals are cornering community lands in their personal names**. Such pitfalls should be warded off. Presently, the valley lands, terrace lands, homestead lands and short-fallows are being recognized as private lands for all practical purposes. In Assam, the State has proper land records, particularly in the plains, while in Manipur the entire valley has been covered under permanent ownership. The Land Reform Act, 1960 of Tripura is perhaps the most comprehensive one, in which (i) land ceiling, (ii) prevention of fragmentation of land, (iii) restrictions of land transfers from tribals to non-tribals, and (iv) non-eviction of share croppers in general have been covered.

4.1.4.8 Crop diversification and commercialization of agriculture are yet to emerge in economy scale, except in certain plantation (tea), spice (ginger, large cardamom) and tuber (potato) crops. As per estimates of the National Horticulture Board (2003), the NER produces 2.6 million tonnes of fruits from 0.287 million ha and 4.00 million tonnes of vegetables from another 0.38 million ha. Three plantation crops *viz*. tea, coffee and rubber cover 3.33 lakh ha area. Rubber with an area coverage of about 45 thousand ha and coffee with about 10 thousand ha are recent introductions, thanks to the efforts of respective Commodity Boards. Small scale cultivation of tea in Assam spreading over 40 thousand ha is a new innovation integrating small landholders in tea production system. Rubber with an area of over 25 thousand ha is already a source of revenue to the State economy of Tripura. **Tea, Coffee and Rubber Boards have planned a number of schemes to promote these crops under small-holder sector.**

4.1.4.9 **Hills and mountains of varying altitudes and temperature regimes provide excellent niches for production of quality seeds of temperate and sub-tropical vegetables**. Women Self Help Groups for vegetable seed production in the hills should be formed, trained and empowered to undertake commercial production and distribution of vegetables seeds. **Leading seed companies, which could provide backward linkages**

with technologies and inputs and forward linkages with processing, packaging and marketing, should join hands with the producer groups under a transparent contract farming arrangement. NABARD and other financial institutions should particularly be interested in promoting such initiatives.

4.1.4.10 Himalayas are great reservoirs of biodiversity. For instance, the NER is considered as the Centre of Origin of certain species of mango, citrus and banana. Many wild species and primitive land forms of tropical vegetables like cucumber, brinjal, gourds, beans and bhindi are available in the region. Rich genetic diversity has also been reported for crops like yams (*Dioscorea* spp.), ginger, medicinal and aromatic plants like *Aconitum, Penax, Terminalias, Cymbopogon, Cinnamomum* etc. A large number of ornamentals and flowers are found to grow in wild and semi-wild conditions and about 600 species of orchids are flourishing in the region. The cold deserts of NW States also possess unique biodiversity of livestock (Yak), cold fishes, temperate fruits, medicinal plants and microbes, which is largely underexploited.

4.1.4.11 **Most of the indigenous species of different horticultural crops have not been exploited fully**. Certain polyembryonic mango types have been reported from Manipur and Tripura but no serious effort has been made for their use. Seeded banana has been domesticated and consumed locally. Some of them have high baby food value. In citrus, 'Assam Lemon', a lemon-citron type, is grown largely but the Satkara (*C.macroptera*), ginger flavoured 'Adajamir'. (*Cassamensis- Dutta* and *Bhatta*), 'Soh-Jew' (a probable sour mutant of *C. limettoides)* and the acidulously sweet citrus types like *Soh – Nairiang* and *Soh-bitara* of Meghalaya and *Tasi* of Arunachal Pardesh are enjoying only very limited commercial value. They need to be exploited more both for table as well as processing purposes.

4.1.4.12 Several indigenous vegetables, not common in other parts of the country, are consumed locally by the tribals. Tree-bean (*Parkia roxburghi*), known locally as 'young chak' is in good demand in Manipur, while the tribals of Tripura grow a species of Vigna (*V.uexilata*) for edible pods and tubers. Winged bean (*Psophocarpus tetragonolobus*) are liked in Mizoram, Nagaland and Manipur, while the roots of a

tropical legume (*Flemingia vestita*) known as 'Soh-Phlang' is often consumed by the Khasis in raw forms. Medicinal plants like *Rauvolfia serpentina*, *Solanum*r *rhasianum*, *Dioscorea prazeri, Coptis teeta* are widely available in the region but not fully exploited commercially. Orchids as medicinal agents have been used by the tribals of the region and in the Khasi and Jaintia hills of Meghalaya alone about 50 species of orchids are reported to be used for different ailments. The crushed leaves of *Cymbodium giganteum* is used for clotting of blood, while the juice of *Vanda coerulea* flower is used as eyedrop for cure of glaucoma. **The wisdom and long experience of local tribals have hardly been gainfully used and not much has been done to refine the indigenous knowledge through scientific experimentations, let alone the poor documentation of the indigenous and traditional knowledge.**

4.1.4.13 The perennial horticulture and plantation crops are high value crops and help in checking soil degradation in the hill slopes. Soils of hills and mountains being rich in organic matter and certain other plant nutrients, some horticultural and plantation crops can be grown organically with minimal use of chemicals. The programme to produce organic tea in certain areas may help add further value to the produce and prove to be economically more remunerative.

4.1.4.14 The North East Hill region has unique advantage of geographic proximity to South and South – East Asian markets like Bangladesh, Maynmar, Nepal, Bhutan, Singapore, China and Thailand. The proposed "The India – Thailand Highway" through Myanmar will enhance sub-regional co-operation and the large markets of S.E.Asia will be much closer to NER. **Cross-border integration through promotion of conducive market oriented agriculture must be aimed.** This calls for definite plan and strategy for development including programme prioritization, integration and implementation.

4.14.15 The creation of the Ministry of Development in North Eastern Region signifies the commitment of the Government of India to accelerate the pace of socio-economic development of the region. As per the work allocation of the Ministry, the North Eastern Council (NER) and North Eastern Regional Agricultural Marketing Corporation Limited (NERAMC) are directly involved in activities related to agriculture

development in the region. In addition, other nodal Departments of Ministries of Agriculture, Commerce and Food Processing Industries are directly involved in promoting agriculture through developing and funding various projects. The technology mission for integrated development of horticulture in the NER is one such plan programme of DAC of MOA in the recent past. A significant amount is already assured by earmarking 10 percent of the Plan Outlay of the Central Government. Notwithstanding the substantial support of the Central Government to the North East and to Jammu and Kashmir in the North West Himalayas, often for obvious political reasons, **the States have generally failed to plan systematically and allocate necessary financial and other resources to agriculture and rural development from their own exchequer. The paucity of adequately trained human resources is further aggravated by the prevalent non judicious deployment of the resources**. It all boils down to the issues related to transparent governance ensuring rational investment in development and timely flow of adequate funds and other resources to the action site without transmission loss.

4.1.4.16 The NABARD has developed a special package for the North East, both for production credit and investment credit, including concessional rate of interest and higher allowance for refinance (upto 25 % of NPA as against 15 % in the country as a whole and for thrust areas even 100 % refinance allowed). NABARD's current activities cover many items such as CAT (Capacity building for Adoption of Technology), SHG programmes, Organic farming etc. which are highly relevant for NER. Similar packages are available for the individual NWR States.

4.1.4.17 For Assam, the Regional office, NABARD has formulated model bankable schemes on Patchouli, Safed Musli, vermi compost, Jatropha biodiesel plantation and others. It has also proposed organization of SHGs for hill people. The roles of VDBs in the hill districts in identification of borrowers and recovery of loans have been emphasized by NABARD, since VDBs have considerable influence over the villagers. Earlier NABARD had tried to channelise credit for rehabilitation of Jhum lands in Mizoram through Teak Plantation Forestry but did not succeed due to non-availability of land records. Credit deposit ratio is generally low in the NER and credit outcome need to be measured, for which NABARD should institute studies through its R &D sector.

4.1.4.18 The North Eastern Development Finance Corporation Limited (NEDFi), a premier financial institution of the country, also helps in development of agriculture in NER. It has micro-finance schemes for providing financial assistance to NGOs and SHGs. Similarly, North East Equity Fund (NEEF) has also been created to help first-generation entrepreneurs. NEDFi has taken up initiatives in promoting medicinal and aromatic plants in NER. Due to NEDFi support, Patchouli cultivation has spread over 1800 acres. It has so far financed 222 projects in agriculture and allied sectors with an estimated project cost over Rs. 26 crore. Under micro-finance, it has supported almost 25 NGOs and over 2000 SGHs. NEDFi's future programmes cover financing contract farming and rural micro-enterprise development.

4.1.4.19 APEDA is providing airfreight subsidy for transportation of horticultural commodities from any State of NER to Kolkata. For floriculture crops, the freight subsidy is even upto 90 % of the fare. All other APEDAs export promotional schemes are equally applicable for the NER. APEDA has already developed 'Agri-Export Zone for Orchids' in Sikkim, in which all concessional provisions are available.

4.1.4.20 NEC provides project finances to NGOs and SHGs to promote floriculture sector, while to develop high quality commercial horticultural farms the promoters may avail credit linked back ended subsidy from National Horticulture Board (NHB) @ 20 % of the total project cost with a maximum limit of Rs.30.0 lakh per project. United Bank of India (UBI) is mainly financing tea gardens and has special schemes for transport subsidy upto Kolkata. The State Bank of India (SBI) targets to cover one lakh families in NER and considers SHGs as a preferred way for bank credit flow as the risk is comparatively low. SBI has provided financial support for passion fruit cultivation and for floriculture (Anthurium) projects in Nagaland. Further, it is contemplating to provide support to apple and Kiwi cultivation in Arunachal Pradesh.

4.1.5.0 Pathways for an Agriculture-led Sustained Prosperity, Peace and Happiness of Hill People

4.1.5.1 The Green revolution has failed to climb the Himalayan heights and **agriculture in Indian hills has, by and large, remained at subsistence level. Majority of the hill States have relatively high concentration of poor and malnourished people. This is ascribed mainly to wrong policies, scarcity of cultivated land, increasing demographic pressure and poor access to technology, credit, market and infrastructure.** Immediate measures are required to address these constraints towards sustainably improving livelihood security of hill people and for arresting and bridging the widening socio-economic gaps between the "lowlands" and the "uplands."

Call for a Major Paradigm Shift towards Knowledge-based Development of Hill Agriculture and Hill People

4.1.5.2 Much of the development efforts made in the hills in the past were based on poor understanding of the hill/ mountain conditions, resources, environment and the socio cultural settings of the people. The mainstream thinking was dominated by the degraded marginal sloping lands, biases against hill farming, marginal land based limitations, forest conservation as priority and the like. **The hillside development policies focusing on forest cover through regulation had excluded local users across a wide range of ecological and socio-economic regimes**. Many of these perceptions were perhaps unfounded. To put the things in right perspective, our overriding recommendation is **to undertake fresh interdisciplinary studies on the Himalayas to generate new data and information about the state of the development process to guide the new efforts on improving livelihoods of hill farmers**.

4.1.5.3 The sustainability prospects for mountain agriculture remain bleak unless the mainstream perceptions about the problems are changed. While the development thinking in the hills views marginal mountain lands as a constraint, for the hill farmers marginal lands are a given condition and diversified livelihood options have been evolved to capture the niches and comparative advantages of available natural resources, namely, mixed farming, nomadism, swidden farming, ecotourism, etc.

4.1.5.4 Farming alone is unable to meet the food and livelihood needs of the families inhabiting hills; therefore they employ multiple livelihood strategies through diversification of household activities. However, these options are also giving diminishing returns and hill farmers are looking for new alternatives. **Unemployment is widespread particularly across the Himalayan States—large force of educated unemployed rural youth from farming families is waiting for opportunities**. On the one hand, demographic pressure on cultivated land is increasing, rendering the already small holdings still more fragmented, uneconomical and unsustainable. Through educating and sensitizing people, **while population growth rate must be reduced, off-farm and non-farm employment opportunities must be created to reduce the pressure**. Off-farm employment should be a major policy element, especially for retaining the young educated masses in rural areas.

4.1.5.5 The development of sustainable hill agriculture systems requires that development planning processes follow certain guiding principles. **The best model of hill area development is to have its sustainability embedded in ecological protection, cultural heritage and human development,** encompassing the following guidelines:

- **Recognize diversity of land, water and bioresource use opportunities**
- Identify and harness location- specific niches
- Hills are less suited for uni-dimensional land use, but more suited to multiple strategies that consider unique characters of smaller sites within the whole landscape; ensuring a balanced relationship between people and land resources
- Productivity is not only based in the biophysical characteristics of hill lands, but also depends on the socio-economic parameters and cultural milieu of a hill environment
- Marginality of mountain and hilly areas is not a static concept, it is a dynamic process; technologies may be known but the other necessary incentives, institutions, or inputs may be missing and need to be dynamically adjusted.

4.1.5.6 It must be stated that much of the woes of hill farmers, apart from poor access to resources, are due to inappropriate technological research and extension interventions.

Only if we take bold steps to restructure and reform agricultural research and technology efforts to bring them in line with the needs of hill farmers—most of the woes of hill farmers would have been solved. **No amount of policy reforms and enhanced plan allocations and investment will make much difference unless right technological pool of options is offered to farmers**. Let it be said that hill farming has added to degradation of water and land only in areas where new technologies were introduced and adopted in a straight-jacketed fashion. Indian agricultural institutions fall much behind in perceptions of hill farming — the integrated approach, planning technological research that is need-based and in providing technological options which are both ecologically and economically desirable. There is in fact little ecology in agricultural science of India today and this gap has shown adverse effect in more marginal areas. **Ecotechnologies for alleviation of ecological poverty and hunger should particularly be emphasized for agriculture-led development of hill people and agro-ecology should be emphasized particularly in the hill agricultural universities' curricula.**

New Policy on Hill Agriculture

4.1.5.7 At the national level there is need to adopt a differentiated approach to hill area development. Hill areas agricultural development objectives in particular and overall hill area development in general are definitely different from plains area goals. The strategic national needs from hills are both products and services. Services are largely relating to conservation of physical resources in the national interest and there is little appreciation of the humanware. The present policy and planning perspective has a major drawback in the sense that there is no recognition of the fact that hill people play important role in providing ecological services to the nation – conserving land, water and most important biodiversity. **There has to be a national policy on compensating citizens for their ecological services they provide to the civic society.** Tools are now available to calculate the economics of ecological services offered by a community, a regional government and state government or even by a farmer. WTO also supports this strategy of compensation and that is what Switzerland and European Union is doing under its new agricultural policy. The new EU policy frame supports compensation for farmers who

contribute to maintain ecological balance through good agricultural practices, keeping land water and air clean.

4.1.5.8 Keeping in view the unique and special agro-ecological and socio-economic settings and recognizing that hill agriculture has not benefited to the desired extent from the various technological and developmental efforts, **the National Policy on Agriculture should have a special parallel, yet integrated, window on hill agriculture so that commensurate strategies, programmes and activities for hill agriculture production, research, technology development, extension, human resources and product development and marketing geared towards socio-economic and agro ecological synergy leading to well being and happiness of hill farmers could be established. Mountain-specific agriculture-led developmental approach should be the main point of hill States' relationship with the Government of India.**

4.1.5.9 The Consultations held in the NER (Shillong) and NWR (Shimla), as also in New Delhi, emphasizing the various issues and opportunities discussed above, strongly recommended formulation of a sustainable hill agriculture and mountain development policy at the national level in which central role of agriculture is duly elaborated and harmonized with environmental and livelihood security. While efficiencies of the various programmes such as the Western Ghats Development, Eastern Ghats Development, Deccan Plateau Development as well as the Ministry of DONER, etc. should be enhanced, their outcome could be synergised by creating a **National Programme on Hill and Mountain Agro-Ecosystem** to coordinate all the concerned programmes of the Government of India. The Coordination Mechanism should preferably be housed in the office of the Prime Minister, with close linkages and interactions with the Ministry of Agriculture, Ministry of Development of the North East Region, Ministry of Environment and Forests, Ministry of Rural Development as well as with the National Development Council. The various existing funding and financing mechanisms such as NABARD, NEDFi, NERC, etc. should be coordinated and synergized and their scope expanded under this umbrella as a **National Hill and Mountain Agro-Ecosystem and Livelihood Development Fund.**

4.1.5.10 **The interdependency and synergy between all sectors of agriculture *viz*. crops, horticulture, livestock, fisheries, forestry and the associated natural resources should be strengthened.** One cannot be excluded by the other. **Explicit policies on rights of tribal people on forests and forest lands should be formulated**. In doing so, the positive role of the forest dwellers in forest and ecosystem conservation, such as the Chipko Movement, should not be ignored.

4.1.5.11 Given the poor accessibility, necessary structural and management changes should be effected towards sustained self-reliance of hill villages to attain true Gram Swaraj of Mahatma Gandhi. Policy changes are equally needed in the management of wild life and tree harvesting, agro-forestry and utilization of non-timber forest produce. The policy statement should explicitly mention that **socio economic and cultural milieu and indigenous knowledge of hill people should constitute the basic fabric of the efforts towards sustainable livelihood security of hill people.**

4.1.5.12 More secure **land rights** may be one of the necessary preconditions to stimulate investments among farmers. **The rights must equally be granted also to women farmers** who often shoulder the bulk of the agricultural work. An enabling policy environment is essential in order to recognize and to strengthen potential developed at the grassroot's level and to encourage people-based initiatives in different areas. Changes are needed in law where it denies access to and use of sloping land resources that are basic to the livelihoods of local people. Shifting cultivators and agro-pastoral communities need that attention more than any one else.

4.1.5.13 Investments and capital formation in agriculture are at an all-time low, adversely affecting agricultural growth and development. The situation is particularly unsatisfactory in most hill States, especially in view of high costs of provisions of infrastructure and services inherently associated with hill regions. Policy to ensure additional investments in research for creating necessary infrastructure and also technology development is required to create a basket of choices of suitable production systems capturing every niche and for strengthening livelihood security. **The concerned**

State Governments must enhance their investments in improving and sustaining the agro-ecosystems.

4.1.5.14 Explicit policies are called for utilization of fallow, degraded wastelands and deforested areas and for promotion of PPP in judicious equitable and sustained use of these resources. Policy guidance on Jhuming will need to be made much more farmer friendly. Land tenureship and right issues should be sorted out as soon as possible.

4.1.5.15 The New Policy on Hill Agro-Ecosystem and Mountain Development should capture commonalities and comparative advantages, synergy and scale of economy options and geo-political consideration. In this context, we may look east and learn from Japanese and South Korean experiences on strengthening hill agriculture. **Japan's new policy on agriculture "considers declining hill agriculture as a national loss**". The thrust of the new policy and the newly enacted **Mountain Village Development Act** is on reversing the trend of declining mountain farming communities and conserving hill agriculture, rather than forests **(Box 4).** Likewise, **the South Korean Marginal Land Improvement Programme** (MALIP) for hilly and mountain areas under its Farmland Law emphasizes the necessity of both ecological and economic considerations **(Box 5)**.

Food, Nutrition and Income Security

4.1.5.16 The hill regions are characterized by small and marginal holdings and resource-poor farm families. Employment security is also poor. The smaller the farm, the greater is the need for marketable surplus, so that the farm family will have some cash income. Therefore, **accelerated progress in enhancing the productivity, profitability and sustainability of the major farming systems is the best safetynet against hunger and poverty**. The major objectives of the agricultural strategies in the hills should be nutrition security of every child, woman and man, income security of farm families and enhancement of ecological foundations.

Box 4

The mountain people and policies in Japan

Japan has over 68 % of its total area as hilly area, which 30 per cent contained of the cropland of the nation. After decades of neglect and biased against hills, agriculture and people inhabiting the hills faced uncertain future. Hill agriculture in Japan faced difficulties of social nature. Alarming rate of households were abandoning hill farmland and over 3.8 per cent of the nation's farming area was abandoned by 1998. As a result, hill-farming communities of Japan faced problem of extinction due to decrease in agriculture and increase in forest area, depopulation and aging of residents. As industrial growth offered ample job opportunities for younger generation of hill farmers, they seemed no longer interested to continue farming their family land.

The factors responsible for declining hill farming in Japan included: decline in the number of farmers and their advanced age; concerns over future prospects of liberalized agriculture trade; decline in job opportunities; delay in social capital infrastructure development; small land parcels making mechanization difficult; intricate topography and small size of land holdings; lack of adequate access roads limiting use of farm machines; higher costs of land grading, irrigation etc. The implications of the rising rate of abandoned farming included increasing national food insecurity; loss of crop resources; and loss of indigenous knowledge of hill farming, threatening Japan's long term national food security interests and posing the question as to, who will know how to farm the hill lands tomorrow?

Having realized the gravity of the situation, Japan made a turn around. Today, *"as a matter of new policy, Japan considers declining hill agriculture scenario as a national loss"*. It is making serious efforts to reverse this trend. The Depopulated Areas Emergency Act and the Mountain Villages Development Act have been put into effect for conserving hill agriculture, rather than forests. The policy aims to realize balanced development of industry through improving the environment, social welfare and traditional agriculture. To support niches based high value farming and income generating options for the hill farming communities R&D support is focusing on: vegetable farming and floriculture with special highland products; animal husbandry on grasslands; labour intensive organic farming; developing forestry; micro enterprises development – food processing etc adding value to the local farm produce; changing tourism development approach to build stronger tourism-farming linkages "*farming for tourism"*. The Shikoku National Agricultural Research Station has been mandated to focus its research on " slope land agriculture". The thrust has been on reversing the trend of declining mountain farming communities and conserving hill agriculture.

Box 5

South Korean Uplands: Towards Ecological and Economic Synergy

Korea has 66 per cent of its total area as hill areas which contain 33 per cent of the farmland of the nation. Korea has been promoting the policy of "*Agricultural Promotion Area* (APA)", which favoured only plain areas for agricultural investment priority. Hill agriculture falling under "*Less Favoured Areas* (LFA)" was thus neglected for investment. As a result, Korean farmers living in the hills found it harder to survive under poor production conditions. The quality of life in the hills was certainly lower than that in cities, encouraging younger generation of farming families to leave farming and farmland for jobs and better livelihoods in the cities. The hardship of upland farmers was further compounded by the shortage of farm labour because of job-induced migration of young upland folks to urban areas. It was a key factor that contributed to accelerated abandonment of agriculture and farmland in the Korean uplands. As an example, in 1993 alone over 66,500 hectares of cropland was abandoned, which was 3.2 % of the country's total cropland. By this rate nearly half a million hectares of cropland in the hills would have become abandoned by the year 2000.

Korea made a shift in its policies, considering that even if hills are less productive, continuing farming on these lands may yield higher positive externality to society than favourable production condition areas. Higher the positive externality of these marginal areas, higher will be the price and percentage of tax payers "*Willingness To Pay (WTP)* ", so as to maintain farming in the marginal upland areas. The trend has encouraged the government to consider reshaping of the policy of agricultural promotion zone for investment and now it has included hill areas also in it. Thus, Korea has adopted a unique tax policy for city dwellers, called "Willingness to Pay" and uses the revenue generated for improving farming and livelihoods in the hills.

Farmland Law of 1994 and Rural Improvement Law of 1994 were other steps taken by the government. One of the more relevant programmes was – "*the Marginal Land Improvement Programme* (MALIP)" for hilly and mountain areas. It was two-dimensional. One, it was to improve the use of marginal upland as productive land; two, it was to promote use of marginal upland for other farm and non-farm purposes; such as, rural resorts, livestock farming, fruit farming, and industrial development. Further, a scheme for compensating mountain farmers through direct cash payment to continue farming their farmlands was also introduced. It had two key objectives, increase food supply and preserve traditional farming areas on hill landscapes.

The lessons of the Korean experience may be summed up by as when the agricultural policies and measures consider only economic values, they are not sustainable and future generations may suffer access to resource base. Therefore, the policies favouring direct and indirect support to maintain hill farming are necessitated by both ecological and economic considerations."

4.1.5.17 **A whole life cycle approach** to the implementation of all nutrition support programmes should be introduced, and horizontal linkages should be established among numerous vertically structured programmes which are currently being

implemented. SHGs can be enabled to establish at least 500 Community Food Banks using locally grown grains as well as grains of under-utilized crops such as millets. Such SHGs should establish forward linkages with markets and backward linkages with Agricultural Universities and Research Institutions, so that they can become technically competitive and economically sustainable.

4.1.5.18 The Hill States should take full advantage of the **National Employment Guarantee Scheme** (NEGS) along with the **Food for Work Programme** (FWP) to achieve comprehensive food and nutrition security under the proposed **National Food Guarantee Act**. The NEGS must be used for creating productive assets and encourage capital formation. In order to achieve greater employment security, both skilled and unskilled employment should be promoted. Tourism, especially health, spiritual and adventure tourism, holds great promise in the hills and mountains and should be actively promoted. For ensuring convergence and synergy among various ongoing programmes, it will be useful to set up a **Hill Farmers' Council for Sustainable Food and Livelihood Security** as a consultative and monitoring body on food and livelihood security which could be a part of the national alliance for elimination of hunger and poverty.

Bridging Information Gaps on Key Indicators and Establishing Village Knowledge Centres

4.1.5.19 Deploying latest GIS techniques, areas of hills/mountains, the existing land use patterns, including those of different gradients of slopes, under various categories of forests and degraded lands, and the like, should be measured and delineated as the highest priority. In the absence of up-to-date and accurate information on such vital aspects, policies, strategies, plans and programmes on hill development and on hill agriculture will be elusive and misleading. With the increasing population pressure on hill lands and hopefully with the prospects of rights of tribals to own at least the degraded forest lands (which may be helpful in checking further degradation), the stipulated information is a prerequisite for undertaking **knowledge-based allocation and deployment of natural resources** to the needy people. Public action is urgently needed to create task forces and research groups, involving major stakeholders, and to provide

necessary facilities to such groups to undertake participatory research to analyze the cause-effect relationships among the various agro-ecological factors and status of soil and water loss/erosion, overall environmental and ecological degradation and deforestation, etc. This work is urgently required to enable the country to correct and avoid the past "mistakes" and to formulate and implement **people-centric** policies and programmes. This will also help promote synergy and convergence among agriculture, forestry, ecology and economy.

4.1.5.20 Under the national movement for creating each village as a knowledge centre, and with the passage of the Bill on Right to Information, especially realizing the geographic isolation, inaccessibility, remoteness and poor connectivity in the hills and mountains, high priority should be given to the creation of **Village Knowledge Centres** (Chapter VIII in the First Report of the NCF). Contents of the information package, besides being dynamic, relevant and user-friendly, should have up-to-date information on markets, trade, prices, new technologies especially on organic agriculture, biodiversity management, traditional knowledge, medicinal and aromatic plants, and weather outlook and risk management. SHGs, especially WSHGs, and the rural youth should particularly be associated with this movement. The public sector and financial institutions should supplement necessary funding requirements, at least in early stages, and help develop human resources. The National Alliance for Rural Knowledge Centres, NABARD, the North Eastern Space Applications Centre and similar establishments in the North West Himalayas, such as the DRDO Centre in the Cold Arid Zone of Ladakh should work together for establishing Rural Knowledge Centres in the hills.

Location-specific Planning and Monitoring

4.1.5.21 Action plan to suit different physiographic and agro climatic zones should be drawn up. In the different regions, action plans should be based on the following five major agro climatic zones – Tropical, Sub-tropical, Temperate, Intermediate and Cold Arid. The objective of the Action Plan should be to maximize the benefits from the different agro-climatic endowments of the States and minimize hazards and risks. Also, a strategy should be designed to promote job-led economic growth through greater

attention to agro-processing and agribusiness. The Hill State's comparative advantage lies in their ability to grow a wide range of fruits, nuts, ornamentals and specialty crops including olive, apricot, apple, walnut, kiwi fruit, avocado and medicinal plants. This advantage must be capitalized through creating specialized groups and adopting an end-to-end approach, linking production with marketing. Restructured Land Use Boards, matching agro-ecological, socio-economic and marketing capabilities and opportunities, should play an important role in advising the farmers about the prospects of different crops/varieties, livestock/breeds, etc.

4.1.5.22 **The State Governments should revitalize their Land Use Boards to play the much needed proactive advisory role**. It must be emphasised that land use decisions are also water use decisions. Therefore, in order to be able to provide an integrated advice, meteorological, ecological and marketing (domestic and export) factors would have to be considered simultaneously and interactively. Such a Board could be located in an Agricultural University and through a virtual college should give proactive advice on the choice of crops and farming systems, so as to achieve a match between demand and supply in farm commodities and to ensure that the most efficient crops are grown in different agro-climatic and agro-ecological regions.

4.1.5.23 The various Hill Area Development Programmes (HADP), including EGDP, WGDP and DPD, have met with varying successes in the different States. Lack of proper planning and judicious use of local resources have resulted in poor outcomes. The impact of the Programmes should be critically evaluated and reviewed to: (i) identify achievements and failures, clearly identifying the elements of successes and failures, (ii) suggest strategies and measures for wide adoption of the successful experiences and propose effective and easy-to-adopt evaluation and monitoring mechanisms and necessary remedial measures for avoiding the failures, (iii) undertake detailed agro-ecological and socio-economic studies in different agro-ecosystems and (iv) recommend policy framework and governance mechanism, including State-Centre coordination, flow of funds to the action site and accountability and increased commitment of the States for meeting the aspirations of the people of such disadvantaged areas. Since a large number

of schemes sponsored by Government of India are operational and funds from various sources are supposed to converge at the same action site, an institutional mechanism should be established or empowered, if not already existing, such as PRIs, to ensure synergy.

4.1.5.24 **Under the HADP, the level of satisfaction among the population with the pace of development is rather poor**. In view of the poor allocation of funds to these areas, the expenditure tends to be thinly spread without creating any serious impact in the ecology and environment of the area. **While the States must have the necessary flexibility to design programmes under the various special area development programmes, there is a need to prepare a perspective plan for these areas over a ten-year programme so that at least at the end of that period, these areas can be brought on par with the rest of the State**. On the implementation side, it is absolutely necessary to ensure people's participation primarily through the Panchayati Raj institutions at the local level. The assistance of credible NGOs wherever available could be tapped. In the Western Ghat region, there is a need to plan and implement a comprehensive integrated watershed development programme in a time-bound fashion rather than continuing with the present practice of thinly allocating the available resources by taking up so many sporadic programmes in different sectors and areas of the region, as mentioned earlier.

4.1.5.25 Hill farmers in border areas are subjected to additional vagaries of war and tension. Under the Border Area Development Programme (BADP), Special Central Assistance is provided as 100% grant for execution of approved schemes in border blocks. Often, the works are implemented largely in the block headquarters. In order to ensure that the villages which are actually on the border benefit from this programme, a change in the spatial unit of the programme to border village Panchayats instead of the border blocks may have to be considered. To ensure that the schemes are not taken up every year on an *ad hoc* basis, there is a need to draw up a perspective plan for implementation under BADP, keeping in view the flow of funds under both the normal

State Plans and the BADP. The decision-making process also has to be decentralized by involving the representatives of the Panchayati Raj institutions at the appropriate level.

Jal Swaraj: Hydrological Balance and Water Security

4.1.5.26 The Himalayas, with snow cover varying from about 1 to 3 million km^2 and around 100,000 km^2 glacier cover, constitute the water towers of India. Recent model studies show that, without the present Himalayas, the temperature over Southern Asia would have been 12^0C higher and there would have been no Indian monsoon. Moreover, the glaciers melt water contributes 400 to 800 km^3/year water to Indus-Ganga-Brahamputra river system - the life line of agricultural security of the country. With such a favourable hydrological regime, one would expect Himalayas and water basins of its rivers to be fully water-secure. But unfortunately, this is not the case; **per capita water availability in the country is likely to go below the scarcity level by 2025.**

4.1.5.27 The normal rainfall in the Himalayas varies from 900 mm in J&K to more than 3000 mm in Assam and Mehgalaya. **Although abundant, the rainfall is highly erratic both in time and space**, and most of it falls in less than 100 hrs as a result of which less than 30 per cent is retained and the rest is lost as run off etc. Cherrapunjee, located in the State of Meghalaya, has the world's highest average annual rainfall of over 11,000 mm. Paradoxically, this wettest place in the world experiences scarcity of drinking water in the summer months. **This harsh reality highlights the most obvious need to conserve and harvest the rainwater.**

4.1.5.28 Another limitation of the hill region is that the hill soils are shallow, thus prone to erosion. This does not permit higher retention of water by soil, leading to run off, siltation of dams and floods. Harvesting of rainfall becomes essential also for reducing the run off which also removes the nutrient enriched topsoil.

4.1.5.29 Against the backdrop of the huge water resources, less than 20 per cent of the cultivated area in the hills is irrigated, as compared to the national average of about 40 per cent. Hence, there is need and scope for increasing irrigated area in the hills for

enhancing productivity and income. **Hill water policy thus must emphasise the integration of farm level, watershed level, agro-ecological zone level and the national level water security**. In this context, we have to address two major interdependent issues towards achieving our **jal swaraj** (water self-reliance). The first one relates to the harvesting of rainwater, groundwater recharge and judicious and sustainable use of the water. The second one (of long-term consequences and implications) relates to the hydrological balance in the Himalayas as dictated by the snow and glacier regimes and the climate change.

4.1.5.30 As regards the first issue, there are several mutually reiterative approaches to address it. **One of the options** is **to create water harvesting structures**. It is proposed that water storage tanks of 15 cu m capacity with or without water delivery systems can easily bring one ha under irrigation. Perennial streams which are a major feature in these regions can be tapped to feed the tanks. The approximate cost of these structures are given in **(Table 8)**. These tanks can best be used for gravity based pressurized drip/micro sprinkler systems.

Table 8.Cost estimates of providing water using 15 cubic meter water harvesting structures with drip irrigation system

State	Cost of tanks of 15 cubic meter capacity without distribution @ 17000 per unit in Lakh Rupees	Cost of tanks of 15 cubic meter capacity with distribution system @ 45000 in Lakh Rupees
Andhra Pradesh	5,648.4	1,4951.7
Assam	91,938.0	243,365.4
Manipur	4,753.2	12,582.0
Meghalaya	8,160.0	21,600.0
Nagaland	8,857.2	23,445.5
Sikkim	3,223.2	8,532.0
Mizoram	3,095.4	8,193.6
Tripura	9,401.3	24,885.9
Himachal Pradesh	18,722.9	49,560.8
J & K	24,875.9	65,848.1
Uttaranchal	26,970.2	71,391.62

4.1.5.31 Rain water harvesting in small lined farm ponds and the storage tanks need to be taken up more vigorously. The farmers must be educated and trained accordingly and should be provided with adequate need-based subsidy for the construction and maintenance of lined farm ponds and tanks. Another simple method of harvesting and utilizing rain water for domestic and agricultural purposes is the roof-top water harvesting, which should be made mandatory in already constructed as well as in the buildings to be constructed in future. Further, the State Governments must take necessary steps to improve the efficiency of the existing Lift Irrigation Schemes (LIS) and to extend it to new potential areas.

4.1.5.32 *Kuhl* (small gravity streams) irrigation is the age-old practice and the major irrigation system in hill states. For instance, it covers about 92% of the irrigated area in Himachal Pradesh. Specific measures to enhance the potential of the existing *kuhl* irrigation system need to be implemented. At site specific locations new *kuhl* structures are required to be laid to increase the area under irrigation. Varabandi (fixation of time) system of water distribution needs to be strictly taken up in the *kuhl* irrigation system, as the farmers at the tail end do not get their share of water while the farmers located at the head reach generally over-irrigate their fields. **Water User Associations**, with active involvement of PRIs, should be established to ensure equitable distribution and effective maintenance of the water system.

4.1.5.33 For the most judicious use of irrigation water, thrust has to be laid on **pressurized irrigation systems**, which would help not only in covering wider areas in the characteristic undulating farm lands, but will also increase the water use efficiency in crop production. It is proposed to cover 200,000 ha under micro-irrigation in the Himalayas during the next 7 years. Hilly regions are tailor-made for promotion of high value horticultural and plantation crops, and, as these crops are ideally suited for drip/micro- sprinkler systems, there is high complementarily between the hill cropping system and the micro-irrigation/ fertigation system. The hill States have generally failed to benefit from the GOIs programmes and financial supports to micro-irrigation.

Wherever adopted, the systems have not performed well due to faulty hardwares supplied under subsidy-supported programmes. **This sluggishness and opaqueness should be remedied urgently.** Strict quality control measures should be adhered to maintain the efficiency and credibility of the system.

4.1.5.34 Activities such as road construction, mining, tunnelling, building construction, deposition of spoil/debris, blasting etc., if taken up non-scientifically, change the hydrology of the region and generally disrupt the availability of natural water resources, such as springs, wells, nullahs, kuhls etc., besides damaging the environment. While taking up such activities the concerned Government agencies must interact and intervene (if required) considering the hydrological repercussions.

4.1.5.35 Special steps will have to be taken to **rehabilitate hydrologic "hot spots" and water bodies** like Dal and Wular lakes and in J&K. **Low Water Parks** should be established to demonstrate as to how to increase income per litre of water. There is scope for groundwater exploitation in the hill, but this is expensive. Low Water Parks involving both the cultivation of high value but low volume and low water requiring crops and the use of fertigation and micro-irrigation techniques will help foster **water literacy, increase water use efficiency and save the precious water** .The approach has to be a **watershed plus system**. Low cost greenhouses using fertigation techniques should be popularized. The National and State level bodies, especially the Land Use Boards, should render proactive advice to stakeholders on crop planning in accordance with meteorological and marketing factors.

4.1.5.36 The role of agricultural implements and machines in enhancing water and labour use efficiency has remained negligible, and this drawback needs to be urgently corrected. Fortunately, precipitation harvesting technologies have already been developed but need to be promoted with due consideration to the stability of slopes and erosion problems. Water harvesting and storage involving use of pond lining materials will also promote fisheries in the hills to further augment food, nutritional and employment security.

4.1.5.37 The declining ground water table is likely to become a serious issue in hills as well. To check the problem, appropriate groundwater recharge measures must be enforced by all stakeholders. The traditional systems of rain water harvesting, groundwater recharging and water use, such as the system of the Kohlis and the Phad irrigation systems of Maharashtra and the Korambu system of the Eastern Ghats, should be protected, popularized and further improved.

4.1.5.38 There must be nodal agencies at State and National levels to develop databases on water resource availability and utilization. **Water banks** should be established and operated in areas which are highly vulnerable to water shortages and stresses. Panchayats, SHGs, Water Associations should play the leading role in implementing this programme. The Village Knowledge Centres should be actively associated with increasing water literacy and in promotion of judicious conservation and utilization of the resource.

4.1.5.39 Human resource development will play a key role in implementation of the suggested measures and spreading the message of the importance and awareness of water conservation. Training courses for farmers as well as for personnel of various levels in the water management systems should be an important component of all water development programmes, including micro-irrigation. Interactions with the field workers can also help in identification of low-cost indigenous technologies already prevalent in the hills. Water harvesting is not only essential for agricultural usage alone, it is equally vital for meeting the domestic and industrial water requirement. These demands increase in greater proportions compared to agricultural requirements with increase in the pace of development of a region. Therefore, the water associations and bodies should have representation and active participation of wide range of CSOs, NGOs and other peoples' organizations towards our goal to achieve and sutain full *jal swaraj*.

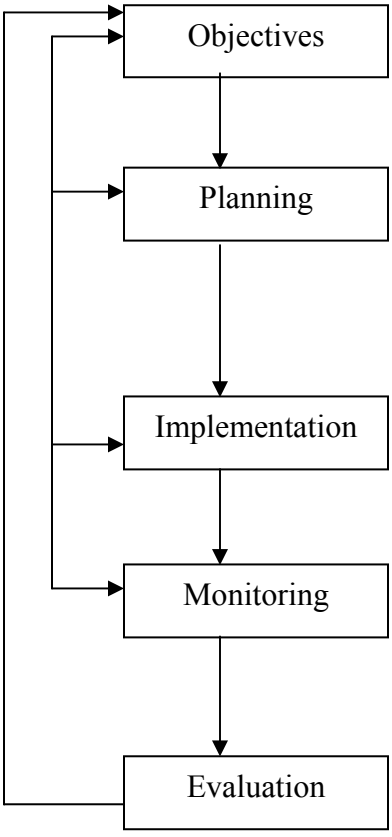
4.1.5.40 Turning to the big picture, it has now been conclusively established both through remote sensing and ground truth based investigations that **the glaciers and the snowfields in the Himalayas are on the decline**. The rate of retreat of the snout of

Gangotri glacier demonstrated a sharp rise in the 20th Century. Recently, it has been reported that the Parbati glacier has retreated by 578 metres between 1990 and 2001 (a retreat of 52 metres per year). Excessive melting of the glacier may have a short term impact of making more water available but it will reduce the river flow in the future thus adversely affecting the hydropower projects on the rivers fed by these glaciers. The sudden melting of glaciers can also lead to glacial lake outburst floods and flash flood tragedies as happened in the recent past. **The hydrological balance in the hilly regions has a direct bearing on the water resources of the adjoining regions particularly the Indo-Gangetic Basin, having very far-reaching consequences on the nation's food, economic and ecological security.**

4.1.5.41 Global scientific interest in the study of Himalayan snow has been in progress for several years. Expedition mode researches are reported by several investigators, but a systematic scientific exploration of these vast snow and ice fields needs a committed approach. A **National Centre on Glacierology** should be established following ICU/UNESCO/WMO supported centres on glacierology at Colorado (USA), Moscow (Russia), Cambridge (UK), Zurich (Switzerland) for collection, storage and dissemination of information on status of seasonal/perennial snow and ice. The centre should undertake research on understanding the interaction amongst biological processes, physical environment and the climatic change and develop early, medium and long term warning systems to enable appropriate and timely responses at various levels. The centre, in collaboration with other similar centres, including those on climatology and climate change in the world, should in particular play a proactive role in advising trends of water availability and overall hydrological situation in the medium and long term to enable necessary adjustments in farming system and germplasm utilization.

4.1.5.42 Notwithstanding the centrality of the adoption of integrated water, watershed and farming development systems, **the need for integrating uplands with lowlands and pursuing an integrated approach to river basin management can hardly be overemphasized**. Such an integrated management system is the result of an iterative process (**Figure 1**). Under the integrated approach, the objective for the

management of the basin are initially formulated for both the lower and upper basin areas. These objectives should be based on local and national priorities, prevailing land uses and unique characteristic of each basin's natural resources, thus linking the watershed and flood plain. Such an integrated approach will help not only enriching the natural watersheds and local hydrological endowments, but would also seek a rethinking on the proposed national plan of physically linking all the major rivers of the country.



Objectives are formulated for the management of the entire basin (watershed and floodplain) on the basis of local and national needs by means of intensive stakeholder consultation.

A plan for management of the basin is formulated on the basis of the objectives, the land-use and resource management needs of the area. This is done through intensive stakeholders participation.

The plan is implemented by all landowners and concerned stakeholders under the guidance of a management board supported by appropriate policy instruments and innovative financing.

Implementation of the plan is closely monitored to assess the impact of interventions and policies, if necessary, interventions can be adapted on the basis of the monitoring results.

The implementation of the plan is evaluated on a regular basis to ensure that the objectives are being achieved. If necessary, the objectives can be adjusted in light of new knowledge or a change in user needs.

Figure 1: The Iterative Process of Integrated Basin Management

4.1.5.43 Since 1970, several legal systems related to water in India were formulated, such as the Model Groundwater Bill, the Model (Water) Bill, Central Groundwater Authority, Central Groundwater Board and National Water Resource

Council. But, none of these have been effective. A recent study of the Indian Academy of Agricultural Sciences (NAAS) has highlighted the serious gaps in implementation of the various legal provisions and in creating necessary institutions for equitable and sustainable management of water. The Academy has made a set of recommendations to overcome the problems, which along with the recommendations in the above paragraphs 5.29 to 5.41 should be implemented by concerned quarters (Policy Paper 32: Emerging Issues in Water Management – the Question of Ownership, NAAS, June, 2005).

Strengthen the Role of Agricultural Machines and Implements

4.1.5.44 **Drudgery in agricultural operations and transport (carrying head load and backload strapped to forehead) should not be acceptable in the modern society. Prevalence of under-nutrition and lung diseases in the hills further aggravates the situation**. Hill agriculture is further handicapped due to the lack of adequate engineering and technological inputs. The difficult terrain and climatic conditions do not permit direct transplantation of technologies from the plains. Moreover, women are predominant labour force in hill agriculture. And as we know, ergonomically female workers are not the same as male workers. But, this is seldom considered while designing agricultural machines and implements, causing greater drudgery to women workers.

4.1.5.45 The mechanical power requirements for the hills cannot be met with the existing tractors and power tillers because of difficulties in negotiating the hilly terrains. Light weight power tillers have been envisaged to fulfill the needs. Central Institute of Agricultural Engineering, Bhopal has made an effort to develop a light weight power tiller indigenously and it is being tested. Industrial support to manufacture these **light weight prime movers** is required along with financial incentives to promote this and other similar power sources. These light weight prime movers could also facilitate the transport of agricultural inputs and produce, as well as for transporting other materials, which are presently being done manually as head loads, with serious health consequences.

4.1.5.46 There is a need to understand and characterize the hill anthropometrics and accordingly design suitable devices, tools and machines to reduce human drudgery. Ergonomic interventions are essential in hill ecosystems to facilitate faster absorption of engineering inputs in agricultural operations. This will permit not only better work efficiency but also improve human health as the occupational health hazards would have been considerably reduced. The youth in hill ecosystems needs to be sensitized and encouraged to acquire relevant skills to pursue the above-mentioned activities. The SAUs in the region need to orient their curricula to include the appropriate courses on engineering skills required for the hill region.

4.1.5.47 The land holdings in hill ecosystems are not only small, they are ecologically fragile. Soil and water erosion problems are widespread. To obviate these difficulties, Protective Cultivation Technologies in the form of green houses, low tunnels, mulches and geo-textiles have proved to be effective and even extend the growing seasons in the hills with significantly higher productivities. Greater emphasis needs to be placed to develop regionally differentiated protected cultivation technologies and then promote them on mass scale to create a long lasting impact on agriculture and society.

4.1.5.48 Post harvest loss reduction and value addition activities are more relevant in hill ecosystems than anywhere else. The difficult terrain and consequent lack of transport infrastructure demands that the agricultural produce is managed well and value addition activities are undertaken in the production catchments so that the transport related problems are minimized. At the same time, the farm incomes and rural employment are enhanced significantly. The development of appropriate post harvest technologies and promotion of agro processing activities are needed to be carried out. For this necessary machines could be imported and/or locally produced and widely popularized. Unit operations that are endemic to hill agriculture and agro-processing should be identified and internalized in research and development activities in the hills, including adaptive alterations in the available machines, tools and implements.

4.1.5.49 With the above backdrop, R & D institutional support for hill ecosystems should be considered critical. The early establishment of the College of Post Harvest Engineering in Sikkim under Central Agricultural University will go a long way in addressing the issues. This institution along with the Central Institute of Agricultural Engineering, Bhopal; Central Institute for Post Harvest Engineering and Technology, Ludhiana; ICAR Research Complex, Barapani and other existing ICAR units located in the hill ecosystems could be expected to provide the necessary R & D support. Besides, State Agricultural Universities located in hill ecosystems need to be strengthened in terms of appropriate human resource and infrastructure to undertake Agricultural Engineering related activities for the local conditions.

4.1.5.50 The state Governments need to have effective delivery mechanisms to translate the R&D outputs into outcomes. Specifically, it involves creating agricultural Engineering Directorates in the hill states to assimilate the technological developments and effectively translating them into action. Bases for manufacture, maintenance and supply of farm and agroprocessing equipment should be created in the hills. Networks of custom servicing and agro-service centres run by rural entrepreneurs and SHGs and duly supported by NABARD and other financial institutions should be established. An All India Coordinated ICAR Project on Mechanisation of Hill Agriculture should be launched. The agro processing activities undertaken by farmer and their dependents in the production catchments should be considered as part of agricultural activities, thereby, not inviting taxation.

Correcting Soil Fertility Imbalances

4.1.5.51 Upto 80 percent of soils sampled in the hills show medium to severe micronutrient deficiencies resulting in decline in the growth rate of total factor productivity and in increase of environmental pollution. **This hidden soil hunger must be corrected through large-scale adoption of micronutrient supplementation of integrated plant nutrient management system based on soil test**. Soil testing facilities should be established at strategic locations, including at KVKs, ATMAs and agriclinics

and should be duly staffed and equipped to undertake timely and accurate soil testing (see First Report of the NCF). **Soil health cards** should be issued to the farmers to facilitate judicious adoption of recommended technologies and to monitor soil health. **Communities' Land Care Movement** involving local people should be promoted by all stakeholders. The extension agents and farmers should be trained in IPNS and necessary life-saving-support should be provided to the farmers, the SHGs and local communities involved in conserving and judiciously utilizing the natural resources.

Conservation and Enhancement of Biodiversity

4.1.5.52 The National Bioresources Development Board, NBPGR and other concerned organisations should help chronicle and prepare **digital inventories** of the bioresources of Hill States, covering plants, animals, fish and microorganisms. In addition, these should assist in the sustainable use of the germplasm of medicinal plants, ornamentals and olives, apricots, seabuckthorn, saffron, *kala jeera,* Pashmina goats and yak. **Genome clubs** should be organised in schools to promote genetic literacy among students. **Hill's unique biological wealth will have to be converted into economic wealth on a sustainable basis.**

4.1.5.53 In several hilly areas commercialization of resources is confronting conservation plans. For these farming communities there is need to work out a package of compensation for rendering conservation services. As yet there has been no practice of compensating custodian hill farmers for maintaining the great hill agrobiodiversity. **The PVPFR Bill, passed in 2001, should be implemented and hill communities should be empowered to realize the Farmers' Rights.**

4.1.5.54 Although commercialization of forest products can help mountain communities achieve sustainable livelihoods, sustainable use of these bio resources, should be ensured through appropriate institutional support and awareness raising. Panchayati Raj Institutions should be suitably strengthened to mobilize local communities to lead the conservation and utilization. **Gene sanctuaries** for selected species, using participatory, IK and TK and scientific approaches, should be established

and judiciously managed. The local communities should be a partner in the conservation process and duly compensated.

4.1.5.55 Hill farmers traditional practices unfold significant knowledge and information about the multiple roles of biodiversity and agro-biodiversity in using marginal lands productivity and livelihood security. The indigenous and traditional knowledge systems should be duly protected under the PPVFR. The Village Knowledge Centres should actively promote **gene literacy**.

Diversification for Enhanced and Congruent Economic, Employment and Ecological Security

4.1.5.56 The farming-based livelihoods in the Himalayas today present a landscape of scenarios, ranging from total diversification and better off farming communities to still continuing subsistence farming, poverty and extreme distress situations of unsustainable farming and livelihood conditions. Lessons of the experiences indicate that besides several other options, such as generating non-farm employment opportunities through infrastructure development for tourism etc, farming will remain the basis for alleviating poverty of the most distressed farming communities. Priority focus on most distressed class of hill farmers is emphasized to avoid further alienation and disparities which are becoming wider. Thus, the next round of hill agriculture diversification interventions (such as the horticulture mission) need to aim at new set of thrusts to **synergistically integrate economics, employment and ecology** over wide range of farming conditions by forging backward linkages to agrobiodiversity / biodiversity and local people and forward linkages with agroprocessing , agribusiness and marketing.

4.1.5.57 At national level there has been a general lack of recognition of the niches that hilly and mountain areas offer to increase income generation opportunities without any serious damage to environment. Therefore, there has been lack of appropriate policies to promote such activities. Much efforts are needed to identify the dormant niches of hill agriculture across the Himalayas. The production niches and biodiversity have potentials to convert marginal uplands and water bodies into productive production systems. There are areas in the Himalayan region that in fact have a significant potential

for research-driven productivity increases, and that the returns on investment in these areas may even surpass favoured areas in the plains. Agroforestry involving high value species such as *Arjun* trees for *Tasar* silk production, Jatropa and other fuel trees, oil-bearing trees and bushes, such as olives in J&K, nitrogen fixing fertilizer trees and other soil health enhancing trees should be promoted in so called degraded lands. **Only proven genetically superior planting materials should be used for these plantations**. Similar opportunities exist for livestock and fisheries, in solo and/or integrated crop-horticulture-agroforestry-livestock-fisheries farming systems.

4.1.5.58 **Horticulture-led transformation**: While there will not be any dispute on priority to horticulture, the choice of most appropriate crops should get priority attention. The Himalayan farmers will need a range of horticulture crops to be able to satisfy all kinds of needs, namely, agro-ecological niches, farmland types and socio economic settings. The well known fruit crops i.e. apples, plums, peaches, pears, oranges, walnuts, kiwi, cherry, etc form one group of developed hybrid crops. **In some States, however, there is high concentration of one or two fruit crops, which may not be advisable in the long run**. For instance, in Himachal Pradesh, apple accounts for over 70 percent of the fruit production, although the apple yield and quality (of certain production systems) are not upto the mark, let alone the neglect of other equally or more promising fruit and even major food security crops. Several other States have also tried to replicate the Himachal's experience but with less than desired outcome. Despite the increased population and distribution of domestic apples, in the post-WTO regime, import of apple from China, Australia and New Zealand is swelling fast because of superior quality and competitive prices. The various apple producing hill States should identify quality varieties most suited to their niches and their production peaks noncoinciding with the peaks in other States to ensure remunerative returns to the growers and prolonged availability of quality apple to the consumers.

4.1.5.59 The Himalayan farmlands and farmers also hold very special niches for other lesser known but native / indigenous horticulture crops, which if promoted will provide exclusive comparative advantage over markets and ecological suitability. Based on market research and agro-ecological mapping and matching, through inter-State

consultation, commercial production and distribution of selected priority species should be systematically undertaken by commodity-specific SHGs or SFEs or through contract farming. High value crops like saffron and *Kala Zeera*, with due R & D support, can prove much more remunerative. Besides the major temperate fruits like apple, pear, walnut, seabuckthorn in cold arid zone, cardamom in Sikkim, organic tea in SFEs of Assam, passion fruit in Mizoram, Sikkim, Nagaland and Arunachal Pradesh, ginger and turmeric in Meghalaya and Mizoram, deserve high priority. Considering profitability, low perishability and ecological compatibility, **greater attention should be paid to the production and marketing of fruit nuts** viz. walnut, pecan and hazelnut. Anthuriums and orchids, through group farming and marketing, could become major commercial enterprises in the Himalayas. The Land Use Boards, NHM and NHB and the proposed National Hill Coordinating Centre should play a proactive role in delineation of production regimes and promotion of marketing to create win-win situation for all the partners.

4.1.5.60 Diversification of hill farming to medicinal and aromatic plants has a distinct advantage, but has remained largely underexploited and unorganized. However, so far the opportunity remains locked up for the hill farmers in the institutional framework. Steps require revisiting sensitive issues of conservation, restricting rights to wild harvesting, removing restrictions on marketing of cultivated produce rather making farming more remunerative, and even enhancing access to land resources to particular ethnic communities. A separate **National Mission on Medicinal and Aromatic Plants** (**NMMAP**) should be established (see First Report and Chapter 4.5 of this Report).

4.1.5.61 Sustainable economic activities, proven technological interventions, timely institutional support and effective partnerships (public-private partnership) should fortify ecological – economic interactions and interdependence. Greater emphasis should be placed on strengthening the links between the producer, the industry and the consumer. Grassroot institutions, including SHGs and cooperatives, should be established and suitably empowered by financial assistance, information flow and skill development for strengthening production–post harvest handling–processing–value

addition–marketing chain. Good experiences of NDDB and sugarcane cooperatives in Maharashtra should be widely shared. Panchayati Raj Institutions should play a leading role especially in mobilizing community actions for conservation and improvement of natural resource base. SMEs should be supported, including through enhancing their access to adequate formal credit, to establish and effectively run agribusinesses in rural areas. Income enhancement and profit margins of farmers, especially of small and marginal farmers, should be a major consideration alongwith ecological security concerns. The successful experiences of one hill State could be easily replicated in another hill State. Creation of clientele clusters with integration of production – processing - marketing, as practiced for apple in Himachal, will be helpful in generating meaningful employment and retaining the Uttaranchal males in their villages linked with their lands and families rather than migrating to cities in large numbers. It is proposed to train 300,000 farmers and 500 trainers at various levels in specialized areas to promote production, processing and marketing of the priority species.

4.1.5.62 New crops from the Himalayan wild biodiversity constitute the greatest strength of the medicinal plants farming sector. These are wild plants most suited to the local environment and qualify as new crops without years of scientific inputs to convert them into cultivated crops. It is revolution of a kind for creating new cash crops, most suited to hills and not thought of in the food sector. **The wild source factor also holds the key to niche and comparative advantage**. This sector is highly significant from the angle of both national strategic interests of conservation and local economic needs. Identifying and developing backward and forward linkages for these new crops of the Himalayas will need to be worked out before putting them on promotion path, especially keeping in view the interest of the smallholders.

4.1.5.63 **We also need new generation of institutional support for this sector to succeed**. For instance, the **Institute of Himalayan Bioresources Technology (IHBT),** Palampur, Himachal Pradesh, which is working on developing the whole chain---identifying the source of new crop from the wild, to developing cultivation protocols, to post harvest processing including the prototypes of machines for each household or

village scale to market linkages, the complete solution package. The IHBT is a rare example of new generation institutions with whole range of new crops of this category from the NW Himalayas waiting to be harnessed for the benefit of the Himalayan farmers. IHBT also provides the clue as to what kind of institutions are needed and as to what should be the strategy to restructure and reform research and extension institutions to enhance their excellence, relevance and responsiveness to the dynamic national and international agricultural and trade scenarios.

4.1.5.64 **Integration of livestock for livelihood security:** Livestock has been the basis of subsistence livelihood of the hill farmers. It has potential to transform into one of the most viable options of agricultural diversification, along with horticulture. Unfortunately, some of the practices such as nomadism, bakarwals and Gujjars' buffalo herds have been facing stiff regulatory controls and find it hard to continue any longer—the distress calls from them are for real. Livestock based livelihood options of these most marginalized and underprivileged people should be seen in right perspective so that regulatory mechanisms are modified to the extent that the farmers are saved from abandoning these options. In view of the increasing domestic demand and export potential for meat, the national capacity should be strengthened for hygienic production, processing and marketing of meat. In some of the hill States, such as Jammu and Kashmir, there is serious shortage of meat, which could be mitigated by rearing of more efficient meat producing animals such as rabbits, lamas and alpacas.

4.1.5.65 Along with the use of most promising and adapted breeds, modern diagnostic and disease management, priority support is needed to reduce acute fodder scarcity and to ensure feed and nutritional security of livestock. Both productive grazing lands and fodder for stall feeding need attention. While the alien invasive weed species should be completely weeded out, quarantine measures should be strictly adhered to avoid further infestation as well as good grazing practices should be enforced. Each State should establish **State Livestock Food Corporation** for comprehensively addressing the livestock nutrition problem. To begin with, in line with the proposed Livestock Food Corporation of India (see Chapter 10 of the First Report). SHG-based 1,000 fodder and

feed banks should be strategically located and supported both by public and private financial and service centres

4.1.5.66 **Fisheries for nutritional and income adequacy:** Science-based integrated fisheries development in the hills can greatly help in bridging the nutritional and income gaps. The NER States should strengthen their capacities to harness their huge fisheries, production, potential, thus minimise their daily costly imports from distant places in the country. Development of markets, especially export markets, through the creation or expansion of Export Zones, for speciality fishes is essential for stimulating domestic distribution as well as exports. SPS and TBT concerns must be addressed effectively to realize gains from the technological advances in fisheries product diversification and value addition, which should be supported also by appropriate fiscal and regulatory policies. Concerted effort is needed to eliminate fish diseases, particularly in the coldwater fishes. Vigorous efforts will be needed to educate producers, processors and exporters in clean and safe production. The private sector is also showing great interest in promoting fisheries in the hills but this must be done with care keeping in mind the equity and environmental sustainability considerations. Necessary research, extension and training back-up is essential to harness the potential (see Chapter 3).

Organic Farming: More of a Necessity and Less of a Choice

4.1.5.67 Organic farming is ideally suited to hill agriculture, especially for MAP and horticultural species and to jhuming. Uttaranchal leads the Himalayan States in adopting organic farming for harnessing the ecolgy-economics synergy and has declared itself as an Organic State **(Box 6).** Himachal Pradesh, Sikkim, Nagaland and Manipur have also taken several steps towards mainstreaming organic farming.

4.1.5.68 Around 50 tonnes of different varieties of organic spices were produced annually under the auspices of the Spices Board which has formulated well-developed protocols for organic production of spice crops, their certification system and market links. To begin with, the hill States should concentrate on production of organic spices (ginger, turmeric, black pepper, large cardamom) and different medicinal and aromatic

plants. Assuming that a market growth of organic spices in Europe, US and Japan is approximately 10% per annum, export of organic spice will get a significant production boost in the coming years. Same is the case of organic tea, where international demand is very high and **smallholders' organic tea gardens** promise high socio-economic returns. About 25,000 model Organic Villages or contract farms of the strategic commodities should be developed in the hills during the next seven years.

Box 6

Uttaranchal: an Organic State

Organic Farming is identified as *sine qua non* for mountain farming in the State

The three pronged strategy comprises of:

- Dissemination of suitable technology.
- Development of appropriate certification regime.
- Building marketing networks.

Institutional framework put in place

- Uttaranchal Organic Commodities Board established in 2003.
- Three Centres of Excellence opened in 2003.
- Uttaranchal Seeds and Organic Produce Certification Agency came into being in 2003 which is first such agency to obtain ISO9001:2000 and ISO 65 accredition from DET NORKSE VERITAS of Netherlands.

Multi agency extension approach adopted

The extension agencies are:

- Grass root level para workers
- Self Help Groups/Farmers Interest Groups
- Agripreneurs/Agriclinicians
- Department of Agriculture

New Concepts evolved and translated into practice successfully

- Model bio-villages (1200 in number covering 20000 farmers/19000 hectares)
- Convergence of pre-harvest and post-harvest practices at farm/village level
- Finger Millets hitherto the most neglected crop now mainstreamed in export quality baby food (Now being exported to Japan/procured for ICDS programme)

Long Term Agenda

- Mapping, in situ conservation and propagation of crop bio diversity
- Integration of ITK in development of package of agronomic practices
- Building a Brand Equity for Uttaranchal products
- Exploring new income generation with outreach programmes
- Networking with other mountain States and working as role model.

4.1.5.69 Although the GOI has already taken steps to have indigenous certification system to help small and marginal growers and to issue valid organic certificates through certifying agencies accredited by APEDA / Coffee Board / Tea Board / Spices Board, the situation is far from satisfactory. **A focused national movement on organic agriculture with a credible certification of the process and produce, coupled with quality and trade awareness and literacy is a *sine qua non* for mainstreaming and integrating organic farming in the national agricultural economy. It must be emphasized that establishing and running credible organic farming systems is much more complex and demanding than the usual inorganic-based agriculture. But, it is do-able and should be done for harnessing the unique opportunities in India and abroad.**

4.1.5.70 Debate on institutional back up support for organic farming to succeed in the hills should be widened and intensified. R& D institutions are still very weak and States will need to work out policies providing enabling environment for promoting organic farming. Also organic agriculture research and technology generation is changing the whole concept of innovators. So far in India farmers have become leaders in innovations and scientific fraternity is looking from the sides. Much of the Green Revolution technology protocols, methodologies and perspectives, to which scientists are used to, are inappropriate for organic agriculture. Organic agriculture may also lead to farmer scientist partnership and real on-farm technology development and refinement. **Organic agriculture is about following ecological principles in farming** and its technological options are therefore sensitive to ecological conditions of a farm. This implies that outside technological solutions will always take second place to on-farm innovations, contrary to conventional Green Revolution technological practices.

4.1.5.71 **In an estimated US $ 30 billion global market of organic products, India's share is hardly 0.1%,** the huge potential notwithstanding. The wide gap is due to poor market research, the lack of certification capacity to ensure quality and brand labelling and the lack of research and development support, including an effective monitoring and technology transfer system. **The Ministry of Agriculture, alongwith NABARD, should urgently bridge this gap by initiating the much-needed market and policy research**. The National Programme for Organic Production (NPOP) having

internationally agreed standards for products and labelling as India Organic was started in May 2000. The hill States should not only be linked with the NPOP, but should be given priority because of the obvious comparative advantages.

Reorientation of Research, Technology Development and Extension and Harnessing of Group Dynamics

4.1.5.72 Agricultural development in the hills should become a knowledge intensive business. Right niche identification, technological support and access to institutional support are the important factors affecting the level of transformation of hill farming. The lack of skilled agricultural work force and poor technology transfer mechanisms in most hill States emphasises the urgent need for a strong **technology policy** in each State and revamping of the research and extension systems.

4.1.5.73 Productivity of hill agriculture is comparatively low and is declining. Greater attention is therefore needed to alleviate the constraints by synergizing economic and ecological values, sometimes promoting services and programmes which bring better economic value even at lower productivity. **Genetically improved strains combining productivity, quality and resistance to biotic and abiotic stresses, IPM and IPNS evolved through farmers' participation should be the pith of the technology packages. Farmer Participatory Research and Knowledge Management Systems should be used for harnessing the rich indigenous genetic heterogeneity for optimizing the benefits of agro-ecological and socio-cultural variability, such as the development of New Hill Rices. Post harvest primary processing, value addition (reducing volume and increasing value) and prevention of post harvest losses by establishing appropriate backward and forward linkages is another priority area awaiting concerted attention and effort**. The status of agro-based industries in the Himalayas is not very satisfactory despite high potential. **The KVKs and ATMA should include strong components of trainings on value addition, rural processing and marketing, and should be restructured accordingly.**

4.1.5.74 Hills being inherently marginal in terms of their natural endowment, simple talk of improving productivity and production of conventional crops and systems prevalent in the plains will not be of much help in the hills. Several public sector Institutes, Universities, coupled with the State Governments' research and technology development institutions have evolved technologies but there is a serious gap in diffusion and adoption of the technologies. There is a need for **reskilling and retooling** research and extension personnel. Alternative extension tools, such as farmer to farmer extension, market-led extension, producer-consumer partnership will need to be refined and popularized. Over 10,000 **farm schools** should be established during the next seven Years. The integrated farming system strategy for hills need to be revisited and fine-tuned to capture the location-specific needs and opportunities The recommendations made by the **Swaminathan Committee** for strengthening research, technology and human resources development in the North Eastern region, especially the setting up of a separate cadre of agriculture researchers should be adopted and implemented without delay.

4.1.5.75 Skill upgradation and capacity building of tribal farmers through intensive training should be seen as the first step before taking up programmes like area expansion of new crops. A structured two-tier training programme needs to be institutionalised. Firstly, the departmental experts and extension agents should be trained by R & D Staff. Secondly, the advanced technologies need to be demonstrated in farmers' fields on selected basis involving the local R & D institutions. **A paradigm shift from unskilled to skilled work and enhancing access to quality (sanitary and phytosanitary measures) and trade (quality, price, market, etc) literacy with reference to home and external markets are essential**.

4.1.5.76 The Agro-horti-silvi-pastoral system developed by ICAR has been identified as economically viable, eco-friendly and sustainable land use system for the NEH region. Technology transfer for valleys and plains has taken place to a limited extent but the models suggested as alternates to Jhuming have not been replicated and adopted. Similarly, the package of practices for rejuvenation of declined orange orchards developed by ICAR have not spread extensively. **Such technology transfer gaps should**

be analysed and their redressal mechanism found in a participatory mode by creating a consortium involving the ICAR institutes, SAUs, other Universities, private sector, NGOs and farmers.

4.1.5.77 **Farming has to become knowledge intensive** if it is to become competitive for which retooling and retraining of extension personnel and establishment of rural knowledge centres are essential. For remote tribal areas groups extension through formation of SHGs is perhaps the best option and it should be easier to organize training of the members of the SHGs. This process empowers the poor and enables them to control direction of own development by identifying their felt needs. Assam has some experience in formation of SHGs and channelling micro-finance through these Groups. Group approach to extension through SHG should aim improvement of agricultural production system of the niche crops and associated support services such as marketing, primary processing and reduction of post harvest losses. The small farmers SHGs should be helped to organize establishment of Small Farmers Estates (SFE) covering an area of 100-200 ha each to capture the economies of scale. It is proposed to establish 25,000 SFEs in hill area during the next seven years.

Supply of Quality Planting Materials and other Inputs

4.1.5.78 Inferior and spurious input supply, specially poor quality seeds and planting materials, fertilizers and pesticides, is a common issue of hill farmers across the Himalayan States. Much needs to be done in this area. One of the main reasons for stagnating yields and low productivity of apple orchards in Himachal Pradesh and Uttaranchal has been the poor planting materials used in the past and non-availability of quality materials for new and replantings. Therefore, it is suggested that as the highest priority, **the public as well as the private sectors should join hands in establishing and maintaining quality mother plant nurseries both for root stocks and desired scion materials.** State Plans for flow of quality planting materials of apples and other priority crops should be number one priority of Himachal Pradesh and Uttaranchal. The recently launched National Horticulture Mission should, in close consultation with the stakeholders, allocate desired financial and technical supports to this most critical area.

4.1.5.79 Although seed production and distribution should primarily be in hands of (enlightened) private sector, there are certain "orphan" commodities and geographic areas where effective leadership and indulgence of the public sector and public-private partnership is essential. In a public-private partnership mode, as beginning to happen in some of the hill States, **Seed Villages, Horticulture and Plantation Crop Rural Nurseries, Seed and Planting Material Self Help Groups, especially Women Self Help Groups, should be organized and supported**. At least 30,00 such units should be established and should constitute the **national grid of certified mother nurseries**. Their stocks should be inventorised and the list should be available for general use. Incentives should be provided to the private sector atleast in the early stages. Individual institutions, Universities - public or private, and Government Departments should be responsible and duly empowered to timely supply breeder and mother planting materials and foundation seeds. **Each State should develop annual plan for timely, quality adequate and rationally priced production and distribution of seeds and other planting materials and should have a credible system of monitoring and correcting the unhindered flow of quality seed from the breeder/originator to the farmers.**

Credit and other Institutional Support

4.1.5.80 In general, access to finance and cheaper credit have not helped hill farmers. Banks favour credit to those who can generate surplus and to small scale enterprises for cost effectiveness and profitability, rather than to small and marginal hill farmers. **Average credit received by a hill farmer is 40 percent of that received by his counterpart in the plains.** As mentioned earlier, NABARD and other banks have come up with credit packages specifically designed for hill farmers, but the actual delivery is dismal. Infact, the formal credit squeeze upon hill agriculture is presently acute. It may mean revival of private money-lending in hilly areas. **The credit regulations are not in conformity with the land tenure systems of NE and therefore the most needy tribal farmers and women-headed households have never been able to benefit from the credit system**. The Kisan Credit Cards scheme has helped only a handful of farmers, and

the women farmers and women-headed households have generally been left out. The issues of land rights and credit access should be addressed urgently.

4.1.5.81 **Service costs and creation of infrastructure, such as constructing an irrigation device or facility are costlier in hills than in the plains. These differences should be considered while deciding the credit level. Credit should also support SMEs to also strengthen marketing, storage and value addition chains**. New innovations are needed in credit and finance system to make the products pro-small and pro- marginal hill farmers. Small farmers have small surpluses for market and that is not seen as viable opportunity by credit and finance systems. Keeping in mind the problems of hill farmers, attitude of the credit institutions towards the poor will need to be adjusted. **The public sector should assist the banks in covering their undue risks in hill areas and in designing and delivering credit products suitable for hill farmers.** Insurance coverage of the hill farmer is almost negligible. **Special insurance products and dispensation mechanism, duly supported by the Central Government, will be needed.**

4.1.5.82 As mentioned earlier, NER has been receiving liberal financial assistance and special schemes for promotion of horticulture and overall agriculture through GOI funded projects and supports of other financial institutions. Shyness of the people, lack of skilled agricultural work force, inappropriate land tenure system and ineffective governance are some of the socio-cultural constraints coming in the way of proper utilization of funds. The apathy of State Governments towards investing in agriculture-led development notwithstanding, the absence of private sector participation in the developmental process has also hampered growth of institutional support in the hills. Land reforms and institutional reforms are interlinked with institutional support and therefore can not be overlooked. The flow of credit and other financial supports to farmers in the NWR have not been as good as in the NER. Suitable institutional arrangements are needed to reduce this disparity. As noted in Section 3, NABARD, NEFDi and SCBs have several schemes to support hill farmers. But, their impact is localized and limited, and often short-lived. The Programmes should be critically evaluated and successful ones should be widely replicated. Lessons should also be learnt

from failed cases both for correcting and resurrecting the past mistakes and for avoiding the future pitfalls.

Central Place of Women in Hill Agriculture

4.1.5.83 Mountain women have traditionally been the invisible work force, the less acknowledged backbone of the family economy. In the hills, whether the men are in the household or have migrated elsewhere to supplement the family livelihood needs, the women have their major share of duties. Looking more closely at the type of work that women do, we can distinguish three main areas, all crucial to keeping the family and indeed the hill economy alive. These three areas are: survival tasks, work in the households and income generation.

4.1.5.84 In particular, hill women have been contributing substantially to the family budget through income generating activities. This is particularly the case for the growing number of female-headed households where men have to migrate in search of work. Even where a woman is not completely alone, contribution of women to the household budget is of utmost importance to the family, more so because women spend more of their income on family welfare. However, even though, women fulfil a great number of essential tasks, they have limited access to and control over income, credit, land, education, training and information. Further, hill women are not only the most important food producers, but are also custodians of rich traditional knowledge of farming practices, food, fuel, feed, fiber and medicinal values and uses of local and indigenous bioresources.

4.1.5.85 It is only recently that participation of women in development programs in hilly areas is being considered necessary. The extension approaches and tools may still be gender biased and therefore much needs to be done to encourage cooperation and partnership of women in hill development. The recent successful experiences with Mahila Mandals and SHGs in several hilly States is a reminder of the potential of partnership of women in hilly areas development. **Women empowerment**, as envisaged in the "New Deal for Women in Agriculture" (Chapter 4, First Report, NCF), assumes extremely high

priority in hill agriculture, **especially enhanced access of hill women to land rights, credit, insurance, education, technology (drudgery-reducing tools and implements), training and skill development and information.**

Completing the Unfinished Land Reforms

4.1.5.86 Traditionally, community ownership of land is prevalent in hill tribal communities, especially in the NER. Valley lands, terraced land, homestead land, short fallow lands are normally recognized as private lands for all practical purposes. Better productivity and higher economic returns from such privately owned land provide incentives for crop diversification and commercial horticulture. **The prevalent land tenure system in Hill districts and absence of land records and legalized ownership rights hamper technology adoption, investment in land care and sustainability and the flow of bank credit**. Land in the hills under shifting (Jhum) cultivation is essentially community land. The Jhuming cycle is getting reduced because of population pressure. If ownership rights on part of the community land presently under the Jhuming can be given, perennial horticultural crops can come up well as a viable alternative. The data on land utilization pattern in N.E.H. Region show that about 60% of the area is under forest and only 17.5 % of the Jhum land comes under cultivation at one point of time. It is thus apparent that large part of the landed area in the region remains unutilized every year and expansion under seasonal horticultural crops including MAP should not therefore be constrained for want of land. The Village Knowledge Centres could be entrusted to prepare land records.

Marketing for Enhancing Farmers' Income and Welfare

4.1.5.87 Farmer-centric marketing and pricing system is the most important factor in agriculture-led socio-economic and livelihood enhancement. An efficient agricultural marketing system is essential for the development of the agricultural sector and for providing incentives to the farmers for increasing production and also for commercialization of agriculture. In hills and mountains, the production-distribution

disconnect is very wide. For instance, in the entire Kashmir Valley and Ladakh, there is no foodgrain market.

4.1.5.88 Inaccessibility and high transport, packaging and storage costs result in unlevelled playing fields for hill farmers in securing remunerative returns for their produces. Therefore, development and use of necessary marketing infrastructures, rural warehouses, roads, market yards (*mandis*), cool chains, **transport and storages in hills should be subsidized to enhance pricing parity**. With increasing diversification of hill agriculture towards horticultural, plantation and medicinal and aromatic plants, the hill farmers will increasingly be trading high proportions of perishable commodities. The HPMC model of apple trading, the NERAMAC for horticultural products trading in the NER, the HOPCOM system of Bangalore, the NDDB marketing network for dairy *plus* horticultural products in various parts of the country alongwith Azadpur Mandi of Delhi have been operational for quite some time with varying successes. While the NDDB model has been most successful, the other models require significant improvement. The APMC reforms and the new Act including contract farming and creation of a Common Indian Market, are expected to suitably strengthen the producer-consumer and end-to-end linkages value addition for and to promote integrated use of processing facilities. Minimum Price Support and Insurance should greatly help the hill farmers and strengthen the agro industries partnerships.

4.1.5.89 Monopolistic practices and modalities have come in the way of free and competitive trade in agriculture-marketing, futures markets, use of latest technologies in post harvest technology, handling of exports, agro-based industries, warehousings, etc. There is also a need for downsizing the distribution chain and helping the farmers to get the better of the consumer price. Rural godowns to prevent distress sales, market exploitation and storage losses should be established. This is crucial. Then, there is also a question of huge infrastructural investments for modernizing our marketing systems. An Expert Committee set up by the Ministry of Agriculture had estimated that an investment of Rs 11, 172 crore in next 10 years would be necessary for infrastructural development for agriculture marketing. It would be reasonable to expect that a substantial part of this

investment may have to come from the private sector. **Given the prevailing poor connectivity and highly inadequate market infrastructures in the hills, the hill States should receive relatively higher proportion of the proposed investment, say atleast, 40 percent, that is, nearly Rs 300 crores during the next seven years.**

4.1.5.90 The draft model APMC Act stipulates reforms to promote competitive markets in private and cooperative sector, to encourage direct marketing and contract farming, to facilitate industries and large trading companies to undertake procurement of agricultural produce directly from the growers and to eventually establish linkages between the producers and the consumers. Some of the States, especially the NWR States, have adopted the revised APMC Act, the remaining States should hasten the process. Support for infrastructures, including information system and for trained human resources should urgently be provided. **Quality, biosafety and trade literacy of farmers and others in the production – processing – marketing chain should be improved.**

4.1.5.91 Fortunately, for hill States, the NHM has substantial funds, including those for marketing, and post harvest development. But, these funds have so far not been used suitably. **The National Director of the NHM should give highest priority to the marketing components rather than to disbursement of subsidies for new planting and production programmes**. If necessary, within the overall provision under NHM, and also coordinating with other ongoing or planned projects, desired funds should be mobilized to adequately support the marketing modernization plans in the hills.

4.1.5.92 **Space distribution of periodic markets and exploitation by the vested groups in the marketing sector are special features in the hills**. Sale to pre-harvest contractors also prevail in certain areas. The marketing system is totally outdated and only a handful of traders cover most of the nearby markets which are essentially 'buyers markets'. Private markets are yet to establish themselves at the areas of production. Due to thin spread of primary markets, the growers normally have to trek a long distance to bring the farm produce and normally sell the produce to the middlemen at a price dictated by them. Although, under the new APMC Act, the private sector is expected to invest in marketing infrastructures, but this may not happen for a long time in the often isolated

difficult-to-access mountain villages, resulting in widening of the socio-economic divides. **To bridge the divide and also to attract private sector investment, the public sector must invest initially in establishing rural market yards and collection points**. Such initiatives will also promote contract farming involving hitherto unreached farmers. **Bio-parks** on major commodities and **Food Parks** should be established by concerned Ministries to promote value-addition, product diversification and total bio-mass utilization.

4.1.5.93 In reality, modern marketing system for the horticultural commodity does not exist in the hills. The new concept of marketing which includes post-harvest handling, assembly, transport, storage, credit, packing and processing is not very easily achievable in the hilly terrains. The communication and transport system is weakly developed as a result of which very often market glut is experienced. In case of fruits like pinepapple, where fruits can be harvested only at full maturity and the fruit is highly perishable and spoilage is very high, there is no integration of marketing of horticulture produce from hills to other parts of the country. Illegal trade of fruits and vegetables with Bangladesh and Myanmar is reported to be going on a substantial scale. Legislation of trade for perishable horticultural commodities with the adjoining countries, particularly Bangladesh, should be able to help in establishing markets in the border areas of most of the NER States for legal trading.

4.1.5.94 Keeping in view the difficult marketing and processing situation in the NER, the Government of India had set up the North Eastern Regional Agricultural Marketing Corporation (NERAMAC) in 1982. The major objectives of NERAMAC was to organise and promote marketing of major agri-horticultual produce and processed product in the region. The corporation has set up a big Fruit Juice Concentrate (FJC) plant in Nalkata in Tripura, a cashewnut processing unit at Agartala, and has opened a few retail outlets and Kiosks. NERAMAC is promoting procurement and marketing of horticultural produce and products to a limited scale. The presence of NERAMAC in marketing is still very negligible and it has to go a long way to make its presence felt for bringing significant improvement in the marketing sector. Under HTM, there is a provision to establish 29 whole sale markets, 199 rural primary markets, 26 *Apni Mandis*,

and 15 grading laboratories for mitigating the problems of marketing of horticulture produce. Also, NEDFi has established a buyer-seller platform in Guwahati. Such initiatives should be operationalised soonest to help improve income of the hill farmer.

4.1.5.95 As no market functions in isolation, isolated markets taken up for development may not be individually important but being collectively inter-linked make a significant contribution to a given commodity or a group of commodities. Thus, separate **Regional Master Plans for Market Development should be prepared for the NWR and NER** . This could serve as a bankable document assessing the State-wise development requirements, phasing out of programmes, indicating State-wise as well as regional order of priority for development, developing a regional commodity map, estimating market space requirement at different locations in different States, framing cost estimates and modernization proposal with strengthening legal and conceptual framework. Further, **a campaign can be launched for development of Rural Periodic Markets (RPMs), Seasonal Markets, Daily markets and PRIs controlled markets preferably through the National Horticulture Mission. The NER could be integrated with South and South East Asian economy for converting the remote and isolated NER into the main route for trade and economic linkage of mainland India with South and S.E. Asia. Likewise, the NWR would be connected with the Near East Asian and North West African countries and with the European common market.**

4.1.5.96 Finally, the power of scale in production–marketing chain must be harnessed. Specialised marketing SHGs, SFEs and marketing cooperatives should be promoted to undertake **Group Marketing**, linking the produce directly with the consumer (buyer).The **Micro-capital Grant** (MCG) support for post harvest management should be integrated with production practice and community based post harvest management facilities and through farmers training on marketing and awareness about price differential on quality, intra and inter seasonal price difference and market to market price difference. The trained marketing groups should be encouraged to avail MCG support for improved marketing of local produce. Seasonal storage as a marketing function for off-seasonal selling could very well be organized with little capital support.

4.1.6.0 Resource Allocation

4.1.6.1 Additional resources are sought for the remaining two years of the present Plan and the five years of the 11th Plan in the areas of resource management, namely, water security, soil health, biodiversity conservation and sharing; special institutional support (credit, insurance and life-saving catalytic interventions); human capital build-up to create skilled and trained human power and empowerment of farming and rural communities such as SHGs and SFEs and gender mainstreaming; services support through strengthened research, technology and extension mechanisms, including policy, management and marketing research towards need and knowledge-based policy changes, adequate and timely availability of quality planting materials; and market infrastructural development.

4.1.6.2 Investments are needed for creating and managing network of water harvesting and efficient water distribution and utilization system in the present and immediate future and a long-term strategy and programme for maintaining hydrological balance in the Himalayas. Factor-oriented (eg. micronutrient deficiencies, agricultural implements, etc) and system-oriented (crop-livestock-tree integration) demonstrations are needed through the mobilization of group power and dynamism by establishment and empowerment of SHGs, SFEs, etc. for integrating production, processing and marketing and creation of non-farm employment. Farm schools, mother nurseries and an effective system for ensuring timely flow of quality seed and planting materials especially for converting marginal and degraded lands into lands of opportunities, production and marketing of certified high quality organic products, including “doubly green” herbal medicinal and aromatic products, will need substantial additional resource allocations. Food, fodder/forage, seed and water banks are required for achieving food, nutritional and clean drinking water security.

4.1.6.3 An additional sum of Rs 2,265 crores, as detailed below, may be provided during the next seven years to cater to the above requirements:

Sl. No.	Requirements for the next five years	Rs., in crores
(i)	Water conservation tanks with and without distribution attachments @ Rs 17,000 without attachment and Rs 45,000 with attachment to be provided in the North-West and North-Eastern hill States, in the first phase covering only 50% of the requirement.	365.00
(ii)	Support to micro-irrigation, establishment and operation of water user associations, repair and maintenance of degraded irrigation systems, expansation of lift irrigation, development and promotion of suitable machines and implements to reduce drudgery and improve efficiency.	300.00
(iii)	Establishment and operation of National Centre on Glacierology	50.00
(iv)	Support to special credit and insurance products and provisions for transport subsidy for improvement of marketing cost parity	500.00
(v)	Marketing infrastructural development	300.00
(vi)	Promotion of organic products particularly for export markets through creation of credible certification system and establishment of 25,000 model organic villages/contract farms (to be partly supported by the Centre).	250.00
vii)	Capacity building through training of 30,000 farmers, 500 trainers and development officials in specialized areas, creation of and support to 10,000 Farm Schools, Small Farmers Estates (10,000) and Self Help Groups (20,000), establishment and operation of foodgrains, fodder and seed banks, soil testing laboratories for micronutrients and strengthening of Village Knowledge Centre for digitizing land records, etc and promotion of production and distribution of quality planting materials by establishing 30,000 units throughout the hill zones.	500.00
	Grand total	**Rs 2265.00**

4.1.6.4 Adequate financial and human resources should be made available to undertake in-depth studies on: (i) the interactions and implications of hydrological

processes, biological productivity, sustainability and climate change, (ii) interrelationships of forest conservation and protection, agricultural production, income, floods, lowland-upland linkages and integration of watersheds with river basins, (iii) land area delineation based on usual geographic surveys measuring only horizontal area and Sat- and GIS-based survey accounting for slopes and implications of the discrepancy between the two measurements, (iv) prospects of organic farming for harnessing unique agro-ecological settings of hills and mountains and the new export market opportunities, and (v) scope and mechanism of implementation of PVPFR Act and realization of farmers' and communities' rights and development of environmental indicators and their use in enhancing ecological sustainability and equity.

4.1.6.5 The inherent handicaps of inaccessibility, marginality, fragility and higher costs (as compared to plains) of product development, marketing, transport and service provisions, as well as the unique opportunities, should be kept in mind while making the allocations. The Central Government have been investing substantially in NER and the Planning Commission-managed Hill, Western Ghats, Eastern Ghats, Deccan Plateau and Border Area Development Programmes, but in a diffused and thinly distributed manner, resulting in poor outcomes and impacts. Focussed priority-based reallocations with clear-cut responsibility, authority and accountability is a must.

4.1.6.6 Horticulture-led diversification under the National Horticulture Mission should emphasise prevention of post-harvest losses, processing, value addition, cool chains and marketing and not subsidy-induced area expansion. Part of the investment in improving water conservation and recycling should be made from the multi-Ministry supported watershed projects in the country. As regards transfer of proven technologies through large-scale demonstrations, funds could be reallocated from the ongoing Mission Mode programmes. Part of the investments of the Ministry of Environment and Forests and the Ministry of Health related to biodiversity conservation and improvement of medicinal and aromatic plants as well as organic agriculture, should be diverted to meet the activities suggested in this Report.

4.1.6.7 In order to cater to the specialized needs of hill agriculture, the ICAR should allocate part of its resources for technology generation refinements and adoption and extension activities. The Council should establish a branch of the Central Arid Zone Research Institute (Jodhpur) in Ladakh to cater to the needs of cold arid agro eco-systems in the high mountains. The efforts of a consortium of institutions related with hill agriculture and mountain development comprising ICAR, CSIR and DRDO as well as agriculture and non-agriculture Universities in the Hills, in association with the International Centre for Integrated Mountain Development (ICIMOD), should be synergized through the proposed National Programme on Hill and Mountain Agro Ecosystem. Actually, often it is not the problem of paucity of funds but it is the problem of non-judicious and poorly-coordinated utilization of the resources, which must be rectified urgently.

Acknowledgement

This Report is based on extensive consultations at various levels and several desk studies. In particular, the National Commission on Farmers is indebted to the ICAR especially the nodal agency ICAR Research Complex for NEH Region, for organizing the Experts Consultation on North East Region Hill Agriculture on the 26th and 27th April, 2005 at Barapani. The Commission is also grateful to all the North Eastern State Governments, including Sikkim, and in particular the host Meghalaya, for deputing their experts and farmers of the States. The Commission also thanks the banks and financial institutions, ICAR Institutions, State Agricultural Universities, NGOs, SHGs, Cooperatives, industries, etc., for their active participation. Most gratefully, it acknowledges the valuable participation of farmers and their very useful contributions in this event.

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and in particular the host Himachal Pradesh, for deputing their experts and farmers of the States. The Commission also thanks the banks and financial institutions, ICAR Institutions, State Agricultural Universities, NGOs, SHGs, Cooperatives, industries, etc. in the region for their active participation. The valuable participation and contributions of farmers are most thankfully acknowledged.

CHAPTER - 4.2

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

ARID AGRO-ECOSYSTEM

4.2.1.0. Introduction

4.2.1.1 Arid and semi-arid regions occupy nearly 40% of geographical area of India **(Figure 1)**. These areas primarily depend on low and erratic rainfall, but intensity of aridity and severity of problems like water scarcity, drought, fragility of natural resources, hardship, poverty and livelihood security are more in the one-third arid areas than in the two-third semiarid region**. In arid ecosystem, the main issues relate to survival and livelihood security** of nearly 9 million families and of about 45 million livestock whereas in semi-arid ecosystem the main issues relate to sustainability and productivity **(Table 1)**.

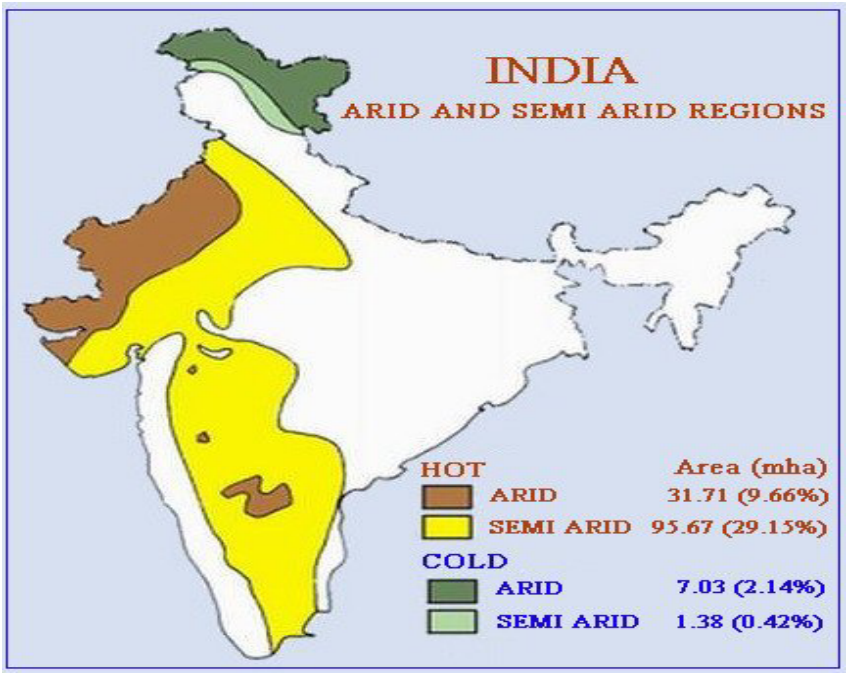

Figure 1. Arid and semi-arid regions of India

Table 1. Differentiating characteristics of arid and semi-arid agro-ecosystems

Parameters	Arid	Semi-arid
Rainfall (mm)	< 450 cv > 40%	450 – 850 cv 25-40%
ET (mm)	1500 - 2100	1000 - 1500
Moisture Index	< -66.6%	-33.3 to -66.6
Aridity	Severe scarcity of drinking water	Moderate water shortage for crops
Drought	Chronically drought prone 1 in 2.5 Year	Drought prone 1 in 5 yr
Cropping	One in normal years	Potential for double cropping
Watershed–based Rainwater Harvesting	Limited scope of runoff harvesting, and use/recycling	Adequate scope
Issues	Survival, Livelihood	Sustainability, Productivity

cv = Coefficient of variation

4.2.1.2. The arid region receives <450 mm annual rainfall with 40% to 60% coefficient of variation against 450-850 mm rainfall in the semi-arid region. Evapotranspiration is four to five-fold higher than that of rainfall in the arid region, while it is only two times higher in semi-arid region. Therefore, **severity of aridity, deficit water balance, scarcity of water and problems of drinking water are much more acute in the arid region**. Natural resources like water, land, and vegetation in arid areas are very fragile, weak, and partly non-resilient, hence prone to irreversible degradation and desertification under excessive pressure of human and livestock population.

4.2.1.3. **Arable cropping is not a dependable proposition in arid region**. Only one crop can be taken in good rainfall year in arid region, while semi-arid regions reap one assured kharif crop and have good potential of double cropping. On an average, one year of good harvest is possible in arid region during a cycle of 5 years, while two are expected to have moderate crops and at least two failures are common. Arid region offers limited scope of water harvesting and its recycling, particularly on watershed basis, but in semi-arid region this has adequate potential. **Droughts are more frequent in arid region, leading to death of livestock in large numbers and near-famine situations**. Therefore, droughts in arid region often necessitate large-scale contingency relief measures and disaster management.

4.2.1.4. Considering the above issues, Govt. of India launched the Desert Development Programme (DDP) for arid region while majority of the semi-arid regions were covered under Drought Prone Area Programme (DPAP). Hence emphasis in arid regions has to be more on resource conservation, controlling of wind and water erosion, and sustainability of agriculture at optimum productivity level. Typical watersheds are uncommon to arid region. Therefore, the unit of execution of sustainable land management should be an index catchment, a cluster of villages or a dhani or even a watershed, if available.

4.2.1.5 Notwithstanding the harsh agro-ecological settings, arid zones are endowed with several distinct assets and opportunities. There is abundance of land, especially waste and degraded lands, which could be converted into productive systems. There is abundance also of solar and wind energy which may provide opportunities for harnessing renewable power for agricultural purposes, especially agroprocessing and small-scale irrigation. The cold arids are particularly suitable for production of off-season vegetables, flowers, fruits and seeds. The rich and unique biodiversity of crops, tree species, cattle and buffaloes and a large number of medicinal and aromatic plants gives unique opportunities for economic and employment diversification. Some of the rare animal breeds, such as *Tharparkar, Gir, Sahiwal and Rathi* cows, Surti*, Zafarabadi* and *Murrah* buffaloes and the famous Pashmina goats hold unparalleled opportunities for livestock-led development of Indian Agriculture. The rich traditional knowledge and wisdom of the local people of the arid zones constitute additional treasure. Therefore, the future development of arid zone is closely linked with **the future prospects of growth of livestock and horticulture sub-sectors** in these areas. The Government of India had stipulated a growth rate of 8 percent in both these sub-sectors in order to achieve an overall growth rate of 4 percent for agriculture as a whole. Given the huge gaps in transfer and adoption of proven technologies both in horticulture and livestock sub-sectors, there is ample scope for achieving and maintaining the projected growth rate during the next few years atleast in the horticulture and livestock sub-sectors of arid zones. Therefore, policies geared to the development of arid zone agriculture should give priority attention to horticulture and livestock.

4.2.1.6. **The contrasting situations and differences in scale, severity and issues of livelihood in arid and semi-arid regions demand that arid regions be separated out for an exclusive policy for drought proofing, land management and livelihood security, and not clubbed together with the semi-arid regions to make policy decisions for the 'rainfed areas' as a whole**. This study gives an analysis of the challenges, issues and opportunities exclusively in arid agro ecosystems and focuses on pathways to synergise livelihood security, sustainability and equity.

4.2.2.0 Distribution and Characteristics of Arid Agro Ecosystem

4.2.2.1. The arid agro eco-system is spread over 31.7 million ha under hot arid and 7 million ha under cold arid region, accounting for 12 percent of the geographical area of the country. The hot arid region mainly covers Rajasthan (19.6 m ha), Gujarat (6.2 m ha), Punjab (1.5 m ha), Haryana (1.3 m ha) and small pockets in Andhra Pradesh (2.1 m ha), Karnataka (0.9 m ha) and Maharashtra (0.1m ha) **(Figure 2)**.

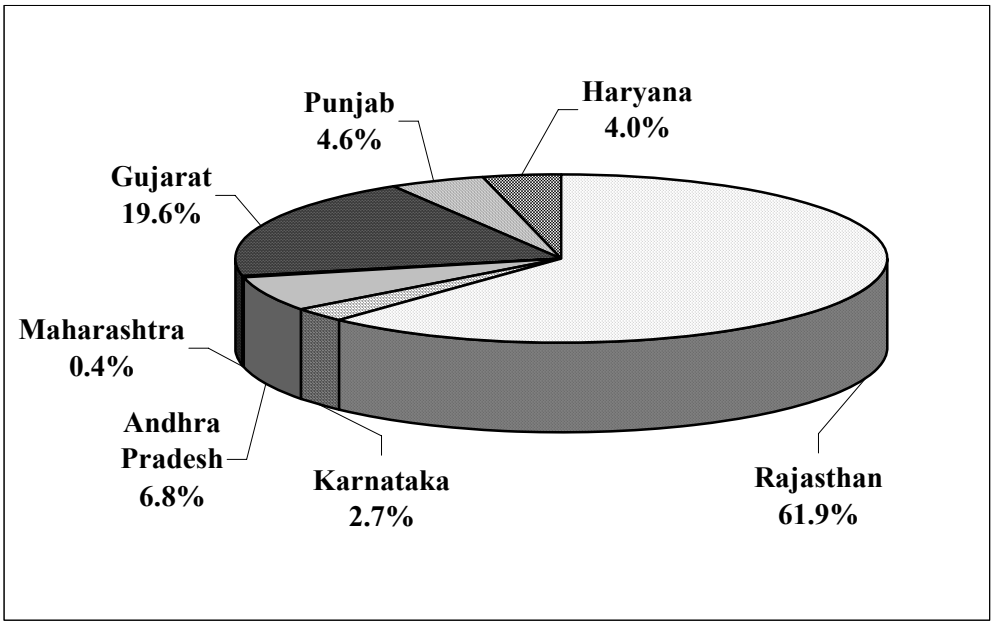

Figure 2. Hot arid areas in India

4.2 2.2. The hot arid zone is characterised by scarce natural resources and inhospitable climate. The annual rainfall varies from 100 mm to 400 mm with erratic distribution (9-21 spells) from July to September. The region experiences extremes of temperature (-2 to 48^0 C), high solar radiation incidence (450 to 500 cal per sq. cm/day)

and high wind velocity. Strong winds with sand storms are experienced during May-July, when southwest monsoon sets in. The soils are generally light textured (60-90% sand), single grained, dry for most part of the year having acidic moisture regime and hyperthermic thermal regime resulting in poor vegetation cover, high soil erosion and sand dune formation under arid regimes.

4.2.2.3. The cold arid zone (7m ha) is spread in the States of Jammu & Kashmir and Himachal Pradesh. Ladakh - Leh in Jammu & Kashmir and Lahul - Spiti in Himachal Pradesh are the main concentrated belts, characterized by long winters, with huge temperature variation between $40^{o}C$ to $-40^{0}C$ and with little (about 90 mm annually) or no rains. The population density in the cold arid region is lowest in the country ranging from 2 to 5 persons per sq km.

4.2 2.4. Arid zones are the most disadvantaged areas in India. Coupled with the permanent negative moisture balance and meager availability of surface water, water stress for the crops, other plants and livestock is very high, and the biological productivity is much lower than in the adjoining semi-arid tracts. Associated with this is the low resilience capacity of the natural resources, high vulnerability to degradation processes, including wind and water erosion and salinization (nearly 41 to 85% groundwater being saline). Moreover, high human and livestock pressures on land in the hot arid areas make the region highly unsustainable and less productive.

4.2.2.5 Emphasis in arid zones must, therefore, be on resource conservation, controlling of wind and water erosion, and sustainable land management for attaining optimum productivity level from crop and livestock sectors. The concept of sustainable land management considers land as a matrix of all the parameters like soil, water, vegetation, topography and weather, and aims at maximizing economic yield through efficient use of inputs in relation to the amount and quality of outputs, but at the same time ensuring protection of the environment in the long term and social security of future generations. Diversified agriculture with emphasis on efficient use of the limited water for farming, and integration of economically important perennial trees/shrubs and grasses to stabilize

the production and sustain the livestock production system need to be given greater attention. Animal wealth provides sustainable support to livelihood, but not yet well organized.

4.2.2.6 The various ecological, environmental, institutional and infrastructural handicaps have exacerbated instability and livelihood insecurity problems in arid ecosystems. **Uncertainty and risk factors bear heavily on cultural and social behaviour, resource conservation and utilization and technology adoption**. The unholy nexus among the various handicaps must be broken by the synergistic force of policy, technology, skilled humanware, market, institutional credit and people's participation. The core issues to be tackled in arid agro ecosystems are land, water and biodiversity security; fodder, feed, livestock and food security; and livelihood security **(Figure 3)**.

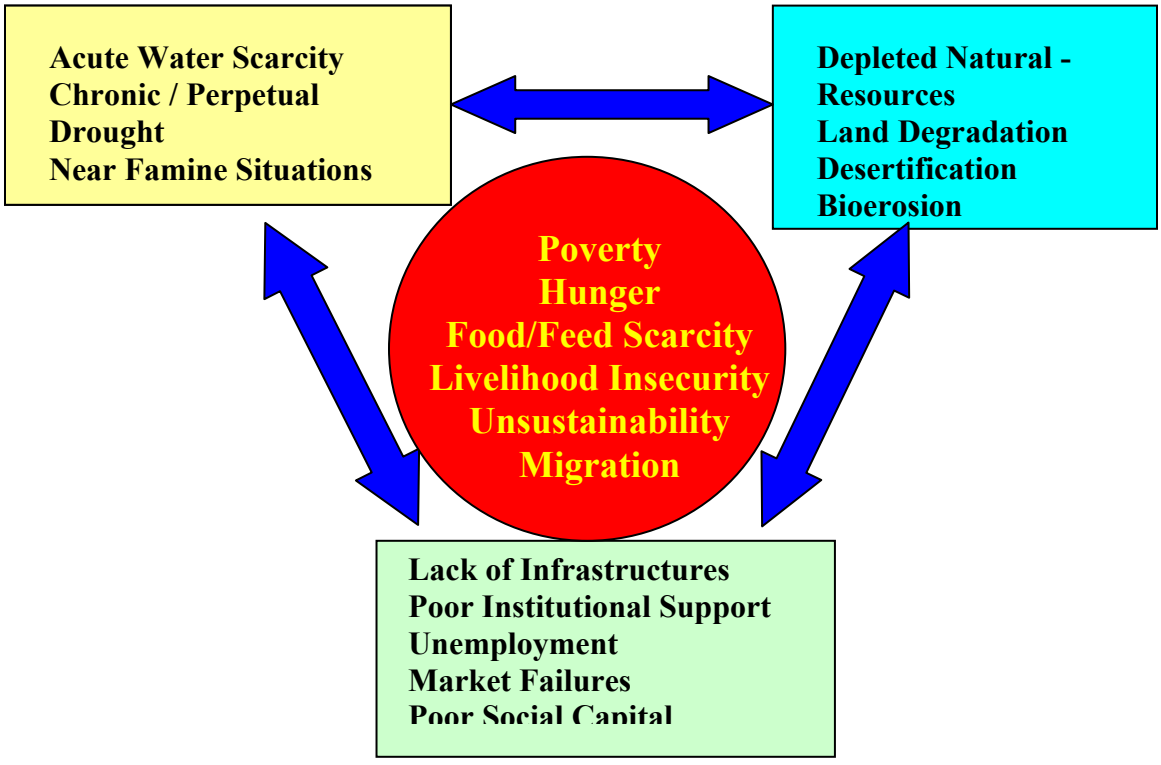

Figure 3. Reiterative forces of poverty and livelihood insecurity in

4.2 3.0 Changing Cropping Systems and Land Use Patterns

4.2.3.1. Increased population pressure and socio-economic demands are forcing changes in farming systems in arid zone. For instance, the human population of western Rajasthan is 22.50 million, which is estimated to reach 27.5 million by 2010 and 33.9 million in 2020 with an increase in density from 108 to 132 to 165 persons per km^2. Average size of holding has declined from 17.77 ha in 1951 to about 6.00 ha now, and is likely to decline further to 4.00 ha by 2020. About 11 % of the rural households own 50 % of land in the region whereas 47 % hold 10% and the rest are landless labour and nomads subsisting on grazing lands/wastelands. **The livestock population being as large as the human population, the pressure on grazing lands is very high**.

4.2.3.2. The demographic and socio-economic pressures have brought significant changes in land use pattern. The traditional values and practices like protecting trees and animals, sacred forests and grazing lands, water conservation through *Khadins* and *Tanka, long* fallow etc. have undergone rapid decline during the last few decades. Dryland farming integrated with animal husbandry has been the prominent land use in the region, where short and long-term fallowing of land, with emphasis on agro-forestry, was most common. New cropping and farming systems have emerged during the post-independence era.

4.2.3.3. Sensing satellite data suggest that wastelands with pastures of different kinds cover about 30% area, mostly sandy waste but there are also other categories of wastelands. These lands are ideally suitable for rangelands and silvi-pasture in less than 250 mm rainfall, and partly for agro-forestry, including cultivation of pearlmillet, arid legumes, clusterbeans, etc. in 250-500mm rainfall zone. **There has been an increase in intensity of cultivation across the region, and more and more fallow and marginal land are being brought under plough, so much so that 39 % increase has been registered in net sown area during the last five decades, at the cost of 25 % decline in fallow land. As more and more marginal lands are being brought under plough, grazing lands are also shrinking**.

4.2.3.4. The major shift in arid zone agriculture was brought in by the introduction of the Indira Gandhi Nahar Pariyojana (IGNP) system. This has transformed the

agricultural scenario in the command areas of the canal, and has vastly improved crop production from the area, but at the same time it has resulted in degradation of the land, especially through waterlogging and salinization (> 190,000ha already affected and about 370,000 ha potentially sensitive). **The irrigation system was unfortunately unaccompanied with drainage system**. In the Banni area of Kachchh, which used to be regarded as the best and the largest natural grassland in Asia, invasion of salinity and *Prosopis juliflora* has degraded the grass communities beyond repair.

4.2.3.5. **Declining groundwater has been a major concern in recent times**. Due to over exploitation, use of crops with higher water requirement, intensive cropping and low rainfall, the groundwater is declining at an alarming rate of 20-40 cm per year. Nearly 75% area encompassing 60 blocks of western Rajasthan has become critical grey zone as it has been over-exploited with respect to groundwater and there has been almost negligible groundwater recharge. In addition, nearly 65 % area in Thar Desert has saline groundwater, having at places fluoride and nitrate levels beyond the permissible limits, thus compelling people to use scarce surface water storage for drinking. Ingress of soil salinity in coastal areas poses yet another serious problem.

4.2.3.6. Cropping systems covering cereals, oilseeds, horticultural crops and cultivated fodders need major attention and focus in arid agriculture. **About 90% of the cultivable land is being used for cropping**. The net sown area has risen from 38% in the late 1950s to 50% now. Double cropping has also spread in 7-8% area due to expansion in surface and groundwater irrigation facilities. However, **nearly 70 per cent of the sown area continues to remain under rainfed drylands**. About 21% farmers have an average farm size of >10 ha, 32% have 4-10 ha, 22% 2-4 ha, and 25% have less than 2 ha. The major crops in the region are pearlmillet, clusterbean, green gram and sesamum, with average productivity of 150 to 250 kg grain and 500 to 1000 kg fodder ha^{-1}. Under irrigated conditions the main rabi crops are cumin, isabgol, wheat and mustard.

4.2.3.7. In western Rajasthan there has been a steady rise in the area under different crops and their productivity, excepting *kharif* pulses. For example, pearl millet production has almost doubled between 1961 and 2000, while its productivity increased

by 123%. During this period, there was 35% fall in production of *kharif* pulses. In Rajasthan as a whole, *kharif* cereal production has increased from 17.5 lakh tonnes during the First Five Year Plan to 38.3 lakh tonnes during the Ninth Five Year Plan. There have been larger increases in production of *rabi* cereals, from 14.93 lakh tonnes to 68.8 lakh tonnes. Sharp increases were noticed in the case of oilseeds production. While *kharif* oilseed production in the State increased from 1.17 lakh tonnes during First Five Year Plan to 10.5 lakh tonnes during Ninth Five Year Plan, the *rabi* oilseeds production increased from 0.93 lakh tonnes to 20.86 lakh tonnes during the same period. The phenomenal increase in oilseeds production is attributed to the expansion of irrigation facilities, other technological breakthroughs, high market demands and high profit margins. Unfortunately, oilseed production demands irrigation, and the chief source of water over large area of its production is groundwater, which is falling rapidly in many areas of the arid region.

4.2.3.8. **Table 2** gives area and yield of main arid zone crops in Rajasthan (accounting for about 62% of the country's arid area) *vis-à-vis* rest of India. It may be seen from the Table that *guar*, pearl millet and certain oilseeds are special crops of arid zones. Directed research and development attention to these crops should be a high priority to exploit the inherent abilities of these highly nutritious crops to contribute to nutritional adequacy, livelihood and sustainability of the inherently fragile ecosystems of arid zones.

4.2.3.9. Increases in coarse cereal production like pearl millet, in spite of its low market value, are largely due to its continued use for subsistence in the rural Rajasthan, as well as use of the non-grain parts as fodder for domestic animals. Development of short duration high yielding hybrids (65 days crop) has been instrumental in increasing pearl millet production in arid zones. Higher vulnerability to weather changes and volatile nature of pulse market did not show such trend inspite of government support. It has been observed that the **average productivity of major crops grown in the region can be further increased by 2 to 3 times with the adoption of improved production technological components** like efficient rainwater management, suitable timely tillage and sowing operations, selection of improved varieties, appropriate intercropping and

crop rotation systems, efficient soil fertility management, proper plant protection measures, including weed management, and contingency/alternate crop planning under aberrant weather situations. However, it is also realized that these technologies work during normal to mild drought years only.

Table 2. Area, yield and production of major arid zone crops in Rajasthan and in the Rest of India

Crop	Arid Rajasthan			Rest of Rajasthan			Rest of India		
	Area (' 000 ha)	Production ('000 tons)	Yield (kg/ha)	Area (' 000 ha)	Production ('000 tons)	Yield (kg/ha)	Area (' 000 ha)	Production ('000 tons)	Yield (kg/ha)
Oilseeds	12418 (14%)	9220 (14%)	742	16730 (19%)	13945 (21%)	834	59460 (67%)	43824 (65%)	737
Bajra	3709 (38%)	1259 (19%)	339	883 (9%)	789 (12%)	894	5063 (53%)	4628 (69%)	914
Guar	1896 (87%)	402 (48%)	212	154 (7%)	82 (10%)	537	137 (6%)	353 (42%)	2568
Kharif Pulses	17341 (10%)	3220 (4%)	186	3545 (2%)	1261 (1%)	356	151014 (88%)	82869 (95%)	549

*** Figures in parentheses indicate the percentages.**

4.2.3.10. During abnormal years of moderate to severe droughts (like in 1988 and 2002), the risk of negative return from dryland crop cultivation is so high that the farmers are reluctant to adopt any improved dryland farming technology as a package. Although traditional land use systems like mixed cropping, agro-forestry with *Prosopis cineraria* and *Ziziphus nummularia* are still practiced, these need to be refined and placed in proper perspective for agricultural sustainability.

4.2.3.11. To cushion the adverse effect of drought, mixed sowing of seeds of various dryland crops, may be 2 or 3, is undertaken depending on micro-farming situation and need. Sowing of pearl millet, clusterbean, moth bean and sesame in an approximate ratio of 8:2:2:1, and thinning of pearl millet population during drought as per the needs and use it as green fodder are normal practices in the region. However, this practice hampers efficient crop management from sowing to harvest and threshing. Pearl millet being a staple food crop, farmers take it on more than 60% of the sown area, but the crop is more vulnerable to drought and late onset of monsoon (beyond 15th July).

4.2.3.12. Research results show that **a reduction in the area under pearl millet to 40% and putting the rest 60% of the holding under kharif legumes (30%), oilseeds (15%) and forage crops (15%) could be profitable**. For such crop diversification inter-cropping systems like mung bean/clusterbean + pearl millet (2:1), sesamum + mung bean/moth bean/cowpea (2:1), castor + moth bean (1:3) are helpful.

4.2.4.0 Horticulture-led Diversification

4.2.4.1. Arid zone horticulture and horticulture-based land use as means of diversification of traditional agriculture are being increasingly considered in developmental plans and policies both in arid and semi arid regions. **The climatic conditions are conducive for production of quality fruits and vegetables**. The sharp fluctuations in day and night temperatures during autumn, spring and summer help in development of sweetness in kinnow, sweet orange, ber and date palm and flesh colour and sweetness in pomegranate arils and mateera pulp. The intense solar radiation and high wind velocity can be utilized in various farming related activities. The fruits like aonla, custard apple, pomegranate and citrus (kinnow, sweet orange) are coming up well in arid climate. Medicinal plants like isabgol and seed spice cumin are already export items from Rajasthan and Gujarat. In this context, changing global policy environment due to WTO, the advantages of dry climate particularly in relation to quality and lesser incidence of diseases and pests should not be overlooked.

4.2.4.2. The cold arid region is suitable for quality production of temperate and rare fruits such as seabuckthorn, exotic vegetables and vegetable seeds. Apricot is a commercial crop in Ladakh and sold as dried apricot. Kargil area is well known for dried apricot. Top working of seedling trees of apricot with improved cultivars amenable for drying has been standardized. This will help in upgrading the quality of the produce from the existing orchards. Technologies for drying of apricot, tent drying and osmotic dehydration techniques have also been developed. But these have not been widely accepted, even though it is reported that osmotic dehydration results in increase of retail price of apricot by seven times (Rs. 140 per Kg against Rs.20 per Kg for traditionally dried pulp).

4.2.4.3. In vegetable crops, technology developed and popularized by DRDO laboratory in the high hills for vegetable growing under **low cost polyhouses has become highly popular for higher yields, extending growing period and for production of good quality seeds of cole crops. The 'trench technology'** developed under National Agricultural Technology Project (NATP) has also revolutionized off-season cultivation of vegetables (even in winter) due to higher conducive temperature in dug out trenches. Strawberry cultivation in trenches in Kargil area is gaining importance.

4.2.4.4. Among spice crops, identification of high yielding genotypes *of Kala Zeera* (SKUKZ- Shong; SKUA –BZ –8-6-1) and standardization of agro-techniques including propagation have helped its commercialization. Similarly, R&D efforts in standardising both production and post harvest technology in saffron have already started paying dividends by enhancing production and quality of saffron in J&K. Patent applications have also been filed for value added saffron pigment and flavour/concentrates based on research efforts.

4.2.4.5. The vast land resource, valuable genetic diversity, surplus family labour, increasing canal command area and developing infrastructure are the other prospects for development of arid zone horticulture. Besides, Central Government Organizations, State Departments of Horticulture and Agriculture, KVKs, NGOs etc; four ICAR institutes and eight SAUs along with setup of AICRP and AZF are providing a reasonable infrastructure for research on various aspects of arid horticulture. More than hundred scientific manpower is directly involved in the promotion of arid horticulture in the country.

4.2.4.6. At present only about 95 thousand ha and 110 thousand ha area in the arid zone is under fruits and vegetables, respectively, giving production of only 0.92 and 1.32 million tonnes. The projected requirements of 2.4 and 5.0 million tonnes by 2020 AD, therefore needs that the production of fruits be increased three times and that of vegetables four times of the current levels of production **(Table 3)**. Moreover, export requirements of horticultural produce and products are expected to grow very fast in the

post –GATT scenario. The peculiar dry and warm blend in the arid region agroclimate offers opportunity for producing quality products of high health standards. This obviously would require R&D preparedness.

4.2.4.7. **Agroforestry plays vital social and economic roles in the fragile ecosystem of arid zones**. Apart from *Prosopis cineraria* (Khijri) and *Technomella indulata* (Marwar teak) based agroforestry models, *Ailanthus* has a very good economics of soft wood and green fodder during scarcity months. Shelter belt plantation along Indira Gandhi Canal has provided good dividends. ***Prosopis juliflora*** **is flourishing in saline soils of Kutchchh in Gujarat – a problem from the point of view of grass pastures, but could be an opportunity to increase fuelwood production from the degraded land**.

Table 3. Fruit production in arid region of India

State	Production ('000 tons)			Requirements ('000 tons)	
	1984	1993-94	2002-03	Current	2020
Rajasthan	22.4	26.4	33.5	617	963
Gujarat	81.6	105.6	134.1	174	278
Punjab	34.0	54.0	68.5	170	272
Haryana	41.0	48.8	61.9	125	200
Peninsular Region	400.0	490.0	622.3	550	650
Total	579.0	724.8	920.3	1636	2363

Source: Central Institute of Arid Horticulture, Bikaner

4.2.4.8. Wastelands can be profitably used for growing medicinal and oil-bearing plants, which have high national and international demands. Many of the species growing wild (e.g., senna), or being threatened (e.g., guggal), and other species having very high survival rates in certain environments (e.g., *Aloe vera*), can be grown on the large wastelands of the region, which will not only stabilize the landscape, but will also provide good income to the farmers.

4.2.4.9. **Rajasthan is the leading State in production of seed spices** like coriander, cumin, fenugreek and chilli. There is wide scope to further increase the area

and production. The crops like fennel and ajwain also show good promise. The production of seed spices during 2000-2001 in coriander, cumin, fennel and fenugreek was 2.31, 0.39, 0.28 and 0.93 lakh tonnes, respectively. In case of chilli, Andhra Pradesh is the leading state with almost 49.1 percent of country's total production, while the share of Rajasthan is about 6.2 percent. More than 90 percent of the spices produced are used in domestic market but there is a good demand in the export market both as raw and value added products.

4.2.4.10. Some of the Medicinal and Aromatic Plants (MAP) like Isabgol, Ashwagandha, Opium poppy, Senna, Guggal, Safed Musli, Henna (*Lawsonia inermis*) grow well in hot arid /semi-arid areas with high recovery of actual ingredients of medicinal value. Henna is known for the natural dye and its commercial export potential is about Rs. 80-100 crores. Already the spread of henna in Rajasthan and Gujarat is reported to cover 35000 ha. Similarly, senna, a medicinal plant is reported to cover about 11000 ha in Rajasthan and Gujarat, where both marketing associations have been formed and processing units established.

4.2.4.11. Isabgol, the seed coat which is known in trade as Psyllium husk or husk is medically important. The crop is cultivated in parts of Gujarat, Rajasthan and Madhya Pradesh as a *rabi* crop. The crop requires cool and dry climate and India is the sole exporter of Isabgol husk in the international market. Another important medicinal plant 'Safed Musli' , the faciculated roots of which are used in preparation of many vital tonics, has become popular for cultivation and has immense commercial prospect. 'Guggal', categorized as an endangered species in the Red Data book, is naturally distributed in the drier parts of Gujarat and Rajasthan and offers good scope for commercial exploitation for its medicinal value. Standardization of propagation techniques of Guggal through stem cutting has enhanced its scope for large scale cultivation.

4.2.4.12. In the cold arid zone, *kala zeera* (*Bunium persicum*) is an important spice crop, growing wild. Due to R&D efforts, its cultivation had spread over 373 ha in Srinagar, Kinnaur, Lahul - spiti and Chamba districts. The benefit: cost ratio of this crop

is reported to be 2.39:1. The crop is likely to spread in larger areas. Saffron, the golden condiment, is the legendary crop of Kashmir and identification of high yielding clones and better post harvest technology have enhanced the scope of better income generation from this crop.

4.2.4.13. A good number of MAPs grow in wild habitat of cold desert region (Kinnaur and Spiti) of Himachal Pradesh. Surveys show illegal exploitation and marketing of medicinal plants from cold desert region. Some of the MAPs, namely, Sarlampanja (*Dactylorhiza hatageria*) and Atish (*Aconitum heterophyllum*) are reported to be highly priced items.

4.2.4.14. A National Seminar on Commercialization of Horticulture in non-traditional areas held on 5-6 Feb 2005, at the Central Institute for Arid Horticulture, Bikaner, has identified the following thrust areas for expansion of Arid Horticulture:

- **Mass multiplication of recommended varieties of fruits and vegetables** by National Seed Corporation, State Seed Cooperation and other line departments like Department of Horticulture, Agriculture and State Farm Corporation etc.
- **Promotion of nursery activities** by progressive farmers and nurserymen if efforts in item No. 1 need supplementation to meet the total requirement.
- **Large-scale demonstrations of crop diversification technologies** on farmers' fields and promotion of animal based components for integration in crop diversification.
- **Promotion of pressurized irrigation and water harvesting structures for orchard establishment**.
- Promotion of **integrated nutrient management** including organic cultivation of arid horticultural crops.
- Emphasis on **IPM** and ensuring timely availability of quality agri inputs including agri-chemicals.
- Establishment of **pilot plants for commercialization of value added products**.
- Organizing **capacity building** programmes at different levels.

4.2 4.15. The recently announced **National Horticulture Mission should have a specific window for Arid Horticulture to ensure integration of production, post harvest management, processing, value addition and marketing**.

4.2.5.0 Livestock: The Anchor of Livelihood Security in the Arid Zone

4.2.5.1. Livestock provide income support to two-third of the population in arid Rajasthan and are the mainstay of desert people. Most importantly, **ownership of livestock in arid agro-ecosystem is positively egalitarian**. For instance, average number of buffaloes per ha holding for marginal and small farmers is about 2 animals whereas for medium and large farmers it is 0.44 and 0.13 animals, respectively **(Table 4)**. Livestock rearing, integrated with crop farming, has proved to be the most viable option in the region, as it stabilizes farmer's income during the poor rainfall years and **saves farmers from acute distresses, even from suicides** (so frequently reported from semi arid regions of Andhra Pradesh, Karnataka and Maharashtra).

Table 4. Category-wise ownership pattern of livestock in Rajasthan

Category	Average number of animals per hectare holding				
	Buffalo	Cattle	Sheep	Goat	Camel
Marginal	2.06	1.51	0.65	3.55	0.05
Small	1.42	0.69	0.59	1.86	0.01
Semi-med	0.80	0.36	0.49	0.98	0.02
Medium	0.44	0.20	0.26	0.54	0.02
Large	0.13	0.16	0.49	0.34	0.01

4.2.5.2. Rearing of cattle, sheep, goats and camels on cultivated land, common grazing land (including oran), etc., is prevalent. Recent animal census has revealed alarming decline in population of camel and sheep, while goat, which is more drought-hardy and is comfortable with the prevailing low amounts of browsing resources, did not decline much. Buffalo, which is exotic to the region, has shown doubling in population during the past 15 – 20 years **(Figure 4**). With the increase in productivity of individual animals, while the overall production of livestock has steadily been increasing, the

livestock density has decreased in the recent years, dropping from 160 livestock per sq km in 1997 to 143 in 2003 – a healthy change indeed.

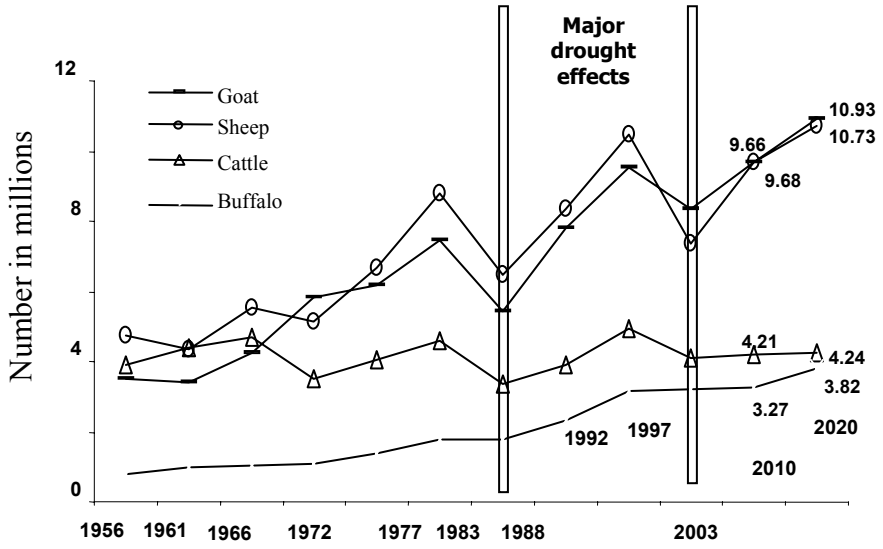

Figure 4. Livestock population of arid Rajasthan

4.2.5.3. Drought-hardy breeds of cattle, sheep and goats are required to be integrated in farming systems of the region, looking into the aspects of breeding, feeding and management of livestock. Farming systems involving animals + grasses + crops + trees + shrubs + horticulture, may bring about perceptible change in the life of people. Off-farm employment and per capita income of the rural people can be considerably increased through appropriate farming system.

4.2.5.4. **The arid region constitutes 30 percent of total sheep, which produces around 40 per cent of total wool production of the country (Table 5).** The sustainability of the sheep production is facing challenges as the pasture and common grazing lands are reducing everyday and there is increase in pressure on these lands. The sheep serves the need of food in the form of meat and milk, of clothing in winter in the form of wool and skin and of maintaining and enriching the soil fertility in the form of manure. Sheep farming is further facing decline with the reduction of pasture land due to advent of canal irrigation system in western Rajasthan. The sheep production system is required to be viable, sustainable and economically competitive with an objective to increase production per unit of land. **Intense effort is required to develop research**

based, regionally relevant, ecofriendly and economically viable sheep rearing practices, meat and wool technologies that could be adopted in different arid settings of the country with varying scale of inputs and investments.

Table 5. Arid zone sheep production

Particulars	India	Arid region (approx)
Sheep population (million)	61.5	18.45
Wool production (m, kg)	47.6	19.04
Mutton production (m, kg)	230.9	92.36
Skin production (million)	22.8	9.12
Manure (m,kg)	9225	3690

4.2.5.5. The Central Sheep and Wool Research Institute, Avikanagar, in collaboration with the Department of Animal Husbandry, Govt. of Rajasthan, aims to transfer technologies for improving sheep production through breeding, nutrition, animal health, pasture development, wool utilization and techniracy. The emphasis is on **Institute Village Link Programme** to achieve an overall integrated development in adopted villages. Socio-economic studies are underway towards improving not only sheep production but also alleviating poverty of sheep farmers. Socio-economic survey of sheep and goat breeders are conducted to achieve this goal. The average annual real income of sheep breeders has been increasing by 8 percent per annum.

4.2.5.6. Arid agro ecosystem, with nearly 23 million goats, accounts for about 16 per cent of the country's goat population, against 12 per cent of the total geographic area, highlighting relatively higher concentration of goats in arid agro ecosystems. In arid zone, a marginal farmer on per ha basis keeps nearly four goats as against two buffaloes and cattle. Goats in the cold arid contribute about 40 metric tonnes of Pashmina, the costliest animal fiber for garments. Goat meat has the advantage of being preferred by all the communities and the demand invariably exceeds the supply. The goat milk contributes more than 4 percent of total milk produced in India, yet its greatly dietary value and superior milk products have not been recognised and exploited for export. The

skins of Indian goats are considered to be of very high quality. The poor man's cow, especially in arid zones and in isolated cold hilly regions, goats offer new opportunities due to:

- Preference of **lean meat** of goat by consumers in India and abroad.
- **Tailor-made foods from goat milk** to better fit the human needs.
- **Goat milk products are being recognized as important health foods** especially cheese, paneer and yogurt and these are parts of cottage industry.
- **Goat butter - a valued consumer item as it contains short and medium chain fatty acids**.
- Valued as the **best bio-organic manure producer**.

4.2.6.0 Challenges, Issues and Opportunities in Arid Agro-Ecosystem

4.2.6.1. The arid agro-ecosystem suffers from low and erratic rainfall, degraded soils and poor crop and livestock productivity. Coupled with poor socio economic base and infrastructure the small and marginal farmers living in these vast tracts are unable to improve their livelihood due to stagnant income and lack of alternate options of income generation. Acute shortage of fodder also limits the livestock productivity. Adoption rate of new technologies is low due to poor investment capacity, risk aversion and inadequate extension services. Rainwater is the critical input in determining the productivity in all these areas, but the inability of managing erratic and deficit rainwater through proper harvesting methods has always been a constraint in upgrading productivity. Soils are highly deficient in major and a few minor nutrients. The erosion of top soil by wind is a widespread problem. **The major challenges and constrains are**:

- **Low and erratic rainfall, high evapo-transpiration, extreme aridity**
- **Scarcity of water, frequent droughts and famines**
- **Sandy, saline and gypsiferous degraded soils with micronutrients deficiencies and low fertility; heavy wind erosion of top soil**
- **Water logging and salinization in command areas**
- **Deep, brackish (high fluoride and nitrate content) and declining ground water, ingressing sea water**

- **Low and fluctuating crop and livestock yields and acute fodder shortage, degraded grazing lands**
- **Poor marketing, processing and value addition**
- **Poverty, illiteracy, conservative society, poor socio-economic base and infrastructure**
- **Risk aversion and poor adoption of new technologies.**

Recurrent droughts are the main constraint with multiple adverse effects. For instance in Rajasthan, in the 2002 drought, separately nearly 45 million people and 45 million livestock were affected, loosing nearly US$ 1 billion worth agricultural products and over 6 million mandays of employment **(Table 6)**. The worst victims of drought are livestock, as their numbers dip by a couple of millions in each severe drought (see Figure 4) year due to forced slaughter and death resulting from poor nutrition and starvation.

Table 6. Impact of drought in Rajasthan

Criteria	**1988**	**2000**	**2002**
Rainfall Deficit (%)	-45%	-29%	-64%
Villages affected	36252	30583	40490
Population affected	31.74	33.04	44.8
Cattle affected (m)	57.23	39.97	45.2
Crop damage (m ha)	7.45	8.94	11.7
Value (m US $)	539.1	763.4	959.5
Loss in agril. Employment (m man days)	3.38	4.66	6.09

4.2.6.2. Against the above weaknesses, the arid agro ecosystem offers windows of opportunities to capitalize and increase income and livelihood of the rural people. The important endowments and opportunities are:

- Abundance of land and mineral resources
- **Abundance of solar and wind energy**
- **Rich biodiversity**, multipurpose tree species (MPTs), nutritious grasses and high quality snow water; rich genetic resources of fruits, vegetables, seed spices and medicinal and aromatic plants.

- Adapted human and **drought hardy animals**; Tharparker, Gir, Kankrej, Sahiwal, Rathi, Nagauri breeds of cattle (their purity although threatened); Mehsana, Surti, Jofrabadi, Murrah, Nagpuri and Khunni buffaloes, besides Pashmina goats of cold desert and other animal breeds are unique genetic treasures of Indian arid zones
- **Traditional wisdom and strong social structure.**

The different regions of the arid agro ecosystem have their specific challenges and opportunities, as described below.

Hot Arid Zone

4.2.6.3 The major challenge in this chronically drought-affected region is sustainable land management that ensures not only adequacy of food, fodder and drinking water, and livelihood support. Inclusiveness and guarantees both for on-farm and non-farm employment are important. Since the region is affected by recurrent drought, crop failure is a regular feature and farmers practice agro-forestry of different kinds and integrated livestock-crop farming. Such integration of crops with animals, trees, shrubs and grasses in a farming system mode helps not only in drought-proofing, but also provides multifarious food, animal, fruit, fodder, fuel and timber products.

4.2 6.4. Water is the most demanding resource in the region, especially during drought. Although the region has traditional wisdom on water harvesting, pipe water supply has gradually deteriorated many structures. Using new technologies developed by various ICAR institutes, SAUs and other NARIs, many of the *tankas, nadis* and *khadins* could be revived. **For a successful and sustainable dryland farming enterprise, conservation of soil and water resources has to be willingly and religiously undertaken by farmers as an integral component of the production system practised by them**.

4.2.6.5. Suitable intermixing of livestock with agroforestry systems can enhance the ability of desert dwellers to sustain under the unpredictable and harsh environment. Livestock farming, though a traditional practice, still lacks a proper scientific and holistic approach. The major bottlenecks in its progress are non-availability of fodder and

drinking water, and shifts in land uses towards extensive and intensive crop farming that have resulted in shrinking grazing resources. Also, infrastructures for mobility of the perishables, processing units for livestock products (e.g., dairy industry), and their marketing facilities, need serious attention.

4.2.6.6. An economic evaluation of the alternate landuse systems shows a benefit-cost ratio of 1.46-1.87 over 1.24 under the arable cropping. This proves the worth of crop-grass-tree-animal system over exclusive arable farming under arid ecosystem **(Figure 5).** Despite there being compelling scientific and economic reasoning in favour of agri-pasture, agro-forestry and silvi-pasture that can also enhance livestock production system, the average farmers in the region still have apathy towards agri-pasture or silvi-pasture. As mentioned earlier, **the region is most suited for livestock-based farming system, yet developments in livestock production systems and their linkage with market economy have not progressed much.**

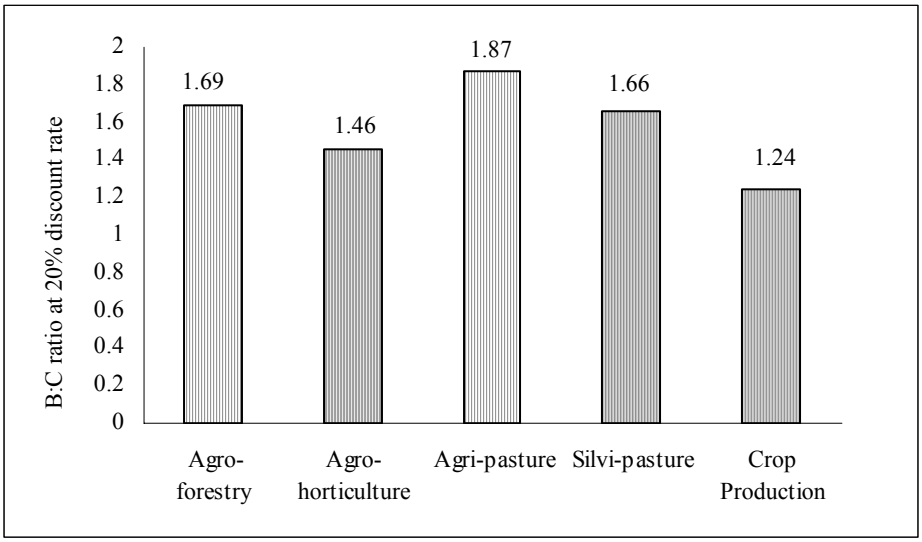

Figure 5. Benefit: Cost Ratio of different alternate landuse systems

4.2.6.7. Another major issue is over-use of the scarce groundwater resource for growing high water-demanding crops. At the current rates of groundwater exploitation, large areas of double cropping will turn into either wastelands having saline-sodic soil, or will revert back to mono-cropping.

4.2.6.8. The third major issue is long-term management of drought, rather than ad-hoc contingency planning for relief, ensuring livelihood support and continued employment, possibly in non-farm sectors. Frameworks for a symbiotic relationship between farm and non-farm sectors need to be established. These complex socio-economic issues need environmentally sound, yet workable policy frameworks. Perhaps, the stakeholders, State, NGOs and GOs may have to work as a consortium for the desired results.

Cold Arid Zone

4.2.6.9. Cold arid zone is characterised by long frozen winter months and very low snow fall and rains and short growing period adversely affect agricultural growth of land-based economy in Ladakh and adjoining areas in stagnant. The soil and water resources have been shrinking and pastures have been declining. However, **unique biodiversity, extreme temperature regime (-40 to + 40^{o}c), low RH (40%), maximum sunny days (300 day / year) and pest and disease free environment are some of the rare features of cold desert eco-system which can be converted to opportunities, if planned properly.**

4.2.6.10. In cold arid areas, **off-season production** (July–September) of vegetables and flowers for other areas can be successfully ventured. Use of **polyhouse** for vegetable cultivation has become quite common, giving the growers benefit of extended growing season, besides freedom form pests and diseases. Among fruits, apricot is a commercial crop in Ladakh area and sold as dried apricot, which is quite popular outside the region. Kargil area is famous for quality produce of black cumin (*kala zeera*) and seabuckthorn is being explored commercially. This zone is a **rich repository of medicinal herbs**, most of which are used in Tibetan system of medicine. The Lahul - Spiti belt is famous for production of disease free seeds of vegetable crops, including seed tuber of potato.

Southern Arid Agro Ecological Setting

4.2.6.11. The Southern Arid Zone is situated in the rain shadow region of SW monsoon along the leeward side of Sahyadris. The mean annual rainfall varies from 500

mm in Bellary to 573 mm in Bijapur (both in Karnataka) and 550 mm in Anantpur (Andhra Pradesh). A large number of seasonal crops (sorghum, pearlmillet, castor, pigeonpea, groundnut, chickpea etc.) and perennial (ber, custard apple, pomegranate, aonla, mango in fruits and *Casuarina, Dalbergia sissoo*, *Acacia* n*ilotica,* neem etc as tree species are grown in the region. Better rainwater management, tree crop-livestock interface, arid-horticulture, biodiversal plantations and livestock-based farming systems offer opportunities in the semi-arid region. Dry land orchards of mango, cashew, tamarind, jackfruit are receiving promotional support. With drip irrigation, grapes, pomegranate, acid lime and sweet orange are important commercial successes in this region.

4.2.6.12. The APEDA has developed a concept of Agri-Export Zones (AEZs) and AEZs focusing horticulture produce / products have already been set up in Andhra Pradesh and Karnataka. AEZs have been established for rose, onions and gherkins in Karnataka. Contract farming has been found to be successful in gherkins and it is reported that VST Natural Products Limited in Andhra Pradesh was able to have contracts with gherkin farmers by providing seeds, credit and other technical inputs for supplying raw gherkins which were processed and exported. Such models may work well for other export oriented crops. Semi-arid zones with provision of supplementary irrigation (micro-irrigation) can produce exportable commodities matching international quality standards by following hazard analysis and critical control point (HACCP) guidelines and Codex standards.

4.2.7.0 Pathways to Sustained Livelihood Security of Arid Zone People

4.2.7.1 In line with the priorities identified under the National Common Minimum Programme of the UPA Government, the Department of Agriculture and Cooperation of the Ministry of Agriculture has formulated a new scheme on “Enhancing Sustainability of Dryland Rainfed Farming Systems” and submitted it to the Planning Commission for approval. The proposed scheme aims at addressing issues like rainwater harvesting and its utilization; in situ soil moisture conservation; use of organics/organic manures; alternate land use; and adoption of improved dryland farming technologies in the arid and

semiarid regions of the country. On a 100 percent funding from the Government of India, during the X^{th} and XI^{th} Plans, sums of Rs 2150 crore and Rs 7,000 crore, respectively, are proposed for implementation of the scheme. At the national level, the implementation of the scheme will be monitored by the National Monitoring Committee chaired by Secretary DoA.

4.2.7.2 The above initiative is indeed a welcomed move. But, it has the risk of running into the same shortcomings as all rainfed programmes in the past which had generally failed to adequately address the farmers' problems of survival and livelihood security specific to the hot and cold arid regions and had drifted towards the relatively more congenial settings of semi arid areas. Therefore, **it is advisable not to club the arid zone research and development programmes with those of the semi arid zone**. This report, thus, addresses the challenges and prospects exclusively of arid agro-ecosystems.

4.2.7.3 **All efforts should be synergised and channeled to ensure survival and livelihood security of farmers and rural people (as also of livestock) in arid zones braving acute water scarcity, frequent droughts and near-famines. Congruence of ecological, economic and employment securities should be ensured through the participatory development and adoption of eco-technologies towards a rational blend of productivity, sustainability, profitability and equity**. Significant adjustments, as discussed below, are required in the areas of policy actions and critical interventions such as technologies, institutions, human resources, investments market and infrastructure to achieve the goal.

A. Policy Actions

National Authority for Dryland Farming Areas: Convergence and Synergy

4.2.7.4 The greatest distress to farm and rural communities occurs in the drylands of the arid and semi-arid regions of the country. Nearly 76% of the farmers committing suicide were dependent on rainfed dryland agriculture. These areas primarily depend on low and erratic rainfall, but intensity of aridity and severity of problems are more in the one-third arid areas than in the two-third semi-arid region. The situation regarding groundwater

use and drawal, which accounts for nearly 70% of the total water used for crop production, is alarming. The principal constraints observed in reaping the full benefits from dryland farming research and development are the following:

- Lack of disaggregated and focused approach, gross operational overlaps among concerned Ministries and Departments with little monitoring and evaluation of empteen number of related programmes.
- Lack of integrated watersheds and sustainable land development approaches, with all members of the watershed and SLM community not working together to save and share water and land.
- Lack of social synergy in the area of land and water use planning, with little emphasis on collaborative efforts in both the production and post harvest phases of farming.
- Dry lands soils are both thirsty and hungry. It is important that steps are taken to overcome these two constraints by judicious water harvesting and use, and by applying to the soil the needed micro and macro-nutrients. The water crisis, especially the fast receeding groundwater and quality, and hunger of the soil caused by micronutrient deficiencies need to be addressed on a priority basis.

4.2.7.5 With the above backdrop, as already stipulated in our First Report, we strongly recommend the establishment of a National Authority for Dryland Farming Areas (NADFA) **(Figure 6).** The Authority will be hosted by the Ministry of Agriculture, with synergistic horizontal linkages with all concerned Ministries and Departments. It should be a multistake-holder entity performing normative as well as policy development and implementation functions geared towards sustainable livelihood security of dryland area people. Its main functions may be:

(i) Formulation, updating and implementation of dryland agriculture research and development policy and programmes.

(ii) Priority setting, direction-giving, coordination, removal of gross duplications, monitoring and streamlining of fund allocations and utilization.

(iii) Supporting and sponsoring sustained institutional and social capital and human resources development and establishing and managing linkages.

(iv) Promoting enhanced water conservation, productivity, equity and sustainability.

(v) Improving post harvest technology, value addition to crop and animal products and developing end-to-end approach to link production with market, leading to enhanced and sustained income and food security.

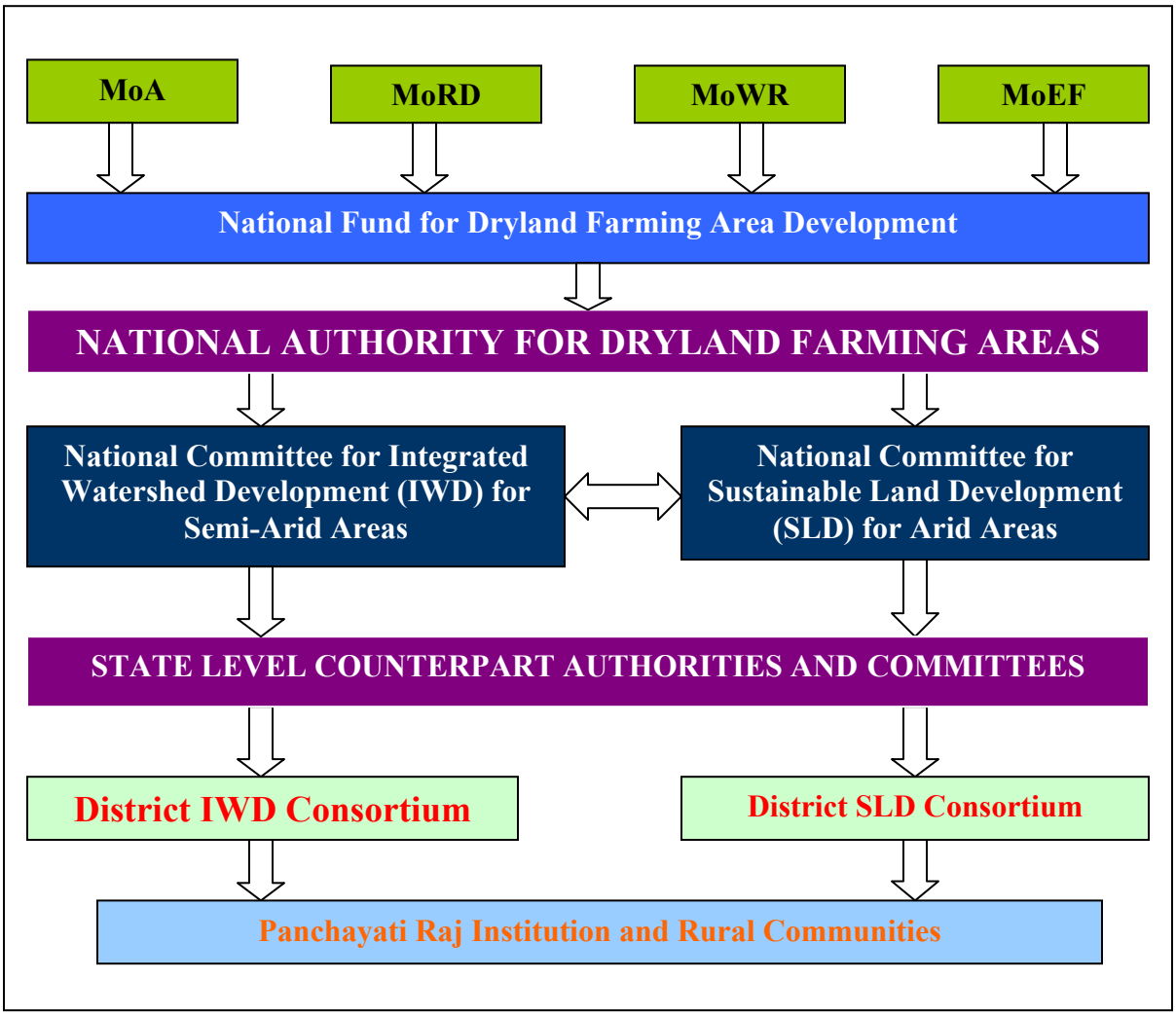

Figure 6: National Authority for Dryland Farming Areas (NADFA)

4.2.7.6 In order to address the differentiated problems and prospects of the semi-arid and arid regions, the Authority may set up separate **National Committees for Integrated Watershed Development for Semi-arid Regions and for Sustainable Land Development for Arid Regions (Figure 6**). These should be constituted and function as a multistakeholder consortia for monitoring the outcomes of the various programmes and collaborations and for making mid-course corrections, if necessary. The various Watershed Development Projects, Mission Mode Projects, such as National Horticultural Mission, Dairy Mission, Oilseeds Mission, Drinking Water Mission, and Drought Relief Programme must function in an integrated manner and internalize the location specificities to synergistically address local problems and to achieve the set objectives **(Figure 7**). The arid and semi-arid zone States should constitute **State level counterpart Committees**, which co-jointly with the National Committee, should ensure timely flow of the earmarked funds to Panchayats at the ground level through the **District IWD and SLM Consortia (**see **Figure 6)**. **The Consortia will be the main technical backstopping units comprising experts from relevant technical fields, development agencies, farmers, private sector, financial institutions, NGOs and other concerned stakeholders. These should be headed by full time experts in the field.**

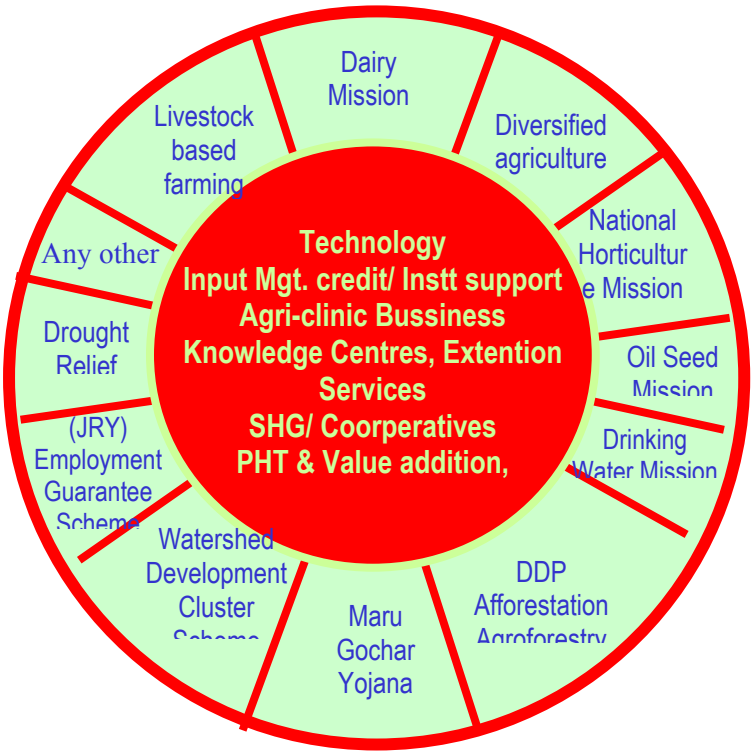

Figure 7. Convergence and synergy among various Programmes and Missions

Sustainable Land Management for Livelihood Security

4.2.7.7 Recognising that acute water deficit, frequent droughts and fragility of land and other natural resources are the distinguishing features of the arid zones, and appreciating that typical watersheds are uncommon to arid agro ecosystems, **Sustainable Land Management (SLM)** should be the focus in arid zones around which should rally all interventions towards sustainable livelihood security. The approach should visualise land as a matrix of soil, water, vegetation and weather. There should be convergence and synergies around SLM to ensure optimal sustainable production and conservation of the ecosystem **(Figure 8)**.

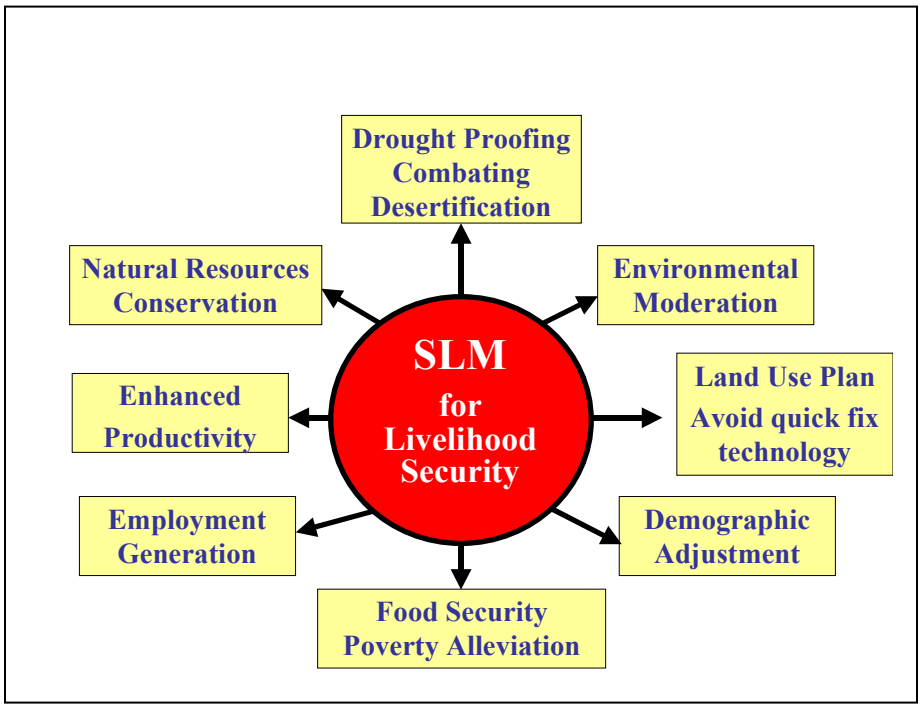

Figure 8. Sustainable land management: multiple benefits

4.2.7.8 The policy must emphasise that land, water and vegetation in arid regions are finite and have limited capabilities. Sustainable **demographic policy and awareness** should be developed by the Government of India and carefully implemented by State Governments to rationally contain population and population-driven over- exploitation in such fragile agro ecosystems which lead to irreversible land degradation, desertification

and migration of people. Unmindful adoption of "quick-fix" technologies, such as growing rice at the cost of rapid groundwater depletion or rearing buffaloes despite scarcity of fodder and drinking water needs a critical appraisal. **Environmental costing** through adopting available or locally-developed environmental-economic indicators should be compulsorily implement by State Governments to deter the misuse of the scarce resources.

Harnessing Group Dynamics

4.2.7.9 NABARD, other banks, SFAC, concerned ministries and departments should facilitate public-private linkages not only in infrastructural development but also in promotion of rural entrepreneurship and in establishment and effective functioning of **SHGs**, **cooperatives, Small Farmers' Estates**, other rural groups and community based organisations, agriclinics and agribusiness centres to facilitate access to quality inputs and to fair markets. **The Government of India and State Governments should suitably strengthen Panchayat Raj Institutions, congrueing authority, financial capacity and accountability to mobilise grassroot level priority setting, programming and implementation in close collaboration with suitable NGOs and CSOs, particularly in establishing public-private sector partnerships to facilitate technology transfer, establishment of rural SMEs and producer-oriented remunerative marketing**. The Smallholder Farm Estates will not only provide the power of economies of scale but will also forge synergy and convergence among various actors and stakeholders and among various processes of production, processing and marketing. Using an **end-to-end approach**, the Estates should establish strong backward linkages with technology, inputs, services and credit and other institutional supports and forward linkages with remunerative markets, income generation and profit sharing.

Agriculture-Risk Fund: Institutional Life Saving Support

4.2.7.10 Institutional credit flow to arid zone farmer is extremely low. These farmers try to minimize their income risks by taking up different economic activities. **The banks need to provide credit for a composite set of activities which may include cultivation**

of crops, some horticulture, small animal husbandry and may be a micro non-farm enterprise, unlike other areas where financing for one economic activity is the general practice. The need is, therefore, to look at these farmers differently and provide them credit line in a more **flexible** manner keeping in view their investment requirements and income flows. Another important aspect is the recurrent and frequent droughts which cripple their income flow rendering the borrowers from banks defaulters and credit unworthy. Rescheduling and restructuring of these loans is not enough in the event of successive droughts. The indebtedness would keep increasing and further accentuate the distress. Under these circumstances, **the Central Government may step in to create an Agriculture-Risk Fund to provide relief to the farmers in case of successive droughts**. This Fund should have contributions from the Central Government, State Governments and the banks in a predetermined fashion.

Insurance: Insulating the Farmer from Risks

4.2.7.11 Given the high risk, coupled with the poor economic condition of the farmers, many of whom are already acutely stressed, an effective insurance mechanism covering the majority poor is a *sine qua non* for sustained livelihood security of arid zone farmers. The provisions and coverages under the existing Agricultural Insurance Corporation of India (AICI) are inadequate as these generally cover the bank borrowers who represent only a small fraction of the comparatively better-off people particularly in arid zone, where the outreach of the banks is poor. **Special insurance products, covering crops, livestock and health of the farming families as a composite micro insurance scheme need to be designed for these areas. Special dispensation to the AICI for developing and marketing such insurance products is required**. Intensive efforts are needed in many blocks of the arid zone, which have been generally bypassed, by earlier programmes and initiatives. **It may be appropriate for the Central Government to provide premium support, say to the extent of 50%, for this insurance coverage as an essential life-saving support system.**

Contingency Funds for Sustaining Agriculture and Livestock in Drought Years in Arid Zones

4.2.7.12 The arid zones are frequented by droughts every other year. **Contingency plans** for meeting the farmers requirements of seeds and other inputs are prepared by the State Government as well as the Central Government including the ICAR. However, most of the State Governments, because of the financial constraints, are unable to provide the required assistance to the farmers. The Ministry of Agriculture, Government of India, also does not have any fund or schemes which may be utilized by State Governments for the purpose. It is, therefore, felt that **a revolving fund of Rs 500 crore may be created in the Ministry of Agriculture, Government of India, for meeting such expenses**. It is suggested that these funds can be provided by suitable reappropriation by the Ministry out of the unspent approved budget estimate under the various Central Sector and Centrally-Sponsored Schemes.

Enhance Investment in the Distressed Areas

4.2.7.13 The all-time low investment in agriculture notwithstanding, the investment in arid zones is paradoxically still lower. The inhospitable weather conditions and frequent droughts have deterred even the public sector from investing in arid zones. Whatever little, the private sector investment is confined to the environmentally better endowed and congenial areas, such as irrigated areas. This has widened the divide between arid agro-ecosystems and other agro-ecological regimes. The following actions are essential towards providing basic facilities and entitlements and for bridging the divides:

- Both, Central and State Governments, should **substantially increase investment in arid zone areas** for agriculture as well as for infrastructure, education and primary health care development, which will also encourage the private sector to investment in these hitherto 'non hospitable' areas**.** Provide **tax holidays** and other incentives to private sector to encourage multilateral investments.

Investment in irrigation, especially micro-irrigation and overall soil and water management, should have high socio-economic and ecological pay off.

- **Strengthen research, technology development and extension system** in a strongly affirmative and need based mode, with emphasis on resource conservation and sustainable use and on marketing and socio-economic aspects. **At least 15 per cent of the development budget should be earmarked for on-farm strategic research to facilitate refinement and quick adoption of technologies.**
- **Augment human resource and skill development** to enhance gainful employability particularly of the rural youth.
- **Engender all agricultural development programmes**, particularly livestock, horticulture, seed and herbal production, processing and marketing programmes.
- Create and strengthen **each village as a knowledge centre** and establish agribusiness and agriclinic centres, and **promote entrepreneurial systems**.

Synchronize Trade Policies with Development Policies

4.2.7.14 Trade, particularly in the liberalized and globalised world, is to be seen as a major development tool. If not handled properly, it will prove detrimental to the welfare of the farmers, especially the smallholders. For instance, development of livestock (which are so very important in arid zone) is closely linked with the trade policies of the Government on dairy products and wool. **The GOI should not liberalize import tariffs on these commodities which will jeopardize domestic production of the vital livelihood resources. Moreover, for the speciality and monopoly commodities, namely isabgol, guggal, cumin, pashmina and others, special trade and pricing policies and strong enabling mechanisms, such as an effective and responsive SPS system, should be created to meet TBT and non-tariff barriers as well as to maintain our market share.**

B. Catalytic Interventions

Income, Food and Nutritional Security

4.2.7.15. Arid areas have been carrying relatively greater loads of poverty, under nutrition and unsustainability. This unholy alliance among the three maladies could be broken only by a still stronger alliance of increased and sustained productivity, profitability and social justice **(Figure 9)**. Equally strong alliance should be forged (and monitored) by the Task Forces on Arid Agro-Ecosystem at National, Provincial, District (the District SLM Consortium) and Village (Gram Sabhas and PRIs) levels for adoption of proven technologies and development strategies for enhanced productivity, creation of increased marketable surpluses by small farmers, prevention of post-harvest losses, value addition and remunerative marketing. The following actions are recommended for enhancing income, food and nutritional security:

- **Enhance productivity and quality** through the adoption of appropriate **ecotechnologies** to attain desired **competitiveness**. Adopt end–to-end approach of development of selected commodities, such as ber, datepalm, seed spices in hot arid zone and apricot and *kala Zeera* in cold arid zone. Promote **diversification** particularly towards horticulture and other high value commodities and **intensify** production by adopting low-cost green houses, microirrigation and fertigation. A special date palm project involving 40 demonstrations and 40,000 ha under commercial production, including low cost green houses for hardening vitroplants should be completed in the next five years.
- Promote **integrated farming system**, coupled with marketing, with special focus on livestock-based farming system, especially sheep, goat and camel economy in the hot arid regions and Pashmina goats and new Bharat Marino and hybrid angora rabbits in cold arid regions. Fifty pilot projects in hot arid and 25 in cold arid zones should be launched.
- Strengthen **value addition** through better post-harvest processing and management and promotion and large scale adoption of new horticultural, herbal and livestock products and efficient marketing system. Due care should be taken of local sensitivities in locating the meat and other such industries.

- Undertake **niche production of hybrid and other vegetable seeds** especially by women SHGs and local cooperatives and establish grain, feed, seed and other fodder banks to be managed by SHGs.
- **Adopt a whole life cycle approach** to the integrated implementation of all nutritional programmes, starting with pregnant women and ending with old and infirm persons.
- **A special programme should be launched for development of the cold desert region** of Ladakh to enhance the productivity, quality, profitability and sustainability of its farm enterprises. Eco- and other tourisms should be further assisted through new initiatives such as Rare Birds Park. Human resource development should be accorded high priority for capturing new of-farm job opportunities.

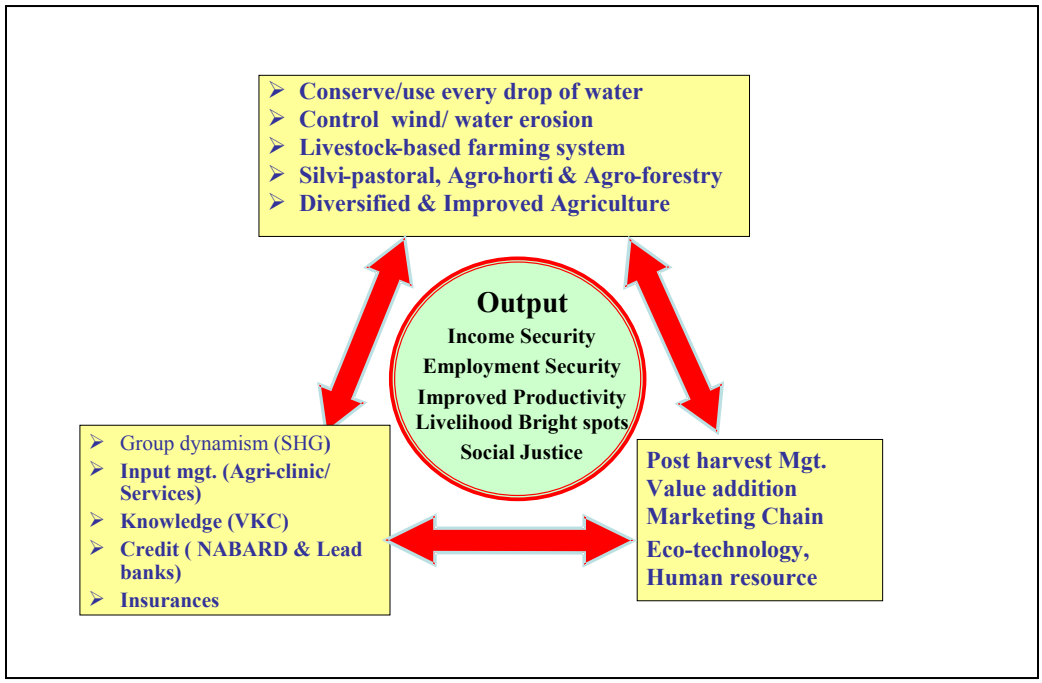

Figure 9. Breaking the unholy nexus

4.2.7.16. The National Rural Employment Guarantee Scheme (NREGS) should be extended to enhance economic as well as physical access to food and also to create assets in integrated watershed and sustainable land development programmes. The Scheme should be linked with the Food for Work Programme (FFWP) to ensure sustained food security to be regularised under a proposed **National Food Guarantee Act** (See Chapter

2). Techniracy should be promoted by Programme Implementation Agencies and District SLM Consortium to develop **skilled human resources** who could be employed more gainfully.

Employment Security

4.2.7.17. Arable cropping is not a dependable proposition in arid zones, especially for small holders. Therefore, alternative and complementary sources of income and livelihood must be developed. For this, **off-farm and non-farm employment** opportunities must be created by the Government as well as by the private sector. Government policies, such as tax incentive to the private sector, development of rural infrastructure, reorientation of research and technology development priorities to generate and transfer technologies for rural people, particularly resource poor farmers, and diversification of the use of the local resources as well as of agro ecological endowments are prerequisites for creation of off- and non- farm employments. It may be added that, almost two decades ago, China took almost 100 million people out from the agriculture sector and employed them in manufacturing and services sectors related with agriculture and primary production systems. For this, China had developed the necessary rural infrastructures, rural agro industries and market connections. Most importantly, the country had made arrangements to train those people and increased their skills in specific areas for their out-of-agriculture redeployment. Similar approach should be adopted by the Central and State Governments in India.

4.2.7.18. Unique features of arid zones should be harnessed for promoting off-farm and non-farm employments. These include ecotourism, spiritual tourism and sports tourism and promotion of agro processing especially based on horticultural and livestock products. For instance, the high dietary value and superior milk products from goat milk could constitute important export products. Further, leather industry based on the huge livestock population of arid zones could be a highly paying proposition, both from the angles of employment as well as income generation. Agroprocessing and value addition industries for horticulture and medicinal and aromatic plants should be promoted in rural areas and small rural godowns should be established to facilitate marketing. Other sources of non-farm employment are the promotion of handicrafts and cottage industries

(as in Gujarat and parts of Rajasthan). Economic activities based on local resources such as marbles, minerals and other deposits should also be promoted to diversify employment opportunities. However, these activities should be consistent with the requirements of environmental sustainability. While the private sector must play a leading role in increasing and diversifying employment opportunities, preference should be given to the local people to avoid migration and social conflicts. However, in order not to compromise with efficiency and competitiveness necessary **training and skill development programmes should be established by the State Governments to train the local people seeking the alternative employment.**

4.2.7.19. The following micro enterprises and marketing approaches are strongly recommended to be adopted towards the goal of enhanced employment, productivity and livelihood security, especially by landless and non-agricultural people:

- Intensification and spread of **household income generating activities** like mushroom cultivation, sericulture, backyard poultry, apiculture and vermicomposting.
- Promotion of **custom hiring of farm machinery**, tools and plant protection equipment etc.
- Establishing and fostering **linkages with market committees by e-networking**
- **Linking SHGs and other farmers organizations/groups with credit, insurance, private & corporate sector to promote Small Holder Estates to benefit from the power of economy of scale**.
- Establishing **ICT based knowledge centre**/internet kiosks for market information and virtual extension service.

Conserving and Utilizing Every Drop of Water

4.2.7.20 **Rainwater harvesting: Reviving the "Dying Wisdom":** Water for agriculture or even for drinking is the key issue of arid region and must become the concern of everyone to conserve every drop of water. In Western Rajasthan, the hub of the country's arid zone, adopting an **integrated water management** programme, the

"dying wisdom" of traditional system of rainwater harvesting in *tanka*, *nadis*, *khadin*, *talab*, etc., should be revived and restored. New technologies developed by ICAR and other institutes for the purpose should be widely demonstrated and adopted. In this context, nearly 1,000 field demonstrations are proposed to be organized by State Governments. Community surface water storage facilities should be provided to all the needy villages where the piped water supply of the Public Health and Engineering Department (PHED) is inadequate to meet the drinking water needs. With an additional rainwater surface storage of 137 mcm, raising the total capacity to 531 mcm, domestic needs of all arid villages of Rajasthan not covered by PHED could be met. About 70-80% harvesting of rainwater may provide community storage to all. Over time, the capacity of *Khadins* and other water storage structures have decreased due to land degradation and crop intensification. Improvement of these devices and structures through enhancing and sensitizing group awareness and their better management are the needs of the hour **(Table 7).** Panchayats, Gram Sabhas, community organizations, NGOs and CSOs must play major roles in this effort.

Table 7. Requirement of traditional rainwater harvesting structures

Rainwater Structure	Existing (no.)	Storage (million cubic meters)	New Structure (no.)	Storage (million cubic meters)	Total
1. Nadi	20,800	322	3,000	90	422.5
2. Tanka	10,85,000	32.6	2,00,000	17	49.5
3. Khadin	550	29.7	490	26.5	56.2
4. Anicut			23	2.8	2.8
					531.0

4.2.7.21 **Groundwater recharge:** Groundwater recharge must be made compulsory for urban as well as rural settings. Due to negative water balance and higher withdrawals, there is hardly any build-up of groundwater in arid regions. Though starved for water, arid regions also face floods, may be once in 10 years, as recently witnessed in the arid agro ecosystem of Gujarat, which may generate on an average 2100-6200 mcm water. **It is estimated that if 1/3rd of floodwater is made to recharge the groundwater,**

it can sustain five recurring droughts. Ephemeral river water should be used to recharge groundwater through check dams, percolation tanks, sub-surface barriers, sand fill dams, induced recharge, etc..

4.2.7.22 Water resource development and management: **Irrigation water being the most critical input in crop production in the arid eco-system,** restoring water bodies and promoting water harvesting should receive major developmental support**. Under Desert Development Programme (DDP), National Watershed Development Programme for Rainfed Areas (NWDPRA), Integrated Watershed Development Programmes (IWDP), Drought Prone Areas Programme (DPAP) and the like, water resource development activities have been promoted by GOI, but often in isolation. These efforts must be converged and synergised at the action site. For instance, several of these programmes have tried agricultural land contour graded bunds and contour vegetative hedge (CVH) as "run-off retention" devices to conserve moisture *in situ* and for improving infiltration. But, in light soils of arid region, such measures may not be very effective. Efficacies of such efforts must be improved by fine tuning of the technologies through a collaborative, integrated and participatory approach. Emphasis on location specificity and precision is the key to the success in all arid zones. The Task Force on Arid Agro Ecosystem should critically examine the outcomes of these programmes with focus on arid zones where little work has been done as compared to that in semi arid and other zones, and prepare a detailed time- and location-targeted action plan to converge and complement the ongoing activities.** About 10 percent of the total investment in watersheds and soil conservation should be allocated for development and fine tuning of technologies for Sustainable Land Management in arid agro-ecosystems**.**

4.2 7.23. The feasibility of rainwater harvesting through farm ponds in areas with rainfall above 400 mm has been well established. Also, there are many examples of recycling such harvested water for successful raising of horticultural crops. It is estimated that **in arid region there is potential of harvesting 70% of rain water for recycling as well as ground water recharge**. Under NATP, seven check dams were constructed in

different areas, which led to recharging of ground water, by 80 m in Matyana watershed area of Junagarh in Gujarat. It is claimed that in four years time farmers could reap economic benefits as a result of sale of fruits and crops raised through use of the water for supplementary irrigation. Such **"bright spots"** should be used for training farmers and extension staff and should be replicated widely by State Governments. Diggi-cum-sprinkler irrigation programme should also work well for vegetables. Similarly, Diggi-cum-drip system developed in CIAH, Bikaner (Rajasthan) may work well for fruit species.

4.2.7.24. In Andhra Pradesh, over 42 lakh ha have been covered by watershed and 9300 micro-watersheds have already been delineated. Similarly, in Karnataka, over 6 lakh ha are under watershed development. Community water management through participatory planning, water audit and district water management agencies are in the water management agenda in A.P. Promotion of micro-irrigation is one of the thrust areas in Karnataka and the State Government has earmarked Rs. 6 crores for drip irrigation for 2005-06.

4.2.7.25. Through Watershed Development Society or Watershed Committee, with farmers participation as per IWDP guidelines, the water resource development for multi-purpose use in arid zones need to be augmented and managed by using participatory approaches. The Panchayats, especially the Pani Panchayats, self-help groups, the SFEs and other grassroot organizations should undertake group operations for water harvesting and management. The Task Force should identify the "nuts and bolts" of the various proven technologies and approaches for water conservation and its efficient use and ensure their time targeted replication in designated areas, as mentioned above.

4.2.7.26. Develop quality micro-irrigation: Pressurised or micro irrigation - drip and sprinkler, should be extensively promoted both by Central and State-Governments for increasing water use efficiency and productivity. So far, generally only larger and well-to-do farmers have benefited from the Central and State Governments' supports (subsidy) to micro irrigation. Moreover, as usual, the subsidy programmes were not handled

properly and substandard and defective equipment hardwares flooded by spurious firms have choked the water flow and the scheme. The process must be freed from corruption and a transparent people-managed programme with clearly defined responsibility and accountability of stakeholders, supported with a quality control and a close monitoring mechanism, should be established. Coupled with fertigation, micro-irrigation could revolutionise protected agriculture/horticulture through the widespread use of low-cost greenhouse technology. The good beginning made in Kachchh and a few other arid areas should be multiplied by the extension and concerned development agencies of the State Government in other analogous arid agro ecosystems, converting the grey deserts into green and blooming deserts. NABARD, other development banks and private sector (primarily through contract farming) should find the initiative attractive enough and jointly undertake replication and diffusion of the technology.

4.2.7.27. **Traveling workshop**: **In order to learn from the successful experiences of other countries on water management in arid agro-ecosystems, a traveling seminar comprising experts from Israel, Egypt, Turkey, Jordan and USA (Arizona) should be organized by the MoA**. The Indian team, after a detailed briefing, should start the field visit and on-the-spot discussions starting from the entry point of the Rajasthan Canal in the arid zone and to all other agro-ecologically different regions of the agro-ecosystem. The **"hot spots"** where recent tensions on water sharing in the Indian arid zone (resulting in a few farmers' death in Rajasthan) should also be visited to assess the ground problems and solutions. Farmers, NGOs, development agencies, ICAR, SAU and State Govt. representatives should join the seminar. Its findings should critically be analysed by the Task Force of the NADFA and presented at the national level in the presence of all stakeholders and concerned ministries and departments and internalized in the national water policy. If necessary, an Indian team comprising the various stakeholders should visit successful sites and experiences abroad.

Drought Proofing, Risk Avoidance and Management

4.2.7.28. The damages caused by droughts, year after year, are huge and destabilizing. Consequently, the Government has to provide equally huge relief funds, with little asset formation and durable impact. In fact, **the drought budgeting during**

the past five years has been higher than the budgeting for irrigation. In order to obviate this recurring loss, several steps, as enumerated in the following paragraphs, should be followed:

4.2.7.29. As mentioned earlier, Special Integrated Agriculture Insurance Programmes, coupled with institutional credit and life-saving assistance programmes should be implemented for arid zone people. Although NABARD and other specialized commercial banks have developed credit plans at district levels and circulated a number of bankable schemes, there is not much credit flow for development of arid agriculture. Bankers generally treat the farmers as borrowers and not as clients. State developmental plans need to be formulated in consultation with the bankers, who must become more farmer-friendly and development-oriented.

4.2.7.30. Complementarily, schemes are needed for adequate drought proofing through popularization of integrated farming and mixed cropping systems by cultivation of agricultural and horticultural crops that are high value and are known for extreme drought tolerance with minimum funding support. Long-term measures such as wind breaks and shelter belt plantation and reinvigoration of local techniques and traditional wisdom for water conservation (reviving the 'dying wisdom' and the *nadis, tankas and khadins*) should be promoted by State Governments, including SAUs, the Consortium, Panchayats and grassroot organizations. **Water literacy and peoples participation in management of water should assume high priority.**

4.2.7.31. **In order to reach the needy and to enhance effectiveness of such schemes, the criteria for classification and delineation of areas as arid, semi-arid and drought prone need to be revisited by the NADFA**. Group dynamism and power of partnership should particularly be harnessed in arid agro ecosystems for mutual reinforcement of confidence of the various stakeholders. Development by small-marginal farmers through SHGs may eventually establish effective Small Farmers' Estates (SFE) which will bring desired convergence among various processes of production, processing and marketing and establish and operate **grain, fodder, feed, seed**

and water banks each numbering about 700. These moves will help create off and non-farm employment opportunities.

Judicious Land Use Planning and Use

4.2.7.32. **Selection of crops and cropping systems:** The State Land Use Boards, State Extension Department, SAUs and farmers together should select crops and cropping systems in arable lands considering rainfall, soil type, length of growing season, marketability and household needs. Replacing low yielding cultivars with improved high yielding ones, which are resistant to abiotic and biotic stresses and optimizing their agro-techniques can easily reduce 20-30 percent cropping area without sacrificing grain production. Low rainfall areas (150-200 mm) and light textured soils with 8 weeks' growing period should be kept for *Lasiurus sindicus* grass, range management and moth bean varieties like RMO-40, CAZRI-Moth 1, 2 and 3. Areas receiving 200-400 mm rainfall and 8-10 weeks' growing period are suitable for short duration legumes, cluster bean, sesamum and agro-forestry. The areas having more than 400 mm rainfall, heavy soil and 8-12 weeks' growing period should be kept under pearl millet, guar, cowpea, and sesamum. Dual-purpose pearl millet variety, providing good grain and fodder yield, such as CZP-9802, should be preferred.

4.2.7.33**.** **Rotation and inter-cropping with legumes:** There is sufficient data at CAZRI showing that pearl millet after clusterbean produces double the grain yield compared to that obtained under mono cropping. Inter-cropping with legumes boosts the yield of the companion crop. Therefore legumes should be introduced in sequence or in rotation for improving fertility and productivity of arid lands.

4.2.7.34. **Revolution with specialized arid zone cash crops:** Arid region is endowed with drought-hardy species of medicinal and aromatic plants, spices and condiments. There are areas which are highly suitable for growing crops like isabgol, methi, mehndi, cumin and medicinal and aromatic plants. As trees have got long gestation period, and reduced crop yields, farmers are inclined to shift to cultivation of these specialized cash crops. Through post harvest and value addition and proper liaison

with industries, economy of arid region can be revolutionized by commercializing these cash crops. Based on the edapho-climatic conditions, crop zones for pearl millet, mustard and special crops should be delineated. Farmers should accordingly be trained and educated by District SLM Consortium and extension agents for growing these crops, their post-harvest management and for improving their economy.

4.2.7.35. **Soil test based micro-nutrient amendments for increasing yields:** Nearly 80-100 per cent of the tested farmers' fields in several pockets of the arid zone were severely deficient in boron, zinc and sulphur in addition to the macro-nutrients like nitrogen and phosphorus. Farmer participatory trials with micro-nutrient amendments increased crop yield by about 50 per cent. **The economic gains with the application of micro-nutrients were substantial**. This technology should be adopted on large scale throughout arid areas of the country. **Additional facilities for soil test analysis for all the 16 macro and micronutrients are needed to implement this programme. To begin with, the Central Government may assist each arid zone district to establish one adequately equipped soil testing laboratory which could reliably test for the various nutrients, especially the micronutrients**. The SAUs and their KVKs should be actively involved in this task. Additional investment both in terms of equipment and human resources are required to create credible soil testing laboratories.

4.2.7.36. **Animal-based farming system and good grazing practices:** Animals are the mainstay of the arid agro ecosystem. **An integrated livestock based farming system, with focus on pastures, horticulture, medicinal plants, bio-fuel and oil bearing plants should be endeavoured**. In the process, culturable wastelands, marginal lands and non-arable lands can be fruitfully utilized for pasture development and silvi-horti-pastures for animal husbandry. Sandy wastelands can also be fruitfully utilized for shrubs and grasses. But, poor grazing practices and high stocking rates, particularly in the sub-alpine pastures have denuned the pastures, sometimes beyond rejuvenation as exotic **invasive weeds** have replaced the native vegetation. **The NDDB cooperative model for production-marketing link for milk and milk products should be adopted throughout the zone**.

4.2.7.37. **Fodder production:** In order to overcome the main bottleneck of the paucity of fodder, the scarcity being 35 per cent during normal rainfall years and as high as 75-80% in drought years, to meet the demand of the huge livestock population in the zone, incentive should be given to farmers to grow fodder crops in part of their lands. Livestock–based farming system should attempt reduction in pearl millet area from 60 to 40 per cent while increasing legumes form 20 to 30 per cent, oilseeds from 10 to15 and forage from 10 to 15 per cent. It has been worked out that in a seven-hectare farming system model, agro-horti may be assigned 30 per cent, agro-forestry 25 per cent, agri-pasture 15 per cent and silvi-pasture 10 per cent. Nearly 300 demonstrations of this model are proposed in the arid zones of Rajasthan, Gujarat and Haryana.

4.2.7.38. **Fodder bank:** The fodder is generally imported from neighboring states during drought at exorbitant rates. During good rainfall years there is a high potential of production of fodder from wastelands, marginal lands, community lands and by assigning some parts of arable lands. **High priority should be given to the production of fodder and creation of fodder banks for the locally grown fodder**. About 1,200 fodder banks are proposed. These fodder banks need to be created at Panchayat Samiti level, preferably with the involvement of SHGs and SFEs, and the fodder can be utilized during scarcity period/drought. Further, with the availability of fodder block machines, both stationary and mobile, **compressed fodder bricks and bundles, easy to transport and store, should be produced at large scale and stored in the fodder banks**. Such bricks, also made of straw plus urea plus mollasses could be made in the adjoining States of Punjab, Haryana and Westerns UP (where surplus straw is available and is often burnt in the field itself) and transported into Rajasthan or other needy states for immediate consumption or for augmenting the fodder banks.

4.2.7.39. **Management of cattle:** During a drought year, a large number of cattle are let loose or sent to gaushalas, which is a unique way of management of cattle population. There are more then 226 gaushalas in arid region of Rajasthan, Jodhpur district alone hosts about 146 of them. These gaushalas have been created for philanthropic reasons, and act as cushion for cattle management during stress. The by-

product of gaushalas are utilized as medicines, insecticides, manures etc. These noble institutions should be encouraged and promoted by State Governments through providing veterinary assistance and training of the care takers for adequate upkeep of the animals.

4.2.7.40. **Saline water fish culture:** Production of **Scampi** in saline water accumulated due to over irrigation and inappropriate water management in major canal command areas, such as Indira Gandhi Naher Pariyojna (IGNP) in Rajasthan, is a profitable proposition. The technology is indigenously available and special extension efforts and incentives should be launched by the States using the saline soils/water for production of Scampi. A benefit: cost ratio of about 1.5 has been realized under several trials in these settings.

Mechanization of Arid Zone Agriculture

4.2.7.41. **Precision and timeliness of agricultural operations are fundamental to the success of arid zone agriculture**. Further, for maximum output we have to shift to high-tech agriculture in selected areas that require greenhouses and specialized equipment for precision farming. There is also need for developing energy-efficient implements for various operations. Trials at various levels have revealed that **crop productivity, operation cost and time and inputs efficiency can be increased by 25 to 50 per cent through mechanization, thus increasing farmers' income by about Rs.3000 to Rs. 5000 per ha**.

4.2.7.42. Feed and fodder shortages are major concerns in arid regions, especially during drought years, when large-scale transportation of fodder becomes too voluminous and, hence, cumbersome. Therefore, appropriate mechanization of harvesting, bailing and storage of fodder is a necessity. Further, harvesting of perennials like Henna, Kair, etc. need special tools.

4.2.7.43 With the increased emphasis on horticulture-led diversification in arid zone, and considering that horticultural harvests are generally perishable, rural processing and value addition will be essential to ensure suitable prices and prevention of post-

harvest losses. Suitable low-cost processing machines will need to be popularized in rural areas.

4.2.7.44 Quality production of equipment through local industry, improving availability of costly implements to farmers through custom hiring centres and capacity building of farmers, industry workers and entrepreneurs are key elements of arid zone mechanization policy framework. Supports of Central as well as State Governments are needed in the following aspects of mechanization:

- **Creating strong R&D centres** for arid zone mechanization.
- **Developing training infrastructure** for capacity building of farmers, operators, industry workers and entrepreneurs of custom hiring centres.
- **Linking banking institutions** for financing different activities including purchases by farmers for setting industry and custom hiring centres etc at reasonable rate of interest.
- **Simplified, smooth and transparent flow of subsidy** to resource-poor farmers for procuring implements and small machines.

Preserving Livestock Heritage and Establishing Gene Banks

4.2.7.45. The National Bureau of Plant Genetic Resources, The National Bureau of Animal Genetic Resources, The National Bureau of Agricultural Micro-organisms and other concerned Central and State agencies, in collaboration with local communities, should help chronicle and digitise inventories of the bio resources of the hot and cold arid zones covering plants, animals, fish and microorganisms. **Genetic and gene literacy movement should be launched for all stakeholders, especially the farmers**. An **integrated conservation strategy**, *in situ, ex situ*, including suitably managed field repositories, will be needed for converting the biological wealth into economic wealth. There is scope for introducing and commercialising exotic germplasm such as of cactus, pear, quandong, cardo, African dove plum, organ tree, marula nut, nance, oyster nut and other nuts. But, this must be done only in accordance with the SPS and IPR provisions, and the three Bureaus must play the Leading role in this context..

4.2.7.46. Traditionally, many of the finest Indian cattle milch breeds like, Tharparker, Gir, Kankrej, Sahiwal, Rathi etc have been evolved from arid regions of Rajasthan and Gujarat. Buffaloes, particularly the breeds like Mehsana, Surti, Jafrabadi are popular in arid regions of Gujarat, Murrah in Southern Haryana and Nagpuri in parts of Maharashtra. **But due to unscientific and uncontrolled cross breeding, the quality of some of the excellent livestock is on continuous decline**. For example, one of the hardiest and best breeds of Tharparker cow has only 10 per cent now. The excellent 'Nagauri' breed, which is famous for draft bullocks, is being relegated due to the use of tractors. In Gujarat, Khunni buffalo, which is capable to subsist on zero management, is on the decline due to degradation of Banni grassland in Kachchh district. These trends should not only be arrested but must be reversed. In fact, **our rich national animal heritage and genetic resources are seriously threatened**.

4.2.7.47. In order to safeguard the precious germplasm, it is recommended that a part of the **Suratgarh Farm (in Rajasthan) of the Government of India should be developed as an *ex-situ* germplasm repository of arid zone livestock**. The centre should also undertake genetic improvement programmes of the local breeds. Quality semen banks to facilitate artificial insemination programmes should also be established at the farm. Additional model animal farms could be developed at strategic locations considering the geophysical characteristics of the area where local breeds could be preserved, germplasm banks could be established and training facilities could be developed on veterinary first aid, AI and improved management practices. In fact, these farms should work not only as a technology transfer centers but should also be instrumental in triggering associated socio- economic changes.

4.2.7.48. **Protection, utilization and further enrichment of wealth of traditional wisdom of the desert dwellers as to how people survived without depletion or over exploitation of natural resources, as well as of tribals who inhabit arid zones in large numbers, is as important, if not more, as the indigenous biodiversity**. Many of the survival and resource conservation and utilization strategies and knowledge are presently under severe strain. Some are no more practiced because of increased demand, weakening of societal control and lack of collective concern. The time-tested values and

traditional knowledge and devices should be systematically documented and fine-tuned to meet local needs and to improve their efficiencies. Several of them provide lead for new and modern technologies. Willing participation and mobilization of local communities and rural institutions from planning through execution in R&D efforts, therefore, assume a high priority. **The PVPFR Act, enacted in 2001, should be implemented to benefit farmers, including tribals, as conservers and breeders**. The National Authority on Plant Variety Protection should be rendered functional as soon as possible. **Loss of a genetic resource is a loss for ever, and it is happening unabated.**

Socio- Economically and Agro Ecologically Differentiated Approach and Utilization of Special Features of Arid Agro-Ecosystem

4.2.7.49. In arid areas, natural resources endowment and development potential vary greatly from location to location. The northwest arid zones and southern arid zones are very different in their agro-ecological endowments and opportunities. In this context, non-arable lands from class V should be assigned to class VIII for permanent vegetation like pasture, silvi-pasture or afforestation. Therefore, **location specificity must be emphasized in micro planning, in allocation of resources and in setting socio-economic targets. Area-based development duly internatlized in the integrated sustainable land use management approach, should be the hallmark of development and growth of arid areas. Therefore, we propose that the ICAR, Land Use Boards and concerned Central and State level agencies should delineate agro ecological sub-regions of the arid districts and the various programmes should be designed primarily by the Consortium to match their capacities**. This will particularly be important for creating assets to ensure sustainability of the land, water and vegetational resources. Some of the important action programmes with high socio-economic and agro-ecological pay offs are described below.

4.2.7.50. **Seed production:** Recognizing that arid zone offers an ideal environment for producing quality seeds because the infection due to various pests and diseases is very low under these conditions, arid ecosystems should be utilized for producing seeds of

selected crops and can become a "Seed Bank" for the country. Farmers can also earn better income from seed production.

4.2.7.51**.** **Organic farming:** The level of fertilizer use due to risk aversion is rather low in arid zones. Since productivity or yields in arid zone are stabilized at lower level, these should best be achieved through organic manures. Organics will also improve soil physio-chemical properties and water retention in profile. Agricultural products such as vegetables, fruits, grains, pulses etc. produced organically should be suitably certified and marketed remuneratively for giving higher returns to the farmers.

4.2.7.52. **Harnessing solar and wind energy for agriculture:** Since there is ample of solar and wind energy available in arid zones and coastal belt of Gujarat arid regions, the natural renewable energy should be harnessed traditionally for agriculture and other commercial uses. Many post harvest industries should be integrated with solar and wind power. **The R&D institutions, involving SAUs and other non-agricultural technology institutions should work together to design and popularize low cost devices to harness solar and wind energies at village as well as household levels.** The State Task Force on Arid Agro-Ecosystem should oversee this activity.

4.2.7.53. **Arid horticulture:** Arid fruits such as ber, aonla, gunda, date, bael have excellent potential for integration in arid zone farming system. It was observed that even in extreme drought of 2002, ber crops fetched 1/3rd of income through horticulture while there was complete failure of crops in the arid areas. Therefore, arid horticulture should be strongly promoted by State Departments of Agriculture and/or Horticulture for drought proofing and to improve the economy of arid land farmers.

Special Attention to the Cold Arid Zone

4.2.7.54. With more and more employment avenues open to the local people today in non-agricultural sector, the land-based economy stands neglected in cold arid zone. However, this situation could prove to be extremely short-lived as the current boom that

Ladakh, Lahul - Spiti and other tourist places are experiencing cannot be considered sustainable. Moreover, much of the opportunity is being mopped up by non-locals. Thus, **there is an urgent need to make land-based occupations more remunerative and economically rewarding**. At the same time, local capacity must be built (particularly in the sphere of entrepreneurship) to help locals tap the commercial possibilities of this sector. The Ladakh Autonomous Hill Development Council (LAHDC) and State authorities in Himachal Pradesh and Uttaranchal should ensure that the conservation of natural resources supporting the land based economy and the move towards increased cooperation between the various stakeholders that are a part of it could be adopted as additional measures.

4.2.7.55. The natural resources that support the land-based economy are themselves deteriorating rapidly. Soil is getting eroded due to the incessant mining of this precious resource. Similarly, water resources (especially glaciers) have been receding for the past many years, purportedly due to the effect of global warming. Pastures have been severely neglected resulting in poor forage availability. This in turn is largely because of the lack of proper irrigation facilities, which has put a severe constraint on the development of the livestock industry in the region.

4.2.7.56. New strategies should be adopted by the LAHDC, particularly the Horticulture and Agriculture Departments to meet the above challenges. Firstly, the region must reduce its dependence on the outside world for critical requirements such as food by strengthening agricultural production and productivity. Traditional technologies should be judiciously blended with modern technologies to build on the time-tested approaches. Diversified integrated farming systems encompassing use of organics and service exchange systems should be pursued. The indigenous and traditional knowledge systems should be protected and gene banks for conservation of the rich biodiversity should be established. Further, additional land should be brought under cultivation and should particularly be allotted to landless farmers for greater equity. Participatory irrigation approaches, adoption of intensive cultivation techniques, greenhouse cultivation, IPM, pasture and forage development, management of zoonotic diseases and optimization of herd sizes and herd insurance should be strengthened**. It would be**

helpful if Pashmina production in *Changthang* could be raised to 65,000 kg per year and in the rest of Ladakh to 6,000 kg by the year 2025 to maintain the leadership of the region in this highly specialized commodity.

4.2.7.57. Secondly, the interest of the people in land-based economy must be revived. The local people, particularly the youth, must be sensitized and made aware of the important role that agriculture, livestock and horticulture have played and will continue to play in the socio-economic and overcall livelihood security of the people in these areas. **Training programmes for skill improvement and promotion of land-based entrepreneurship should be undertaken through producers' groups and Self Help Groups (SHGs) as well as by individuals to streamline the production, value addition and marketing activities. Assistance in the form of credit, marketing infrastructure and support prices will be essential for linking the producers with the consumers**.

4.2.7.58. Thirdly, agriculture (in a comprehensive sense) must become remunerative to the farmers and to all those linked with it. **The cold arids constitute special niches for vegetable seed production, floriculture (off season cut flowers and bulbs), medicinal and aromatic plants and several highly nutritious rare fruits like seabuckthorn and nuts like walnuts and "exotic" vegetables**. In order to receive remunerative returns from these specialty products, strong marketing initiatives, linking the producer with the consumer at mutually beneficial terms should be created. Existing systems such as the HPMC (Horticultural Produce Marketing Corporation), marketing cooperatives, *Mandis*, and agriclinics should be strengthened through additional infrastructural and database and information sharing facilities. Greater use of small effective machines to enhance productivity of the labour force, integrated soil and water management through the plant, soil and water testing facilities and knowledge-based technological interventions will be essential for increasing overall productivity and profitability. **The ICAR should open a regional station of the Central Arid Zone Research Institute (CAZRI) in Ladakh to cater to the technological needs of the cold arid region. Linkages with other initiatives, especially those of DRDO and ISRO**

should be ensured. An integrated cold arid area development programme for soil, water and biodiversity conservation should be intensified.

4.2.7.59. Fourthly, the economic growth must be synergized with environmental and ecological security. Priority should be given to pastures improvement, increased efficiency of existing irrigation facilities, and to the creation of additional irrigation resources by harnessing micro irrigation devices and by tapping hydro, solar and thermal powers in a participatory mode. Improved fodder production and sustainable grazing systems and good grazing practices should be evolved and enforced. In this context, **traditional migration patterns should be revived** and conditions should be created for extended stay at summer pastures, both for herders and livestocks. The socio-economic and cultural interests and roles of the herders and nomads, who are distinct and important component of the cold arids (as also in hot arids) should be duly promoted by the State Governments. Moreover, as climate change is already impacting the glacier regimes and snow lines in the cold arid zones, **research and technology development processes should focus on evolving and adopting coping and new climate change management mechanisms, such as creation and maintenance of new artificial water bodies. The proposed National Centre on Glacierology (see Chapter 4.1) should address these issues**.

Bridging Technology Gap: Connecting the Disconnect

4.2.7.60. There is almost a total disconnect between research and extension. A good number of Central Research Institutions of ICAR and of SAUs, particularly research through All India Co-ordinated Research Projects (AICRPs), NARP, NATP and others, have developed technologies for arid regions. Pioneering work in natural resource management (NRM) at CAZRI, Jodhpur for arid zone and CRIDA and ICRISAT at Hyderabad for semi-arid zone, on dry land horticulture under AICRP (Horticulture) and at CIAH, Bikaner and on livestock at CS & WRI, Avikanagar, CIRG for Goats at Makhdoom, NRC for Camel at Bikaner and DRDO's agricultural technology development initiatives at Ladakh alongwith the J&K State Government initiatives are worth mentioning. Production system research (PSR) has generated technologies on land

and water resources, cropping systems, soil microbes, salinisation in IGNP areas, low-cost greenhouse and offseason cropping and production of high value low volume products, including seeds in cold arid areas and characterization and improvement of breeds, brackish water fish culture, feed enrichment and reproductive efficiency improvement in livestock sector. But, only those technologies (as elucidated in **Box 1**) which had linkage with value addition and marketing have been adopted and majority of the other technologies continue to await adoption.

Box 1.

Arid Zone Horticulture: Some Success Stories

Ber Cultivation

- With the introduction of improved cultivars the area under ber in Rajasthan has increased during 1984 to 1996 from 229 ha to 829 ha. And production from 1387 t to 4145 t.
- Varieties such as Gola, Seb, Mundia, Umran were found to be promising in this region.
- A preliminary survey has shown that 5 million plants are produced every year which generates employment to the tune of 37,500 man days.
- On average Rs. 20,000 per ha is realized as net profit in normal rainfall years. Even in extreme drought condition in 2002 in Rajasthan, ber fetched 1/3rd of the income when there was complete failure in other crops.

Henna Cultivation

- Henna (*Lawsania inermis)* is known for natural dye and leaves are used for cosmetic purpose. Its export potential is Rs. 80-100 crores.
- Identification of high yielding MH-1 and MH-2 varieties (3-3.5 q/ha) with high quality of dye and distribution of saplings of improved varieties helped in the spread of henna to about 35000 ha in Rajasthan and Gujarat with a net return of Rs. 10,000 per ha.

Senna Cultivation

- Senna (*Cassia angustifolia*), an ideal crop for degraded land with leaves of medicinal value, is a drought hardy shrub.
- High yielding cultivars Tuticorin and Bikana with 8-10 q / ha /year yield helped in spread of senna cultivation to over 11,000 ha in Rajasthan and Gujarat.
- A Senna composite with 3.8% sennoside content, against 2.84% in commonly grown one,has been developed.
- A net return of Rs. 10,000 per year per ha is expected from senna cultivation in arid zone. The estimated export potential of the crop is Rs. 11 crores.
- Marketing associations have been formed for senna and processing units established in Bikaner and Jodhpur.

4.2.7.61. Transferable technologies for sustainable land use and enhancement of productivity of crop and livestock sector are now reasonably well developed. The Angora rabbit production is popular in hilly areas of H.P., U.P., Eastern region and Tamil Nadu.

One Angora rabbit can give net income of Rs. 150 to 200 per year. Such successful experiences should be widely adopted through creating grassroot institutions and public-private linkages. Other transferable technologies include: the Bharat Merino Sheep, enhanced reproductive ability of sheep, hybrid rabbits, fat lamb production, handloom woven blankets, wool camel hair blended products, hand made felts from blended rabbit and sheep wools of inferior quality. **About 2000 large-scale demonstrations of catalytic technological interventions are proposed to be carried out by State Governments in collaboration with private sector, NGOs, SAUs and ICAR to disseminate the technologies**.

4.2.7.62. Given the pivotal role of livestock and horticulture sub-sectors in arid zones and high perishability of their products, **very high priority should be given to post harvest processing**, **value addition, storage and establishment of cool chains. A post harvest technology wing should be added to each KVK to bridge the gap between production, distribution and pricing. Accordingly, the KVKs should be redesignated as Krishi and Udyog Vigyan Kendra (KUVKs)**.

4.2.7.63. Majority of the technologies developed by the various institutes await transfer and effective adoption. The Poor socio-economic base of small and marginal farmers and inadequate extension services are responsible for slow rate of adoption of new technologies, resulting in huge technology transfer gaps **(Table 8)**. New extension and technology transfer mechanisms are needed to bridge the gaps. Group approach of extension through formation of self-help groups (SHGs) is one such approach. **The small farmers SHGs in clusters should be helped to organize establishment of Small Farmers Estates (SFEs) covering an area of 200-500 ha each to capture the economies of scale**. It is proposed to establish 1000 SFEs during the next five years. Landless labourers should be supported with specialized activities like vermi-composting, beekeeping, IPM activities etc. SFEs for horticultural crops will suit well both in arid Rajasthan and Gujarat and semi-arid Andhra Pradesh and Karnataka.

Table 8. Yield gaps (technology transfer gaps), Bijapur

Crop	10 years back	5 years back	Present (2003)	Potential	Gap-Potential
Pearlmillet	398	524	468	1500	1032
Groundnut	400	438	476	1180	704
Sunflower	400	495	545	900	855
Rabi Sorghum	430	450	485	1200	715
Chickpea	220	240	265	900	635

Source: CRIDA, 2004

4.2.7.64. Seed spices and medicinal and aromatic plants (MAP) should be promoted as sources of income to people living under harsh climatic conditions of the deserts. This highly specialized group of crops must be raised with technology backstopping and intensive training of poor farmers in the arid zone. Such skill development training will be effective only through SHGs and SFEs under scattered low population density areas. Wherever advantageous to the farmers, **contract farming** to ensure remunerative marketing of these specialty crops should also be promoted.

4.2.7.65. Training and follow-on extension support including provision of limited non-repayable **micro-capital grant (MCG) to the SHGs and SFEs** through making suitable provisions in various developmental schemes need immediate attention. The micro-capital grants will be provided to the groups and estates for adopting modern technologies to improve production, value addition and marketing.

4.2.7.66. Group capacity building will be crucial and structured support / participation of technical personnels both in public and private sector will be required. Services of SAUs, R&D units, KVKs, ATMAs and grassroot organizations should be rendered for organizing training of trainers as well as farmers. **Farm schools**, representing **"bright spots"**, numbering nearly 500, will be used for farmer to farmer training. Training focusing women empowerment should concentrate more on gender friendly technologies / messages favoured by women. For example, **skills in raising**

quality planting materials of horticultural crops and post harvest handling of farm produce may suit women farmers better.

Farmer–Centered Marketing

4.2.7.67. Due to small size of holding and low productivity of arid crops, the quantity of marketed surplus of individual farmers is generally low, which constrains smallholders from bargaining effectively. High transportation cost of small-sized marketable surplus raises the transaction cost. Further, higher inter-village distances make provision of marketing infrastructure like road connectivity, telephone links, location of storage godowns and emergence of processing units, relatively less viable compared to those in densely populated areas. As the public sector investment in infrastructure in arid areas remains a low priority, private investors, of course, show less interest in such investments. Keeping in mind these features unique to arid zone, **special support should be provided to the marketing centres, whose success will underpin the livelihood security of the arid zone farmers, as the future productions will increasingly be market-led**.

4.2.7.68. Out of 25 agricultural commodities for which national agricultural price policy is operative, there are several commodities which are grown in arid areas. These include pearlmillet, blackgram, greengram, moth, and mustard. Even wheat is grown wherever irrigation facilities are adequately available. By very definition of arid agriculture, farmers are able to harvest a satisfactory crop only in one out of three or four years. In such years, prices of these commodities, particularly during the peak marketing season, go below the support levels announced by the Government of India and situation warrants price support purchases by the public agencies. But, unlike rice and wheat in regular surplus producing areas (of Punjab, Haryana, Western UP & A.P), the arrangements for support operations either do not exist or farmers have to agitate for quite some time and then only support operations commence. By that time, several farmers are compelled, by cash needs, to sell to private traders at lower prices. While the need for support operations in these areas is all the more acute (because such occasions arise in a year after a lapse of 3 to 4 years), the farmers of arid areas do not get benefit due to faulty planning.

4.2.7.69. Apart from the commodities covered under national price support policy, there are several commodities which are **life-line** of arid farmers, for which the provision of Market Intervention Scheme (MIS) of GOI exists **but due to lack of prudent planning, full benefits of MIS do not reach the arid farmers**. Such commodities are guar, cumin, coriander, fennel and fenugreek and should be included in MIS. The inter-year price fluctuations in these arid zone crops are relatively larger hence provision should be made to insulate farmers from abnormal price dips.

4.2.7.70. There are several other commodities and products of arid zone which have special geographical indications, and considerable demand in distant markets, including overseas markets. These include sojat ki mehandi, kair, sangari, bikaneri bhujia, isabgol etc, which have considerable potential of increasing employment and income through branding and organised marketing and this requires (i) working capital support to farmers, (ii) modern terminal markets, (iii) strong market information system, (iv) branding and publicity and (v) organized, transparent and professional markets. After careful market research, special market plans and facilities should be created for these specialty products. Following the NDDB pattern, SAFAL type (as in Bangalore) venture should be established in Western Rajasthan, to begin with. Considering that forward linkages of production with value addition and marketing is the most crucial step in the end-to-end approach, **the venture should be allocated the necessary financial support (nearly Rs.75 crores) for one 100-acre modern terminal market. The pay off from such an investment will be high, estimated at least 15 % IRR, not only in financial terms but also in social terms through increased employment opportunities and greater access to nutritive and high quality products.**

4.2.7.71. Notwithstanding the recommendations contained in the Chapter on Marketing of this Report, the following strategies for strengthening production and marketing linkages in arid zone should be followed:

- **Increase public investment in marketing infrastructure like rural roads, small rural storage godowns, cold chains and processing units. Relax**

viability norms and provide tax and other incentives to private investors to invest in arid areas.

- Modern Transactional Banking in villages or in cluster of villages. **The village knowledge centres must play key role in collecting and disseminating market and price information on relevant commodities**.
- Adopt the revised APMC Act and amend State Agricultural Produce Marketing Acts to encourage private investment in agricultural marketing and contract farming arrangements.
- **Effectively implement price support policy in arid areas**. Instruments of advance planning and preparation for price support operations should be put in place at the State level.
- **Market Intervention Scheme for arid areas should be prudently formulated and implemented. Both Central Government and States have a role**.
- The role and functions of State Agricultural Marketing Boards and Agricultural Produce Market Committees should be redefined to include promotion of marketing organizations/ contract – marketing arrangements of products specific to arid areas.
- **Agricultural marketing system research should be made a part of priority research under NARS for arid areas**.
- **Special commodity parks/zones** recently announced by the Government for arid-zone specific commodities should be put in place and made functional as early as possible.
- Extension agencies and NGOs must give emphasis on **training of farmers in post-harvest operations, group marketing, packaging and branding at farm/village level and quality maintenance; enhancing quality and trade literacy**.
- Develop **periodic markets** and increasing numbers of **farmers' markets** and provide grading, sorting, standardization facilities in villages.

4.2.8.0 Financial Implications

4.2.8.1 **A National Agriculture Risk Fund**, as an institutional lifesaving support, is required to be set up by the Central Government for providing relief to the farmers in the event of successive droughts commonly experienced in Arid Agro-Ecosystems. Given the Poor economic condition of the farmers, many of whom are acutely stressed, **Special Insurance Products**, combined with **Special Dispensation Mechanism**, will be required to insulate the farmers from the high risk situation in arid zones. The Government of India may meet 50 per cent of the cost. The State Governments are called upon to provide **Micro Capital Grants** to SHGs, SFEs and other such groups to strengthen their capacities for backward and forward linkages in the production–processing-marketing chain, as initiated in Gujarat. The Central Government will be required to establish a **Special Market Intervention Scheme** for supporting prices of specialty products of arid zones in the year (once in 4 years or so) when the harvest is good. In order to bridge the serious gaps in marketing, a modern market centre will need to be established at a strategic place, preferably jointly by the Central and the concerned State Government.

4.2.8.2 In order to bridge the huge yield gaps and to capture new opportunities in productivity and income growth, increased **financial resources will be needed for establishing advanced soil testing laboratories** for addressing the micronutrient and other soil fertility imbalances, **system-oriented on-farm demonstrations, supply of quality planting materials, promotion of "protected" (low cost greenhouse) production of high value commodities, strengthening of value addition and post harvest management and conservation of bio-diversity**. Increased investment will also be required for establishing **fodder, feed, grain and seed banks**, training and capacity building at various levels, establishment of village knowledge centres and data bases. Additional financial resources will be required also for undertaking new researches and development of new technologies, new methods of extension and technology transfer such as the use of **farm schools, traveling seminars**, environmental costing and its realization etc. The Department of Agriculture and the ICAR of the

Ministry of Agriculture should provide part of the funds needed through re-ordering of priorities under their ongoing programmes.

An additional sum of Rs. 1,275 crore as detailed below, may be provided in the budget to cater to the above mentioned requirements (of which Rs.1075 crore to be provided by the GOI and the remaining Rs. 200 crore to be provided by State Governments) to implement the various activities during the next seven years, including the remaining two years of the current Five Year Plan and five years of the next Plan.

- A National Risk Fund ---- Rs.500 crore (GOI)
- Special Insurance Products and Dispensation --- Rs. 300 crore (GOI)
- Micro-Capital Grant to support drought proofing and to assist and mentor SHGs and SFEs ---Rs. 300 crore (State Government Rs. 200 crore and Central Government Rs.100 crore)
- Special Market Intervention Scheme ---Rs. 100 crore (GOI)
- Establishment of modern marketing centre --- Rs. 75 crore (GOI)
- Contingency fund--- Rs. 500 crore (GOI)*
- Strengthening horticulture-led diversification--- Rs. 300 crore (NHM)*
- Livestock *ex situ* germplasm conservation at Suratgarh Farm--- Rs. 100 crore (ICAR)*
- Augmenting water availability by promoting rainwater harvesting, groundwater recharge and water bodies restoration, development and management --- Rs. 250 crore *
- 2000 large scale demonstrations, establishment of 700 each of fodder, feed and grain banks, 1000 Farm Schools --- Rs. 300 crore *
- Soil health care based on soil test, including micronutrients analysis and popularization of agricultural machines and implements--- Rs. 200 crore*
- Commercialization of date palm production, support to micro-irrigation supply of quality vitroplants and other planting materials --- Rs. 120 crore*

* To be met through redeployment of resources from existing National Horticulture Mission and other National Missions, Watershed Projects, ATMA, ICAR's KVK and other projects and by using National Rural Employment Guarantee Scheme and Food for Work Programmes.

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CHAPTER - 4.3

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

COASTAL ZONE AGRICULTURE

4.3.1 Our country is endowed with a long coastline of about 7,500 km of which the mainland accounts for 5,400 km, Lakshadweep coasts extend to 132 km and Andaman & Nicobar Islands have a coastline of about 1,900 km. Nearly 250 million people live within a distance of 50 km from the coast. The coastal zone is also endowed with a very wide range of coastal ecosystems like mangroves, coral reefs, sea grasses, salt marshes, sand dunes, estuaries, lagoons, etc., as well as with a rich diversity in both living and non-living resources. The coastal areas are assuming greater importance in recent years, owing to increasing human population, urbanization and accelerated developmental activities. These anthropogenic activities have put tremendous pressure on the fragile coastal environment and on marine biodiversity.

4.3.2 The coastal areas are subjected to frequent natural hazards. Some of the serious natural calamities in recent years are the super cyclone, which hit the Orissa coast in 1999 and the tsunami that occurred on 26 December, 2004. Along the coastal zone millions of farm and fisher families live and earn their livelihood. A Committee set up by the Ministry of Environment and Forests to review the coastal Regulations Zone Notification of 1991 under the Chairmanship of Prof M S Swaminathan has recommended that all development along coastal areas should be based on the principles of integrated coastal zone management, giving concurrent attention to the sea and land surface. India has nearly 2 million sq. km of sea surfaces available for economic use under the Exclusive Economic Zone of the UN Law of the Sea Convention. Unfortunately at present, coastal zone resources are being exploited in an unsustainable manner.

4.3.3 In chapter 3 on Fish for All in this report, we have recommended that an expert Committee may be set up to develop proposals for aquarian reforms on the lines of land reforms. The aim is to promote harmony between artesenal and mechanized fisheries on

the one hand, and agriculture and aquaculture on the other. We have also proposed the setting up of **Fish for All Resource and Training Centres** on the model of Krishi Vigyan Kendras for the purpose of imparting the latest technical skills to fisher women and men in all aspects of sustainable capture and culture fisheries. The training will cover the entire range of activities from capture or culture to consumption. This will help to avoid the growing conflicts between farmers and aquaculturists. We have also recommended Low External Input Sustainable Aquaculture (LEISA) in order to ensure that aquaculture can be practiced without ecological and social harm.

4.3.4 It would be useful to organise **Women's Aquaculture Estates** along the coast through Women's Development Corporations and financial institutions for the purpose of assisting *dalit* and fisherwomen to take to sustainable and profitable aquaculture. Seawater constitutes more than 97% of the available global water resources. In launching the Dandi March 75 years ago, Mahatma Gandhi wanted to stress that seawater should remain a social resource and should not be privatized either by Government or industry. In view of our long shoreline, it would be useful to initiate a programme on **"Sea Water Farming for Coastal Area Prosperity".** Such a programme will involve the planting of mangroves, salicornia, atriplex and other halophytes. In the canals, shrimp/prawn farming can be undertaken. Such agro-aqua farms will generate considerable income and employment for coastal fisher and farm communities. We recommend the establishment of agro-aqua farms under the seawater farming project in about 50,000 ha in the States of Gujarat (Kutch), Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa and West Bengal. Coastal wastelands could be identified for this purpose. This kind of agro-forestry involving salt tolerant tree species and shrimp farming would provide additional livelihood opportunities which are very urgently needed in many coastal areas where considerable environmental damage is taking place due to increasing human population and unemployment.

4.3.5 The Sea Water Farming for Coastal Area Prosperity programme can be taken up in tsunami affected States with funds provided for rehabilitation. The planting of mangroves and other trees will confer both ecological and economic benefits. The

mangroves, casuarina and other tree species will serve as bio-shields, reducing the fury of cyclonic storms and tidal waves. **Hence, we recommend that the Sea Water Farming for Coastal Area Prosperity Programme, based on sound scientific principles of agro-forestry may be given priority in the livelihood rehabilitation programmes being sponsored under the Prime Minister's Relief Fund.**

4.3.6 In the field of agriculture, rice cultivation is the predominant land use near coastal areas. The ground water resources are getting depleted and in some cases there is seawater intrusion in the aquifer. The data of the extent of ground water use in different coastal areas are given in table 1 below:

Table 1: Extent of Ground Water Use in Coastal Areas

State / Union Territory	Resources (Million ha. Mtr/yr)	Development (%)
Andhra Pradesh	3.52909	26.10
Goa	0.02182	8.30
Gujarat	2.03767	49.29
Karnataka	1.61750	33.06
Kerala	0.79003	18.99
Maharashtra	3.78677	34.70
Orissa	2.01287	15.22
Tamil Nadu	2.64069	62.55
West Bengal	2.30914	32.19
UT of Dadra & NH	0.00422	12.81
UT of Daman	0.00071	80.00
UT of Diu	0.00037	94.84
UT of Lakshadweep	0.003042	39.12
UT of Pondicherry	0.01746	77.63
Total	18.79875	Average 35.38

States, which still have a good untapped reservoir of groundwater near the sea, should use this invaluable resource very carefully.

4.3.7 Programmes should be developed for the conjunctive use of sea and fresh water. There is considerable potential for agro-forestry systems involving casuarina and several palms grown along with annual crops like arhar (pigeon pea). Already in many places casuarina, cashewnut and coconut are planted in a sequence from the shoreline. **Unfortunately, research on coastal agriculture is very inadequate. There is need for**

a Coastal Systems Research Programme (CSR) on the lines of Farming Systems Research Programme carried out in inland areas. Such a CSR programme should give concurrent attention to coastal agro-forestry, crop and animal husbandry and capture and culture fishings. **We recommend that ICAR may initiate an All India Co-ordinated Research Programme on coastal agriculture with the help of CSIR** (National Institute of Oceanography, Goa and the Central Salt and Marine Chemicals Research Institute, Bhavnagar) and State Agricultural / Animal Husbandry / Fisheries Universities. Currently fisheries research is fairly extensive, but coastal agriculture research is yet to receive the attention it needs.

4.3.8.0 The Coastal Zone Regulation Committee has recommended the following ground rules for management and sustainable use of coastal land and aquatic resources. We enclose these principles:

4.3.8.1 Ecological and cultural security, livelihood security and national security should be the cornerstones of an integrated coastal zone management policy.

4.3.8.2 The coastal zone would include an area from territorial limits (12 nautical miles), including its sea-bed to the administrative boundaries or the biological boundaries demarcated on the landward side of the sea coast. The coastal zone management should also include the inland tidal water bodies influenced by tidal action and the land area along such water bodies. This area should be taken up for an integrated, cohesive, multi-disciplinary and multi-sectoral coastal area management and regulatory system

4.3.8.3 Regulation, education and social mobilization should be the three major components of a participatory and sustainable Coastal Zone Management strategy. Panchayati Raj institutions in coastal areas should be fully involved in the educational and social mobilization programmes.

4.3.8.4 Coastal regulation needs to be based on sound scientific and ecological principles and should safeguard both natural and cultural heritage. Heritage sites need particular

care and should be conserved in their pristine purity. These include areas of environmental significance, rich in biodiversity and scenic beauty. Bird sanctuaries, parks and breeding grounds of migratory birds should be protected.

4.3.8.5 **The precautionary approach** should be used where there are potential threats of serious or irreversible damage to ecologically fragile critical coastal systems and to living aquatic resources. Scientific uncertainty should not be used as an excuse for the unsustainable exploitation of coastal resources – both living and non-living.

4.3.8.6 Ecological economics should underpin economic activities, so that present day interests and future prospects are not antagonistic. Significant biological, cultural and natural assets should be considered incomparable, invaluable and irreplaceable and should receive overriding priority in the allocation of resources for coastal area protection and conservation

4.3.8.7 Coastal policy and regulations should be guided by the principles of gender and social equity as well as intra-generational and inter-generational equity, (i.e. the interests of future generations). They should be based on Mahatma Gandhi's dictum, "Nature provides for everyone's needs, but not for anyone's greed". All stakeholders should be involved in decision-making. Precious biological wealth, coming under Marine Biosphere Reserves, should be managed in a Trusteeship mode, with all the stakeholders protecting the unique natural wealth of biosphere reserves as Trustees and not as owners. A case study should be made on how the Gulf of Mannar Biosphere Trust is functioning, so that the Trusteeship pattern of sustainable management by the principal stakeholders can be replicated.

4.3.8.8 The regeneration of mangrove wetlands, coral reefs and sea grass beds as well as the promotion of coastal forestry and agro-forestry will confer both short and long term ecological and livelihood benefits. Carbon sequestration through coastal bio-shields will make an important contribution to promoting a balance between carbon emission and absorption, in addition to offering protection during coastal storms and calamities like

tsunami. An important lesson taught by the tsunami disaster is that the rehabilitation of degraded mangrove forests and the raising of coastal plantations of *salicornia, casuarinas, Vetiver* and appropriate species of halophytes will represent a "win-win" situation both for nature and coastal human habitations. No further time should be lost in initiating a national coastal bio-shield movement along the coasts of the mainland of India as well as islands. This can be a priority task under the National Rural Employment Guarantee and Food for Work Programmes.

4.3.8.9 The severe loss of life and livelihoods as well as property caused by tsunami in Andaman & Nicobar Islands and in the coastal regions of Tamil Nadu, Kerala, Andhra Pradesh and Pondicherry teaches us that short term commercial interests should not be allowed to undermine the ecological security of our coastal areas. Human memory tends to be short and neglecting the lessons of tsunami will be equivalent to writing off the future of coastal communities.

4.3.9 The prospects for sea level rise as a result of global warming and climate change are real. Therefore there is need for anticipatory research to meet the consequences of a rise in sea level to both agriculture and aquaculture. Integrated Coastal Zone Management will be possible only if there is convergence and synergy among numerous activities along the coast. Since several Ministries / Departments / Institutions are involved in the use of coastal land and water resources, it would be useful to set up a **National Board for Coastal Agriculture** under the Chairmanship of the Union Minister for Agriculture and Food in order to provide the coordination needed in policy formulation and task implementation in the area of coastal agriculture including capture and culture fisheries. Sustainable livelihoods have to be found for large numbers of landless labour families living along the coast if further damage to fragile coastal ecosystems is to be avoided. Also, we should harness seawater for sustainable tree farming and for fisheries.

4.3.10 Our coastal land and water resources can provide income and job security to millions of families living in coastal land areas provided we use them scientifically. Both

to benefit from this opportunity and to safeguard millions of children, women and men living along the coast from the fury of natural disasters like cyclones, storms and tsunamis, it is high time that we start initiating integrated and coordinated efforts to improve the productivity and profitability of fisheries, forestry and crop and animal husbandry along our 7,500 km coast line.

4.3.11 Integrated farming systems and the conjunctive use of sea and fresh water will open up new windows of livelihood opportunities for the 250 million people living in the coastal zone. We suggest that the proposed **National Board for Coastal Agriculture** (agriculture will cover crop and animal husbandry, fisheries and forestry) be set up soon. The Board should also have the Ministers in charge of Environment and Forests, Science and Technology, Ocean Development, Water Resources and Commerce and senior representatives from all the Coastal States and A & N and Lakshadweep Islands as Members, so that a holistic view on all aspects of sea water use and coastal agriculture management can be taken.

CHAPTER 4.4

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

MISSION FOR THE PROSPERITY OF SUGARCANE FARMERS

4.4.1.0 Sugarcane and Sugar Industries

4.4.1.1 Sugar industry is the second largest agro-based industry, next to textiles in India. However, it is by far the largest agro-based industry in rural areas. Nearly all other agro-based [large] industries are set up in urban areas. The sugar industry consists of two stages of production process- first, farm level sugarcane production and second processing of sugarcane into sugar. Sugarcane processing also generates valuable by-products, which are used in many downstream industries. There are 553 sugar mills in the country, out of which 453 were in operation during 2002-03. About 60% of the mills are in the cooperative sector, 35% in the private and 5% in the public sector. The sugar production during 2002-03 was 20.1 million ton as against 8.75 million ton in 1988-89.

4.4.1.2 Sugarcane cultivation, which is the first stage in the process of producing sugar, occupied around 4.30 million hectare in 2002-03 and produced 282 million ton of cane. Sugarcane occupies less than 2.5% of the total cultivated area and contributes nearly 7.5% gross value to the agricultural production in the country. About 4.5 million farmers grow sugarcane and a large number of agricultural labourers are involved in sugarcane cultivation, harvesting and other ancillary activities.

4.4. 2.0 SWOT Analysis – Sugar Industry and Sugarcane Cultivation

4.4. 2.1 Strengths

4.4.2.1.1 India is the second largest producer of sugar in the world after Brazil. During 2000-01 to 2002-03, India's share in cane sugar production was around 15%. The industry has enabled the country to be self-reliant in this highly sensitive essential commodity of mass consumption. During the last three years, India exported about 4 million tons of sugar. The sugar industry pays well over Rs 10,000 crore to the sugarcane growers every year for cane, about Rs 1600 crore by way to excise duty and about Rs 600 crore as purchase tax and cess on cane. The total value of sugar produced is around Rs 24,000 crore. The sugar industry provides direct employment to nearly 0.5 million

workers, and a host of others gain employment in industries, which use its by- products as their raw material. Molasses, a by-product of the sugar industry is the main raw material for alcohol and alcohol- based industries. In India, a total of 290 distilleries with an installed capacity of about 3200 million litres are functioning; out of these, 107 distilleries are attached to the sugar factories themselves. Sugarcane bagasse is an important source of power in the sugar mills. Bagasse is also being used as raw material for paper industry. Another by-product, the press mud, contains plant nutrient and could be an important source of organic manure for the crops. The sugar factories, particularly the cooperative sugar factories have been the focal point for socio-economic development in the rural areas by mobilising rural resources, generating employment and higher incomes, transport and communication facilities. Further, many sugar factories have established schools, colleges, medical centres etc for the benefit of the rural populations in the area which have long-term productivity consequences.

4.4.2.1.2 Sugarcane is the only raw material for all the major sweeteners produced in India. Besides the sugar factories and other industries based on the by-products of these factories, sugarcane also supports rural and cottage industries, viz. gur [jaggery] and khandseri industries which together produce about 10 million tons of sweeteners.

4.4.2.1.3 Sugarcane is more profitable relative to other crops in the area where it is planted.

4.4.2.3.0 Weaknesses

4.4.2.3.1 The health of the sugar industry is not good and it is facing problem in attracting fresh capital. The sugar mills often find it difficult to pay for the sugarcane supplied by the farmers on time. The large and surplus production in recent years and the limitation of storage space and the costs involved had aggravated the problems. Obsolescence of technology and machinery is another factor along with unsustainable low installed capacity of many factories. Over 40% of the factories are reported to be more than 40 years old. In many of these factories mechanical breakdowns are more than normal, fuel consumption is much higher and extraction rate is low. Poor management [lack of professionalism particularly in the cooperative and public sector units] and diversion of funds are the other weaknesses of the sugar industry. Short crushing season and lack of development of alternative feed stock are other issues, which need attention.

4.4.2.3.2 The major problem of the sugarcane cultivation is the stagnation/decline in the average yield over the years. An average all India yield of above 66MT/ha was achieved in 1991-92 where as in 2002-03 it was 64.6MT/ha. The highest average yield during the last 12 years was obtained in 1994-95 at 71.3MT/ha and more or less similar average yields were obtained in 1998-99 [71.2MT/ha] and 1997-98 [71.1MT/ha]. However, since 1998-99, the average yield has continuously declined. The reasons for the stagnancy/ decline are discussed subsequently.

4.4.2.3.3 The mismatch between cane production and demand from the sugar factories is another issue. Over time, the growth rates in cane crushing capacity, quantity of cane crushed and sugar production has outstripped the same in terms of area under cane, its yield rate and total production. Thus, a situation of general cane shortage has been created, leading to competitive bidding up of the price of cane, which is the major item of cost in the production of sugar. The problem was compounded by the decline in sugar prices during 2001-02 to 2003-04 causing serious financial problems to the sugar industries and the sugarcane growers due to mordinate delay in payment of cane prices.

Table 1: Compound Annual Growth Rate: 1950-1999 (In percentage)

Particular	**1950-59**	**1960-69**	**1970-79**	**1980-89**	**1990-99**
Area under cane	3.83	0.63	1.88	1.45	1.66
Cane Yield	1.28	1.13	0.66	1.21	1.09
Cane production	5.11	1.76	2.45	2.66	2.75
Actual crushing Capacity	2.89	1.87	1.57	1.70	4.70
Cane Crushed	8.04	2.27	4.63	5.24	4.05
Sugar Production	8.00	2.86	4.69	5.34	4.02

Source: Indian Sugar: Nov. 2001

4.4.2.4.0 Opportunities

4.4.2.4.1 The silver lining for the sugar industry in India is the rapid growth in the per capita consumption of sugar, the rate of growth in population and the fact that the consumption of sugar as a proportion of total consumption of sweeteners viz. sugar, gur and khandseri is also increasing. Based on the growth trends, the average per capita consumption of sugar in India is estimated to increase from the level of 18.3 kg per year in 2001-02 to 23-24 kg by 2010. Even on the basis of an average consumption of 21 kg

per year and the projected population 1.16 billion by 2010, the total demand of sugar is estimated to increase to 24.3 million tons. Further, the domestic prices of sugar during the last about a year or so have also firmed up. Another important opportunity for the sugar industry is the potential of its by-products particularly molasses for manufacture of 'ethanol'. Based on the research findings, upto about 20% ethanol could be blended with petrol even without any change in engine design and carburetor. Ethanol is not only eco-friendly, but could also be foreign exchange saver for India. This is becoming more relevant by the day with increasing international prices of crude. It is also possible to have car engines totally run on alcohol, as in Brazil, which could further save the consumption of petrol. There is also considerable potential for production of many value added products from cane juice and also developing full potential of production of green fuel from bagasse.

4.4.2.4.2 On sugarcane production, the major opportunities are the large potential to increase the productivity of cane and also the sugar recovery levels. As per the agro biological calculation and considering 50% use of solar radiation and 30% transpiration loss in sugarcane, it is considered possible to have a yield of 600Mt/ha [based on a paper submitted by the Vasantdada Sugar Institute, Pune]. Some of the progressive farmers in Maharashtra have achieved 350MT/ha yield. The following table shows

Table 2: Yield position and potential of sugarcane

S. No.	Details	Sub-Tropical Zone	Tropical Zone	Average India
1	Average yield of sugarcane 2001-02 (MT/ha)	52.07	82.73	67.40
2	Yield obtained in crop demonstrations (MT/ha) [average]	78.05	102.30	90.40
3	Yield in crop yield competition (MT/ha) [average]	175.00	256.50	215.75

[Based on information provided by the Vasantdada Sugar Institute, Pune]

4.4.2.4.3 This is further strengthened from the fact that the average yield in Tamil Nadu was 101.6MT/ha in 2001-02 and 106.8MT/ha in 2002-03, even Karnataka had achieved average yield of above 81MT/ha in the above years. The potential to improve average recovery level is also there, with Maharashtra consistently achieving well over 11%

recovery for last about 8 years and Karnataka well over 10.5% during the last 4 years against the all India recovery of around 10.3% during 2001-02 & 2002-03. The above shows that technology and do-how does exist in India to achieve a much higher level of productivity and quality of sugarcane production, the need however is to make well planned concerted efforts in this direction.

4.4.2.5.0 Threats

4.4.2.5.1. Sugar is probably the most distorted among agricultural products in the global market mainly due to policy distortions in some major developed countries like the U.S, Japan, EU etc. which has kept the global demand much lower. It not merely affects the export demand of Indian sugar, but also creates problems due to possibility of cheaper imports. Other important issues for the sugar industry are the aspects relating to the pricing of the sugarcane. If the cost of sugar is to be brought down in a regime of free global trade, pragmatic policies need to be evolved through mutual consultations with the stakeholders involved in the supply of the three major inputs i.e., the sugarcane, interest on bank credit and the labour costs which contribute about 90% of the cost of production of sugar.

4.4.2.5.2 The threats to sugarcane cultivation mainly arise from the weaknesses and threats to the sugar industry as the fortunes of the sugarcane farmers are closely linked with the sugar factory/ processing unit in the area. The prospects of expansion in sugarcane area are now extremely limited due to the high water requirements and the claims of the other crops. Further, sugarcane being a soil nutrient exhausting crop, the farmers have to plan crop rotations and also take care of the soil health for sustainable production

4.4.2.6.0 Sugarcane Cultivation - The Developments

4.4.2.6.1 There has been in the past a steady growth in area under sugarcane cultivation. The area under sugarcane was only 17.07 lakh hectares in 1950-51 which increased to 44.3 lakh hectare in 2001-02. It declined to 43.6 lakh hectare in 2002-03. Since there are year-to-year fluctuations in the area under sugarcane.

Table 3: Area under sugarcane (averages for five years –1966 to 2002)

Period	Area under sugarcane [000 hectare]	Increase over the previous 5-year average (%)
1966-67 to 1970-71	2449	-
1971-72 to 1975-76	2650	8.20
1976-77 to 1980-81	2876	8.52
1981-82 to 1985-86	3092	7.51
1986-87 to 1990-91	3362	8.73
1991-92 to 1995-96	3769	12.10
1996-97 to 2001-02	4139	9.81

4.4.2.6.2 The area has increased by nearly 69% in 30 years. The average increase in every five years has been around 9%. However, the area under sugarcane to the total cropped area has remained more or less constant at about less than 2.5%. Sugarcane is also considered to be most profitable among the major crops in India. The possibilities of similar increases in the sugarcane area in future are however is extremely low due to competition from other crops and the soil and water requirements.

4.4.2.6.3 Nearly 92% of the sugarcane is cultivated in irrigated conditions. While in the sub-tropics 6-8 irrigations may be sufficient, in the tropical regions the sugarcane crop requires 16-18 irrigations.

4.4.2.6.4 Sugarcane is generally grown in all States in India excepting the hill States. However, ten States had more than 1 Lakh hectare under sugarcane during 2002-03 accounting for nearly 96% of the total sugarcane cultivating area in the country.

Table 4: Sugarcane area, yield, total production and sugar recovery

Sr. No.	State	Cane area Lakh, ha.		Cane Yield M.T./ha		Cane Production. Lakh, M.T.		Sugar recovery % Cane	
		2001-02	2002-03	2001-02	2002-03	2001-02	2002-03	2001-02	2002-03
1	Uttar Pradesh	20.35	18.52	58.0	62.8	1179.82	1163.24	9.53	9.53
2	Maharashtra	5.78	5.99	78.1	61.8	451.40	370.15	11.60	11.64
3	Karnataka	4.07	3.85	81.1	84.4	330.17	324.79	10.72	10.79
4	Tamilnadu	3.21	2.84	101.6	106.8	326.20	302.82	9.61	9.88
5	Andhra Pradesh	2.18	2.34	82.9	65.8	180.82	153.87	10.01	10.10
6	Gujarat	1.76	2.03	70.9	69.4	124.65	140.71	10.79	10.13
7	Bihar	1.13	1.87	46.0	24.6	52.11	46.01	8.78	9.00
8	Haryana	1.61	1.80	57.6	44.4	92.70	80.00	9.95	10.13
9	Punjab	1.42	1.54	65.1	60.3	92.50	92.90	9.45	9.72
10	Uttaranchal	1.26	1.30	60.0	59.3	75.55	77.08	9.41	9.51
	All India	**44.30**	**43.61**	**67.4**	**64.6**	**2984.22**	**2815.75**	**10.27**	**10.36**

The above data shows that the yield in tropical area States is higher than the sub-tropical States. The highest yield per hectare in 2002-03, was observed in Tamil Nadu [106.8 M.T./ha] followed by Karnataka [84.4 M.T./ha], Gujarat [69.4 M.T./ha], Andhra Pradesh [65.8 M.T./ha], Maharashtra [61.8 M.T./ ha]. It is worth noting that the yields in Andhra Pradesh and Maharashtra during 2001-02 were 82.9 M.T./ha and 78.1 M.T./ha respectively and the decline during 2002-03 was mainly because of drought conditions and the pest attack in Maharashtra. As against the above, the yield among the sub-tropical States during 2002-03 was highest in UP [62.8 M.T./ha] followed by Punjab [60.3 M.T./ha], Uttranchal [59.3 M.T./ha], Haryana [44.4 M.T./ha] and Bihar [24.6 M.T./ha].

4.4.2.6.5 The recovery rates were highest in Maharashtra [11.64] followed by Karnataka [10.79] and Gujarat [10.58]. The recovery rates were also good in Haryana [10.13], Andhra Pradesh [10.10] and Tamil Nadu [9.88]. The lowest recovery rates were in Bihar at about 9%.

4.4.2.6.6 A worrisome aspect is the stagnation in all India average over the years and continuous decline of average yield over the last five years.

Table 5: Yield stagnation of sugarcane over the years

Year	Yield M.T./ha	Year	Yield M.T./ha
1991-92	66.1	1997-98	71.1
1992-92	63.8	1998-99	71.2
1993-94	67.1	1999-00	70.9
1994-95	71.3	2000-01	69.6
1995-96	67.8	2001-02	68.2
1996-97	66.5	2002-03	64.6

4.4.2.6.7 As stated earlier, with anticipated increase in population to 1.16 billion and the per capita consumption of 21 kg, by 2010, the requirement of sugar in India would be about 24.36 million tons. Keeping in view that increase in area under sugarcane may be extremely difficult to achieve [in the context of other crops], it would be necessary to increase the yield to atleast 80 M.T./ha and recovery from the present level of 10.36% to 11% by the end of 2010-11 to have sugar production of around 25 million ton to take care of the projected increase in demand.

4.4.2.6.8 Two aspects of sugarcane production which impact the average yields but are often ignored are the 'ratoon' and 'adsali' crops. Ratooning of crop is a common practice [around 40% of the total cane produced is through ratoon crop], it is more prevalent in UP where over 50% of the sugarcane production is from ratoon crop. Ratooning brings down the cost of production and leads to early maturing which helps the factories to start early. However, the yield under the 'ratoon' crop is lower than the plantation crop. This partly explains the low average yield in UP. In fact, the farmers generally neglect the ratoon crop, which brings the yield down. With integrated ratoon management, maintaining required plant population through gap filling by settlings, use of adequate fertilizers and need based micro-nutrients, better irrigation management, plant protection care etc. training of the farmers and more intensive extension work by the extension staff and the sugar factories is called for higher yields from ratoon crops could be taken. Maharashtra has large areas under the 'Adsali' crop, which is grown over a period of 15-18 months. The yield under this crop is higher than the other crops by about 30-35%. In Maharashtra around 20% area is covered by Adsali, which improves the overall average yield figures of Maharashtra.

4.4.2.6.9 The main reasons for recent decline in sugarcane yield are the weather conditions, attack of 'white woolly' aphid in Karnataka, Maharashtra etc. and delayed

cane payments in certain areas which led to constraints in use of desired quantity and quality of inputs. The other constraints leading to lack of improvement in productivity are as under:

(a) Inadequate care of the ratoon crop and constraints in adequate availability of quality planting material.
(b) Depletion of micro - nutrients from soil due to monoculture and unbalanced application of major nutrients.
(c) Depletion of organic carbon in the soil due to gradual shift towards application of mainly inorganic fertilizers.
(d) Low adoption of available technologies for increased production and productivity.
(e) Inadequate research/extension efforts in developing/adopting location specific varieties and development of superior varieties with high cane yield and high sugar content with resistance to biotic and abiotic stress for different regions.
(f) Inadequate efforts for identification of varieties with high input use efficiency in terms of water requirement, micro-nutrients, sunlight and varieties suited to low input conditions.
(g) Inadequate attention to use of crop residue from sugarcane and sugarcane industry by-products such as press mud, sugarcane trash and distillery effluents.
(h) Inadequate attention to tissue culture.
(i) Problems in timely and adequate availability of quality inputs including credit.
(j) Inadequate attention to development and dissemination of information regarding better farm appliances/equipments for harvesting, ploughing, planting etc.
(k) Poor drainage in some areas.
(l) Lack of adequate participation of the sugar factories in the development of sugarcane. A cane development department with adequate and competent staff is essential for each sugar factory.

4.4.2.7.0 Issues Concerning Sugarcane Growers

4.4.2.7.1 Sugarcane is a perishable crop. It has large bulk with an average all India yield of nearly 65 tons per hectare in 2002-03. Further, the sucrose content in sugarcane declines if it is not crushed quickly after the harvest. The above factors make it prohibitive for farmers to carry their crop to any distance. Around 90% of the sugarcane

is crushed for making sugar/khandseri/gur/jaggery etc. By and large, therefore the growers are tied up with the sugar factories/other processing units. The sugar factories also require firm arrangements for supply of sugarcane. The practices regarding sugarcane area reservation, the pricing and marketing tie up etc. peculiar to sugarcane cultivation which impact the growers are discussed in the following paragraphs.

Cane Area Reservation

4.4.2.7.2 Sugarcane is an essential commodity under the Essential Commodity Act, 1955; as such the Government is empowered to control its production, distribution and supply. The Government regulates its supply to sugar factories under the Sugarcane [Control] Order, 1966. The power of regulation of cane supplies has been delegated to the State Governments. Under the above order, the Government is empowered to reserve area for a factory having regard to the crushing capacity of the factory, the availability of sugarcane in the reserved area and the need for production of sugar with a view to enabling the factory to purchase the quantity of sugarcane required by it. The cane growers in the reserved area are required to enter into bond with the sugar factory for supply of a specified quantity or percentage of sugarcane grown by him/her. The grower is not allowed to supply cane to any factory outside the reserved area unless he/she obtains a permit for this purpose. The factory is also under an obligation to crush the entire cane, which is bonded by the growers.

The benefits of reservation are:

- It controls the cost of transportation and loses of sucrose due to the time taken in taking it to factories located at a distance.
- It helps the factories to regulate the cane supply according to the crushing capacity available each day. In absence of such an arrangement, the factory may have inadequate supplies of sugarcane on certain occasions, while on other days, the supply may far exceed the capacity. The mills in this situation may have to install higher capacities to crush all the sugarcane which may be supplied during the peak season which would lead to higher cost of production or alternatively the growers may have to wait with the cane which in turn would lead to reduction in sucrose contents.
- Helps in building linkages between the mills and the growers.

- Encourages the mills to take up cane development work.
- Helps the banks to link credit with marketing.

4.4.2.7.3 However, if the factory refuses registration or bonding or is unable to crush sugarcane within the normal season or within 15 days after the normal season, the grower is permitted to supply the cane to another factory. On the other hand, during the period of cane shortage poaching of sugarcane becomes a serious problem. Though the State Governments impose penalty for poaching, unless it is adequate it does not serve as a deterrent to the factories. In Punjab, for example, the penalty on conviction in a court was only Rs. 2000, which was grossly inadequate. This needs a review by the State Governments.

4.4.2.7.4 Further, the reservation of area needs to be on a long-term basis say, 5 to 10 years with provision for review by the State Government to ensure better linkages between the grower and the factory. The second appeal in the case of dispute could be to the Government of India. There could be a system of social audit which could also facilitate decision making in case of disputes. In UP, the area reservation is for one season at a time which is not conducive to orderly cane development work. Long-term reservation provides the necessary incentive to the factory to undertake the development work in its reserved area. This also encourages building of long-term credit arrangements with the banks. Issue of reservation order of long-term periodicity was also favoured by the Standing Committee of the Lok Sabha on Food, Civil Supplies and Public Distribution (1995-96), as well as by the high Powered Committee on Sugar Industry under the Chairmanship of Shri Mahajan [1998]. Further, it is also important that the reservation of area is done systematically and is conducive to efficient functioning of the mills. There are instances where the villages allotted to different sugar mills are interspersed. This needs to be corrected in consultation with the factories/growers.

Cane Pricing

4.4.2.7.5 Sugarcane accounts for more than 60% of the cost of production of sugar. The Central Government fixes a Statutory Minimum Price [SMP] in terms of Clause 3 of Sugarcane (Control) Order 1966 with regard to the:

- Cost of production of sugarcane.

- Return to the grower from the alternate crop and the general trend of agriculture commodities prices.
- Availability of sugar at reasonable prices to the consumer.
- The price at which sugar produced from sugarcane is sold by the producer of sugar;
- Recovery of sugar from the cane.

The Commission for Agricultural Costs and Prices [CACP] while recommending the SMP also takes into account other factors such as current realization from sugar sale, the demand and supply situation, level of sugar stocks, cost of transportation, international price situation and the need for stability in sugarcane production. Further, according to the law, the farmer is also entitled to an additional payment out of price realization by the factories (Clause 5 A of the Sugarcane Control Order, 1966). The sharing formula which is commonly known as 'Bhargava Formula' [(R-L)/2] has been discussed subsequently.

Table 6: Increase in SMP

S. No.	Sugar Season	SMP per qtl. at 8.5% recovery [Rs.]	Increase per qtl. over the previous year in Rs.
1.	2000-01	59.50	3.40*
2.	2001-02	62.05	2.55
3.	2002-03	69.50	7.45
4.	2003-04	73.00	3.50

** [The SMP for 1999-2000 was Rs. 56.10 per qtl.]*

4.4.2.7.6 For the year 2004-05, the CACP had recommended that the SMP for sugarcane payable by the sugar factories be fixed at Rs. 74.50 per quintal linked to be basic recovery of 8.5% subject to a premium of Rs. 0.88 for every 0.1% point increase in the recovery above that level. At All India average recovery rate of 10.29%, the SMP recommended worked out to Rs. 90.25 per quintal. The CACP also recommended that the SMP needs to be announced by the Government at least one year in advance to give the price signals, the delayed announcement of SMP did not serve any purpose in providing price signals to the growers to help in matters relating

to allocation of land and other resources. If the SMP could be announced for a longer period say about 3 years, it would help in better planning and stabilizing cane production. The feasibility of such announcement could be examined by the CACP. While the SMP has been steadily increasing, the sugar prices during the last 4-5 years upto 2002-03 had been rather low. **Table 7: Sugar prices –1999 to 2003**

S. No.	Year	Index Number of whole sale prices on monthly average [Base 1993-94 =100]
1.	1999-2000	141.2
2.	2000-2001	138.9
3.	2001-2002	131.7
4.	2002-2003	117.1

The situation started improving rather slowly during 2003-04 and the prices firmed up in 2004-05. The SMP needs to carefully balance the interests of the growers and the factories. While the sugar prices were declining, the SMP for sugarcane continued to increase which also contributed towards increasing the sugarcane price payment arrears [discussed later.] leading to an unsustainable situation. Some of the other important issues connected with SMP are discussed in the following paragraphs:

Fixation of SMP on Regional Basis

4.4.2.7.7 The sugar industry has been suggesting that the SMP needed to be fixed on a regional basis- one for the tropical region i.e., Maharashtra, AP, Tamil Nadu, Karnataka, Orissa & Gujarat and the other for the sub-tropical region covering states of UP, Punjab, Haryana, Bihar, Uttranchal, Rajasthan and MP. The suggestion for regional SMP is mainly because [a] the yield of sugarcane is higher in the tropical region as compared to sub-tropical region and hence the cost of cultivation is lower [b] the sales realization from free sale sugar in sub-tropical region by factories is higher than the tropical region and the variation is large ranging from Rs. 44 to Rs. 110 per quintal.

While it is true that the cost of cultivation as well as the realization from free sugar sales is lower in tropical region, fixation of SMP on a regional basis would be against the fixation of support price of all other agricultural commodities which is on a

national basis. Further, the cost of cultivation differs within the tropical and sub-tropical regions as also within the State, under the circumstances it may lead to many other similar demands. In any case, the region which is more suitable than the other [has a lower cost of production] should get the price benefit for expanding and growing. Further, such regional SMP would not be in line with the developments in the markets which are getting integrated at national and the international level.

Raising the Base Recovery Rate from the Present 8.5%

4.4.2.7.8 Upto 1971-72 [sugar season], the base recovery level was taken at 9.4%. On the recommendation of the Agriculture Price Commission to reduce the base recovery level to 9%, the Government decided to reduce it to 8.5% which continues since then. The All India recovery level has been improving and was 10.32% in 2001-02. Keeping in view the above, as also the interest of the farmers, there is a need to increase the base level recovery. It is understood that the CACP has also suggested for 2005-06 that the base recovery level may be fixed at 9%. The factories having a lower average recovery [for the season] may have to improve their cane development efforts including the cane collection arrangement and the operational efficiency. Improving the recovery rate benefits the farmers as they get higher price for their produce and it also leave a surplus to the factory as it has higher production and hence higher income by sale of sugar etc.

4.4.2.7.9 There is also a suggestion to link the sugarcane price to the sucrose contents of the cane as is done in some other countries. While this may be a better strategy to encourage the farmers to grow better varieties, this could be done only after satisfactory arrangements for assessing sucrose contents of the cane could be tested and become generally acceptable. This however needs to be expedited and done in a time bound manner. Under the circumstances, for the time being existing arrangements may have to continue. However, it may be possible even now to fix incentive prices for varieties, which have higher sucrose contents with a view to encourage the farmers to take up cultivation of these varieties.

The State Advised Price

4.4.2.7.10 Some of the State Governments have been fixing the sugarcane prices commonly known as the State Advised Prices [SAPs]. Unfortunately, there is a

normal tendency on the part of the State Governments to raise the prices, which could even become uneconomic for the sugar factories. According to the Mahajan Committee Report [1998], "This tendency may get accentuated in the era of unstable and coalition Governments where short-term consideration of political expediency may outweigh consideration of the long-term impact on the sugar industry in the State and consequently in the long-term, interest of the cane growers themselves. There is also some sort of competition among the States for announcing higher cane prices than the other and this tendency is likely to be accentuated."

4.4.2.7.11 A connected issue is the general apprehension of the growers that the clause 3 of the Sugarcane [Control] Order, 1966 which indicates the aspects to be considered for fixation of the SMP includes among other two clauses which tend to influence in favour of fixing of lower prices of sugarcane. These clauses are [a] availability of sugar to the consumers at a fair price and [b] sugar producers sell price at which sugar produced from sugarcane. Deletion of these two clauses would mean that the common unmerited perception about the cane prices deliberately being fixed lower to keep the levy price lower for PDS purposes would be generally laid to rest. Incidentally, the clause 5A of the Sugarcane Order 1966, which states that the farmer is entitled to an additional payment out of the price realization by the factories, has implementation problems. Under this formula [Bhargava Formula], the farmers and the mills share the excess realization broadly in the ratio of 1:1. The sharing formula is: [R-L]/2. Under this, R is the realization from the sale of sugar [levy and free] and L is the unit cost of production. However, there have been considerable delays in the notification of the Zone-wise 'L' factor by the Govt. of India and factory-wise additional sugarcane price to be determined by the State Government. The 'L' factor for four season was announced in February 2003 and for 2001-02, the 'L' factor was announced on 6 April, 2005. Information regarding announcement of cane price by the State Government on the basis of above details is also not available raising doubts about the effectiveness of the implementation of the above clause. Prima facie the formula appears to be in order save for the implementation delays. If it could be announced quickly at the end of the season, the impact would be much better. A connected question however is as to why the farmer should not have a share in the

value of the byproducts of the factory, which are sugarcane based. The problems of sugarcane pricing are serious. A continuous upward movement of the sugarcane prices without any relationship with the price of sugar is not sustainable. It is welcome that the Government of India have constituted on Expert Group on New Sugarcane Pricing Policy. It is hoped that the new pricing policy would serve the interests of the growers and the factories in a more equitable manner and to the satisfaction of all concerned.

Delayed Payment and Cane Arrears

4.4.2.7.12 It is not only necessary to ensure remunerative price for the produce, but it is also important that the farmers are paid the price promptly. The farmers cite long delays in payment of sugarcane prices by the sugar factories as a major reason for less than the optimum level of input usages leading to low productivity. The Govt. of India have amended the Sugarcane [Control] Order, 1966 evaluating the Central Govt./State Government/Officers authorized by the Central Govt./State Governments to recover the arrears of cane prices remaining unpaid after 14 days supply of sugarcane by the growers, together with interest @ 15% per annum thereon, as arrears of land revenue. However, in practice there is considerable delay in making the payment to growers. There have been agitations/demonstrations regarding arrears in cane price payment and it has often become an issue taken up by political parties. The cane arrears on 30.04.04 were reportedly Rs. 2568 crore mainly due to poor sugar prices during the last 2-3 years and accumulation of sugar stocks with the factories. Due to the stringent provisions against delay in cane payments, the factories do want to avoid the delays but financial constraints often make it extremely difficult for them. In view of the high build up of cane arrears, the Govt. of India decided to create a buffer stock of 2 million tons of sugar for one year in December 2003 (subsequently extended by one more year). Further, the Government also announced two packages of special assistance to the State Governments. A sum of Rs. 678.06 crore was allocated as a one time assistance to the Governments of UP, Uttranchal, Bihar, Punjab and Haryana to help clearance of sugarcane price arrears for 2002-03 by private sugar factories subject to the following conditions: -

(a) It would cover difference between the SAP and SMP with regard to the sugar factories in the private sector only.

(b) The assistance would be in the nature of a soft loan at a concessional rate of interest of 4% p.a. with an initial moratorium of 3 years and repayable in 3 years thereafter.

(c) The assistance would be contingent upon the State Government undertaking not to declare SAP in future either formally or informally.

(d) The money would be released to the farmers directly by the District Officials.

In addition, the Government of India also provided a one-time assistance to the State Government by permitting them to raise additional market borrowings to the used for liquidating the cane price arrears of the mills in the cooperative and public sector in the States where SAPs were announced and all mills in States where the practice of SAP announcement did not exist. The conditionality of assistance were broadly similar to the first scheme with moratorium of 5 years and repayment in next 5 years of loans extended by the State Governments to the factories. As a result of the above schemes, the arrears as on 30.09.2004 came down from Rs. 2568 crore [30.04.04] to Rs. 560 crore. During 1992 to 1997 the peak level arrears formed nearly 20% of the total cane payment. The arrears in 2004 had formed nearly 30% of the total cane payment. The cane payment arrears have generally been lower in the case of cooperative sugar factories and rather high in the case of public sector units. Strict enforcement of law regarding timely payment of sugarcane price to the growers is called for.

Cane Supply Arrangements

4.4.2.7.13 Cane supply arrangements are extremely important both for the growers and the sugar factory. Sugarcane is perishable and the sucrose contents get reduced if it is not milled within a short period after harvesting. For the factory it is important that it gets adequate supplies of cane for as long a period as possible to increase the crushing season and also within the least possible time after the harvest. The growers are also interested to supply their sugarcane soon after maturity to get the income as well as time to prepare the land for the next crop. Different varieties of cane reach their optimum sucrose content at varying period. There is therefore need for considerable planning regarding the timing/varieties etc. planted in the factory area and also in managing the flow of cane

supplies. The factory wants a planned inflow of cane as per its installed capacity. Since a large number of farmers [normally about 10,000 to 15,000 farmers] supply the sugarcane to each factory in about 150 to180 days a very careful planning and fine-tuning is necessary to complete the operations efficiently for the maximum benefit of the farmers and the factory.

4.4.2.7.14 As already stated, the State Governments reserve the area for various sugar mills in the State. However, the practices regarding cane supply vary considerably in the States. The major cane producing States could be divided into three groups regarding the sugarcane/supply arrangements. Maharashtra & Gujarat have a similar system, the tropical States of Tamil Nadu, Andhra Pradesh & Karnataka follow another system and the sub-tropical States i.e., UP, Bihar, Punjab & Haryana have a different system.

4.4.2.7.15 In Maharashtra, Gujarat and some parts of north Karnataka, the growers supply cane ex-field to the factory and the sugar factories [which are mostly organized as co-operatives] arrange for the harvest and transportation of the sugarcane. The harvesting in this arrangement is obviously planned by the sugar factory as per its requirements and the crop in the area based on variety/maturity etc. The factories engage harvesting/transporting groups/contractors who handle the entire operations. Many of the factories own carts/trolleys etc., which are used for transportation of the cane. The operations are smooth and save the growers from organizing harvesting and transportation frequently to dispose off the entire produce. However, the State Governments/CACP may examine it whether certain norms could be developed for harvests and transportation costs and cap be fixed.

4.4.2.7.16 In Tamil Nadu and Andhra Pradesh, the factories have been assigned area on long-term basis. This has encouraged the factories to take up cane development work more seriously, leading to better yields and recovery rates. The growers handle the harvesting and transportation. The direct relationship between the grower and the factory has an overall good impact on cane cultivation and development. There are no outstation procurement centers unlike in sub-tropical regions, which lead to delays and consequently poor recovery percentage. The factories bear transport cost upto a certain radius and the balance is borne by the grower.

Box - 1

Sugar Industry and Sugarcane Farmer Relationship- The EID Parry Way

E.I.D Parry (India) Ltd is the largest producer of sugar in Tamil Nadu. The four factories run by the Group crush about 33-35 Lakh ton of cane to produce about 3.5 lakh ton of sugar a year. The Integrated Sugar Complex at Nellikuppam besides producing sugar, generates green power through cogeneration and supplies to State Electricity Grid. A Distillery and Organic Manure Plant also form part of this Integrated Sugar Complex.

- The company has established a Cane Development Department with three wings viz. R&D, Cane Extension and Cane Operations as compared to the industry where generally there is only the Cane Operations wing in the Cane Department. The R&D wing has full fledged inhouse research facilities with the disciplines of Plant Breeding, Entomology, Pathology, Agronomy, Soil Science and Farmer Training. The company invests close to Rs.2 crore per year and has invested about Rs.35 – 40 crore over the past ten years on Research and Development with a focus on increasing the sugarcane productivity levels. This unit has also helped in developing some sugarcane varieties suiting the local needs.
- The technology transfer form lab to land is effectively implemented through cane extension and cane operations wings of the Cane Department.
- The technology services provided to the farmers for raising sugarcane crop (from planting to harvest) is intense with the result, the average cane yield of the farmers has gone up from 80 ton to 100 ton per hectare over the years.
- The technical services provided to the farmers coupled with the prompt cane payment have resulted in loyalty of the cane farmers to the sugar factory, which is evident from the fact that there is no sugarcane diversion to jaggery manufacturing, whereas the percentage of diversion of sugarcane for jaggery ranges from 10-30 in other factories.
- The company ensures that the payment to the farmers is made within 14 days of the supply of sugarcane.
- The company helps in arranging institutional credit to the growers and regularly conducts Farmers Training Programmes on sugarcane cultivation.

The key factor behind E.I.D Parry's success in the sugar industry comes from building a close relationship with the farmer over four decades. The Company has set as its mission that it will attempt to increase the farmers' income three times in five years through R&D, extension and operation services to the farmers. In all about 90, 000 farmers are supplying sugarcane to the four sugar factories of the group. Recently the Company has finalized a tie up arrangement with LIC and Cholamandlam Insurance to

4.4.2.7.17 In UP, which has nearly 45% of the sugarcane growing area of the country, the area reservation is done for one season at a time and the factories are also asked to open and operate cane purchase centers. In some cases, the factories operate as many as 100 purchase centers. The sugarcane is purchased through the Cane Cooperative Societies and the sugar factory does not have direct relationship with the grower. The payments for the cane are also made through these societies. These societies enter into agreement with the factory regarding the supply of cane. Under this arrangement, the sugarcane is harvested by the grower and supplied at the purchase center/factory gate. The factory meets the cost of transportation from the purchase center to the factory. The Cane Cooperative Societies prepare supply calendar and issue supply slips [Parchies] to the growers. These supply

slips are issued on the basis of the last 2-3 years supplies of sugarcane. The quota of a farmer is divided in the expected days of running of the sugar factory and he/she is issued supply slips in equitable proportion. As the supply entitlements are fixed on the basis of last 2-3 years supply, the farmers are reluctant to introduce better varieties, which could increase the yield due to anticipated difficulties in selling the excess production. The factories indicate their daily requirement of cane separately for supplies at the Gate [Factory] and at the purchasing centers. Weightment both at the Factory Gate as well as the Purchase Centre is expected to be done in the presence of the representative of the Cane Grower Cooperative Society. However, of late, due to staff constraint, the cane Grower's Cooperative Societies are often unable to send their representatives for the weighing. The farmers do apprehend that the weightment may not be correct and would like electronic weighing scales to be installed at all places. Further, the sugarcane growers also complain about the long waiting period at purchase centers. The arrangement is complicated. It also leads to delay in reaching the cane to the factory and consequent decline in recovery percentage. The farmers engage harvesting teams and have to harvest their field repeatedly. The system is not former friendly. The system is also not effective linkages between the sugarcane growers and the factories.

4.4.2.7.18 The arrangement in Punjab and Haryana is similar to UP excepting that the cane is supplied by the farmers directly to the factory. In Bihar Cane Cooperatives are working in certain areas where the cane is routed through these societies but elsewhere it is direct to the factory.

4.4.2.7.19 The system of purchase of sugarcane by factories through the Cane Cooperative Union has been considered to be less efficient as compared to the direct linkage of farmers with the factories. Since the sugar factories have mostly computerized preparation of cane supply calendars, issuing supply-slips to the farmers and maintenance of farmer wise records etc. the role of the cane cooperatives has dwindled. Further, the farmers also complain about red-tapism in the cane cooperatives. The Lok Sabha Standing committee on Civil Supplies & Distribution [1995-96] recommended direct link between the farmers and the factories. The Tuteja committee on Revitalization of Sugar Factories [2004] also favoured direct tie up of farmers with the factories and a tri-partite agreement between the banks, farmers and factories. The compulsory routing of the

sugarcane supplies through the Cane Union needs a review. To began with UP could consider trying the direct linkage of the sugar factories and growers at least on a pilot basis and evaluate the same.

4.4.2.7.20 The factories need to have a well planned programme of crushing with respect to different varieties of cane grown in their reserved area. The farmers growing early varieties and ratoon should be able to harvest their cane early so that they get the benefit of switching over to these varieties. The issue of supply slips should be strictly on the basis of maturity of crop and planning dates.

4.4.2.8.0 OTHER ISSUES

Khandseri & Gur

4.4.2.8.1 Khandseri and gur provide traditional sweeteners at lower prices than the white sugar and also an outlet for disposal of cane to the growers in areas where sugar mills are not operating or do not have enough capacity to crush the entire cane production. The use of sugarcane for gur and khandseri has come down from about 55% in 1980-81 to 28.9% in 1999-2000. Among the major sugarcane growing states, the percentage of cane used for gur & khandseri during 2001-02 was highest in UP (39.4%) followed by AP (34.5%) Tamil Nadu (31%) and Karnataka (24.4%). With growth of incomes and urbanization, the per capita consumption of gur and khandseri is likely to come down.

4.4.2.8.2 Uttar Pradesh has a very large number of khandseri units. During 1994-95, the khandseri units in UP crushed over 90% of the sugarcane crushed by the khandseri units in four major khandseri producing States i.e., UP, Haryana, Andhra Pradesh and Karnataka. Khandseri has an important share in the sugarcane economy of UP as around 13% to 15% sugarcane is crushed by these units. In UP only around 50% of the sugarcane is crushed by sugar mills. In certain parts of UP, only about 20% cane goes to the sugar mills against an average of nearly 80% in Maharashtra.

4.4.2.8.3 However, most of the khandseri units are small sized with crushing capacity of less than 100 TCD [about 74%]. Nearly 31% of the units operate at less than 50 TCD capacities. About 80% of the units operate with less than 6 rollers, which would mean that these units are likely to extract only about 70% of the juice. Over 1 lakh people are employed in the khandseri units. The overall recovery rate of khandseri units is around

7% to 7.5%. The gur/jaggery is mostly manufactured in the unorganized cottage industry sector. Again, UP has the largest number of gur manufacturing units. Average employment in the gur making units is 10 persons

4.4.2.8.4 Excepting in times of scarcity, the price paid by khandseri/gur units for sugarcane is lower than the SMP. However, these units invariably make prompt payment for the sugarcane supplied to them, which attracts some of the sugarcane farmers. The growers needing immediate/quick cash for their produce do tend to divert part of their crop to these units though the price paid to them is lower than the SMP. Incidentally, a substantial number of these units [more than 50%] are located within 20 km of sugar factories in UP, Karnataka and Tamil Nadu, which would mean that these units interfere with the cane supplies in the registered areas of the factories. This is particularly so in UP where there is no long-term reservation of area and the linkage of growers with factories is also not direct.

4.4.2.8.5 A connected issue is that in the years of high price for gur, the manufactures are willing to pay a higher price for cane which leads to diversion of cane from the sugar factories, thus adversely affecting their working. As nearly the gur/khandseri units use 26- 27% of the sugarcane, there is also a need to relook at the tax incidence on these units. It may be appropriate to treat khandseri units with above 500 TCD capacity and those with less than 500 TCD capacities differently for excise purposes. The larger khandseri units [above 500 TCD] may also he required to pay SMP for the cane supplied to them atleast during the normal crushing season.

4.4.2.8.6 There is need for improvement in operational efficiency of both khandseri and gur units. One way could be to create a Khandseri Development Fund at the State level through levy of a cess, which could be used for providing need-based support (margin money, low rate of interest) for modernization/expansion to units located outside the reserve area of the factories.

4.4.2.8.7 There is a need for extension work regarding improved methods of gur production and storage not only among the gur producing units but also among the farmers who produce and store gur for their domestic consumption.

Distance between Sugar Mills

4.4.2.8.8 While the sugar industry was delicensed in September 1998, the distance criterion of 15 km has been retained. The minimum distance criterion is necessary to avoid shortage of cane for the factories on a regular basis. The distance of 15 km appears to be adequate for a factory with 2500 TCD plant. However if the plant is bigger say, 5000 TCD or more, the above distance may be grossly inadequate and harm the interests of both the factories and the growers.

4.4.2.8.9 The Committee on Revitalization of Sugar Industry [Shri Tuteja Committee-2004] also looked at this issue and concluded that to ensure availability of sufficient cane for a sugar factory of 5000 TCD, a minimum radial distance of 25 km will have to be maintained. As 5000 TCD is sustainable, the minimum distance between two factories may be increased from the present 15 km to 25 km. The Committee also felt that additional capacity beyond 5000 TCD should accrue through increase productivity and not by expansion of area under sugarcane.

Box – 2

Phased Decontrol of Sugar

Government has been following a policy of partial control and dual pricing of sugar under the Essential Commodities Act, 1955 which covers sugar and sugarcane. Under this policy the Government as levy sugar collects a certain percentage of sugar produced by the factories. The levy sugar is distributed under Public Distribution System [PDS] at lower prices. The non-levy sugar is allowed to be sold according to the quantity released by the Government as per the free sale sugar release mechanism. The percentage of levy sugar has been reduced over time and w.e.f. 1st March 2002, the levy obligation is now only 10%. The monthly release mechanism was introduced before the independence and has been useful. Sugar is produced only during 4-5 months and released in a controlled manner over the year. The objective is to ensure a reasonable price to the consumers as also to the sugar factories.

The announcement of complete decontrol of sugar from April 2003 resulted in panic sales, which reduced the prices, and many sugar factories suffered financial set back. On request from the industry the Government decided to defer the proposal of decontrol of sugar by two years i.e., upto September 2005.

The Government have also permitted forward trading in sugar.

Margins in Sugarcane Cultivation

4.4.2.8.10 Among the major crops in India, sugarcane is the most profitable crop. Dr. Abhihit Sen, in the 'State of the Indian Farmer: A millennium study' on Cost of cultivation and Farm Income worked out the A_2 Cost per hectare [all paid out expenses plus rent paid on leased land] and output, at current value for major crops for 5 years time slice of 1981-86, 1988-93 and 1995-2000. He stated, "Sugarcane is the most profitable crop in the country with weighted average profit over paid out costs per hectare at Rs.

30,825 during 1995-2000. Profit per hectare from this crop was highest at Rs. 52,704 in Tamil Nadu followed by Karnataka and Haryana at Rs. 44,283 and Rs. 37,955 respectively. It was somewhat above average but lower in the range of Rs. 23,000–26,000 in major cane producing states of Maharashtra and UP. However, even at this level and taking into account the larger crop period, sugarcane was more profitable than other crop rotations in these states."

4.4.2.8.11 Even when the margin of the gross value of output over the C2 costs [A2+interest on value of owned capital assets including owned land minus land revenue + imputed value of family labour] are taken for 1995-2000, the sugarcane crop gave larger surplus [Rs. 16,705 per hectare] on all India basis than the other crops like wheat [Rs. 5242 per hectare], Tur daal [Rs. 5458 per hectare], Jute [Rs. 3049 per hectare], Cotton [Rs. 4221 per hectare] and Rapeseed [Rs. 4129 per hectare]. The surplus in case of Paddy was only Rs. 2793 per hectare.

4.4.2.8.12 However, with increasing costs of inputs and declining yields during the last 5 years, the margins in sugarcane cultivation have been squeezed in spite of the increase in SMP. In this connection the Commission for Agricultural Costs and Prices in their report for crops sown during 2004-05 season observed as under:

"The primary concern before the Commission is that the cost of production of sugarcane is rising consistently over the years. There is limited possibility to arrest the rising cost of cultivation. At the same time, increasing price for sugarcane affects the financial viability of the sugar mills. A balance has to be struck between the rising cost of production and declining sugar prices nationally and internationally. **The rising cost can be partially compensated through increasing the productivity. There is, therefore, an urgent need to increase the productivity of sugarcane so that the sugarcane cultivation becomes more remunerative. Presently, there is a wide gap in productivity of sugarcane between tropical and sub-tropical regions of the country, the productivity of sub-tropical region being much less than the national average. The southern states, over a period of time, have increased the productivity through appropriate adoption of new varieties replacing the traditional ones. Such initiative is critically lacking in sub-tropical regions. The Commission emphasizes that the Government**

must do all that is needed to enhance the productivity of sugarcane in sub-tropical States. For adoption of new varieties and new technology in sugarcane production, agriculture extension plays a key role which is lacking in many States. The sugarcane mills in southern India, where productivity has gone up substantially over the years, have taken a lead role in extension programme. Going by the success story, the Commission recommends that the "Government should initiate appropriate measures to encourage the public private partnership in research and extension programme with particular emphasis on ratoon management, propagation of disease and pest resistance varieties, integrated plant nutrient management and judicious water management assigning the lead role and responsibility to the sugar mills, for raising the productivity levels of sugarcane. The Government must also pay particular attention to raising yields in the sub-tropical regions".

The Committee on Revitalization of the Sugar Industry [Shri Tuteja committee-2004] also recommended that suitable steps by various stakeholders [including State Governments] are necessary to ensure that sufficient sugarcane is developed and grown in the mill areas for economic viability of sugar factories.

4.4.2.9.0 Strategies to Improve Productivity and Quality of Sugarcane Production

4.4.2.9.1 The strategies to improve the productivity and quality of sugarcane production are discussed in the following paragraphs.

Seasonal and Varietal Planning

4.4.2.9.2 Implementation of season wise and variety wise planting programme in the area of each sugar factory is one of the most important aspects of ensuring supply of quality cane throughout the crushing season. The harvesting planning has to be done on the basis of the planting programme in the entire area. There are few factories, which take up scientific season and harvest planning [maturity wise]. The factories, which adopt such planning, get good results. An equally important aspect is increasing the area under better varieties. In Maharashtra the area under COC 671 and CO 86032 varieties is around 80%, which has helped in improving the recovery percentage. Much work in this regard may have to be done in UP, Bihar and MP through extension efforts Shri Tuteja Committee

[2004] referred to earlier, also felt that there was an urgent need for replacement of low sugared variety of cane through extension services in UP.

Production of Quality Seeds

4.4.2.9.3 Good seeds provide the basis for production of good crop in general but it is more so in the case of a crop like sugarcane, which is propagated vegetatively. The sugar factories have an important role in this regard as they could raise nurseries with foundation seeds obtained from the research stations. The factories could also have contract with some progressive farmers for maintenance of nurseries. There is also a need to reduce the seed quantity at the farm level to cut down the costs of seeds. The costs could be reduced substantially by transplanting polybag-raised seedlings or planting one eye-bud setts. Use of tissue culture for breeder seeds to raise foundation seeds is becoming popular in Maharashtra, Tamil Nadu etc. The advantages of tissue culture seedlings raised setts are:

(a) Assured genetic purity and uniformity
(b) High planting ratio
(c) High germination [about 95%]
(d) Early germination
(e) Disease & pest freeness
(f) Quicker coverage of area by improved varieties
(g) Increase in yield of crop

Efforts should be raise say, about 50% of the foundation seed plots annually with tissue culture seedlings in next 4-5 years. The sugar factories may have to be supported for having tissue culture laboratories.

Water Management

4.4.2.9.4 Sugarcane being a long duration crop, water management is important particularly in the tropical region where 15-16 irrigations are required. Drip and sprinkler irrigation have enhanced water use efficiency as compared to furrow irrigation without adversely affecting the soil fertility. However, the high capital cost and irregular electricity supplies are the major constraints in adoption of this system. The after sale service of the equipment also needs improvement. According to studies, drip system

saves irrigation water by about 35 to 55%, fertilizers by about 30% and increases the yield by about 25-30%.

Soil Fertility and Plant Nutrient Management

4.4.2.9.5 Sugarcane is an exhausting crop and it is important to take special care to maintain soil health. Integrated nutrient management ensures sustainable production. Use farm yard manures [F.Y.M.], vermi-compost, bio-compost or green manures alongwith needed dosages of NPK and other micronutrients is necessary to maintain sustained high yields. Greater attention needs to be paid for encouraging use of pressmud, sugarcane trash and distillery effluents for improving the sugarcane productivity Use of bio-fertilizers could helps in reducing the use of nitrogenous fertilizers.

Crop Rotation and Intercropping

4.4.2.9.6 It is essential to follow proper crop rotation according to the agro-climatic conditions to improve the biophysical properties of the soil and reduction in pest incidence. Monoculture of cane has resulted in substantial reduction in productivity. Proper sequence of cropping such as sugarcane leguminous crops is suitable for sustainable productivity. Some suggested crop rotations are:

- Rice – Sugarcane – Ratoon – Groundnut
- Groundnut - Sugarcane- Ratoon - Groundnut
- Cotton – Sugarcane – Ratoon – Vegetables
- Vegetables – Sugarcane – Ratoon - Green gram
- Green Manure Crop – Sugarcane – Ratoon – Groundnut
- Soybean – Sugarcane – Ratoon - Soybean/Groundnut.

High value inter crops like vegetables, oil seeds, pulses are remunerative and are appropriate for growing as inter crops to provide additional income and reduce risks in the long duration crop of sugarcane.

Use of Farm Implements and Machinery

4.4.2.9.7 Tractor drawn sugarcane planter, trash shredder, interculture implements, stubble shaver, rotavator, sub soiler plough etc. are useful and cost effective in sugarcane cultivation. There is need to make these implements available at cheaper rates/hiring at farmer's level. Use of sugarcane planter and interculture equipment could reduce the labour cost substantially. Cane planting done by planter improves bud germination. On a

rough basis, the cost of planting cane could be reduced by about Rs. 1500/- per hectare with the use of planter. Efforts are needed to design indigenous sugarcane harvesters, which could reduce harvesting cost and also avoid losses due to labour shortages during the peak cane harvesting periods in sugarcane producing States.

Plant Protection - Integrated Pest and Disease Management

4.4.2.9.8 Plant protection is often a neglected part of sugarcane cultivation. To control seed borne diseases like smut, grassy shoot etc. and the pests like scale, mealy bugs etc. the planting material should be treated with fungicides and insecticides. There are parasites for control of bores and predators for controlling sugarcane woolly aphid. The sugar factories/extension agencies could play an important role in adoption of integrated pest control practices collectively by the farmers in an area.

Sugarbeet as a Supplementary Crop

4.4.2.9.9 With the availability of tropicalised sugar beet varieties, there are possibilities of lengthening the crushing season of the factories. It is possible to cultivate sugar beet in the winter season, which is ready for harvest in about 5.5 to 6 months. The preliminary trials have indicated a crop of about 50 M.T./ha with sugar contents in the beet at above 16% is quite feasible. However, it would require additional machinery/other investments in the sugar factories for beetroot washing, slicing, diffusion and clarification of the juice etc. It is rather early to assess the prospects of sugar beet cultivation in sugarcane producing areas. It would be necessary to have after pilot projects to assess the potential of sugar beet and evaluate it as a supplementary feed stock for sugar factories.

Transfer of Technology

4.4.2.9.10 The available technologies are needed to be transferred to the farm quickly and efficiently. Conduct of result demonstrations, operational research projects, problem based training programmes, visits of farmers to the research stations/Agriculture Universities/pilot farms/leading farmer's fields, publications of literature in local language, exhibitions, use of audio visual aid etc. are essential for transfer of technology. It is also useful to encourage the leading farmers by awards and felicitations etc.

Identification of Appropriate Technologies

4.4.2.9.11 It is customary to say that the small/marginal farmers do not adopt better technologies due to ignorance and unwillingness to change. This may be partly true but often the technology is not adopted due to its inappropriateness to the farmer's needs, resources and risks taking ability. Efforts are necessary to fit research to the farmer's needs and requirements. Gaps in support system i.e., extension machinery, credit and input supplies could be the major reason for gap in technology adoption.

Role of the Sugar Factories

4.4.2.9.12 The sugar factories have an important role in sugarcane development in their area. **A public private partnership i.e., a close relationship between the research institutions/extension machinery and the sugar factory is essential for cane development in the reserved area**. Unfortunately, barring a few, the sugar factories in sub-tropical region have not paid adequate attention to cane development. The factories need to have adequate qualified, trained and motivated Cane Development Staff for the development work. It may be a good idea for each factory to have a cane Development Council representing the farmers, the factory and the Government [including research organizations] to advise in the matters of cane development.

Box - 3

Sugar Development Fund [SDF]

Sugar Development Fund was formed in 1982 under the Sugar Development Fund Act, 1982 passed by the Parliament, for financing various programmes in mission mode for development of sugar industry. A sugar cess @ Rs. 14 per qtl on levy and non-levy sugar in collected and is credited to SDF after deducting the cost of collection of the cess. Eligible purposes of loans from the SDF include modernization of the sugar factories, development of sugarcane in the area of the sugar factory, establishment of Bagasse-based cogeneration power projects, production of Ethanol and defraying expenditure for the purpose of building Buffer Stock with a view to stabilizing prices of sugar etc. The position of the Fund as on 31.03.04 was as under:

Cess collection transferred to the Fund	:	Rs. 3006.00 crore
Amount disbursed	:	Rs. 2528.93 crore

The disbursements under modernization/rehabilitations were highest at Rs.1252.39 crore followed by expenditure on buffer stock maintenance [Rs. 473.84 crore]. The repayments by 31.03.2004 had aggregated Rs. 839.19 crores.

The interest rate on SDF loan, which was 9% p.a., has been recently reduced to 2% below the Bank Rate.

There have been two main problems in availment of loans by the factories from the SDF. The first is the matter of security. The borrowing unit is required to provide either the State Government Guarantee or Bank Guarantee for the loans. This is difficult due to reluctance of the State Government/the cost of Bank Guarantee. The Government may consider alternative security like the charge on sugar factories assets for granting loans under SDF. The second problem is that the unit costs for various investments are not being updated regularly. It is understood no revision has taken place for over 10 years making assistance under SDF grossly inadequate. These cost norms need to be revised periodically. The operations of SDF need to be more flexible and user friendly.

4.4.2.10.0 Import and Export of Sugar

4.4.2.10.1 India has exported about 4 million tons of sugar during the last three years. The value of exports during 2001-02 and 2002-03 was Rs. 1728 crore and Rs. 1693 crore respectively. During 2003-04 [upto July 2004] the exports had already aggregated Rs. 707 crore.

4.4.2.10.2 Sugar was brought under the decanalized system in January 1997 but the quantitative ceilings were fixed. These quantitative ceilings were also removed w.e.f. April 2001. In order to boost exports, the Government have taken following measures:

(a) Sugar meant for exports exempted from levy obligations.

(b) Sugar released for exports treated as advance free sale sugar to be adjusted within 18 months.

(c) Sugar factories allowed reimbursement of expenditure incurred an internal transportation and freight charge upto Rs. 1000 per ton.

(d) Allowed neutralization of ocean freight disadvantage on exports shipments @ Rs. 350 per ton.

(e) Handling and marketing charges upto Rs. 500 per ton on export shipment.

Box - 4

Competitiveness of Indian Sugar

The Global market in sugar is not truly competitive. The market is highly distorted in the major developed countries like USA, Japan, EU with quotas, tariffs and use export subsidies. This not only affects the export demand for India sugar but also poses a challenge of cheaper imports to the domestic production.

Indian sugar is reasonably import-competitive. Even if Indian sugar is not import-competitive for some units during specific years, there is no reason to be guided by narrow commercial interests of cheaper imports. The spectrum of by-products from sugarcane is competitive and makes it possible to cross-subsidise the farmer without sacrificing the interests of the consumers. It is also necessary to remember that even if the import prices are low, it is quite likely that India's entry for imports would push up the prices. Further, the competitiveness of other countries in exports may be also in some cases due to their subsidising the exports in different ways.

It is important that the competitiveness of sugar industry is assessed on the use of the entire bio-mass of sugarcane and all the by-products and not only the sugar. However, it is necessary to make all efforts to reduce the costs of sugarcane, labour, transport, packaging etc., to improve the competitiveness of the sugar industry. A strategy could be to develop pragmatic pricing policies of inputs through mutual consultations with the stakeholders of these inputs. This could be quite important in respect of the prices of sugarcane, which constitute about 60% of the cost or sugar.

4.4.2.10.3 Since, sugar shows considerable variations in production, it is appropriate that India builds up its export market. We should also continue our efforts aggressively at international level to get rid of global distortions in the world sugar market. It would also be necessary to increase investment in improving sugar quality to meet international standards. An important connected issue would be to have a pragmatic sugar packaging policy. Compulsory packaging in Jute bags of 100 kg causes two fold problems: it adds to the costs and repacking in 50 kg [internationally demanded pack size] costs additional money.

4.4.2.10.4 Import or sugar was allowed under open General License in March 1994. Customs duty on import of sugar gradually increased to 60% in February 2000 along with countervailing duty of Rs. 850 per ton. During 2002-03 and 2003-04 [upto July only negligible quantity of sugar was imported]. However, in the year of shortfall in production, more imports would be needed. It would be appropriate that when necessary, we may import only raw sugar, which could be processed into white sugar by the industry in India.

4.4.2.11.0 The By-Products

4.4.2.11.1 Sugarcane is a versatile crop. Nearly every part of this bio-mass has industrial potential and uses. The process of making sugar also releases certain by-products having considerable value. So much so that production of some of these products could be profitable enough that sugar could in a way be considered as one of the by-products. In specific situations, the sugarcane could be crushed for making those products and sugar production could be controlled.

4.4.2.11.2 Bagasse, molasses and filter cakes could be considered as the major by-products of the sugar industry and the green tops, cane trash, spent wash, furnace ash and flue gas could be considered as the minor by-products.

4.4.2.11.3 Bagasse is being used as fuel to meet the steam requirements of the sugar factories. A small percentage of bagasse is also used for making paper/particle boards etc. Co-generation of power could be an important by-product of the sugar factories. Technological changes [change from low pressure boilers] could considerably enhance the capability of the industry to generate substantially more power, which could be sold to the National Grid. One problem with this power is its seasonality. However, it is possible to preserve bagasse and use the same for power generation over a larger period. According to the report of the Committee on Revitalization of Sugar Industry [Tuteja Committee Report-2004] the sugar industry has a potential of producing 5000 MW of power.

4.4.2.11.4 Molasses is an important by-product of the sugar industry, which is used extensively for manufacture of potable alcohol, and a number of alcohol based chemicals. An extremely important aspect is that molasses generated 'Ethanol' [dehydrated alcohol] is a good oxygenate and could be used as a blend with petrol for motor fuel. Brazil is the world's largest producer of 'Ethanol'. There are well over 20 million vehicles in Brazil, which are either pure alcohol powered or run with ethanol mixed petrol [about 22% ethanol blended with petrol]. With increasing prices of crude oil, the promotion of alternate motor fuel has become extremely important.

4.4.2.11.5 The Tuteja Committee [2004] has recommended the following policy interventions:

(a) Oxygenation of gasoline may be made compulsory.
(b) Central Government may formulate long-term policy for blending of ethanol with petrol.
(c) Fiscal and other incentives may be in place for a minimum period of five years.
(d) Purchase price for ethanol may be fixed for a period of 3 years [with suitable price escalation clauses].
(e) The Central Government may take steps to prevent frequent changes in the Power Purchase Agreements by the State Electricity Boards for cogeneration projects.
(f) National Energy Policy may have provisions for (a) mandating the proportion of 'green' power to be purchased in the overall power purchase in the State (b) preferential tariff for cogenerated power. The Central Electricity Act may also be suitably amended to provide teeth to the policy to support 'green' power.

4.4.2.11.6 A carefully worked out policy in regard to the by-products of the sugar industry could make substantial difference to the sugar industry. The increased profitability, better production planning for sugar and other products [change in product mix] could benefit the growers, help in stabilizing sugar prices, save in foreign exchange [use of ethanol] by reducing oil import bill and help the sugar industry.

4.4.2.11.7 (vi) Another aspect worth considering is the need to develop value added products from sugarcane to boost the demand for cane and improve the profitability of sugarcane cultivators. Some of these products could be tetra-packed cane juice, flavoured jaggery, and syrup from cane juice, liquid sugar and commercial production of vinegar. Perhaps, it may also be possible to produce cane juice wine on commercial scale.

4.4.2.12.0 Sugar Industry - Problems

4.4.2.12.1 It is a well-known fact that the welfare of the sugarcane farmers is closely linked to the working of the sugar factory, which processes the cane grown by him/her. Many sugar mills have also been the focal point for economic and social development in rural areas by generating employment, increasing incomes and creating facilities like schools, colleges, hospitals etc. About 60% of sugar mills in India are in the cooperative sector, 35% in the private sector and the remaining in the public sector. The cooperative form of organization is definitely beneficial in an agro-based industry like sugar. The

cooperative being a member's organization is concerned with the integrated development of the area, which in the long-term also has beneficial productivity consequences.

4.4.2.12.2 The sugar industry is going through a serious financial crises period. The adverse weather conditions in certain parts of the sugarcane growing-area, attack of pests [white woolly aphid], depressed sugar prices nationally and internationally led to low cash realizations, huge cane payment arrears and serious financial crunch for the industry. In many cases, the value of stock was not enough to cover the working capital loans outstanding to the banks, affecting normal business operations and difficulties in servicing the debts. In some cases, the routine off-season maintenance was affected. The sugar production during 2003-04 was projected at a level of 13.8 million MT against 20.1 million MT in 2002-03. The 2004-05 [Oct-Sept] started with high stocks, low sugar prices and huge cane payment arrears. While, late in the year prices started improving, due to low cane production, it was not possible for well over 100 factories to start crushing during the 2004-05 season creating further difficulties in meeting fixed costs and wage bills etc.

4.4.2.12.3 The Government of India set up a Committee under the Chairmanship of Shri S.K. Tuteja, Secretary, Ministry of Food, Consumer Affairs & Public Distribution, Government of India in March 2004 [referred to earlier in this chapter]. The Committee was to identify the problems faced by the sugar industry and suggest a package for its revitalization to make it viable, self sustaining and globally competitive. The Committee gave its report in December 2004. Some of the important recommendations of the committee are given at appendix-II. The Government may take an early view regarding various recommendations concerning revitalization of Sugar Industry. A weak Sugar Industry would adversely affect the welfare of millions of sugarcane farmers and India would eventually loose its position of premier producer of sugarcane and sugar

4.4.2.12.4 In view of the detailed coverage of the problems of the sugar industry and recommendation for its improvement/revitalization given by the Tuteja Committee, this aspect is not being discussed in this chapter. However, the causes leading to sickness in sugar industry are discussed very briefly in the next paragraph.

4.4.2.12.5 One of the main reasons for sickness of sugar industry is the inadequate availability of the sugarcane which could be due to various reasons including faulty location, inadequate attention to development work, competition from Gur, and Khandseri units, non-availability of adequate and timely inputs to the growers, poor crop and harvest planning and lack of long-term relationship with the growers and the mismatch due to the faster growth in sugarcane crushing capacity as compared to the increase in sugarcane production. Another reason could be the payment to the growers at rates which are not sustainable for the factory. This could be due to fixation of high SAP or payment of excess price due to apprehension of poaching etc. Another reason is the low equity and high indebtedness particularly in the case of the cooperative sugar mills. High interest rates charged by banks, particularly the cooperative banks could be another reason for high debt service obligations. There are also cases where the sugar factories have expanded or diversified without bringing adequate owner's equity [cooperative sugar factories]. In the years of higher production, the factories have to carry larger stocks increasing the debt burden and interest liabilities. As a matter of fact, sugar industry has to carry stocks for larger periods and any slackening of demand adds to the problems. Obsolescence of technology and machinery is another factor along with unsustainable low installed capacity of the mills or other problems. It may also be stated that in some cases the rigorous Government Controls, which were exercised on the sugar factories in the past, might have also contributed to sickness of some unit.

4.4.2.13.0 Technology Mission on Sugarcane [TMS]

4.4.2.13.1 The importance of the sugarcane cultivation and sugar production in the country cannot be over emphasized. There is a need for improving the productivity, profitability and sustainability of sugarcane farming and also modernization of the sugar industry. The strategies to improve the productivity and quality of sugarcane production have been discussed at an earlier paragraph [15]. The need is to introduce packages of technology, services and public policy for the purpose. At present, there is some multiplicity of the Government departments/organizations, both at the Centre and State, dealing with this subject. Although sugarcane is an important commercial crop providing employment on a large-scale in rural areas, there is no special programme or Centrally sponsored scheme of the Agriculture Ministry exclusively for improving the production

and productivity of sugarcane in the country. The Department of Sugar is implementing the SDF Scheme, which has components for improving the productivity of sugarcane, but perhaps the main focus is with regard to the health of the sugar industry. In the field of research also, though the ICAR is doing its own research efforts through its various schemes and Institutes, the full potential of their research is yet to be achieved.

4.4.2.13.2 **Therefore, in order to have a coordinated and focused attention for implementing the strategies discussed earlier to improve the productivity and quality of sugarcane production it is proposed that a** Technology Mission on Sugarcane [TMS] be formed jointly with the sugarcane growers' organisations, cooperatives, sugar factories, banks and research organisations, on the basis of a seed to sugar approach. The objective of the Mission would be to increase the all India average productivity to at least 80 MT/ha. [present average of (2002-03) 64.6 MT/ha against the average yield in many countries already well above 100 MT/ha] and improve the sugar recovery to 11% [from the present 10.3 against the Australia average at 14.25%] with a view to minimizing the cost of production to improve the competitiveness of sugar production with focus on use of better quality seeds, efficient soil, water and nutrient management and taking care of soil and plant health. The above improvements in yield and recovery would help in increasing the production to 25 million tons of sugar in 5 years which would take care of the projected consumption in India at 24.3 million tons.

4.4.2.13.3 The Technical Mission on Sugarcane [TMS] could have three major components:

(a) Intensification of sugarcane research
(b) Technology Transfer
(c) Improving the productivity and quality of sugarcane.

The Intensification of sugarcane research in the following main areas is called for:

(a) Breeding sugarcane varieties/hybrids resistant to biotic stresses including development of transgenic varieties etc. suitable for different agroclimatic and soil conditions.

(b) Improving seed production technology including tissue culture techniques and its standardistion.

(c) Optimisation of resource use efficiency through development of integrated soil, water, nutrition, pest and weed management. Strategies for sustainable productivity and production. Improvement in ratooning for better yields.

(d) Further development work in eco-friendly technologies in IPM, biofertilizers etc.

(e) Development of appropriate and cost effective equipments, tools and machinery for sugarcane cultivation particularly in planting, harvesting etc.

(f) Exploring/evaluating/developing sugarbeet as a supplementary feed stock.

4.4.2.13.4 The above intensification of research would require investment in infrastructure mainly for establishment of a hybridization center for development of sugar hybrids. At present, the major work in this regard is being done at Coimbatore on parents whose flowering synchronizes during a short span at Coimbatore. To supplement the above, another hybridization center could be established. The unused/excess physical facilities already available at existing research stations/centres and their suitability may be looked at carefully before a new place is identified for the proposed centre. This facility would be useful to the sugarcane breeders to get additional crossed seeds. Further, the existing facilities for molecular biology and genetic engineering at the research set up at the Sugarcane Breeding Institute, Coimbatore, Indian Institute of Sugar Research [IISR], Lucknow and Vasantdada Sugar Institute [VSI], Pune need to be strengthened for developing varieties including transgenic which are resistant to biotic and abiotic stresses and would give higher yields and recovery. The estimated costs for building these facilities would be around Rs. 20 crores. **These developments would help in long-term improvement o f sugarcane varieties etc to ensure that the productivity and quality level are sustained and improved.**

4.4.2.13.5 Research studies for optimization of resource use efficiency, crop protection, use of bio-pesticides, bio-fertilizers, development of appropriate and cost effective instruments/machinery for sugarcane will have to be supported. A research programme for about five years with clear monitorable output indicators, yearly milestones with final output target will have to be worked out, funded, closely monitored and achieved. A preliminary identification of suggested research studies by the Vasantdada Sugar Institute, Pune are listed at Appendix-I. These could be considered along with similar other suggestions for firming up the research agenda on the subject.

4.4.2.13.6 While exact research items, their allocation to different research bodies including Universities, monitoring systems and costs will have to be worked out, on a rough basis an amount of about Rs. 100 crore to Rs. 125 crore may be required for this purpose. The ICAR/Sugarcane Breeding Institute, Coimbatore/IISR Lucknow and VSI, Pune may have to play a major role under this programme. It will also be important that the end users i.e., the farmers and the sugar factories are actively associated in firming up the research programmes etc.

Technology Transfer

4.4.2.13.7 There is a wide gap between the potential and realized productivity. [Please see the details at para 4 (ii)]. The productivity gap between, the tropical and sub-tropical zone is large. Further, in Tamil Nadu average productivity of 106.8 MT/ha was achieved in 2002-03. Karnataka has also been achieving average productivity of over 80 MT/ha. There are also wide gap in sugar recovery between different States, ranging from over 11.6% in Maharashtra to only 9% in Bihar. The low recoveries could be attributed to poor quality of cane and inefficient making of sugar. As regards the quality of cane, there is much room are improvement particularly in the sub-tropical areas [The average sugar recovery in 2001-02 in sub-tropical zone was about 9.67% as compared to about 10.75% in the tropical zone. Nearly 55% of the factories in Maharashtra, 26% in Karnataka and 11% in each in Andhra Pradesh and Gujarat are having more than 11% recovery of sugar]. However, this would require considerable step- up in extension efforts. The need is to develop and introduce a more effective technology transfer system, which demands proper strategies for effective planning, implementation and evaluation of activities in the technology transfer process. It is said that perhaps the farmers adopt about one third of the available technologies, which needs to be improved.

4.4.2.13.8 The objective of the programme under the TMS could be as under:

(a) Develop seed production chain by organizing breeder, foundation and certified seed production programme and available better seeds to the farmers.
(b) Promote use of quality planting material produced by tissue culture.

(c) Transfer production technologies developed by ICAR/Agriculture Universities etc. to farmers through field demonstrations, farmer/extension workers training programmes, farmer to farmer learning and exchange visits to different areas/States.

(d) Bringing more area under efficient irrigation systems like drip, sprinklers etc.

(e) Minimize crop loss by adopting IPM technique, promoting bio-agent production in farmer's fields.

(f) HRD for updating knowledge/skills of the farmers and field staff.

(g) Reduce cost of cultivation and restore soil health through green manuring, trash manuring and use of press mud, vermi - compost etc. Deteriorating soil health is one of the main reasons for productivity decline/stagnation and it needs more attention.

4.4.2.13.9 The technology transfer programme would have to be done jointly by the staff of the Agriculture Department [AD] and the staff of the sugar factories. The staff of the AD and the factory could prepare farmer wise production programme for each factory in consultation with the farmers and undertake the same after due approval etc. This would become the basis for improving productivity and quality of sugarcane. The farmer training programmes may be given special focus. Assuming about 10,000 to 15,000 farmers in the area of each sugar factory, it may take about 4-5 years to cover all [50 to 60 programmes of about 50 farmers each in a year]. Farmer to farmer learning and visits to other areas/States may be given adequate importance in the training programmes.

4.4.2.13.10 Devising appropriate training programmes keeping in view the farmer's needs, beliefs, attitudes and problems would be the crucial part of the entire programme of technology transfer. All technologies are not appropriate for all resource conditions. Small and marginal farmers who are resource poor and require technologies, which are appropriate for them, cultivate nearly 45% of the sugarcane area. There has to be integration of the technology support systems, technology generation and technology transfer.

4.4.2.13.11 Much of the anticipated increase in productivity and quality of production may come about through use of quality seeds. Development of seed production chain will be accorded a high priority. This may have to be primarily implemented through ICAR/Agriculture Universities/VSI, Pune etc. Assistance may have to be provided to the

above organizations to maintain genetically pure nucleus seed, production of breeder seeds and foundation seeds. The Sugar factories could also associate in production of breeder seeds depending upon their capabilities and set up. **The programme of production of certified seeds will have to be done by the sugar factories/farmers. The programme of seed production may be planned in the ratio of 1:10:100 for breeder, foundation and certified units and with a view to replace ¼th of the area with fresh seed material every year [replacement of seed alone can increase the productivity by about 10 to 12%].**

4.4.2.13.12 Subsidy may be provided for production of foundation/breeder seeds for 5 years. The programme details may have to be worked out by the ICAR in consultation with the State Governments, Agriculture Universities, VSI etc. On a rough basis of subsidy of Rs. 40,000 per hectare for breeder seeds and Rs. 10,000 per hectare for foundation seed, the subsidy component would come to about Rs 16 crore in the first year. The total requirement of subsidy breeder/foundation seed programme for five years would work out to about Rs.100 crore including the subsidy for maintenance of nucleus seeds. Another about Rs. 500 crore may be needed [details will require to be worked out] for training, demonstration and other extension related expenses as additionality to the extension efforts being presently done. This may be worked out on sharing basis between the Center, State Government and Sugar Factories. Out of this additional investment of Rs. 500 crore in extension efforts over five years the Centre's share may be Rs. 250 crore. Focus of these programmes may be mainly on small and marginal farmers, which constitute about 43% of the total sugarcane farmers.

Box –5

Sugarcane – DSCL way of bringing prosperity to the farmers

The DCM Shriram Consolidated Ltd (DSCL) started its first crushing season in 1997-98 in U.P. having 16,748 hectare under sugarcane in its area with intensity of sugarcane cropping at only 26%. The challenge to the company was low productivity due to poor technologies, low yielding and susceptible varieties, poor soil conditions and low water availability. The DSCL realized that to ensure regular and adequate supply of sugarcane either the area had to be increased or the yield had to go up and maximum possible share of the sugarcane produced in the area had to come for crushing at the factory. The Company moved in the matter by extending credits for farm inputs, ensuring availability of quality inputs at reasonable rates, providing extension services for popularizing modern agri-techniques, soil testing, providing better varieties of seeds, recommending proper crop rotation, inter-cropping and developing close relationship with the farmers.

The result is that the average productivity has increased in the last four years from 42 ton/ha to 55 ton/ha and the yield in paired row spacing upto 75 ton/ha to 120 ton/ha. The farmers are also getting additional income of Rs.5000 to 10,000 per hectare from inter-cropping. Further the intensity of sugarcane cultivation has improved to 52% and the area under sugarcane to 50,000 hectare.

The Company established the first Haryali Kisaan Bazar (HKB) in July 2002 and now there is a chain of 16 HKBs in four States viz. Uttar Pradesh, Haryana, Punjab and Rajasthan. These units provide fertilizers, insecticides, pesticides and seeds of different crops, agricultural implements, diesel, petrol and lubricants through BPCL petrol pumps to ensure better quality and quantity cooking gas to farmers through Bharat gas agency, different FMCG products of daily use, veterinary medicines, green card facility by using ATM through rural branch of ICICI Bank and giving crop extension

Improving the Productivity and Quality of Sugarcane Production

4.4.2.13.13 **It is felt that the sugarcane cultivation could be revolutionized by a strong proactive role of the sugar factories, banks, financial institutions and the Government both the Centre and the State Governments.** The broad objectives of the programme could be stated as under:

(a) To increase the productivity and quality of sugarcane in all sugarcane growing States, of the country while keeping the area under sugarcane constant.

(b) To maintain sustainability of the sugarcane farms.

(c) To increase the profitability of the sugarcane farmers.

(d) To encourage the sugar factories to establish additional facilities for sugarbeet processing.

4.4.2.13.14 This is the most important part of the project. The benefits of focused research support, extension work, improved availability of better quality seeds/varieties and inputs has to be converted into higher productivity and better quality of output. **The farmers wise production programme worked out for each factory would be the basis. There could be two main components of this programme.** The first relating to establishment of certain infrastructural facilities like Soil Testing Laboratories and Tissue Culture Laboratories at the factory level to support the programme for scientific cultivation and improve the availability of superior planting material in their reserved area. To provide incentive to the sugar factories to invest in creating the above facilities, the Government may provide 25% capital subsidy for development of about 250 Soil Testing Labs [unit cost of about Rs. 40 lakh] and 125 Tissue Culture Laboratories [unit cost of nearly Rs. 105 lakh]. The amount may work out to about Rs. 50 to 60 crore. The factories may raise the balance of 75% from their internal resources/banks etc. **The soil testing labs should work to prepare a soil health card for each farm and specially assess the micro nutrient deficiencies so that the same could be applied on the soils to improve their productivity. It is felt that this development alone could improve the productivity of farms by at least 15-20%. Further, it may also be necessary to encourage establishment of bio-fertilizer units. The use of nitrogen fixing and phosphate solubilizing biofertilizers in sugarcane significantly increases the cane yield besides as much as 25% saving in inorganic nitrogen. The potential demand for all types of biofertilizers for sugarcane is estimated at 0.90 lakh MT against the production of 0.13 lakh MT. It is, therefore, suggested that the Government may encourage establishment of such units [about 300 units] by providing 25% subsidy. On a rough basis the subsidy may work out to nearly Rs. 45 - 50 crore.**

The second component of the programme i.e., taking up scientific cultivation, using proper nutrients based on soil test reports, introduction of drip irrigation, need based farm mechanization, improving ratoon management, green manuring, improving irrigational facilities, using better quality certified seeds, providing adequate credit for purchase of inputs etc. could be supported by banks under their normal development programmes.

However, it would mean intensification of efforts, development of new model schemes, training of the field staff of the banks, close monitoring and eventual evaluation. The National Bank for Agriculture and Rural Development [NABARD] which has an important promotional and developmental role may be nominated as the nodal agency to prepare factory wise credit intensification programme based on farm plans [referred to earlier] prepared by the extension staff and the factories, to be incorporated in the District Potential Linked Credit Plans prepared on an annual basis by NABARD for all the districts in the country. These programmes may have to be dovetailed with the District Credit Plans of the banks. These plans may be aggregated at the State/National level. It is felt that sugarcane cultivation presents excellent opportunities for the banks to intensity their credit operations. Sugarcane is a highly profitable crop and has assured marketing tie up with the sugar factories. The need is to have a focus and an agency for coordinating, problem sorting and giving a lead to the entire investment programme. A kind of role, which is tailor, made for NABARD.

4.4.2.13.15 NABARD may also lead the training of the bank staff in this credit intensification programme. The Banker Institute of Rural Development [an autonomous national level training establishment established by NABARD] may take the lead role in preparation of course contents, reading material and training of the trainers of the banks and other training institutions involved in training of the bank staff.

4.4.2.13.16 The Government may provide a small service charge to NABARD for the credit intensification programme at say 0.5% on the basis of incremental credit disbursed under the programme. Assuming incremental lending of Rs. 10,000-12,000 crore, a provision of Rs. 60 crore would be adequate.

4.4.2.13.17 A High Level Committee of about 15 members consisting of the representative of Government of India, Four State government [on rotation], NABARD, RBI, Commercial Banks [on rotation], the Federations of the Cooperative Banks, ICAR and Industry may be constituted under the Chairmanship of the Union Agriculture Minister or his nominee Government of India with Chairman/ MD, NABARD as Member Secretary. The Committee may broadly oversee the entire programme.

4.4.2.13.18 Similar Committees may also be created at the State level under the Chairmanship of Agriculture Production Commission of the State and the Incharge of the Regional Office of NABARD as the Member Secretary to oversee the programme in the State. For undivided and focused attention the TMS may be placed under the exclusive change of a senior level officer in the Govt. of India to the designated as 'Mission Director'. Similarly, in the major sugarcane growing States, the Governments may also designate a State level 'Mission Director' to act as the 'nodal officer' for the programme.

4.4.2.13.19 To sum up the total cost of the programme may be around Rs. 900 crore in a five year time slice as detailed below:

A. Intensification of research efforts	: Rs. 125 crore to Rs. 150 crore
B. Technology Transfer	: About Rs. 600 crore of which the Centre's share may be Rs. 300 crore
C. Improving the productivity and quality of sugarcane	: Rs. 160 crore

Needless to say, the above are rough estimates and the details would require to be worked out.

4.4.2.13.20 The Project would aim to reach in 5 years, all India average productivity of above 80 MT/ha and recovery level of 11% which would produce nearly 250 lakh tons of sugar [on the assumption that about 62.5% cane would be available to the sugar factories for crushing][*]. This would mean additional sugar production of about 50 lakh tons in the fifth year of the project, from the level of production of 2002-03, which would value [on the basis of Rs. 14000 per ton] about Rs. 7000 crore. For achieving an average productivity of 80 MT/ha it is expected that the average productivity in the tropical region would increase to 95 MT/ha against the level of 82.73 MT/ha in 2001-02 and the average productivity in sub-tropical region would increase to 70 MT/ha against the average of 52 MT/ha in 2001-02. It is also assumed that the area under sugarcane in tropical and sub-tropical region would continue to be in the ratio of 60:40 as at present.

[*] During the last 4 years the total use of sugarcane for khandseri gur, chewing seed and other purposes has never exceeded 135 million MT. In view of the possibilities that the demand for these purposes may not grow [may decline] the cane available for sugar would be 225 million ton i.e. about 62.5% of the production. This is based on an estimated total sugarcane production of 360 million MT [450 lakh hectare with average production of 80 MT/ha] and average sugar recovery of 11%.

4.4.2.14.0 SUMMARY OF RECOMMENDATIONS

4.4.2.14.1.0 SUGARCANE PRODUCTION

4.4.2.14.1.1 Good seeds provide the basis for good crop in general but it is more so in the case of sugarcane crop, which is propagated vegetatively. The programme for production of breeder seeds/foundation seeds needs to be supported. The sugar factories could play an important role in raising nurseries with foundation seeds from research stations. Replacement of seed is important. The replacement of seeds by the farmers in fourth year could improve the yield by 10% to 12%. [Para 4.4.2.9.3 & 4.4.2.13.11]

4.4.2.14.1.2 There is an urgent need for replacement of low sugared variety of cane in UP, Bihar, MP etc. through extension efforts. [Para 4.4.2.9.2]

4.4.2.14.1.3 There is a need to reduce the seed quantity at the farm level. The cost of seeds could be reduced substantially by transplanting polybag-raised seedlings or planting one eye-bud setts. [Para 4.4.2.9.3]

4.4.2.14.1.4 Tissue culture needs to be encouraged for assured genetic purity, better and early germination, quicker coverage by better varieties and higher sugarcane yield. The sugar factories need to be supported for having tissue culture laboratories.

[Para 4.4.2.9.3]

4.4.2.14.1.5 Proper care of 'ratoon' crop could increase the sugarcane yield. Maintaining required plant population through gap filling by settlings, use of adequate fertilizers, need based micro - nutrients and plant protection care could help in increasing the yield of ratoon crop. Training of the farmers and more intensive extension work by the extension staff and sugar factories is called for. [Para 4.4.2.6.8]

4.4.2.14.1.6 There is a need for the sugar factories to have soil testing laboratories so that soil health card for each plot of land in the reserved area could be prepared and need based micronutrients and fertilizers could be applied. This alone could improve the yields by 15% to 20%. [Para 4.4.2.13.14]

4.4.2.14.1.7 The cane area reservation needs to be on a long-term basis (5 to 10) years with provision for review by the State Government, to ensure better sugarcane development efforts by the factories and effective linkages with the growers. Social audit

of the arrangement may be taken up which could also facilitate the decision-making in case of dispute. [Para 4.4.2.7.4]

4.4.2.14.1.8 Monoculture of sugarcane has resulted in substantial reduction in productivity. Proper sequence of cropping such as sugarcane-leguminous crops is suitable for sustainable productivity. [Para 4.4.2.9.6]

4.4.2.14.1.9 The high capital cost and irregular electricity supplies are the major constraints in adoption of drip/sprinkler irrigation systems. The after sale service of the equipment also needs improvement. According to studies, drip system saves irrigation water by about 35 to 55%, fertilizers by about 30% and increases the yield by about 25-30%. [Para 4.4.2.9.4]

4.4.2.14.1.10 Crop specific equipments need to be popularized. The sugarcane planting done by planter improves bud germination. On a rough basis, the cost of planting could be reduced by about Rs. 1500/- per hectare with the use of planter. Efforts are also needed to design indigenous sugarcane harvesters, which could reduce harvesting cost and also avoid losses due to labour shortages during the peak cane harvesting periods in sugarcane producing States. [Para 4.4.2.9.7]

4.4.2.14.1.11 The sugar factories/extension agencies could play an important role in adoption of integrated pest control practices collectively by the farmers in an area.

[Para 4.4.2.9.8]

4.4.2.14.1.12 Greater attention needs to be paid in use of crop residue from sugarcane and products much as press mud, sugarcane trash and distillery effluents for improving sugarcane production. [Para 4.4.2.9.7]

4.4.2.14.1.13 There is scope for increasing the use of bio-fertilizers in sugarcane cultivation. The use of nitrogen fixing and phosphate solubilzing bio-fertilizers in sugarcane significantly increases the cane yield besides as much as 25% saving in inorganic nitrogen. The Government may support establishment of bio-fertilizers units by providing capital subsidy. [Para 4.4.2.13.14]

4.4.2.14.2.0 CANE PRICE

4.4.2.14.2.1 SMP needs to be announced by the Government at least one year in advance to give price signals and also to help in the allocation of land/other resources. If the SMP could be announced for a longer period say about 3 years, it would help in better planning and stabilizing cane production. There should be very strict enforcement of the law regarding timely payment of sugarcane price to the growers.

[Para 4.4.2.7.7 & 4.4.2.7.12]

4.4.2.14.2.2 The SMP needs to carefully balance the interests of the growers and the factories. While the sugar prices were declining/stagnating, the SMP for sugarcane continued to increase which also contributed towards increasing the sugarcane price payment arrears. [Para 4.4.2.7.7]

4.4.2.14.2.3 Though suggestions have been made, it may not be appropriate to have SMP on regional basis. [Para 4.4.2.7.7]

4.4.2.14.2.4 Linking the sugarcane price to the sucrose contents of the cane as is done in some other countries could encourage the farmers to grow better varieties. However, it could be done only after the equipments for assessing sucrose contents of the cane are tested and become generally acceptable by the growers. This needs to be done on a priority basis. However, for the present it may be possible to fix incentive prices for varieties, which have higher sucrose contents with a view to encourage the farmers to take up cultivation of these varieties. [Para 4.4.2.7.9]

4.4.2.14.2.5 Prima facie the Bhargava formula for sharing the surplus of income from the sale of sugar over the cost of production 50:50 by the growers and the factories appears to be in order save for the implementation delays. If it could be decided quickly at the end of the season, the impact would be much better. [Para 4.4.2.7.11]

4.4.2.14.3.0 CANE PROCUREMENT [SUPPLY] ARRANGEMENTS

4.4.2.14.3.1 In U.P. and Bihar the system of sugarcane procurement for crushing on the basis of ‘Parchies’ issued to the farmers through the Cooperative Cane Societies/Union needs to be reviewed. This system leads to delay in reaching the sugarcane to the factories [collection is usually at the purchase centers] and is also not farmer friendly.

This system is also not effective in developing linkages between the farmers and the factories. [Para 4.4.2.7.17]

4.4.2.14.3.2 Though the State Governments impose penalty for poaching of sugarcane, unless it is adequate it does not serve as a deterrent to the factories. In Punjab, for example, the penalty on conviction in a court was only Rs. 2000/-, which was grossly inadequate. This needs review by the State Governments. [Para 4.4.2.7.3]

4.4.2.14.3.3 It may be appropriate to treat Khandseri units with above 500 TCD capacity at par with sugar factories for payment of SMP during normal cane season and also for excise duty etc. [Para 4.4.2.8.5]

4.4.2.14.3.4 The electronic weighing scales needs to be installed at all purchase centers/factory gates, so that the sugarcane growers are satisfied about the accuracy of weight and it would reduce their waiting time. [Para 4.4.2.7.18]

4.4.2.14.3.5 As 5000 TCD is sustainable; the minimum distance between two factories may be increased from the present 15 km to 25 km. [Para 4.4.2.8.9]

4.4.2.14.4.0. KHANDSERI/GUR PRODUCTION

4.4.2.14.4.1 There is need for improvement in operational efficiency of both khandseri and gur units. One way could be to create a Khandseri Development Fund at the State level through levy of a cess, which could be used for providing need based support [margin money, low rate of interest] for modernization/expansion to units located outside the reserve area of the factories. [Para 4.4.2.8.6]

4.4.2.14.4.2 There is a need for extension work regarding improved methods of gur production and storage not only among the gur producing units but also among the farmers who produce and store gur for their domestic consumption. [Para 4.4.2.8.7]

4.4.2.14.5.0 SUGAR DEVELOPMENT FUND

4.4.2.14.5.1 The Government may consider alternative security like the charge on sugar factories assets for granting loans under SDF. The unit costs for various investments under SDF assistance are not being updated regularly. It is understood no revision in unit cost has taken place for over 10 years, with the result assistance under the SDF is grossly

inadequate. These cost norms need to be revised periodically. The operations of SDF need to be more flexible and user friendly. [Box – 3]

4.4.2.14.6.0 SUGAR BEET

4.4.2.14.6.1 The potential of the sugar beet crop [which could be cultivated in winter] needs to be analyzed and considered carefully as supplementary feed stock particularly with a view to increasing the crushing period and saving on water use. It would be necessary to take up pilot projects in different areas to evaluate sugar beet as a supplementary crop. [Para 4.4.2.9.9]

4.4.2.14.7.0 SUGAR- EXPORT/IMPORT

4.4.2.14.7.1 Since, sugar shows considerable variations in production, it is appropriate that India builds up its export market. We should also continue our efforts aggressively at international level to get rid of global distortions in the world sugar market. It would also be necessary to increase investment in improving sugar quality to meet international standards. An important connected issue would be to have a pragmatic sugar packaging policy. Compulsory packaging in Jute bags of 100 kg adds to the costs and repacking in 50 kg bags [internationally demanded pack size] costs additional money.

[Para 4.4.2.10.3]

4.4.2.14.7.2 In the year of shortfall in production, imports would be needed. It would be appropriate that when necessary, we may import only raw sugar, which could be processed into white sugar by the industry in India. [Para 4.4.2.10.4]

4.4.2.14.7.3 The competitiveness of sugar needs to be assessed on the use of the entire biomass of sugarcane and all the by-products and not only sugar. [Box - 3]

4.4.2.14.8.0 VALUE ADDED PRODUCTS

4.4.2.14.8.1 There is a need to develop value added products from sugarcane to boost the demand for cane and improve the profitability of sugarcane cultivators. Some of these products could be tetra-packed cane juice, flavoured jaggery, and syrup from cane juice, liquid sugar and commercial production of vinegar. Perhaps, it may also be possible to produce cane juice wine on commercial scale. [Para 4.4.2.11.7]

4.4.2.14.9.0 RESEARCH

4.4.2.14.9.1 Efforts are necessary to fit research to the farmer's needs and requirements. Gaps in support system i.e., extension machinery, credit and input supplies are some of the contributory factors in large gap in technology adoption. [Para 4.4.2.9.11]

4.4.2.14.9.2 Public private partnership between the research institutions/extension machinery and the sugar factories is essential for cane development in the reserved area. This could facilitate extension work and needs to be encouraged. [Para 4.4.2.9.12]

4.4.2.14.10.0 ETHANOL/COGENERATION

4.4.2.14.10.1 Tuteja Committee [2004] recommendations regarding policy interventions in the matter of 'bio-fuel' and co-generation of power by sugar factories need favourable consideration.

- Central Government may formulate long-term policy for blending of ethanol with petrol.
- Fiscal and other incentives for ethanol production may be in place for a minimum period of five years.
- Purchase price for ethanol may be fixed for a period of 3 years [with suitable price escalation clauses].
- The Central Government may take steps to prevent frequent changes in the Power Purchase Agreements by the State Electricity Boards cogeneration projects being implemented by sugar factories.

National Energy Policy may have provisions for (a) mandating the proportion of 'green' power to be purchased in the overall power purchase in the State (b) preferential tariff for co-generated power. The Central Electricity Act may also be suitably amended to provide teeth to the policy to support 'green' power. [Para 4.4.2.11.4]

4.4.2.14.11.0 SUGAR INDUSTRY

4.4.2.14.11.1 The recommendations of the Tuteja Committee [2004] regarding revitalization of the sugar industry needs an early decision. [Para 4.4.2.12.3]

4.4.2.14.12.0 TECHNOLOGY MISSION ON SUGARCANE [TMS]

4.4.2.14.12.1 The average all India yield of sugarcane has been declining during the last five years. Even earlier it had shown tendency of stagnation. During the last 12 years ending 2002-03, the highest average yield of 71.3 MT/ha was achieved as far back as in 1994-95. On the basis of projections, the demand of sugar is likely to reach 24.3 million tons against the production of 20.1 million tons in 2002-03. In view of the limitations in increasing area under sugarcane, the Central Government may establish a Technology Mission on sugarcane with the objective of improving the productivity and quality of sugarcane production. The Technology Mission should help in achieving the All India average sugarcane yield of at least 80 MT/ha [against 64.6 MT/ha in 2002-03] and an average recovery of not less than 11% [against 10.36% achieved in 2002-03] in five year

[Paras 4.4.2.3.2 & 4.4.2.13.2]

4.4.2.14.12.2 The TMS may have three components i.e., intensification of sugarcane research, technology transfer and improving the productivity and quality of sugarcane production. The research establishments may work on breeding sugarcane varieties for different agro-climatic/soil conditions and higher sucrose contents, making available foundation seeds to factories/select farmers for improving availability of quality seeds, suggest improved practices, develop appropriate tools and provide the research support for sustaining increase in productivity and quality of sugarcane. The Agriculture Department & the Sugar Factories would have to work together and provide extension support. The sugar factories need to prepare soil health cards for each plot of land in the reserved area growing sugarcane and also the farm wise production programme.

[Paras 4.4.2.13.3 & 4.4.2.13.6]

4.4.2.14.12.3 Each sugar factory may constitute Cane Development Council representing the farmers, the factory and the Government [including research organization] to advise the factory on the matter of sugarcane development. [Para 4.4.2.9.3]

4.4.2.14.12.4 NABARD may be declared the nodal agency to coordinate the availability of credit and prepare a factory wise credit plan based on the farm wise production plans prepared by the Sugar Factories/representative of the extension Department of the State Government. [Para 4.4.2.13.14]

4.4.2.14.12.5 A Committee at the National level chaired by the Hon'ble Union Agriculture Minister and having representation of the concerned Ministries of the Central Government, State Government [on rotational basis] Banks, [on rotational basis] ICAR, Industry, RBI and NABARD may over see the programme. Appropriate Committees at State level may also be constituted to averse the implementation of the programme in the respective State. [Paras 4.4.2.13.17 & 4.4.2.13.19]

4.4.2.14.12.6 For undivided and focused attention, the TMS may be placed under the exclusive charge of a senior level officer in the Government of India to the designated at Mission Director. Similarly the major sugarcane growing states may also designate a State Level Mission Director to act as the modal officer for the programme.

[Para 4.4.2.13.18]

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Appendix –I

Intensification of Sugarcane Research

S. N0.	Name of project	Number of centres to be involved
	A. CROP PRODUCTION	
1.	Studies on different integrated package of practices to revolutionize sugarcane productivity & recovery.	32
2.	Studies on effect of different sources of seed as certified, T. C. Sampling, STP on yield & quality of sugarcane.	32
3.	Studies on crop suitability of maximization of productivity of sugarcane.	32
4.	To study the suitability of intercropping in sugarcane cultivation.	32
5	To evaluate multiple ratoon management technique to increase productivity with low cost.	32
6.	Evaluation of sugarcane genotypes for moisture stress	10
7	Influence of metrological parameters on growth of sugarcane, yield, recovery and validation DSSAT CANE GROW model in five agro climatic zones in India	12
8.	Integrated nutrient management in sugarcane.	10
9.	Reclamation of problematic soils.	4
10.	Evaluation of fanjet irrigation, surface and subsurface drip irrigation system in Sugarcane agriculture.	14
11.	Fertigation with trash management of sugarcane under rain gun sprinklers irrigation.	14
12.	Studies on fertigation through drip irrigation system in sugarcane agriculture.	14
13.	Subsurface irrigation with rubber porous pipe in sugarcane agriculture.	14
14.	Microprocessor based automatic drip irrigation with manually controlled drip and furrow irrigation in sugarcane agriculture.	14
15.	Studies on planting geometry for adoption of micro irrigation system in sugarcane agriculture.	14
16.	Irrigation scheduling under drip irrigation system in sugarcane agriculture.	14
17.	Mechanization for sugarcane production system.	4
	B. CROP PROTECTION	
1.	Bio-management of sugar factory and agricultural wastes through application of vermin-technology	8
2.	Performance of different farming systems for sustainable sugarcane production	12
3.	Evaluation of forewarning models for the outbreak of diseases of sugarcane.	10
4.	Survey of sugarcane diseases	11
5.	Integrated disease management in sugarcane	20
6.	Evaluation of the various 9 PM modules for the control of SWA, fly, borers & grubs.	12
7.	Studies on the management of sugarcane wooly aphid (SWA), white fly, borers, white grubs with a major emphasis on planting system, intercropping, nutrient and irrigation in sugarcane.	6
8.	Research on microbial, plant origin pesticides (aromatic, medicinal & other plant extract) and organic biopesticides for management of sugarcane pests.	6

Appendix II
Major Recommendation for Sugar Industry by Shri Tuteja Committee

1. To ensure that the sugar factories in drought / flood affected States get adequate working capital to start their crushing operation in 2004-2005, a package of assistance for rescheduling their debts may be provided. Under this package sugar factories, which were operational in 2002-03 sugar season, may be covered.

2. All loans as on 31-03-2004 may be deferred / rescheduled to long term loans repayable in 10 to 12 years, beside a moratorium of both interest and principal for 3 years stating from 2004-05. Loans to be covered under this package are the deficit in stock value as on 31-03-03 (Rs. 1,500 crores), which was rescheduled into working capital term loan, deficit in stock value as on 30-09-04 (Rs. 1,000 crores) and other term loans (Rs. 4,000 crores). The exact terms of the package may be worked out by NABARD and RBI (in consultation with the state governments) on a case-to-case basis taking into consideration the debt service obligations and the capacity to repay of these sugar factories.

3. NABARD may provide (allow) pre-seasonal loans as per their existing norms to sugar factories in Maharashtra and Karnataka.

4. Government of drought/ flood affected states may be allowed additional open market borrowings to help sugar factories to meet the fixed costs and 75 % entitled wages (of 2004-05 and 2005-06 season and arrears of 2003-04 season) of mills which were operational in 2002-03 sugar season but may have to remain closed in 2004-05 and 2005-06 sugar seasons due to no-availability of sugarcane; The State government may offer this as loan to sugar factories at a rate of interest of 4 % per annum, the Central Govt. may provide interest subsidy to meet the difference between the coupon rate on the bonds raised through additional market borrowings and 4% as was done last year when State Governments were allowed the same facility for clearing cane price arrears.

5. A scheme similar to the one available for integrated textile units should be sanctioned for the sugar sector for reducing their debt service burden.

6. In the case of units set up keeping the incentives of 1993 and 1997 in view, the excise duty payable on levy sugar namely Rs. 38/quintal may be charged on 50 % of sugar sold

by these units under their free sale quota as against excise duty of Rs.71/quintal payable on free sale sugar.

7. All eligible cases for restructuring in the sugar industry may be taken under the Central Debt Relief [CDR] scheme. The present minimum principal exposure of Rs. 20 crores may be brought down to Rs. 10Crores.

8. Working capital to cooperative sugar factories may be made available through National Cooperative Development Corporation (NCDC) at a subsidized rate of interest. For this purpose, NCDC may arrange cheaper funds through External Commercial Borrowings (ECBs) and the Government of India may accord permission as well as provide guarantee in this regard.

9. A body like BIFR may be set up for rehabilitation of cooperative sugar mills and NCDC may be appointed as the Nodal agency for preparing rehabilitation packages for sick cooperative sugar mills.

10. The financial restructuring of cooperative sugar factories under rehabilitation package may generally comprise the following components:

- Conversion of full/part of outstanding State Government loans into equity.
- Infusion of additional equity by the State Government/members of the society.
- Reschedulement of outstanding loans of banks & financial institutions and waivers concessions in interest on outstanding loans of cooperative sugar mills.

11. NCDC while acting as a nodal agency may work out a suitable rehabilitation package involving the above steps and also, working out required amount of interest subsidy for revival of a sugar factory, in consultation with term lenders, banks and National Federation of Cooperative Sugar Factories.

12. In order to improve profitability of sugar industry through value addition to by product like bagasse and molasses, cooperatives sugar mills having potential for setting up of diversification projects may be encouraged. In this context, NCDC may also explore the possibility of arranging external commercial borrowings and Government of India may accord permission as well as guarantee in this regard.

13. VRS in the sugar sector may funded by commercial banks.

14. Necessary assistance may be provided from SDF for the following purposes:

- Installation of appropriate effluent treatment systems (to achieve zero discharge) including installation of heat exchangers for cooling and condensing, tertiary treatment of effluents and labs for monitoring effluent quality.
- Installation of bag filters/high efficiency wet scrubbers/electronic precipitator to meet standards of air emission

15. As sugar industry do not discharge any toxic or highly polluting wastes, it may be placed in ORANGE category.

CHAPTER - 4.5

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

CONSERVATION, CULTIVATION AND MARKETING OF MEDICINAL PLANTS

4.5.0 Introduction: The Challenge and the Potential

4.5.1 Medicinal and aromatic plants provide a window of opportunity to concurrently strengthen health, food, nutrition, and livelihood security of farm families and agro-ecological security of the environment. Their potential is especially immense in the Indian context where traditional systems of medicine have been used over the years to address human, animal and plant health. Globally also, the potential is being recognized and it is becoming increasingly apparent that *Health for All* can be assured only by strengthening traditional systems of medicine.

4.5.2 Business opportunities in recent years are expanding due to diversified usages of herbals in pharma, nutraceutical, cosmetic and agro-chemical industries. Whereas India's current turnover from the herbal industry is estimated to be around 50,000 million rupees (40,000 million rupees in the domestic market, 10,000 million rupees in exports) given the burgeoning global demand trends, this size can increase exponentially in the next 10-15 years. According to a World Bank study, the world market is poised to grow to US $ 5 trillion by 2050. That being the scenario, India as one of the biodiversity rich countries with a rich heritage of traditional medicine has the potential to be a leading player in the sector. This calls for major sprucing up first on the domestic front in the areas of cultivation, research, standardization and regulation to ensure safety, quality and efficacy, and pricing and marketing. A focused strategy has to be undertaken simultaneously to place our products in the international market.

4.5.3 The key challenges in this endeavor are doing research to establish the safety, quality and efficacy of the traditional health products and gearing up supplies via large-scale cultivation and appropriate post-harvest technologies. This again calls for immediate research into development of sources for quality planting materials and

standardization of agro-technologies and agro-economics. But if done in a proper manner, the medicinal plants sector can be a major area for generation of employment and income.

4.5.4.0 Background

4.5.4.1 India has one of the world's richest medicinal plant heritages. It has 10 bio-geographic zones and 25 biotic provinces. About 8000 species of plants are used in local health practices for human, veterinary and agriculture related applications. Around 1800 species are systemically documented in the codified Indian Systems of Medicine - *Ayurveda, Unani, Siddha, and Gso-rig-pa* which source their drugs from medicinal plants. Over 10,000 herbal drug formulations have been recorded in codified medical texts of *Ayurveda.* Thus, we are uniquely positioned to capture the new opportunities both locally and globally in providing increasingly sought-after holistic healthcare solutions for human, veterinary and agricultural purposes.

4.5.4.2 Of the indigenous systems of medicine, *Ayurveda*, the traditional system is based on Vedic scriptures and is practiced all over India. *Siddha* is extensively practiced in Tamil Nadu and adjacent States. *Unani*, also known as Greek / Arabic systems, is popular among the Muslims, particularly in the Deccan plateau. *Gso-rig-pa* or the Tibetan system of medicine is practiced in the trans-Himalayas and NE. More than 15 lakhs practitioners of both the codified and folk streams of the Indian Systems of Medicine and Homeopathy (ISM&H) use medicinal plants in preventive/promotive and curative applications. Already there are 4.6 lakh, registered practitioners of ISM&H and around 7843 registered pharmacies of Indian Systems of Medicine (ISM) and 857 of homeopathy. The World Health Organization (WHO) has estimated that about 80% of the population of developing countries relies on traditional medicines, mostly plant drugs for their primary healthcare needs. Moreover, about 25% drugs in modern medicine are also derived from plants. On account of the fact that crude derivatives of medicinal and aromatic plants are non-narcotic having little or no side effects, the demand for these plants is on the increase in both developing and developed countries. Examples of plants with effective derivatives are Aswagandha *(Withania somnifera)* widely used as an immuno-modulator; Sarpagandha (*Rauvolfia serpentina*) for reducing blood pressure; Sallai Guggal

(*Boswellia serrata*) for rheumatoid arthritis; Chitrak (*Plumbago zehlancia*) for improving digestion and Turmeric (*Cucuma longa*) for diabetics. There are estimated to be over 25,000 effective plant-based formulations available from indigenous medicine for a wide variety of health conditions, including for animal and plant health.

4.5.4.3 Several hundred genera are used in herbal remedies and in traditional or folklore medicines throughout the world. They are used in the form of crude drugs which are dried parts of the medicinal plants, roots, stem, wood, bark, leaves, flowers, fruit seeds and in some cases whole plants and their extracts. There is a much smaller number of plants used by allopathy from which individual active constituents are isolated and used as medicines, either alone or in combination. The structure of isolated molecules can also be used as precursors for synthesis the drugs.

4.5.5.0 Current Scenario

4.5.5.1 The growing needs of the pharmaceutical industry in the country have created problems of supply. One of the major difficulties being experienced by the industry is that of obtaining sufficient quantities of medicinal plants for the manufacture of genuine medicine.

4.5.5.2 In India, 90 percent of the collection is still from the wild. Only few medicinal plants are cultivated on a large scale. The information regarding the area under cultivation and States where cultivation is in progress is given in the table below:

Table: Area under cultivation of major medicinal plants in India

Sl. No.	Common name	Botanical name	Producing States	Estimated area (ha)
1.	Psyllium	*Plantago ovata*	Rajasthan and Gujarat	55,000
2.	Opium poppy	*Papaver somniferum*	Madhya Pradesh, Uttar Pradesh and Rajasthan	20,000
3.	Senna	*Cassia senna*	Tamil Nadu, Rajasthan and Uttar Pradesh	20,000
4.	Coleus	*Coleus forskohlii*	Tamil Nadu, Karnataka and Andhra Pradesh	450
5.	Cinchona	*Cinchona spp.*	Darjeeling (West Bengal) and Tamil Nadu	8,000
6.	Ashwagandha	*Withania somnifera*	Madhya Pradesh, Rajasthan and Uttar Pradesh	5,000
7.	Safed muesli	*Chlorophytum sp.*	Madhya Pradesh, Gujarat and Uttar Pradesh	5,000
8.	Periwinkle	*Catharanthus roseus*	Andhra Pradesh, Karnataka, Tamil Nadu and Maharastra	4,000
9.	**Khai katari**	*Solanum spp.*	Maharashtra	4,000
10.	***Sarpagandha***	*Rauvolfia serpentina*	Madhya Pradesh	2,500
11.	***Ipecac***	*Cephaelis ipecacuanha*	Darjeeling (West Bengal)	100

Source: *EXIM Bank Occasional Paper No.98 "Export Potential of Indian Medicinal Plants and Products" published by Quest Publications in 2003*

4.5.5.3 It was only during the Eighth five year plan period, that a programme for the development of medicinal plants was launched by the Department of Agriculture and Co-operation (DAC) with a focus to conserve the medicinal plants by the establishment of herbal gardens, production of planting material by the establishment of nursery at different locations, demonstration of the cultivation practices through the establishment of demonstration plots, provide the support for expansion of area and infusion of technologies through effective transfer. But farmers often face disappointment in absence of effective marketing system. The Department of Indian System of Medicines and Homeopathy (now AYUSH), also initiated the programme during the Eighth five-year plan to develop agro-technology of some selected medicinal plants. Some laboratories of CSIR have also contributed in identification of molecules of medicinal

plants. While there is an expansion in area under medicinal plants certain transit and other regulations of the forest departments discourage the cultivation of medicinal plants by the farmers. Even plants growing in the farmers' field require clearance certificate from the District Forest Officer for marketing.

4.5.5.4 The Planning Commission, Government of India had set up a Task Force on Conservation and Sustainable Use of Medicinal Plants in 1999. The Task Force studied the issues involved and submitted an exhaustive report in 2000 (hereinafter referred to as TF Report on MP). Setting up of the National Medicinal Plants Board was an outcome of the recommendations of this group. Most of the recommendations of the group however remain on paper. Their implementation in itself would give proper thrust to the development of the sector.

4.5.5.5 As per a study undertaken by the Foundation for Revitalization of Local Health Traditions (FRLHT), Bangalore at present, about 926 medicinal plant species are involved in All India trade; of these 760 species are largely collected from the wild. About 48 species are exported and 42 are imported. As per an EXIM Bank estimate, the international market of medicinal plants related trade is to the tune of US $ 60 billion per year having a growth rate of 7% per annum. The annual exports of Indian plants are valued at Rs.10,000 million. In terms of market share in production value, India holds only the sixth place with a mere 7 per cent share whereas China accounts for about 33 percent. 70 percent of the medicinal plant exports from the country is in the form of crude drugs and extracts and only 30 % is finished products.

4.5.5.6 The Basic Chemicals, Pharmaceuticals & Cosmetics Exports Promotion Council (CHMEXCIL) is responsible for the promotion of medicinal plant based products and APEDA is entrusted with the task of export promotion of medicinal plants. So far, setting up of agri-export zones for Aromatic and Medicinal Plants in Kerala and Uttaranchal, have been approved by the Government.

4.5.5.7 According to the TF report on MP, we also import some 15 medicinal plants, which can be made domestically available as well (e.g. Akkalkada - *Anacuclus pyrethrum*, Jestimadh - *Glycrrhiza glabra* (Pakistan, Iran, Afganistan), Dalchini - *Cinnamomum zeylanica* (China), Gajpimpli - *Scindapus officinalis*, and Kankol - *Piper cubeba* (Indonesia), Chopchini - *Smilax china*, Maiphal - *Quercus infectoria* and

Revchini - *Garania pictoria* are mostly met through imports). There are also imports of medicinal plants of foreign origin and medicines like ginseng.

4.5.5.8 No authentic recorded information is available about the volumes of trade of medicinal and aromatic plants within the country. The collectors (both permit holders and others) exploit the plants, through tribals, local people and forest dwellers. The collected material is passed on to the traders in towns and cities. Each of the major traders has one or more indigenous drug manufacturers and private pharmacies as their customers for purchasing the raw plant material from their contractors and other growers of medicinal and aromatic plants in different parts of the country. In the absence of any regulatory mechanism, the trade of these plants, particularly medicinal plants is very secretive. Prices for individual medicinal plants vary with demand, availability and quality. The quality characteristics are ill-defined; for some species they depend on the percentage of active ingredients, appearance, absence of foreign matter and other particular conditions that may be laid down in the relevant pharmacopoeia, formulary or in the purchaser's specific requirement. Moreover, the ingredients for the final product are contained mostly in certain part(s) of the plant e.g. leaves, root stem, flower, and fruit, and not the whole plant. But due to the ignorance of the collector coupled with the need to earn more, the whole plant is destroyed.

4.5.5.9 The traded materials include leaves, barks, fruits, seeds, roots rhizomes, gums, husks etc., the value of which range between Rs.10/- to Rs.145/- per kg. The major industrial buyers of dried raw herbal materials in the domestic market are around 50 companies which include leading companies like Zandu, Baidynath, Sami Labs, Himalaya, Natural Remedies, Dabur, Sandu, Charak, long-standing traditional manufacturers like Arya Vaidyashala, Kottakal, Kerala, Ayurvedic Pharmacy, Gururaja and a large number of small level manufacturers of *Ayurvedic* medicine and some leading herbal extracts exporters.

4.5.5.10 The WHO has introduced a series guidelines for collection, cultivation, production, certification, registration and marketing of medicinal plants, through five important practices viz., Good Agriculture Practice (GAP), Good Manufacturing Practices (GMP), Good Laboratory Practice (GLP), Good Clinical Practice (GCP), Good Selling Practice (GSP). The Indian medicinal plants-based industry is yet to take to this in

a concerted fashion. Under the ISM&H, most pharmacies are family owned companies and trade is largely unregulated.

4.5.6.0 SWOT Analysis

4.5.6.1 A SWOT analysis can help bring out clearly the areas needing attention. The TF report on Medicinal Plants, 2000, highlighted the following constraints facing the sector, which are still relevant:

i) Depletion of the resource-base, which is the foundation of the entire sector.

ii) Decline of folk traditional medicines, a source of primary health care for an estimated 800 million people in the country.

iii) Impoverishment of rural people, who are stewards of the resource base and the holders of traditional ecological and medical knowledge, through inequitable marketing channels.

iv) Medicinal plant trade is inefficient, imperfect, informal and opportunistic.

v) Crude drugs supply situation is shaky, unsustainable and exploitative; adulteration takes place.

vi) Deficient toxicology studies and standard preparations to improve the quality, efficacy and effectiveness of the traditional drugs.

vii) Unsustainable wild harvesting

viii) Lack of coordination amongst various stakeholders such as Govt. of India (Ministry of Agriculture, Environment & Forests, ISM&H, S&T etc), State Governments, private traditional medicine sector, research institutes, NGOs, international networks etc.

4.5.6.2 Going by the SWOT matrix, a sectoral analysis of the Medicinal Plants sector is attempted below.

4.5.6.3.0 Strengths

4.5.6.3.1 India has vast agro-climatic zones, is biodiversity rich, and has a long history of traditional medicine practice. Given the agro-climatic suitability and variability, biodiversity richness and treasure of traditional knowledge and historical use pattern of Medicinal and Aromatic Plants (MAPs) in India, the prospects for intensifying and diversifying the country's herbal industry are unmatched.

4.5.6.3.2 Traditionally, medicinal plants constitute the principal healthcare resource for the majority of our population. Herbal-based and traditional medicines have also been major components of the animal healthcare system in the country also. India being home to every fourth farmer as well as to every fourth livestock in the world, the importance of the country's industry in veterinary and livestock disease management can hardly be overemphasized.

4.5.6.4.0 Weaknesses

The weaknesses are in the areas of quality standardization, cultivation, market and research.

4.5.6.4.1 Quality

i) The greater part of the collection is from the wild. The collected material are sold to traders of medicinal and aromatic plants, who using their limited knowledge sort out the saleable ingredients in a crude manner thus resulting in contamination with other material leading to poor quality standards.

ii) As bulk of the harvest (wild and cultivated) is marketed as raw product several of the active principles and ingredients are lost rather fast; poor post-harvest management, processing and marketing and lack of marketing chains severely affect quality, safety and efficacy of the products.

iii) Many of the plants are sensitive to climatic conditions and require specific temperature, humidity etc., while being stored and / or transported. Hitherto, this aspect remained neglected both by the growers and collectors. Since the international market is highly conscious about the quality aspects of the production, our success in the export market has been insignificant.

4.5.6.4.2 Cultivation

i) The major constraints being experienced by the cultivators of medicinal plants are non-availability of quality planting material of improved varieties, lack of development and extension support in the cultivation and processing, and unorganized marketing.

ii) The cost of production is usually high for the cultivated crops as compared to those collected from the wild as a result of which the cultivation of the crops has not been an attractive proposition for the farmers.

4.5.6.4.3 Marketing

i) Some of the other key factors hindering cultivation of medicinal plants are lack of, information on market prices and dependable market support, Good Agricultural Practices, proper support from banks and financial institutions, price parity with wild produce, access to good storage facilities and appropriate post harvest technology. No systematic distribution and marketing network exists, and the growers have to depend on the middlemen who generally deprive them of their legitimate share of revenue.

ii) India is today even importing some plants needed by the industry to meet internal demand. 70% of the exports are in the form of crude drugs.

4.5.6.4.4 Research

i) Despite the long and historical tradition and high dependence on herbs for health security, the research and technology development efforts in the sector have remained meager.

ii) One of the major difficulties of medicinal plants cultivation on a large scale is the lack of scientific and appropriate agro-technology and agro-economics for different climatic zones of the country. Although several organizations viz., Indian Council of Agricultural Research (ICAR); CSIR Laboratories, various Indian Universities, etc., and Research Councils of indigenous systems of medicine, Department of Indian System of Medicine (ISM – Ayush), Government of India, have taken up the work of development of appropriate agro-techniques, and development of high yielding varieties of medicinal plants, more effort and multi-centric on-farm trials are needed keeping in view the demands of trade and industry.

4.5.6.4.5 Opportunities

i) The revival and renewal of global interest in traditional medicine offers a great opportunity for growth of the sector. World demand for herbal products has been growing steadily at 10-15% per annum.

ii) There are great opportunities for strengthening and synergizing the herbal-based human and livestock healthcare systems in the country. Therefore, the need for the amalgamation of currently scattered ethno pharmacological information through a

systematic validation of efficacy, doses, administration and safety component coupled with availability issue of the traditional herbs can no longer be ignored or delayed.

iii) It is extremely relevant to not only conserve the rich herbal biodiversity but also to cultivate it for utilization by the industries to meet the domestic and export demands in a sustainable manner and also to maintain desired quality standards. Sustainable production and continuous value addition will ensure effective conservation of the target populations and species. Shift from collection and conservation mode to conservation and cultivation for utilization will ensure purity, authenticity and availability of MAPs for pharma and aroma industries including poly-herbals for nutraceuticals.

iv) We can set a national target to turn into a major exporter of finished products instead of raw drugs, to emerge as a global competitor in this sector.

v) Cultivation has to be initiated for import substitution of the produce being imported currently.

vi) The national system, encompassing the public, private, industry, practitioners of traditional healthcare systems, NGOs, CSOs, tribals and other communities and farmers, can be organized and strengthened to judiciously harness the resources towards interactively enhanced and sustained health, nutritional, income and employment security. The National and State Medicinal Plant Boards can play a pivotal role in bringing together the various stakeholders.

4.5.6.4.6 Threats

i) Infrastructure in the Indian systems of medicine is below optimal in all areas - education, R&D, standardization and quality control. There is growing pressure for communicable benchmarking of products and processes.

ii) At present about 90 per cent collection of medicinal plants is from the wild and since about 70 per cent of the plant collections involve destructive harvesting, many species are endangered/ threatened. Some are in the Red Data Book and threatened with extinction. No measures are taken to replenish the natural resource base through fresh planting. Such collections constitute poor quality raw materials as these contain veritable adulterants. This trend must be halted especially in case of those species where the extraction from the wild has been highly destructive as in the case of *Swertia, Picrorrhiza, Podophyllum,*

Aconitum, Commiphora, Terminalia, Coscinium, Santalum, Valeriana, Rauvolfia, Jatamansi.

iii) As the price paid to the gatherers tends to be very low they often mine the plants with a view to earn more income. As a result several plant species have become endangered.

iv) China's business approach to development of the sector has seen it corner a large share of the export market. They have a good regulatory system in place in line with international requirements with regard to GAP, GMP, GLP, GCP and GSP. The work they have done to place ginseng for instance in the world market is commendable. Besides meeting its domestic requirements, China is earning US $ 5 billion from world trade.

v) WTO, patents, biopiracy, IPR issues related to traditional knowledge in the face of lack of organized database of traditional knowledge, threatening resource base and changing regulatory environment of the importing country are major threat factors.

vi) In recent times, there have been reports in the news of reservations abroad about the efficacy of herbal medicines and their being a potential health hazard due to high concentration of heavy metals. The bio-efficacy of ISM has to be urgently established and proper labeling and certification done.

vii) India has to spruce up fast, if it does not wish to be left behind. If critical investments are not made into research India will miss the bus. Critical investments for establishing standards of safety, quality and efficacy are essential, as they will dramatically increase the consumer acceptance of traditional herbals both in India and globally.

4.5.7.0 Recommendations

4.5.7.1 Given the current scenario, the recommendations of the TF report on MP can be reiterated to begin with as strategies for kick starting the sector. Extracts from the recommendations are reproduced below:

The policy for sustainable development of medicinal plants resources should aim at -

a. *In-situ* conservation of medicinal plants in protected areas, herbal gardens, sacred groves, preservation plots and forest areas rich in medicinal plants.
b. *Ex-situ* conservation through cultivation, Joint Forest Management, gene banks etc.
c. **Developing medicinal plant conservation areas (MPCAs) inside as well as outside protected areas.**
d. Research and development efforts for developing agro-techniques, extension & dissemination of information on cultivation of super genotypes.
e. Establishing linkages between farmers and pharmaceutical industries for promotion of organic and contract farming.
f. Formalising and organising marketing by providing information and possible interventions at various levels.
g. As prices paid to the gatherers tend to be very low, they often 'mine' the natural resources, as their main objective is to generate an income. Formalisation of market may resolve the problems of exploitation and impoverishment of gatherers.
h. Policies regulating safety and efficacy need to be evolved based on recognition of the uniqueness of tribal and folk medicines, and this should be linked to intellectual property rights to ensure that community benefit from the use made of their technology.
i. A regulatory system is urgently needed to restrain indiscriminate and illegal wild harvests:
    - Setting up of *in-situ* forest gene banks;
    - Critically endangered species should not be harvested.
    - A list of species and habitats from which collection is permissible should be scientifically prepared by every State Forest Department and over harvesting

should not done; there should be switchover to plants which are not in the red list.

- Harvesting should be done at the right stage in scientific and non-destructive manner.
- Good Trade Practices should be followed in the collection – fair price paid to primary collectors and fair cess paid to the State Forest Department.
- Recommended post-harvest procedures should be followed.

4.5.7.2 From the farmers' perspective, technical advice on package of practices for cultivation, availability of quality seeds, certification and labeling, promotion of contract cultivation, harmonization of collection and cultivation to ensure competitive price are immediate needs for promotion of medicinal plant cultivation as a viable livelihood option. All initiatives should focus on the goal of establishing safety, quality and efficacy standards for medicinal plants products.

4.5.7.3 Some of the steps needed in this direction are: designating competent certification agencies; encouraging cooperative farming of medicinal plants; R&D on the top 10 export priority species with respect to quality, efficacy and safety; addressing emerging issues on patenting and IPR for traditional knowledge.

4.5.7.4 Immediate measures are needed in the areas of **Policy, R&D Input supply, Market and Pricing Support** as discussed below. A Mission mode approach is warranted. **A National Mission on Medicinal and Aromatic Plants** maybe organised, to ensure that the sector receives the integrated attention it deserves. The recently approved National Horticulture Mission (NHM) includes MAPs, but given the already large number of fruit, vegetable and flower species to be addressed under the NHM, the MAPs may not receive the special support, attention and leadership it urgently needs. The Mission should converge and synergise policies on agriculture, forestry, environment, health and pharmaceuticals and commerce covering the components impacting the growth and development of MAP industry. Pending the preparation of a full-fledged Mission, a **distinct Mini-Mission** may be organized for MAPs under the ongoing NHM. A dynamic leader in the area of medicinal plants and herbal medicine may be appointed as the coordinator of the Mini Mission for MAPs.

4.5.8.0 Policy Action

4.5.8.1 There is need for Policy support for science-based judicious conservation, utilization and commercialization of medicinal plants to promote heath, food, nutrition, employment and income security of the people. In this context, the following policy elements are essential:

i) The National Mini Mission should on priority basis address the issues of R&D (quality, safety and efficacy), *in-situ* conservation, sustainable wild harvest, cultivation, pricing and price parity, marketing, trade, income of the growers, partnerships, institutional supports, networking, availability of quality materials, training, information system and awareness.

ii) **The Mission should have a Policy Guidance Committee (PGC), an apex level body comprising the Ministers of Agriculture, Health, Environment & Forests, Commerce, and Science & Technology, to give direction.** The PGC could guide the restructuring of the National Medicinal Plants Board (NMPB) on the lines of NDDB, to enable it to perform effectively and work for the objectives and targets of the Mission. The functioning of the Board in a competitive and professional manner will in itself help resolve many of the issues facing the sector.

iii) The NMPB's website should include details of medicinal plants programmes of all Government Departments and Ministries, e.g. DBT, DST, CSIR, ICAR, MoRD, MoEF and AYUSH, in order to avoid duplication of efforts. It should be one-stop window for all information on the sector, sourcing from all the various departments and ministries.

iv) The Mission via NMPB should support

- creation of network of certification agencies using internationally accepted standards for both cultivated and wild produce;
- support forestry sector to set up State level Seed Centres for collection and certification of planting material from forests
- wholesale supply of quality seeds of high priority species;
- initiate mega projects under PPP for high priority tree species.
- emulate DBT models for PPP on R&D projects for herbal products.

v) Promotion of Public-Private Partnerships (PPP): There should be clear cut policies on agro-forestry and reforestation involving tree medicinal plants, tree and non-timber product harvest from forests, land reforms to enable replanting of degraded and wasted lands under PPP mode. The National Mission should through PPP with an ethical private sector company, strive to launch one global herbal product of the outreach like the Chinese *ginseng* every five years, with backward linkages for generation of rural employment.

vi) Promotion of Contract farming: Appropriate codes of conduct should be in place and confidence building among stakeholders

vii) Mandate different Commodity Boards to promote intercropping with plantation crops like coffee, rubber, spices and coconut

viii) The Mission should address the issues of quality and standardization, regulatory controls, code of conduct for collectors/gatherers from the wild in accordance with the CBD and Gene Treaty provisions.

ix) The Mission via NMPB should advocate institutional support through credit not only for production but also seed grants for value addition, market development, promotion of grassroot organizations, SHGs, cooperatives, insurance coverage and price support system for medicinal plants and establishment of community herbal gardens. It should support promotion of ecosystem specific home and **community herbal gardens** to enhance household human and livestock health security.

x) The Mission should encourage NABARD to examine providing Seed Fund to NGOs & CBOs to support viable community-owned enterprise for collection, cultivation, processing of MPs for income-employment benefits to rural poor. NABARD and EXIM Bank should therefore have a package of grant and credit programmes for MPs, and not just crop support programmes

xi) The Mission should support enhanced investment in MAP research, technology development and industry growth to effectively integrate the phyto-industry with national health, nutrition and rural employment.

xii) The TF report on MP had recommended that the Forest Department establish 200 "*Vanaspati Van*" in open forest areas (each having an area of about 5000 hectare) for commercial supply of crude drugs to pharmacies and for exports. The "Vanaspati Van"

should be managed by a registered society headed by Divisional Forest Officer under JFM system.

xiii) **IPR and TK:** Policies regulating safety and efficacy need to be evolved based on recognition of the uniqueness of tribal and folk medicines, and this should be linked to IPR to ensure that community benefit from the use made of their technology. A library database can be prepared and maintained under the **National Innovations Foundation** (NIF). The library can be used as proof of prior art by the examiners of Patent offices, nationally and internationally.

xiv) Crude drugs of standard quality need to be identified and preserved as the reference standard. The TF Report on MP had therefore recommended establishment of a **National Repository of Crude Drugs of ISM&H** with an excellent herbarium having authentic reference samples. This center should have the crude drug samples (processed medicinal plants), herbarium specimen, chemical finger print profiles, anatomical slides, supporting literature and a collection of living plants. It should provide easy access to wide range of groups including traders, medical practitioners, plant chemists, TM students, academics, regulators as well as the pharmaceutical industry. User services will also have to be made available. This repository should then become the **official certification centre** for raw materials. The drug industry can get the raw materials certified from the centre.

xv) To ensure quality, there should be Statutory State Drug Testing Laboratories. It is necessary to designate **safety evaluation centres** with Good Laboratory Practices (GLP) norms. This will facilitate the acceptance of the drugs at a global level.

4.5.9.0 Research, Technology Development and Extension

4.5.9.1 Research on standardisation of quality, safety and efficacy for the best traditional products is sub-critical. Very little value has been built on the indigenous and traditional knowledge. The All India Coordinated Research Project of ICAR should be revamped and networks forged with other related research institutions – CSIR, CIMAP, CDRI, industries, NGOs and CBOs and ICMR, AYUSH, MoRD, DST & DBT. The network will not only partly offset the problems linked with low investment in the sector, but would also open the gates for wider domestic and global acceptance of traditional knowledge products.

4.5.9.2 Recent studies have shown that in addition to the genetic variation of different populations of a given species and from one part to the other part of the same plant, the GxE effect is generally very high. Using new tools and technologies, the R&D system must fill this knowledge gap so that the future developments could be knowledge-based.

4.5.9.3 Research on all aspects of MAPs with special reference to improving their productivity, medicinal qualities, availability of quality planting materials, storages, cold chains, processing, value addition and adaptability to grow under *ex situ* conditions should be undertaken. Multi-location testing of promising materials, both local and introduced, should precede recommendations for production in identified agro-geographic locations.

4.5.9.4 ICAR Research Institutions and Agriculture Universities should undertake to evaluate germplasm, identify sub species, and develop varieties. TK leads should be harnessed to help identify research priorities.

4.5.9.5 The TF report on MP had recommended the following, which continues to be of importance –

a. Development of agro-technological packages under different ecological conditions and information on intercropping, rotation cropping and use of bio-fertilisers, organic farming etc.
b. Human Resource Development of farmers by organising training and awareness programme on various aspects of medicinal plants sector development including seminars and conferences.

4.5.10.0 Quality Planting Material

4.5.10.1 One of the major constraints faced by the cultivators of medicinal plants is the non-availability of quality planting material. Given that a large part of the collection is currently from the wild, there is need for synergistic inter-sectoral program between the forestry and agricultural sectors wherein germplasm is supplied by the forestry sector and selection, breeding and agro-trials is done by the agricultural sector, for promotion of cultivation.

4.5.10.2 **Planting Material Supply Network (PMSN)** in the form of Herbal Bio-villages must be set up so that small scale farmers can generate material for large scale farmers.

Plant Tissue culture units of R&D institutes should provide certified nucleus stock to small farmers.

4.5.10.3 Village level **Medicinal Plant Nurseries** and **Seed Production Centres** of commercially viable plant species managed by trained women SHGs and agricultural/botany graduates can develop as suppliers of quality planting material. They should have back-up support from the R&D institutions and forward linkage with concerned Institutions and Farmers' forums. The National Medicinal Plant Board through their State wings can coordinate this programme and buy back and distribute to farmers through appropriate delivery points. **Seed Banks** may be established for plants that are in demand for commercial use.

4.5.10.4 Tissue Culture for large-scale production of medicinal plant seedlings and introduction of such facilities at village/community level in the areas potential for medicinal plant cultivation managed by trained educated housewives or unemployed botany/agriculture graduates and attached to some reputed local organizations (private/NGO or Govt.) can play an important role.

4.5.10.5 For protection of different endangered medicinal plant species, encouragement should be given to Government and semi-government tissue culture laboratories for multiplication of endangered species so that planting material can be supplied on large scale.

4.5.10.6 Large-scale availability of high quality planting material can be promoted by developing a protocol for bulk production of super genotypes and seedlings through a network of nursery of medicinal plants.

4.5.10.7 Collection and sale of forest tree seeds by the Forest departments is also a source for planting material.

4.5.10.8 State Agricultural Universities maybe assisted to establish quality control laboratories so as to fix quality parameters for various plant species and their varieties.

4.5.11.0 Marketing

4.5.11.1 Assurance of market is the major factor for giving impetus to cultivation. Closely linked is the development of related infrastructure, need for network of godowns for storage and on-site post harvest facilities. Market research should be strengthened and

geared to identify the most appropriate species, real time information on supply and demand and trade balance, pricing and price levels and parity, and diversification prospect.

4.5.11.2 Market Infrastructure:

i) NABARD and/or Ministry for Rural Development should support the establishment of a network of decentralized scientifically designed storage godowns in rural areas – that could store harvested produce. NGOs & CBOs should also be encouraged to manage these godowns. Primary value addition at the collectors and farmers level should also be studied and adequate infrastructure support like quality testing lab, drying yards, raw drug processing unit, packing unit be set up in identified districts.

ii) Post harvest technology for the plants, their grading, packaging and method of storage need to be developed. Small cost effective processing units to serve the need of a cluster of villages will be a good idea. Primary processing at village level will reduce problem of storage and the risk involved.

iii) Being matters of health and nutrition concern, GAP, GMP, HCCAP and other such measures should be routinely adopted in the production–processing–consumption chain. This calls for intensive training and educational efforts to create quality, standards and trade literacy and awareness at all levels and among all stakeholders.

iv) Research organizations must devise rapid methods for analysis of quality attributes of the raw and finished products for pricing, adulteration control and IPR protection. The quality measures should be harmonized with international standards and guidelines especially to capture new opportunities in the globalised economy and to ward off non-tariff barriers to trade.

4.5.11.3 Demand Forecasting:

i) An efficient agency, say a research institute should be identified to establish a long-term MIS that could be supported by MoRD and the NMPB. Through Market intelligence, the industry must define the quantity of plants required for at least 3-4 years so that farmers can be informed accordingly and necessary facilities could be extended to the farmers to realize the production target. Marketing chains should be studied and restructured with a view to increase profitability to growers.

ii) Industry must spell out the quality of produce that would be acceptable to them at a fixed price for a fixed period. R&D organizations should be in a position to generate the desired material if not available and make the input available for cultivation. Appropriate packages of incentives and subsidy for cultivation and product development must be devised on case-to-case basis in area specific mode and on the criteria of marketing.

iii) Detailed studies should be undertaken on plants that have the highest global demand and a systematic approach devised to export them. The TF report on MP had recommended focused strategies to popularise twelve major Indian Plants For Various Ailments in the World Market and listed the plants –

1. Ashwagandha (*Withania somnifera*) for Geriatrics problem.
2. Bala (*Sida Cordfolia*) for neurological disorders.
3. Brahmi (*Bacopa monnieri*) for memory disorders.
4. Geloy-Gaduchi (*Tinospora cordifolia*) As immuno-modular
5. Chiraita (*Swertia Chirata*) for liver disorder
6. Kutki (*Picrorrhiza kurroa*) for liver disorder
7. Gudmar (*Gymnema sylvestre*) for diabetes
8. Ashoka (*Saraca asoca*) Uterine Tonic
9. Satavari (*Asparagus racemosus*) Anti-Ulcer, Aprodisiacs
10. Amala (Amalaki) (*Emblica officinalis)* for Rasayana, Geriatics
11. Arjuna (*Terminalia arjuna*) for Cardiac disorders
12. Gugglu (*Commiphora wightii*) for cholesterol related disorders, Arthritis

iii) There is a need to conduct extensive R & D on these plants not only to improve their varieties, enhance availability but also to establish their efficacy in various clinical conditions mentioned above. While undertaking this research there has to be active interface with the industry so that there is proper demand assessment and the research leads to patents being obtained and new drugs being marketed for public benefit and for exports. A well-formulated strategy has to be worked out for placing the product in the world market. Indian Missions abroad should be equipped to play a positive role in dissemination of information on Medicinal Plant-based products.

4.5.11.4 *Contract farming*, a new opportunity elaborated in the new APMC Act, is ideally suited for promoting the cultivation of medicinal plants and crops. Appropriate codes of

conduct on contract farming suited to the needs and aspirations of the various stakeholders, especially the small and marginal farmers, should be formulated and judiciously implemented. The extant success as well as unsuccessful experiences of contract farming in this sector should be critically analysed and necessary institutional and service supports should be provided to rapidly multiply the successful experiences. Promotion of cooperative farming and **Small Medicinal Plant Farmers' Estates** may also be explored. More Farmers' groups like *Gram Mooligai, Jeevani, Sanjeevani*, should be organized to take up MP cultivation in a focused manner. Lease of common property land for the purpose may be explored.

4.5.11.5 In order to give the power of economies of scale to small farmers, **Medicinal Plants Growers' Association** each covering about 100 ha could be formed on the model of SHGs. Capacity building in the areas of cultivation and marketing will have to be organised. Such growers' association can enter into MoU with companies to outsource raw materials for drugs. Herbal estates could also be promoted for bringing about an end-to-end approach in relation to medicinal plants and herbal medicine. Currently such community-based enterprises constitute even less than 0.01 percent of the medicinal plant production and trade. This should be raised to the tune of at least 5 to 10 percent during the next 4 to 5 years. MoRD should promote direct financing of innovative NGOs & CBOs through its employment programs for this purpose.

4.5.12.0 Pricing

4.5.12.1 There is no organized pricing policy for MAP products, raw or processed. There is often a huge disparity in the prices of wild harvests and cultivated harvests, the former being much cheaper. This price disparity is the main deterrent to the domestication and cultivation of medicinal plants. A transparent and adequately researched and scientifically assessed pricing policy and system should be in place in the Forestry and Agricultural sectors to bring price parity for all harvests. Uttaranchal has initiated this approach and its outcome should be closely monitored both by the State and National Medicinal Plant Boards and, if found encouraging, the approach should be adopted/adapted in other States.

4.5.12.2 The above move will help also in minimizing, if not completely eliminating, the unsustainable indiscriminate wild collections, as also in promoting sustained production through organized cultivation. The industry would thus need to be more quality conscious and nature-friendly.

4.5.12.3 The Commission on Agricultural Costs and Prices (CACP) of the Ministry of Agriculture, in close consultation with the Ministry of Environment and Forests, and Department of Ayush of the Ministry of Health, particularly the NMPB, and Ministry of Commerce, should address the problem of pricing. A special Working Group, involving the various stakeholders - the growers, the foresters, the gatherers, the traders, the industry and the practitioners, should be constituted to critically examine issues and to suggest guidelines for price fixation and to declare prices of medicinal plant produce.

4.5.13.0 Agro-ecologically and Socio-economically Differentiated Approach

i) Striking a balance between Conservation – Collection – Cultivation -

Production, collection and marketing of Medicinal Plants/Crops have so far generally been on ad-hoc basis. Flash success stories such as those on vanilla and *Safed Muesli,* (*Chloraphytum borivilianum*) have enthused several medium to large-scale farmers and corporate houses to diversify towards Medicinal and Aromatic Crops (MACs), often ignoring agro-ecological suitability. This "quick fix" approach, with little understanding and appraisal of medium to long-term marketing and pricing trends, has often been short-lived and shaky. The supplies soon outpaced demand and the resultant price crashes and market failures adversely affected the farmers.

ii) The NMPB has previously identified 32 priority species. These needs to be reprioritized and differentiated, based on a set of criteria and indicators as listed below and State-wise lists prepared:

(i) domestic and export demand
(ii) ecological sustainability
(iii) social acceptability
(iv) financial viability
(v) agro-technological feasibility

(vi) availability of quality planting materials

(vii) market chain product storage and distribution, and

(viii) regulatory support.

iii) Using the above criteria and other new and emerging indicators, the prioritization process should be kept in a dynamic mode. Special attention should be given to matching the soil, water, biodiversity and cultural attributes with the sustained and enhanced production of the intended and potential species particularly to facilitate creation of effective export zones to ensure judicious supply-demand management. The State Medicinal Plant Boards should provide packets of ready cultivation procedures and marketing aspects to farmers. The priority lists should be reviewed periodically, say once in three years.

iv) For a smooth and gradual transition from wild harvest to cultivated production of the MAPs, the following aspects must be addressed:

- Threat status of various species should be re-assessed so that time bound cultivation strategies of different groups can be drawn. A tentative classification may have categories like critically endangered perennials, endangered but highly regenerative, vulnerable but collected by destructive means, under threat due to high level of consumption etc.
- Special attention should be paid to endangered, vulnerable and threatened species for their conservation and cultivation, and on case to case basis impose restriction or even ban harvesting of endangered species from their natural habitats
- While part of the requirement may be met by sustainable harvesting from the wild by tribal and forest communities / dwellers, bulk of the requirement should be met through planned and suitably organized cultivation by area-specific local farmers. Further, for species in larger demand, the supply should be entirely based on cultivation
- Areas rich in medicinal plants can be developed into **Herbal Sanctuaries,** so that this unique biological wealth can be safeguarded and conserved for posterity. The TF report on MP had recommended the establishment of 200 Medicinal Plant Conservation Areas (MPCA) covering all ecosystems, forest

types and sub-types in the country, (inside protected areas *viz.* national park, wild life sanctuary, biosphere reserves, preservation plots etc.) for *in-situ* conservation of important species.

- Species not amenable to commercial farming need to be conserved in their natural ecosystem for regulated utilization. A mission mode approach needs to be adopted for developing this area. The rare medicinal plants should be conserved in well-established gardens. Medicinal plant conservation areas need to be identified across the country, in different climatic and agro-ecological regions
- Over-harvested endangered perennial MAP species and tree medicinal plants in high demand should be planted in public-private partnership framework as agro forestry systems on priority basis. Degraded forestlands and wastelands should be planted with such tree species, which will not only provide a sort of "forest" cover but would also become important source of income and employment.

v) State Agricultural Universities, Department of Agriculture and nurseries of the Department of Horticulture should undertake the programme of collection and conservation of different species of medicinal plants prevalent in a region and their multiplication on a large scale. KVKs and NGOs working in the area can assist in the process. Many of the medicinal trees will need 8-10 years for gestation and readiness for economic growth. Farmers need to undertake a cropping system, which will be suitable to give them economic return from the first year onwards. Therefore intercropping with species of shrubs and trees as a package should be developed through State Agricultural Universities.

vi) An end-to-end approach, linking the producer, processor, industry and the consumer, with effective backward-forward linkages, involving the partnership of farmers, research and extension services, credit and input support, processing and market is a success story of a mega project on *guggal* in the arid zones of Rajasthan. The public-private partnership (PPP) is functioning in a model form with a win-win situation for all partners. Based on supply-demand analysis and agro-ecological compatibility, the *guggal* experience should be multiplied not only for *guggal* alone but also for other MACs. In

order to capture scale of economies, small farmers estates (SFE) and MAP self help groups, especially women SHGs, for the various domains should be created and supported through formal credit, training and group marketing. Such an approach will also be helpful in adoption of the quality, safety and efficacy standards.

vii) **Herbal Biovalleys** may be developed on the model of the Silicon Valley for computer software, for providing the infrastructure needed for the conservation and sustainable use of medicinal plants. The Herbal Biovalley will provide the biological software essential for a dynamic medicinal plant industry. The infrastructure for seed multiplication including tissue culture facilities, establishment of nurseries of elite material, validation, certification and producer-oriented marketing and other centralised facilities to facilitate efficient decentralized production, will have to be provided. A Project Design Team may be immediately constituted with members drawn from the NMPB, NBDB, NABARD and APEDA, to prepare a Business Plan for the world's first Herbal Biovalley in Kerala as recommended by the Kerala Commission on WTO Concerns in Agriculture, and at other suitable locations in Western and Eastern Ghats and western, central, eastern Himalayas and in the NE region.

4.5.14.0 Organic Farming of MAPs

The demand for organic food and other products has been growing rapidly. Organically grown MAPs are seen as "doubly green" products and have tremendous global demand and appeal. Hill States like Uttaranchal have declared themselves as Organic States and organic pockets are being set aside in other States, where MAP species, most suited to the settings, constitute the preferred crops. However, the organic movement is yet to be streamlined in terms of selection and use or detoxification of sites, standardization and application of production protocols, certification of the process and the product, pricing and marketing. The various stakeholders, led by NMPB, must develop a detailed road map and monitoring mechanism for organic MAPs industry addressing production, certification, pricing and marketing issues.

4.5.15.0 Information Portal on Medicinal and Aromatic Plants

4.5.15.1 Database and information on various aspects of MAPs are highly inadequate. The NBMP was supposed to have established the information portal, but the work is far from satisfactory. The information system must be strengthened and a competent agency (University or research institute) must undertake comprehensive survey to have full real time information on demand and supply and species and domain-wise production, pricing and marketing. Databases on GAP (good agricultural practices) and GMP (good manufacturing practices), indigenous and traditional knowledge of various medicinal, nutraceutical, aromatic, cosmetic and agri-chemical products should be created. The library database on TK on medicinal plants should be linked to the portal.

4.5.15.2 Details of medicinal plant programs of all Government departments and ministries should be given. There should be a national database on the medicinal plants of India with State-wise checklists and reliable information on botanical identities, distribution, threat status and agricultural information

4.5.15.3 The reorganized and strengthened NMPB and its corresponding State level Boards, in close collaboration with the National Bureau for Plant Genetic Resources (NBPGR), should prepare detailed biodiversity registers, especially identifying indigenous and traditional uses of the germplasm. The need of the hour is to document the indigenous knowledge related to Indian herbs and plants and their medicinal and other uses and convert it into easily navigable computerized databases for easy access.

4.5.15.4 An inventory of raw materials used by the industry needs to be built up. The state government should make the listing of raw materials (medicinal plants) consumed by each manufacturer within its domain mandatory. This will help in determining those medicinal plants that are in high demand and also establish a case for cultivation of those plants that are the verge of extinction. This information can then be integrated at the national level.

4.5.15.5 With the thrust on creating village knowledge centers across the country, SHGs of medicinal plants may be formed in biodiversity rich areas, and rural youth trained in information and data management system. Necessary hardware and connectivity should be provided by the public sector in the early stages, which in due course of time should be supplemented by the private sector and financial and banking institutions.

4.5.16.0 Financial requirement

The TF Report on MP had in 2000, recommended an allocation of Rs.1000crore for development the sector. It is recommended that an equivalent amount be made available to the proposed National Mission on MAPs in order to enable it to launch a dynamic programme in the areas of conservation, cultivation, scientific validation, and marketing under distinct brand names. To quote the TF report on MP: "a comprehensive package of assistance and incentives is needed to promote medicinal plant sector as a thrust industry, on the lines of gems, jewellery and info-tech".

4.5.17.0 Acknowledgements

A two-day consultation on Sustainable Management of Medicinal Plant Resources with the different stakeholders – medicinal plant cultivators, research institutes, government officials, industry, bankers and NGOs, was organised in Bangalore in collaboration with the Foundation for Revitalization of Local Health Traditions (FRLHT) and the University of Agricultural Sciences, Bangalore, to deliberate on the core issues facing the sector and the steps needed to address them. Special thanks are due to FRLHT for giving their comments on the paper.

CHAPTER - 4.6

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

ORGANIC FARMING

4.6.1 There is a growing interest in organic farming practices in several parts of India, partly due to an expectation of higher prices for organically produced farm commodities. Some states like Uttaranchal would like to be known as an **"Organic Farming State"**. The National Academy of Agricultural Sciences (NAAS) has issued a Policy Paper on Organic Farming, which concludes that while synthetic pesticides can be avoided, complete exclusion of fertilizers may not be advisable under all situations. NAAS recommends that "a holistic approach involving Integrated Nutrient Management (INM), Integrated Pest Management (IPM), enhanced input use efficiency and adoption of region – specific promising cropping systems would be the best organic farming strategy for India." To begin with, the practice of organic farming should be for low volume, high value crops like spices, medicinal plants, fruits and vegetables. NAAS has also emphasized the need for intensive research on soil fertility and plant health management and on issues relating to microbial contamination of food arising from the use of farm yard manures. (Organic Farming: Approaches and Possibilities in the context of Indian Agriculture, Policy Paper 30, NAAS, February 2005).

4.6.2 The Tenth Five Year Plan provides for the establishment of a National Institute of Organic Farming and Certification. Internationally acceptable certification standards and institutional structures are urgently needed. The International Federation of Organic Agriculture Movement (IFOAM) is the leading international organization which sets the guiding principles for organic farming. **IFOAM has defined organic agriculture as follows:**

"Organic Agriculture includes all agricultural systems that promote environmentally, socially and economically sound production of food and fibers. Recycling nutrients and strengthening natural processes help to maintain soil fertility ad

ensure sustained production. Pests and diseases are controlled with naturally occurring means and substances according to both traditional as well as modern scientific knowledge. Organic agriculture excludes synthetic fertilizers and pesticides, and genetically modified organisms".

4.6.3 In order to develop a well-defined strategy for helping farm families take to organic farming, particularly in medicinal and horticultural plants, NCF organized a consultation with IFOAM in March 2005, at the M S Swaminathan Research Foundation, Chennai. Dr Bernward Geier, Dr Beatrix Tappeser and other leading foreign and Indian experts participated in the consultation.

4.6.4 The main principles of organic farming are the following:

To work as much as possible within a closed system, and draw upon local resources

i. To maintain the long-term fertility of soils
ii. To avoid all forms of pollution that may result from agricultural techniques
iii. To produce foodstuffs of high nutritional quality and sufficient quantity
iv. To reduce the use of fossil energy in agricultural practice to a minimum
v. To give livestock conditions of life that conform to their physiological needs and to humanitarian principles
vi. To make it possible for agricultural producers to earn a living through their work and develop their potentialities as human beings

4.6.5 The basic focus of organic farming should be first, to produce farm products for the home market; and second for the export market when there are prospects for obtaining a premium price. The global market for organic food is estimated at US$ 30 billion of which India has currently less than 0.1% market share. It will be useful to prepare **Organic Farming Took Kits,** based on IFOAM principles, to assist farmers on the do's and dont's relating to the production of organic farm produce. It is also desirable to promote the formation of **Small Farmers' Organic Agriculture Estates** to confer the power of scale at the production and post-harvest phases of farming for farm women and men owning small holdings. It will also be necessary to develop and introduce low cost but nationally and internationally acceptable certification standards and procedures.

4.6.6 There are a large number of farm families practicing organic farming in different parts of the country. There are also local level organic farmers' associations. It will be advisable to organize a **National Federation of Organic Farmers' Associations** on the pattern of IFOAM. Farm schools on the lines recommended by NCF in its first report also may be established in the farms of outstanding organic farmers. Farmer to farmer

learning on organic farming procedures through the establishment of such Farm Schools as well as through the establishment of Organic Farmers' Clubs will be useful, **since organic farming is not defined by what we do not do, but by what we do.** Diverse certification procedures cause confusion and hence National Certification mechanisms and agencies are essential.

4.6.7 Constraints and Opportunities

4.6.7.1 Indian soils are both hungry and thirsty. The great challenge in organic farming is the maintenance and enhancement of soil productivity through the provision of the needed macro- and micro- nutrients. How can we ensure that yields do not go down affecting adversely the marketable surplus available to small producers? The Chinese model of integrated organic and inorganic farming is ideal for small farmers but this is not acceptable to IFOAM. IPM and INS procedures which do not include mineral fertilizers or chemical pesticides are however acceptable. This will call for more research on biopesticides, bio-fertilizers, herbal pesticides and genetic resistance. **There is need for greater investment on research relating to the development of the biological software essential for linking crop productivity and quality in organic farming. In particular, there is need for more research on soil health enhancing efficient fauna and micro-organisms**. In this context, ICAR should develop high accuracy, low cost and rapid result giving soil- testing procedures based on nano-technology.

4.6.7.2 Genetically modified crops are presently excluded from organic farming by IFOAM. Like China, we may have to keep an open mind on this issue. A blend of Mendelian and Molecular breeding and pre-breeding and farmer participatory breeding may help to combine the beneficial features of organic farming and Recombinant DNA technology particularly in staple crops. Our National Agricultural Research System will have to develop **bio-organic farming methodologies**, which can help to enhance productivity without associated ecological harm, by integrating the best in frontier science with the best in traditional wisdom.

4.6.7.3 Presently, Indian farmers are not getting premium prices for organically grown farm communities. There is need for greater consumer education. For convincing consumers, the nutritional and health advantages of organic foods will have to be clearly

established. **The highest priority will have to go to natural method of pest management, since pesticide residues in water and food are becoming major public health problems. The research back-up at present for successful organic farming is inadequate. Organic farming needs even greater research support than chemical farming.**

4.6.7.4 Under our conditions, higher productivity and better quality are both essential. Krishi Vigyan Kendras can organize special training programmes for explaining to farmers the dos and dont's relating to organic agriculture. **Organic Farming Zones** can be promoted under the National Horticulture Mission for fruits, vegetables, tea, spices and medicinal plants, so that certification and quality control become easy. Cost of certification also has to come down, to enable small farmers to get certification.

4.6.7.5 Above all, more market research is needed. Small farmers, who may lose to some extent in yield by not applying mineral fertilizers, should not suffer in income due to lack of higher prices in the market. Organisations like the Spices Board are doing good work in helping small producers grow organic spices for the export market. High value products like **basmati rice**, will benefit further in relation to net return, if they can also be marketed as genuine **Organic Basmati Rice**. **Organic Cotton Cultivation** has been successfully popularized in Maharashtra. The Maharashtra experience needs to be replicated in other cotton growing areas.

4.6.7.6 IFOAM's principles are based both on ethical and scientific considerations. In the Indian context, priority to organic farming will have to go both to horticulture and plantation crops as well as to crops like cotton where heavy doses of chemical pesticides are applied. Medicinal plants should be cultivated only by organic methods. Ultimately, income enhancement and work security for farmers, and nutritive quality and freedom from pesticide residues for consumers should be the bottom line of all agricultural technologies.

4.6.7.7 Small farmers practicing crop-livestock mixed farming are able to take to organic farming more effectively than those who have no farm animals. In Assam and Northeast India, there is heavy rain during May-September (Southwest Monsoon period). Fertilizer application results in considerable leaching losses and hence farmers avoid

making investment in mineral fertilizers during the monsoon season. Therefore, this season is ideal for raising organic rice and other crops. Similarly, there are opportunities for developing Andaman and Nicobar Islands into organic farming islands. **It would be useful to develop a national strategy for organic farming, specifying regions, crops and seasons, ideal for raising crops through organic farming techniques.** Thus, research, extension and capacity building activities in relation to organic farming need considerable strengthening. Ultimately, net income per hectare will determine farmers' continued interest in organic farming.

CHAPTER - 4.7

ENHANCING PRODUCTIVITY, PROFITABILITY, STABILITY AND SUSTAINABILITY

BIOFUELS

4.7.1 There has of late been much interest among farmers and State Governments in exploring the economics of growing plants like Jatropha and sugarcane for the production of bio-diesel and bioethanol. Farmers' organizations have to get proper extension advice on the advisability of shifting their land use to the cultivation of crops for bio-fuel production. A well-defined Biofuel policy based on science and economics needs to be developed jointly by the Ministries of Agriculture, Rural Development, Petroleum, Non-Conventional Energy Sources (MNES) and Science and Technology. ICAR and CSIR will have to be actively associated. Based on a detailed discussion with experts in this field, we wish to offer the following suggestions -

4.7.2 There is a growing oil intensification of the Indian economy and more than 70% of the oil used in the country is imported. The oil import bill is over 3% of GDP and is likely to increase further, since crude oil prices are projected to rise to as much as US $ 90 per barrel. Hence, we have to step up our efforts in mobilizing both nuclear energy and all forms of non-renewable energy sources. Bio-fuels derived from plant-based resources assume importance in this context.

4.7.3 International Scenario

Among the major countries in the world in bioethanol production, Brazil is a front-runner, and has been using with gasoline, 22% ethanol blend produced from molasses and sugarcane juice. USA uses corn as the main source of bioethanol. Thailand uses sugarcane as well as cassava for ethanol. Japan, Germany, Canada, Australia, Indonesia, South Africa, Sweden are the other leading countries using ethanol blends. Bio-diesel is being used in USA, Austria, Finland, France, Germany, Greece, Czech Republic, Ireland, Italy, Spain and Sweden. The main sources of bio-diesel in these countries are rapeseed, sunflower, olive oils, which are however edible oils and are not appropriate in the Indian context, where we are importing nearly 50% of our edible oil requirements.

4.7.4 **Indian Scenario**

Use of ethanol as automotive fuel was first made in Mysore in 1938. Dual fuel operation in diesel engines was experimented at the Indian Institute of Science (IISc), Bangalore, in 1950. Oil crisis in the seventies, prompted the Government to test performance of ethanol-gasoline blends in cars, scooters, three wheelers and tractors in the 1980s. Methanol diesel blends were successfully demonstrated in DTC buses during 1986-92, followed by 93 Government vehicles using 10% gasohol during 1993-95 under a MNES R&D project. R&D in bio-diesel has taken up at IIT Delhi, IOC(R&D), IISc. Bangalore, Tezpur University, IIT Chennai etc. Ministry of Petroleum and Natural Gas have taken up pilot projects on 5% ethanol blends in gasoline in nine States since January, 2003.

4.7.5.0 **Plants of Potential Value**

4.7.5.1 The major source of bio-diesel in India is non-edible oil seeds. The technology for production is indigenously available. Bio-diesel provides bio-degradability, non-toxicity and is sulphur-free. The oxygen content is about 10%, which gives better emission characteristics in terms of CO, HC & PM.

4.7.5.2 The production potential for bio-diesel is nearly 20 million tonnes per annum. Only a few million tonnes have been utilized (due to lack of demand). Also from about 100 varieties of oil seeds, only 10-12 varieties have been tapped so far. Non-edible oils are being tested for production of bio-diesel. Estimated potential varies from 0.1 to 20 million tones, out of which 20 to 25% has been utilized. More than 100 non-edible oil bearing trees exist in India.

4.7.5.3 The important potential tree species for bio-diesel in India are as follows:

Table 1

Name	***Botanical Name***	***Oil content (%)***
Neem	*Azadirachta indica*	20
Karanja	*Pongamia pinnata*	27-39
Kusum	*Schleichera*	34
Pilu	*Salvadora oleoides*	33
Ratanjot	*Jatropha curces*	30-40
Mahua	*Madhuca indica*	35
Bhikal	*Prinsepia utilis*	37
Undi	*C.inophyllum*	50-73
Thumba	*C.colocynthis*	21
Sal	*Shorea robusta*	20
Nahor	*Mesua ferrea*	45
Jojoba	*S.chinensies*	50

4.7.6 National Bio-diesel Strategy

4.7.6.1 Bio-diesel can be made from both, virgin or used vegetable oils (edible and non-edible). Bio-diesel needs no separate infrastructure for storage and dispensing as the existing facilities can be used. Also handling bio-diesel is safer. In addition, plantations of *Jatropha* and *Pongomia* would lead to gainful utilization of wasteland, of which there is more than 50 million hectares in the country. At a national level, a bio-diesel programme has the potential to create employment opportunities on a large scale, particularly in rural areas in the various activities along the production-use chain, such as growing plants, collection of oil-bearing seeds, extracting oil from the seeds through expeller units, trans-esterification for making bio-diesel for blending and use with conventional diesels for distribution at retail outlets. A **systems approach** is necessary for ensuring that the different components of bio-diesel programme are effectively coordinated and bio-diesel becomes a cost effective alternative.

4.7.7 Research, Extension and Demonstrations

4.7.7.1 The yield from the petro-plants need to be significantly increased and the efficiency of trans-esterification also has to be significantly enhanced, so that the bio-diesel production becomes economically viable. For this purpose, there is urgent need of

creating interdisciplinary research groups including agronomists, biotech researchers and energy technologists who could work together in the thrust areas for R&D, such as: genetically modified high yielding petro-plants, design and development of continuous Bio-diesel reactors, improving process efficiency and energy optimization for decentralized production.

4.7.7.2 Demonstration activities on bio-diesel currently under progress in the country include programmes of MNES. The Ministry of Petroleum including IOC has also entered into a MoU with Indian Railways for a study on the complete value chain of bio-diesel. In line with this, IOC has taken up plantation on 70 hectares of Railway land at Surendra Nagar in Gujarat. More than one lakh saplings of Jatropha have been planted at the site. Tests have been conducted with 5 percent, 10 percent and 20 percent blends of Jatropha bio-diesel in diesel, on diesel locomotive engine for power specific fuel consumption, firing pressure and exhaust gas temperatures. Trial runs on Shatabdi and Jan Shatabdi Express trains have been carried out with 5 percent and 10 percent bio-diesel. IOC has jointly with Haryana Roadways, also launched field trials on 40 buses of Gurgaon depot in April, 2004,

4.7.8 National Mission on Biofuels

4.7.8.1 The Planning Commission in coordination with various Ministries and Agencies prepared a Report on Biofuels in 2002-2003[3], which has proposed a National Mission on Biofuels from Jatropha plantations. A Detailed Project Report has also been prepared for this Mission and the Ministry of Rural Development has been assigned the task of implementation with the following targets: By 2006-07, Jatropha cultivation on 2 lakh ha of degraded forest land and 2 lakh ha of non-forest land, to yield 5% bio-diesel blend with petroleum diesel; 20% blend is proposed by 2011-12. However, the detailed project report for this mission is still under the process of finalisation and the mission is yet to start. Meanwhile, various activities focused on Bio-diesel, are being taken up by other Ministries, including in particular Ministry for Agriculture, Ministry of Petroleum and MNES.

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[*] Report on Biofuels, Planning Commission, Government of India, 2003

4.7.8.2 As stated above, a number of Ministries and Agencies both in the public and private sectors are working on different aspects of biofuels including bio-ethanol and bio-diesel. The Ministry of Petroleum including the oil companies under it and in particular IOC (R&D) have been active in carrying on demonstration trials effect of biofuels on engine performance. The Ministry of Non-Conventional Energy Sources has been taking up R&D and Demonstration Projects on technologies for conversion of fuel stock into biofuel and the utilization of the biofuel for different end users. MNES has taken up a Village Demonstration Project in selected villages to demonstrate the use of biofuels in stationary engines. The Department of Science and Technology, Department of Scientific and Industrial Research & CSIR have been also active in technology development in commercialization of different aspects of Biofuel technologies. The Department of Biotechnology is taking up activities for genetic engineering for increasing yield and quality. Ministry of Environment is focusing on afforestation as well as environment issues.

4.7.9 Need for Convergence and Synergy in Technology, Public Policy as Sectoral Responsibility

4.7.9.1 If we wish to make speedy and steady progress, there is no alternative except to bringing about integrated action among various Government Departments and research agencies. The Ministries / agencies which should work together are indicated in table 2 below:

Table 2

S.No	Action	Partners
1.	Identification of seeds and developing suitable methods for extraction of oil from them and processing them to convert to into biofuels, blending of biofuels; and modification in engine technology, use of biofuel as transport fuel, evolving methods to use rotten and excess food grains for ethanol production; developing policy frame work.	ICAR, CSIR, Ministry of Non-Conventional Energy Sources, Ministry of Science and Technology.
2	Availability of biofuel particularly ethanol for transport sector without hampering its availability to chemical and chemical beverage industries.	Ministry of Food and Consumer Affairs/ Ministry of Chemical and Petrochemicals
3	Pricing of biofuels including taxation	Ministry of Finance and State Governments
4	Storage of Seeds and biofuels	Ministry of Food and Consumer Affairs and Ministry of Petroleum and Natural Gas
5	Distribution network and use in automobiles and other oil based engines	Ministry of Petroleum and Natural Gas
6	Availability of land and cultivation of crops to produce feedstock for biofuels	Ministry of Rural Development/Ministry of Agriculture and Ministry of Environment and Forest
7	Production of biofuels	Ministry of Food-processing, Ministry of Industry and Small Scale Industry.
8	Plant genetics for increasing yield and quality	ICAR, Department of Biotechnology
9	Environmental issues	Ministry of Environment and Forest.
10.	Field Action Plan	State Governments

4.7.9.1 Ensuring the Sustainability and Success of the Biofuel Programme

4.7.10.1 Farmers need to be assisted to undertake farming of crops used in ethanol and other biofuels, by ensuring purchase of these products at a minimum support price by government and industrial units, educating them about the species for biofuels, and cultivation techniques, and providing them with high quality seeds/saplings etc. Quality control and certification of the planting material are urgently needed.

4.7.10.2 Suitable mechanisms need to be developed to collect and store agri-residues such as rice straw, so that these wastes which are otherwise burnt, become a commercial commodity for farmers and would be available for ethanol production This should be supported by developing the necessary industrial infrastructure to process the collected biomass for production of ethanol/other biofuels and the by product industrial wastes so generated, could be used as manure.

4.7.10.3 Use of wasteland may be encouraged to develop plantations of *neem*, *karanja*, *jatropha* and other such species for bio-diesel production. Mechanisms need to be developed to collect oilseeds from forests. The wood generated from plantations could be utilized as feedstock for wood gasification to generate electricity. Wasteland should be used as collection centres for agri-residue. This process will have multiple benefits like land reclamation, employment generation, decentralized electricity generation etc.

4.7.10.4 Extensive support needs to be provided to R&D institutions to work on developing suitable process development for biofuels from various feedstock and for developing agronomic practices for growing crops for biofuels in wasteland. ICAR and CSIR should jointly undertake this function in cooperation with State Agricultural Universities.

4.7.10.5 Panchayati Raj institutions have a major role to play in creating awareness among people about *Jatropha* and other species, for cultivation in wasteland, common land and farm hedges. Panchayats/clusters of Panchayats have to be identified for this purpose. There is need for collaboration with State and Central Government organizations - National Seed and Vegetable Oil Development Board, National Dairy Development Board etc.

4.7.10.6 Industrial sector needs to be encouraged to increase ethanol production from all available feedstock such as cereals, agri-residues, and starch-based crops besides optimizing the present level of production from molasses. The production of bio-diesel from various non-edible oils seeds also needs to be encouraged. For this purpose, necessary incentives such as soft loans for establishing new industries, updating existing industry and tax holiday, need to be provided.

4.7.10.7 In order to accomplish these tasks a '**National Biofuel Board**' may be set up. The Board should develop a Roadmap for use of biofuels in petrol and diesel engines in a time bound manner besides taking necessary steps to introduce the policy measures, some of which have been proposed above. The Board should be supported with appropriate financial resources.

4.7.11 Farmers' Perceptions

4.7.11.1 Farmers are getting confused signals about the economic viability of the programmes suggested to them. They are not sure about the quality of seeds / planting material given to them. They are not yet clear whether there will be a buy back arrangement on terms favourable to the growers. Factors relating to **cost, risk and return determine farmers' acceptance and enthusiasm** in relation to new programmes. The sooner a farmer-centric **National Biofuel Board** comes into existence with the active support and participation of all stakeholders, including farmers' and women's organizations, the greater will be the prospect for making progress at the speed the country needs urgently to ensure economically affordable energy security

4.7.11.2 **The success or failure of the Biofuels programme will depend on our ability to ensure that the processing units are able to source the required quantity of raw material at the right time, in right quantities and at economically viable prices.** Many dedro-thermal plants have failed because of inadequate linkages with raw material supply. The feedstock for the biofuel industry has to come from agriculture. **Unless the interests of biofuel farmers are protected, the investment made at the processing end will go to waste**.

4.7.11.3 We, therefore suggest that the proposed **National Biofuel Board** may have the following composition:

Chairperson: The Member, Planning Commission, in charge of Energy

Members : Member (Agriculture) incharge of feedstock production
Member (Processing and quality control)
Member (Marketing, industry-farmer linkages through contract purchase etc.)
Member (Centre-State coordination, linkages with private sector, global technology watch)

4.7.11.4 A Board of the above kind may function like the Atomic Energy Commission with specific targets, autonomy and accountability. It can then attend to bio-feedstock production, use and marketing in an integrated manner with benefits to both farmers and the country.

CHAPTER 5

AGRICULTURAL MARKET REFORMS

5.1 Agriculture marketing includes all activities in the movement of agricultural produce from farm where it is produced to the consumers/industries and trade as per the demand. This covers physical handling and transportation, initial processing and packaging, grading and quality control for sales transaction for meeting the requirements of the different consumers/users and storage. Marketing plays the vital function of providing an outlet for the produce of the farmers and a supply line to the consumers/users. An efficient marketing system is essential for the development of the agriculture sector, providing incentives to the farmers for commercialization, increasing production and giving appropriate signals for production planning and research activities. It should encourage competition among the traders and protect the interest of the small and marginal farmers whose bargaining and holding capacities are limited.

5.2 In an agrarian economy like India, the fluctuations and the levels of prices of farm produce have considerable impact on the growth of production, the inter-sectoral distribution of income and the purchasing power with the majority of the rural population, which to a large extent determines the growth trajectory of many industries. The Government have, therefore, to constantly watch and intervene, when necessary, in the matters concerning agriculture marketing.

5.3 Some of the characteristic features of the agricultural produce marketing in India at the time of Independence were (a) sales immediately after harvest mainly for meeting the cash needs – mostly distress sale at discounted prices, sale of ungraded produce, loose carrying of the produce and lack of on-farm storage facilities (b) predominant role of the village trader and inter locking of credit and commodity market (c) Use of unstandardised weights/measures by the traders and high market charges which included charges like ‘mudat’ ‘dharmada’ ‘arahat’ etc. (d) direct sale by farmers and absence of farmers’ organizations to reach volumes and protect the interests of the small producers.

5.4 Three basic requirements for building a sound agricultural economy are a productive technology package, efficient delivery of services alongwith remunerative and stable market prices for the produce. One has to remember that the market could inflict

underserved losses on the farmer, even when he had applied modern technology and produced efficiently. This is more so now. Presently market led production is the key to an efficient production system. Better prices and larger surpluses would come to the producers who understand the market better and produce what the customers want. The situation was different at the time of Independence when the economy was less open, there was shortage of production against demand and the customers did not have much choice. At that time, the important issue was to save the farmers from the malpractices of the traders and facilitate growth and development of an orderly marketing arrangements.

5.5 In view of the above, after independence, the Government introduced various measures broadly covering the development and extension of marketing network and the actual regulation of the conduct of market. Government interventions covered not only market yard but also trading, stocking, quality maintenance, grading etc. Measures were also introduced by the Government for intervention in prices, procurement and also in import and export of agriculture commodities. Various instruments of fiscal and monetary policies of the Government also impact the cost of performing various marketing functions including transportation, stocking and trading in the markets.

5.6 Organized marketing was promoted through a network of regulated markets. A massive programme for creation of the marketing network was taken up. As on 31st March 2004, as many as 7418 markets had been brought under the ambit of regulated markets. Most of these markets are wholesale markets. In addition, out of 27,294 rural periodical markets [village haats, shanties etc], nearly 15% function under the regulated framework. The basic objective of setting up the network of markets was to protect the interests of the farmers and eliminate various malpractices of the traders. Fair play and transparency in transactions was aimed at. Most of the State Governments and the Union Territories enacted legislations (APMC Act) to provide measures for development of agriculture produce markets.

5.6.1 In view of the supply side constraints, the need for orderly functioning of the markets and protecting the interests of the producers and consumers, besides the APMC Acts various other legal enactments were promulgated by the Centre and the State Govts. These included the following:

- Prevention of Food Adulteration Act, 1954
- Essential Commodities Act, 1955
- Standards of Weights & Measurement Act, 1976
- Prevention of Black Marketing & Maintenance of Supply of Essential Commodities Act, 1980
- Consumer Protection Act, 1986
- Bureau of Indian Standards Act, 1986
- Agriculture Produce (Grading & Marketing) Act, 1986

5.6.2 In addition, there are also specific orders covering various products like meat, vegetable oils, milk & milk products, fruit and fruit products, pulses, edible oilseeds, edible oils, solvent extracted oil, deoiled meals etc. The recourse to the provisions under these orders etc is mainly intended to be given during periods of scarcity and to stop the malpractices. Some of these orders also cover activities like storing, packing, quality, blending, processing etc. The Government of India also regulates future trading in agricultural commodities. These Acts and orders were promulgated during periods of scarcity and have perhaps outlived their utility. These need a revisit and may be scrapping in many cases.

Box-1

Essential Commodities Act

The multiplicity of Acts and Government orders for regulating the conduct of market functionaries and processing units is not only restricting competition among those who deal and ultimately buy farmers' produce but also increase the transaction cost for marketing operations. There is a need to review the Essential Commodities Act and other legal instruments, which impact the marketing and processing activities. The Task force on Employment Opportunities (Planning Commission 2001) had observed 'The Essential Commodities Act is a central legislation which provides an umbrella under which the States are enabled to impose all kinds of restrictions on the storage; transport and processing of agricultural produce. These controls were traditionally justified on the ground that they were necessary to control hoarding and other type of speculative activity, but the fact is that they do not work in times of genuine scarcity and they are not needed in normal times. Besides, they are typically misused by lower level of administration and become an instrument of harassment and corruption'.

Tenth Five Year Plan Document [Para 7.8..11]

5.7.0 Strengths of the Regulated Marketing System

5.7.1 The main strength of the agricultural produce marketing system, in India is the huge network of markets. As on 31st March 2004, as many as 7418 markets were under the ambit of the regulated markets. Most of these were wholesale markets. In addition, out of

the 27,294 rural periodical markets, about 15% functioned under the regulated framework. The regulated markets, have also achieved certain amount of success in providing transparent transactional methods/marketing practices, basic amenities and services conducive to an efficient marketing system. Some of the developments in the marketing system at the primary market level and farmers marketing practices are: [a] The marketed surplus per farm has gone up. The overall marketed surplus-output ratio is estimated to have improved from 33.4% in 1950-51 to 64.1% in 1999-2000 [b] There has been some standardization of market-charges and the liability has generally shifted to the buyers [c] The quality of market information, available is much better than what it was during the 'fifties and sixties' [d] The market sales have increased [e] There are sectors where sales through the cooperative or groups are substantial [f] Inspite of the restrictive features, the system has made space for contract farming/direct marketing /other innovative practices like ITC's e-choupal etc.

5.7.2 According to a study [1991] the expenses of the farmers in respect of commission, weighing, hamali, brokerage etc, for marketing their produce came down by about 50%. In a recent study done by the Karnataka State Agriculture Prices Commission [2002] in respect of 3408 farmers, revealed that about 29% of the sample farmers sold their sample produce through the regulated markets. The farmers cited competitive prices [52.4%] correct weighment [20.1%], easy and early payment [12.4%], quick transaction [1.5%], and no buyer at village (4%] as reasons for their using the regulated markets. It was also revealed by the above study that the farmers received higher prices in respect of Paddy, Soybean, Ragi, Greengram, Bengalgram and Groundnut by selling in the regulated markets. However, in case of Tur, the highest price was at the farm gate, where as in the case of Maize and Jowar, the farmers selling in the rural periodic market received the highest price.

5.8.0 Weaknesses of the Regulated Marketing System

5.8.1 However, inspite of the development of the regulated agriculture produce marketing system, several weaknesses such as, distress sales immediately after harvest, absence of grading and packaging at the farm level and inter-locking of credit and commodity markets continued. Further, the regulated marketing system did not offer the farmers virtually any options/choices, the market charges became high and the farmers complain

about lack of transparency in weighing & auction as also the poor treatment given to them at the market yards. There is a need to have more transparency in the auction systems and curbing the manipulations of prices by the traders. The other weaknesses in the present marketing system are listed below:

- Thin spread of the regulated markets in many States
- Inadequate development of the rural periodic markets which are the first contact point for the growers
- Inadequate infrastructural facilities at the regulated markets.
- Large variations in the market fee/charges across the States
- Variations in the entry tax/octroi and sales tax
- Lack of transparency in auctions and other trade related activities
- Failure to develop a common trade language
- Inefficient working environment

5.8.2 The Karnataka study (2002) referred to earlier, indicates that inspite of better prices in the Regulated Markets **nearly 71% of the sample farmers chose not to sell at the regulated markets.**

Table 1: Farmers unable to use Regulated Markets - Reasons

S. No.	Reason Cited	Percentage of sample farmers not selling through the regulated markets
Reasons Related to Markets/Marketing Practices		
1.	Distance	31.2
2.	No knowledge of regulated market	8.0
3.	Payment delay	7.8
4.	No provision for Paddy sale	5.4
5.	Harassment by Hamals/Coolies/ cheating in the weighment/ removing 4-5 Kgs	3.1
6.	Long wait for weighing	1.4
Reasons not related to the Regulated Markets		
7.	Good price at the local market	18.4
8.	Small quantity	12.7
9.	Advance taken	9.0
10.	Others	3.0
Total		100

It is clear from the above findings that the regulated markets could have performed better with more developmental efforts and professional management. The APMCs and the State Agriculture Marketing Boards also need to pay more attention to curb manipulations in the marketing system. Coupled with the fact that only around 29% of the sample farmers used the regulated markets is a sad commentary on the performance of the APMCs/ Market Boards.

Box-2

Regulated Markets- Karnataka

The major operational weaknesses at the Mandi are [a] existence of malpractices such as unauthorized charging of commission from the farmers, considerable amount of produce taken away as sample, arbitrary deduction from the weight and lack of transparency in transactions. [b] Bureaucratisation in the management of regulated markets has prevented them to become farmer-friendly institutions. It is understood that more than 80% of the market committees have been superceded. [c] The traders, commission agents, other functionaries including weighmen / hammals /coolies etc. have in many places formed strong associations and do not allow entry of new persons. [d] While most of the APMCs and the SAMBs are financially well placed, adequate investments in the development/improvements/modernization of the market yards have not been made. There are instances where the funds have been diverted to the Government accounts. [e] Adequate investment in development of rural primary markets [haats/shanties etc.], which are the first contact point for the farmer, have not been made.

The farmers feel that there should be arrangements for supply of their daily domestic requirements and key inputs required for cultivation in the Market Yard itself. To improve the operations at the Mandis, it may be useful to have a more broad based board consisting of representatives of genuine farmers, traders and even commission agents. Holding of regular election of market committees and State Agriculture Marketing Boards are also equally important.

Extracts from the Report of the study done by Karnataka State Agriculture Price Commission-2002

5.8.3 The variations in market charges and taxation in different State/UTs is shown at Appendix I. The taxes and levies charged in certain states on the primary transactions are very high. In Punjab, it worked out to 11.5% and Haryana 10.58%. Some States also levied 'Rural Development Cess' and 'Infrastructure Cess'. Another issue is the present system of levy of fee at multiple points in the regulated market. An option could be to have a single point levy of market fee to cover the entire process of marketing by the farmers. The paradigm of efficiency in marketing and produce handling rests on the reduction in the transaction cost.

Box -3

Barriers to internal trade

The complex tax structure and multiplicity of state-level taxes distort the process of trade and marketing. Inter-state and Centre-State harmonization of tax laws and their administrative systems can facilitate the simplification of the tax regime. Octroi on transport of goods, where still in force, needs to be looked at and phased out. The permit system for the transport vehicles [issue of national permit] needs to be reviewed. The harassment to which the operators are subjected to [insistence on showing the drafts paid for obtaining the national permit or demanding payment for tax and fee at the border check posts.] needs to be curbed. The move towards a nation-wide uniform value added tax [VAT] is desirable. VAT is a multi-stage tax, which is levied on the value added at each stage. As each input going into final product is taxed only once, this tax avoids cascading and multiple incidences, and should be easy to monitor and implement. The state VAT, with a harmonized rate structure across the states, could replace all other sales taxes and other taxes like turnover tax, octoroi and entry tax etc.

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5.8.4 The major constraint of the regulatory framework of the agricultural produce marketing system is that it discouraged investments by the private sector, allowed certain monopolistic practices to develop and generally discouraged free trade and competition. It is surprising to note that a processor has to pay a fee on commodities brought into the notified area for processing without any service/value addition by the regulatory authority. In the present arrangement the farmers have no choice. In case they want to sell their produce in the wholesale market, they have to come to the regulated markets. Absence of choice and competition has adversely affected the development of markets and interest of the farmers and consumers in the changed circumstances.

5.9.0 Marketing Infrastructure - Amendments to the APMC Act, etc.

5.9.1 Let us now look at the marketing infrastructure for the agricultural produce marketing in India. The infrastructure is important for performance of various marketing functions, broadening and deepening of the market and also transfer of appropriate price signals for improving the marketing efficiency. As already stated, there are 7418 markets under the ambit of regulated markets. This works out to one market for 459 Sq. Kms. In Assam the coverage for each market is 2257 Sq. Kms followed by Himachal Pradesh [1600 Sq. Kms.], Orissa [1053 Sq. Kms], Rajasthan [830 Sq. Kms], Madhya Pradesh including Chattisgarh [719 Sq. Kms], Gujarat [490 Sq. Kms.], Tamil Nadu [481 Sq. Kms], Uttar Pradesh including Uttaranchal [476 Sq. Kms]. The thin spread makes it difficult for the farmers to bring their produce to the regulated market particularly in areas where the road connectivity is not upto the mark. The need is to give a greater

focus to the development of rural periodic markets, which are the first contact point for the farmers. The States where the coverage was better than the all India average were Punjab [74 Sq. Kms], West Bengal [152 Sq. Kms], Haryana [155 Sq. Kms], Bihar including Jharkhand [214 Sq. Kms], Andhra Pradesh [319 Sq. Kms], Maharashtra [359 Sq. Kms] and Karnataka [406 Sq. Kms]. Infrastructural facilities help in reduction in marketing costs, which help in improving the realisation of the growers and reducing the price, which the consumer pays. The infrastructural facilities in most of the regulated markets are inadequate. The table below indicates the lack of facilities at these markets.

Table 2: Lack of Facilities/Amenities at the Regulated Markets

S. No.	Facility/Amenity	Percentage of Regulated Market Yards not having the facility/Amenities
1.	Common Auction Platform	33
2.	Price Display Boards	39
3.	Common Drying Yards	74
4.	Grading Equipment	70
5.	Agriculture Input shop	71
6.	Drinking Water taps	72
7.	Seating Benches	72
8.	Pledge Financing	83
9.	Public Address System	66
10.	Drainage System	45
11.	Cold Storage	91
12.	Storage godown	26
13.	Weighing Equipment	15
14.	Toilets	12
15.	Bathrooms	43
16.	Electric lights	11
17.	Boundary walls	16
18.	Internal roads	11
19.	Garbage disposal system	16
20.	Banks	58
21.	Post Office	72
22.	Security Post	58
23.	Processing Unit	93

5.9.2 The Directorate of Marketing and Inspections, Government of India have established Central and Regional laboratories for certification under the AGMARK system. So far, grade standards have been notified for 164 commodities. During, 2003-04 (upto December) commodities valued at about only Rs.3525 crore were graded for

internal trade and about Rs.30 crore for export purposes. Standardization and appropriate grading arrangements/facilities are important. While for exports, the grading according to laid down standards is compulsory, for commodities sold in the domestic markets, grading has remained voluntary. **This is a serious bottleneck in our market system, which necessitates sale of individual farmer's lot leading to delays and exploitation in pricing and also makes scientific and transparent auction system difficult to introduce.** It may be necessary to have quality standards for all agricultural commodities and compulsory grading system may be introduced in a phased manner.

5.9.3 The Inter-Ministerial Task Force on Agriculture Marketing Reforms, which gave its Report in May 2002, observed as under "High investments and entrepreneurial skills are required for creation and management of the agriculture marketing infrastructure. **The situation of control by the State has to be eased to facilitate greater participation of the private sector, particularly to engender massive investments required for the development of marketing infrastructures and other supporting services. Investment requirements for the development of marketing, storage, cold storage infrastructure in the country during the Xth Plan has been estimated to the order of Rs.12, 230 crore**."

Table 3: Estimates for marketing infrastructure development

S. No.	**Infrastructure**	**Physical No.**	**Outlays required (Rs. in Crore)**
I	Wholesale markets	561	1,122
II	Rural Primary Markets	6,984	2,793
III	Grading, standardization and quality control units at village/market level	1,000	80
IV	Strengthening AGMARK laboratories/modernizing testing facilities/awareness and training programmes		35
V	Godowns in private sector/FCI/CWC/SWC/NCDC/Rural godowns	129.82 lakh tones capacity	3,480
VI	Cold storage/onion godowns/cold chain etc.	56 lakh tones	4,720
	T O T A L		12,230

5.9.4 The Task Force further observed that in order to encourage private sector to make large investment for developing alternate marketing infrastructure and supporting services, the provision of the APMC Act would need modification to create a lawful role for the private sector in the marketing development. **There was also a need to** [a] **reduce regulatory controls and simplify procedures** [b] **making complementary investment by the State and Central Government** [c] **providing subsidy to the private sector initiatives to attain economic viability** [d] **ensuring adequate credit flows to agriculture marketing and** [e] **declaring the market development projects as 'infrastructure projects' within the meaning of Section 10(23G) of the Income Tax Act. To attract promoting agencies to take up infrastructure projects, the Central/State Governments need to additionally extend support in the allocation of suitable land to set up the markets, provision of village land for Farmers Associations and collection centers, deregulation of area from the APMC Act where new markets were to be set up, ensure fast approval of foreign technical assistance, import of equipment and for services like electricity, water, sewage, telephones, etc. The Task Force also felt that the Central Government support for investment in market infrastructure might be linked with deregulation and reforms in the agriculture-marketing sector.**

5.9.5 Following main amendments in the APMC Act were suggested: -

- Enabling private and cooperative sectors to establish and operate (including levy of service charge) agriculture marketing infrastructure and supporting services.
- Direct marketing of agriculture commodities from producing areas and farmer's fields, without the necessity of going through licenced traders and regulated markets.
- Permitting 'Contract Farming' programmes by processing or marketing firms. Incidence of taxes by way of market fee, cess, duties, taxes etc. on procurement of agriculture produce under the above programme be waived or minimized.
- Rationalisation of levy of market fee by introducing single point levy of market fee in the entire process of marketing in the State

5.9.6 The progress in amendment of the APMC Act in different States and the Union territories is given at Appendix II. It would be seen that there is no APMC Act in Kerala,

Manipur, Andaman & Nicobar, Dadra & Nagar Haveli, Lakshdweep and Daman & Diu. In case of Tamil Nadu, the Act provides necessary reforms and hence no amendment is required. Madhya Pradesh, Himachal Pradesh, Sikkim, Andhra Pradesh, Nagaland have made the requisite amendments. In the case of Maharashtra, Rajasthan, Haryana, Karnataka, Gujarat, Punjab and NCT, Delhi part of the reforms have been completed. In most of these States, further amendments are likely to come about in due course. In the case of States like Orissa, Assam, Mizoram, Arunachal Pradesh, Tripura, Chattisgarh, Meghalaya, Jammu & Kashmir, Uttar Pradesh, Uttranchal, Goa, West Bengal, Pondicherry and Chandigarh some administrative action has been initiated but the reform process would take time. In the case of Bihar and Jharkhand, the administrative work is also yet to start. **The Govt. of India is attaching considerable importance to the reform of the APMC Act and is playing a very proactive role**. However, the response from some of the state is not adequate. The Government of India have circulated a draft of amended APMC Act and the draft of agreement for Contract Farming to the States for their guidance and further action. The Agriculture Ministry also held a conference of the State Ministers incharge of Agriculture Marketing in November 2004 at Bangalore under the Chairmanship of the Hon'ble Union Minister for Agriculture for evolving a nation wide consensus on reforms in marketing sector and to accelerate the pace of its implementation. It was felt that the reforms in APMC Acts were necessary for creating a nation wide integration of the agriculture markets, facilitating emergence of agriculture markets in private and cooperative sectors and creating a conducive environment for private sector investment in the market infrastructure.

5.9.7 The Inter Ministerial Group also made certain recommendations for promotion of forward and futures markets in agricultural commodities, development of negotiable warehouse receipt system and deepening of marketing credit etc. which are discussed in subsequent paragraphs.

5.9.8 The role of the APMCs and the State Agriculture Marketing Boards [SAMBs] needs to change from regulation to development in the changed production and demand environment. The APMCs and SAMBs should be primarily involved in grading, branding and packaging and building up markets for the local products in domestic and even international markets.

5.9.9 The Government of India have also announced a reform linked Central Sector Scheme "Development of Marketing Infrastructure, Grading and Standardization" during X^{th} plan period. Under the scheme, assistance is available for agri-infrastructure projects to those States, who undertake suggested reforms in the APMC Act.

5.10.0 The Producer's Perspective

5.10.1 Discussions with farmers across the country give the impression that they consider 'market' as a major constraint for further diversification and commercialization of their agriculture. More and more farmers have begun to realize that market led production is the key. The farmers appeared to be quite wary of the advice of the extension staff, which is generally not based on sound knowledge of the market. The present marketing arrangements, which primarily focus on regulation rather than development and innovations, is falling much below their changing expectations. In future, product-quality and specialty products are going to be important in both domestic and international markets. The extension staff and the farmers need training and guidance in maintenance of quality standards and specifications. The extension agencies/NGOs/PRIs could play a role in the knowledge dissemination. The Indian agriculture needs to move from low value agriculture to high value agriculture. There will be need to improve infrastructure for quality testing facilities [laboratories] and related infrastructure at all the levels. There is urgent need to provide extensive training to the farmers. The concept of 'Farm Schools' for lateral training of farmers needs to be pursued. The farmers would also need proactive advice on matters relating to land use with a clear view on the market. Such proactive advice may have to be based on meteorological, marketing and management information [taking into account soil characteristics, irrigation water availability and other agro-ecological conditions]. A restructured State land Use Boards supported by a team of technical experts/agencies could perhaps render such advice to the farmers. There have been instances where the farmers in large number switched over to certain commercial crops which did not have large enough market to absorb the increased production leading to a crash in prices.

5.10.2 In developed countries, it is fairly common for the farmers to organize themselves under the banner of the commodity that they produce. Farmers producing pulses in USA are organized under UNIGRAIN that decides about production and marketing of pulses

to obtain better prices for the pulses and links itself with producers of products made from pulses. It communicates with the Government on important policies relating to prices/tariffs etc. It also disseminates information to all pulses growers on market trends etc. Plain Cotton Cooperative Association [PCCA] in another farmer owned organization in USA. Such organizations could play an important role in developing market orientation of the growers in our country and could also generally help in articulating farmer's issues on commodity basis. The DMI in the Agriculture Ministry could perhaps take a lead and encourage formation of commodity wise farmer's organizations. The National Egg Coordination Committee is a fine example of the producer's organization, which has done very well in development of poultry industry.

Box-4

National Egg Coordination Committee (NECC)

A movement of Farmers, for the Farmers

The NECC played a crucial role in promoting the production and consumption of eggs and is trying to lead the poultry sector to the path of profitability. NECC advertising campaign, which used to appear regularly on television in the early 1990s, certainly caught the imagination of the nation. A catchy tune combined with visuals was used to promote the consumption of eggs. The campaign's creativity won many accolades. But its success was really felt when egg consumption went up significantly and this benefited farmers across the country. In effect, it was farmers (more than 25000), under the banner of the NECC, who began the movement, causing a revolution of sorts. With its faith in farmers and in marketing techniques and its commitment towards the cause of agriculture, the NECC has contributed towards bolstering India's poultry sector.

In 1981, the egg industry was hit by an unprecedented crisis. At that time, traders who did not take into account the cost of production or the demand and supply situation determined the price of egg. Eggs were procured at artificially lowered prices. Once they built up enough stock, prices would be increased. During the high-price season traders did not buy eggs from the farmers. The price of egg was thus manipulated so that eggs could be bought at a low price and sold at a higher price. Obviously, this system did not benefit either the producer or the consumer. The NECC has expanded its scope to include:

- The fixing of remunerative egg prices across the country;
- Price support operations in cooperation with the National Agricultural Cooperative Marketing Federation of India (NAFED);
- Market intervention through Agrocorpex India Limited (ACIL), a marketing company with only poultry farmers as shareholders, promoted by the NECC;
- Rural market development by promoting distribution channels; Including eggs in the Noon Meal Programme for school children introduced by the government of Tamil Nadu;
- Mass communication programmes to promote egg consumption.

With an increase in demand for eggs, poultry is one of the fastest growing segments in the country. A study on the Indian food industry done by the Confederation of Indian Industry (CII) and management consultants McKinsey, says: "The poultry sector has the potential to grow at 20 per cent per annum over the next 10 years." The study has set a target of Rs.4, 80,000 crores a year by 2005 for this sector.

5.11.0 Direct Interventions in Marketing by the Government

5.11.1 Besides the administered price regime which covers declaration of minimum support price (MSP) for selected crops, statutory minimum price (SMP) for sugar cane, levy price for rice and sugar and the central issue prices for rice, wheat and coarse cereals for sale under the Public Distribution System (PDS), there is also direct entry of Government through the public agencies in the market. Stocks of rice and wheat are maintained by the State, cereals and sugar are distributed through the PDS at prices lower than the market and there are open market operations by public agencies to ensure orderly price movement of important agricultural commodities. The Cotton Corporation of India, the National Agricultural Cooperative Marketing Federation of India (NAFED), the Jute Corporation of India, the TRIFED and the state level marketing federations also undertake open market operations. In addition, the Government have also encouraged cooperative organizations to undertake marketing functions on behalf of the farmers (through these have not been much of a success except in some sectors). The Government have also been intervening in the market under the Market Intervention Scheme (MIS) in respect of commodities not covered by MSP, but on a selective basis. This role needs to be strengthened particularly in the case of sensitive commodities.

5.11.2 However, not withstanding the direct intervention by the Government, the markets of agriculture commodities have been largely dominated by individual traders in the private sector. The private trade handles about 80% of the marketed surplus of agriculture commodities. It is estimated that there are about 20 lakh wholesalers and nearly 50 lakh retailers, which include nearly 4 lakh shops operating under the Public Distribution System. Besides the traders, the processors also enter the market. The hullers, shellers, rice mills, wheat millers, pulses (dal) mills and other processors including expellers, crushers, solvent extraction units, oil refining units etc. are the bulk buyers in the market. These processors are very large in number and operate at different levels of scale,

mechanization and efficiency. The role of processors has also increased in certain commodities. Bakeries, flour mills, dal mills, fruits/vegetable processors enter the market directly and are buying more. The consumer is also consuming more of bakery products/flour rather than buying wheat and processing it in the home or in the neighbourhood 'Chakki'.

5.11.3 The market for fruits, vegetables, meat, poultry products etc. is also dominated by the private sector. Processed fruits/vegetables/meat products etc. still form a very negligible part of the total market. However, with increase in urban purchasing power and changing life style the market for processed food is growing and is set to grow rapidly in the coming years. Though, large companies are getting into the processed food sector, at present the sector is dominated by the unorganized sector.

5.11.4 In spite of the fact that the agriculture produce market sector has a very large number of players, due to infrastructural bottlenecks, geographically dispersed market places, absence of a well organized futures market, there are localized monopolistic tendencies and manipulations which often adversely affect the interest of growers.

5.12.0 Agriculture Price Policy

5.12.1 Agriculture price policy instruments are used to influence the level and fluctuation in prices and importantly the spread from the farm gate level price received by the producer and the price paid by the ultimate consumer. While initially, the State was mainly concerned with regulating the private traders, imports and distribution of food-grains etc. at low prices, after the mid sixties, the focus was on using the price policy for increasing the domestic production and providing food-grain to the consumer at reasonable prices. **In India, it is important to note that the producers are also the major consumers of food-grains unlike in many other countries where the farmers constitute a very small percentage of the populatio**n. The Commission for Agriculture Costs and Prices [CACP] has a major responsibility in the matter. The CACP is required to monitor the movements in the terms of trade for agriculture sector and the fair sharing of the gains arising from the application of technology and public investment in agriculture between the farmers and the consumer.

5.12.2 The 25 commodities covered under the Minimum Support Price account for over 80% of the gross cropped area and 75% of the value of output. Some other commodities, which are not covered under the MSP, are included under the Market Intervention Scheme [MIS] discussed earlier.

5.12.3 The Govt. while fixing the level of the support price for a commodity keeps in view the various factors including (a) the cost of production (b) change in input prices (c) input-output parity d) trend in market prices (e) demand and supply situation (f) inter-crop price parity (g) effect on industrial cost structure (h) effect on general price level (i) effect on cost of living index (j) international price situation (k) the parity between price paid and prices received by the farmers.

5.12.4 The cost of production is one of the main considerations in deciding the level of the MSP. However, it is not easy to decide the cost of production. The cost of production of the same crop varies between regions and between farmers of the same region. The CACP recommends the MSP on the basis of the weighted average cost of production in states giving consideration to the variability of the cost of production over the States, taking into account also the factors of production, paid as well as the imputed values of unpaid factors in fixed and variable cost of production. The risk factor and the marketing and post harvest expenses are however, not taken into account. The CACP could look into these aspects.

5.12.5 An important issue is the poor implementation of the MSP in all regions except Punjab, Haryana, Andhra Pradesh, to some extent UP and MP and consequently the market price often rule lower than the MSP. Further, except wheat and paddy, the MSP mechanism rarely benefits farmers of the remaining crops. **There is need for a much stronger protection of MSP in different regions of the country for all commodities**. The Eastern region needs special attention because of the widespread rural poverty in the region as also the fact that the region has considerable potential to improve productivity, if adequate care was taken regarding pricing, marketing, technology and credit support.

5.12.6 Another connected issue is the delay in issue of support price [MSP]. The announcement could influence the decision of the farmers in allocation of land and other

resources only if it is made well before the sowing season. While announcement for Rabi have been often well in time, the MSP for Kharif in the past had been delayed.

5.12.7 Not withstanding the above constraints, the MSP may have to be continued in the foreseeable future and its implementation should be improved. However, the strategies may have to change in view of the changed circumstances. We are not facing scarcity conditions and the economy is much more open than what it was earlier. The High Level Committee on Long Term Grain Policy 2002 (under the Chairmanship of Prof. Abhijit Sen has favoured the MSP around the national floor level prices with all India open ended operations. However, to protect the farmers from market risks, the above Committee suggested price and income insurance coupled with negotiable warehouse receipt system.. These developments may take time and hence the change in strategy may have to be gradual. The commodities, which are not covered under the MSP, market intervention on a selective basis also needs to be resorted to for ensuring that the prices realized by the farmers are stabilized. Price behaviour of sensitive commodities like onions, potatoes, tomatoes etc. needs to be closely watched particularly during the glut season for need based market intervention under MIS. However, the policies regarding monopoly procurement of cotton in Maharashtra, levy on rice mills etc. need to be reviewed.

5.12.8 The small and marginal farmers are more concerned about the cost of production and more particularly the cost of paid out inputs. Any strategies to minimize subsidies on inputs and compensating the farmers by allowing increase in prices would need to be examined very carefully as most of the marginal farmers in particular are likely to be net buyers of agriculture commodities. However, there is no doubt that input subsidies need a closer look and a much better focus.

5.12.9 The pricing policy has contributed towards achieving self-sufficiency in food-grains and also assisted in commercialisation and diversification of our agriculture. In spite of general criticism that populism and not economic consideration are responsible for various decisions, the Government have, to a large extend balanced sharing the gains of technology and public investment between the farmers and the consumers. However, as stated earlier, the MSP could not be effectively ensured across the country and the

prices in different parts of the country have often been lower than the MSP. **Perhaps it could also be said that the price signals, research, extension and public policy together could have contributed more in improving the dryland agriculture and greater diversification and faster movement from low value agriculture to high value agriculture in the country**. It is also very important that the import tariffs on farm commodities produced in the resource poor regions (particularly dryland) like oilseeds are carefully monitored and maintained at levels to provide enough incentives to the dryland farmers.

Box 5

Long-Term Grain Policy

The High Level Committee on Long Term Grain Policy—2002 under the Chairmanship of Prof. Abhijit Sen had examined the various aspects connected with the Minimum Support Price [MSP] and Price Support Operations. The Committee had observed as under:

"MSP policy was critical in India's achievement of food grains self sufficiency but is now grossly distorted. Nonetheless we are convinced that MSP policy should continue, but with immediate correction. We recommend.

1. The Central Government should announce the MSP policy before the sowing season on recommendations of the CACP.

[a] The CACP should be made an empowered statutory body.

[b] In recommending MSPs, which should apply on Fair Average Quality [FAQ] grain, the CACP should go strictly on the basis of C_2 cost of production (i.e., all costs including imputed costs of family labour, owned capital and rental on land) in more efficient regions.

[c] The CACP should also indicate its estimates of A_2 + FL costs (i.e., costs actually paid plus imputed value of family value labour) for relatively high cost regions.

[d] The CACP should recommend only a single MSP for paddy.

[e] The MSP, set at a floor price on the recommendations of the CACP, should have a statutory status. In particular, the responsibilities of the Central Government and obligations of the State Governments should be defined clearly.

[f] All agencies, Central, State, Cooperative or Private, which are a part of public grain management, should be legally bound by the MSP policy.

[g] If the present situation continues, where some States impose excessive levies on MSP purchase, the Central Government may announce its MSP policy by declaring a procurement price inclusive of an uniform 4% allowance for such levies over the MSP.

2. Once the Government announces the MSP, it should underwrite open-ended purchase of FAQ grains to assure the growers an adequate return to their cost. It should be the responsibility of the Central Government to make the fiscal and banking provisions necessary to enforce MSP throughout the country"

5.13.0 Other Issues

5.13.1 With the international agriculture commodity price scenario and forecasts generally indicating stable prices during the next three-four years, there is urgency to bring about improvement in the efficiency of production and marketing to ensure that our agriculture remains competitive. Inefficient post harvest operations, infrastructural constraints, too many intermediaries, little value addition and the regulatory rather than the developmental and promotional to the marketing are some of the factors, which have been coming in the way of efficient functioning of the markets for agricultural produce. Harvesting and post harvest operations are as important as the production process itself. Unfortunately, harvesting, threshing etc. are inefficiently done, which leads to considerable loss in value. For example, the losses to the farmer in rice crop for different post harvest operations have been estimated at harvesting (1 to 2%), stacking, bundling, storing (2 to 7%), farm level haulage (1 to 3%) and drying (1 to 5%). Then, there are the milling losses of about 2 to 3 %. Storage is another serious problem in our supply chain. A Planning Commission Study showed 6.8% loss due to storage, pests and rodents [5%] and moisture/birds etc. [1.8%]. According to the National Institute of Agriculture Marketing (2000) and the study of John Moore & others (1973) the average losses under wheat, maize and pulses were estimated at 7%, 10% and 9% respectively. The post harvest and storage losses for fruits and vegetables were huge and varied between 14% (Apples) and 70% (Papayas). The losses for Citrus (57.5%) Banana (50%), Cauliflower (49%), Tomato (27.5%), Onions (25.5%) and Potato (22.5%) were quite high. The situation of storage of the perishable commodities is very unsatisfactory both regarding adequacy as well as operational efficiency. The cold storage capacity is grossly inadequate. Further, the costs of creation of cold storage facility as well as the operational costs are much higher than similar facilities, say, in the USA. Poor transportation arrangements and handling are other areas of concern particularly for perishables like fruits and vegetables. Except in few cases, fruits and vegetables are often packed in gunny bags, some times vegetables are stashed on top of each other in the trucks etc., the handling is extremely poor with the transporter refusing to accept any responsibility for proper handling leading to deterioration in quality. Bullock carts, tractors, trolleys, trucks are generally used for transportation of agriculture produce from the farm gate.

Fruits/vegetables are often transported to long distance from farms to Markets in open trucks/trolleys etc. losing quality, weight, water and even quantity all to the detriment of the grower. The constraints [other than those at the Market] could be summed up as under:

- Inefficient harvesting and post harvest handling
- Lack of storage facilities at the farm level
- Problems of proper transportation from farm to mandi, huge costs and long time involved.
- Constraints in transportation from mandi - general lack of wagons, silos and sometimes even bagging materials.

5.13.2 The PRIs/ NGOs/ SHGs could play an important role in improving the awareness of the farmers about the post harvest losses some of which could be reduced by use of slightly different equipments or simple improvements in handling the produce. There is need for introducing post-harvest technology wing in every Krishi Vigyan Kendra (KVK).

5.13.3 Another problem is the large number of intermediaries in the marketing chain. There are often 6 to 7 and sometimes even 8 intermediaries before the produce reaches the consumers. Each intermediary adds margins. Costs are involved in intermediation, which can be minimized by improving efficiency, but not eliminated. It is however, important to reduce the large margins, which are added at each stage. These margins sometimes add up to 100% to 150% without significant value addition. According to available information from various studies, the producer gets about 25% to 30% of the consumer's price in the case of wheat, maize and rice. However, the milk producers under the 'Anand model' get about 60% of the final price. In fruits and vegetables, the mark ups by the intermediaries touch about 60% of the costs while the same is reportedly about 6 to 8% in the USA. High-mark up means low returns to the farmers as a percentage of the retail price and secondly the consumer pays a high price. There is a need for tightening the supply chain and eliminate some of the intermediaries. This is important and needs all efforts for promotion. Normally 3-4 intermediaries between the producer and the consumer should be able to discharge all the functions. Farmer's own organizations (cooperatives and others) for aggregation and dealing with the Mandi level

organization would help in eliminating at least two/three intermediaries. As price received by farmers in direct sales to the consumer is better [in absolute terms and also in proportion to the price paid by the consumer] and the consumer also pays a lower price, some of the States are experimenting with 'Farmers' Markets' Apni Mandi or 'Rythu Bazaars' for fruits and vegetables etc. These experiments and replications need to be encouraged Contract Farming, ITC's e-choupal, SAFAL etc. are initiatives to improve the supply chain.

Box - 6

National Dairy Development Board (NDDB)

An Institution of National Importance

Due to very wide dispersal of producing and consuming units of milk, the unorganized sector continues to dominate the milk marketing in India. However, the market structure for milk is constantly changing. The organized sector now handles above 20% of the milk output in the country. The cooperative sector accounts for nearly 50% of this. There are over 1.10 lakh milk producers cooperatives federated into district milk unions and State Dairy Federations, which have organic links with the Mother Dairy at the national level. It is heartening to note that the milk producers in the Anand Model of milk production get net of intermediation, about 60% of the final price. In other basic foods, the returns are as low as 30% of the final price. NDDB supports the development of dairy cooperatives by providing them financial assistance and technical expertise. Over the years, brands in milk products created by cooperatives have become synonymous with quality and value. Brands like Amul (GCMMF), Vijaya (AP), Verka (Punjab), Saras (Rajasthan). Nandini (Karnataka), Milma (Kerala) and Gokul (Kolhapur) are among those that have earned customer confidence.The Dairy Cooperative Network i) includes 170 milk unions ii) operates in over 338 districts iii) covers nearly 1,08574 village level societies iv) is owned by nearly 12 million farmer members.

Milk Production

- India's milk production increased from 21.2 million MT in 1968 to 88.1 million MT in 2003-04.
- Per capita availability of milk presently is 231 grams per day, up from 112 grams per day in 1968-69.
- India's 3.8 percent annual growth of milk production surpasses the 2 per cent growth in population; the net increase in availability is around 2 per cent per year.

Marketing

- In 2003-04, average daily cooperative milk marketing stood at 148.75 lakh litres; annual growth has averaged about 4.2 per cent compounded over the last five years.
- Dairy Cooperatives now market milk in about 200 cities including metros and some 550 smaller towns..
- During the last decade, the daily milk supply per 1,000 urban consumers has increased from 17.5 to 52.0 litres.

Innovation

- Bulk vending - saving money.
- Milk travels as far as 2,200 kilometers to deficit areas, carried by innovative rail and road milk tankers.
- Ninety-five percent of dairy equipment is produced in India, saving valuable foreign exchange.

Macro Impact

- The annual value of India's milk production amounts to about Rs. 880 billion.
- Dairy cooperatives generate employment opportunities for some 12 million farm families.

In sum, NDDB is a unique example of an organisational innovation with a focus on human resource and co-operative development in India. By placing technology and professional management in the hands of the village societies it has helped to raise the standard of living of millions of poor people. These processes prove that true development is the development of the people and this could be achieved through putting the instruments of development in the hands of the people.

5.13.4 Value addition is another issue. In spite of a large chain of intermediaries the value addition is almost insignificant. The jute bag in which the farmer had packed the potatoes is most likely to reach the retailer and sometimes the buyer, who would spend considerable time in selecting the potatoes while bargaining about the price with the shopkeeper. There would be considerable mark up but virtually no value addition. The worst situation is in the case of vegetables/fruits. Since only about 2% of the fruits/vegetables are processed, there is also very little backward linkages from the processors. However, of late the consumers have started showing their preference for buying processed/semi processed/convenient foods, which is likely to give a boost to backward linkages.

5.13.5 With the implementation of the Horticulture Mission, the production of fruits and vegetables is likely to register substantial increase. The growth of processing industries will be essential to bring better returns to the farmers, particularly, in the matter of the prices of non-tables fruits. The Government may consider encouraging setting up processing zones in rural areas for processing of fruits/vegetables for domestic market on the pattern of processing zones for exports. The possibilities of extending Income-Tax and other benefits/concessions to these units for 5 years on the lines of concessions available for the export oriented units may be considered. The packaging costs of the food processing industry are rather high. It is important to develop cost effective packaging options for the development of the processing of fruits and vegetables.

5.13.6 The fresh fruits and vegetables do have large export potential particularly to the Middle East and Western countries with large Indian population. However, poor infrastructure [storage, transportation, cargo space/rates, facilities at the air/sea ports, etc.] lack of adequate institutional support [credit, market development] and insufficient research efforts are constraints in realizing the potential

5.14.0 Marketing through Pre-Production Agreed Arrangement

5.14.1 In the case of certain vegetable/ fruit crops and also specialty crops a new agribusiness model of pre-production agreements between the farmers and corporate houses/processing companies/others are being practiced. These arrangements are being loosely referred to as contract farming though in may of these cases there is no formal

contracts between the farmers an the prospective buyers. Attempts are being increasingly made for building up linkages between 'farm and the market'. Since the agro-based and food industry requires timely and adequate inputs of the needed quality, several of these business houses have attempted to establish convenient system/ models for the purpose. Some of these attempts in certain pockets including contract farming arrangements tried in India are the tomato crop in Punjab [Hindustan liver Ltd & Pepsi] mustard crop in Punjab [Markfed- a cooperative organisation], potatoes [Mc Donalds], wheat in Madhya Pradesh [Rallis & Hindustan Liver Ltd], maize [Venkateshwara Hatcheries Ltd], basmati rice in Punjab, western UP [Pepsi] cotton in Combatore, Tamil Nadu [Appachi Cotton Company (ACC)], Barley in Belgaum, Karnataka [Ugar Sugar Works Ltd] etc.

5.14.2 In several of these cases, there have been gains in productivity after adoption of the above system as the farmers had the benefit of a higher degree of managerial services, technical extension, quality seeds/plants, fertilizers and credit etc. the models have usually been successful in case of crops with niche markets or export potential. It is not clear whether these models would work in case of other crops as well. While it appears almost certain that the productivity could go up initially but problems do start emerging thereafter. In Punjab, where Pepsi & HLL tried these arrangements for tomato, potato and chilli some farmers reported problems like poor technical assistance, delayed payments, manipulations of norms etc by the purchaser. It was reported that some farmers had to wait at the factory gate for a day or so leading to weight loss of tomatoes with the result the firm received more concentrated produce at the same price.

5.14.3 The crucial aspects of these arrangements are those relating to price fixation and dispute resolution. The arrangement which does not fix the price, does not shift the market risk from the producer to the buyer; where the price is specified in the agreement and the prevailing price at the point of marketing is higher, the grower would try to avoid selling under the agreement and would sell in the market. If however, the price is lower, the buyer would try to buy in the open market rather than from the farmers with whom there was the agreement. So, there is an unusual situation, if there is no fixed price, both the grower and the buyer are exposed to market risks and if there is a fixed price in the agreement, there are complications in enforcing it. In a 'niche' market or a specialized product the situation is different. In some cases the processor/trader [buyer] might have

already entered into a sale contract or have an export order where the specialized product is needed. Here the market price has no relevance and for both the grower and buyer, it is 'win-win' situation to continue working for each other. In the case of other commodities, if the idea is long-term relationship, both the parties may keep temptations to deviate in abeyance. However, such situations where one of the parties is unwilling to honour cannot be ruled out completely. Enforceability of the agreements in the court of law is another issue. It is extremely doubtful whether an individual farmer could take a company to court. For the company also, going to the court against one farmer may not be worthwhile, as the damages awarded may not justify the cost. **Under the circumstances, the parties may prefer to have only an understanding with each other**. While it is a fact that the purchasers are financially stronger and farmers have weak bargaining strength, often the farmers have local clout to make things difficult for the purchasers. The companies sometimes use a system of reward and punishment to ensure that a long-term relationship develops. Instances of boycotting the entire village [where some farmers ditch the purchaser] or denying certain other benefits to the defaulting farmers and rewarding/honouring them in public functions where they continue supplying produce are not uncommon.

5.14.4 As long as the bargaining power between the two parties is unequal, the models would remain fragile. One way perhaps could be that the producers form groups or cooperatives, which in turn may deal with the purchaser. This would empower the producers and the group/cooperative could become a better guardian of their interests and the arrangements would have better strengths as regard enforceability. Ultimately, these models have to sustain on the momentum of each group's self interest, each party is closely hooked to each other and if any one link breaks, it is not good for the model as a whole. One has also to remember that the possibilities exist that the purchaser will in due course reduce the prices and other benefits offered to the growers. The important issue is whether the grower is better off as compared to the earlier farming situation or not. If so, this is worthwhile. If the grower is too much worried about the larger share going to the purchaser, it will not help. The attempts however, should be to improve the bargaining power of the producers as mentioned in the earlier paragraph.

5.14.5 It may also be useful to look at the conventional 'Contract Farming' model. The contract farming is defined as a system for the production and supply of agricultural/ horticulture produce under forward contracts between producers and buyers. The essence of such an arrangement is the commitment of the producer/seller to provide an agricultural commodity of a certain type at a time and a price and in quality required by a known and committed buyer. The contract farming arrangements could contribute to a) facilitating emergence and growth of processing/trading units b) export of produce from the small farmers c) encouraging high quality production d) enable producers/purchasers to realize economies of scale e) allocation of risks between the producer and the purchaser. While the farmer bears the production related risks, the purchaser bears the market risks f) better credit linkage g) better managerial focus h) better input availability. The contract farming agreements could be broadly classified into three, not mutually exclusive categories: a) market-speciation b) resource providing and c) production management.

5.14.6 There are only limited experiments in contract farming in India excepting in sugarcane cultivation and some niche products, however, the Government have circulated 'Contract Farming Agreement and its Model Specifications' among the States. As regards the dispute settlement, the suggestion is to have a body representing the sponsor, farmers and other interested like the Market Committee as the Forum, which could act as arbitrator. The suggestion is that the APMC Act when revised may have an appropriate provision for compulsory registration of all contract farming agreements and the procedure for settlement of disputes arising there from. While providing for a 'Forum' for settlement of disputes is desirable, compulsory registration may perhaps not be the most appropriate strategy for contract farming. Another suggestion made is a clause to ensure that the sponsor/purchaser shall not have any right whatsoever over the title or possession of producers land. This is generally welcome to ensure that apprehensions of the producers losing their land are laid to rest.

5.14.7 One also needs to take note of some criticism of contract farming. The first is that the purchaser is quite likely to be interested in short-term gains/profit maximization and may, therefore, suggest practices, which in the long run are not good for the land/other assets of the producer. The purchaser has the option of 'moving on' after a few years of

'exploitation' of an area. The second issue relates to possible shifts in favour of export-oriented crops at the cost of crops providing basic food. The third is the preference for the larger producers in choice of partners by the purchaser, ignoring the small landowners. Such practices over a long time could encourage the small farmers to enter into sub-agreements with the larger farmers there by adding a tier between the grower and buyer or to sell/lease out their land and work as labourers.

5.14.8 It is early to form any clear judgment about contract farming. However, there is no denial that the model offers possibilities of scale economies and also helps in building linkages in the value chain, linking producers directly with the processor/trader. With changing consumption pattern and increasing demand for processed/specialty foods both by local population and exports, these arrangements could multiply in future. The need for the State is to play a proactive role in these developments and not be satisfied by only regulating these developments. **The urgency is to work out a code of conduct for contract farming which is farmer centric to ensure that the interests of the farmers particularly the small farmers are not compromised. Till such a code of conduct is introduced and the farmers are empowered by formation of groups/cooperatives to deal with the buyer on their behalf, one has to be rather cautious about the contract farming system in India.**

5.15.0 Recent Initiatives in Developing Alternate Markets

ITC's E-Choupal

5.15.1 ITC's E-Choupal provides the farmer an alternate route to the Mandi, without going through the regulated market or the compulsion of selling to the corporate at a predetermined price [under contract farming], as also access to good quality input. It is already covering over 29,000 villages, about 3.1 million farmers through 5,050 Choupals. The ITC has an ambitious plan of covering 10 million farmers and 1lakh villages with a business turnover of over Rs. 10,000 crore by 2010. The Choupal provides live quotes of not only ITC's own prices but also prevailing prices in the Mandis across the State. The internet kiosks, [initial capital cost funded by ITC] but operated and managed by a local village person [Sanchalak] also provide information regarding weather, farm practices, risk management, prices of inputs, the price quotes for certain agriculture commodities and an offer to purchase his produce without going through the regulated markets. The

model appears to be an improvement over the contract farming models in as much as the prices are basically determined by the market system of demand and supply. For the ITC, the benefit comes from lower cost of procurement and quality raw material. The ITC also gets a fee from various companies [37 as reported] that sell their products through the e-choupal. These companies display their products on the site, offer special prices and also train the farmers in the usage of their products. The ITC gets a commission on the sales. The Sanchalak gets 5% on all the sales through his kiosk.

5.15.2 In marketing his produce through the e-choupal, the farmer also saves the labour charges, middlemen commission, handling charges and perhaps also in certain unauthorized charges which he may have to pay in the regulated markets. Further, there are no doubts about the weighment [electronic weighing scales are used] and the payment is prompt. The farmers appear to be quite happy with this marketing option now available to them. The ITC purchased 60,000 tons of crop through e-choupal in 2001-02. In 2003-04 it was 2,10,000 tons and in four months of 2004-05, the crop purchased was 1,80,000 tons. Under the arrangements, the farmers could either bring the produce to the ITC warehouse/factory and get reimbursed for the transportation cost, or could hand over at one of the collection centers or Sanchalaks. The crops covered are soybeans, wheat, coffee and shrimp [in Andhra Pradesh under Aqua-e-choupal]. The company has plans to expand into other crops like spices. The company saves on procurement costs and gets the desired quality.

5.15.3 The States covered under the above project either amended the APMC Act or allowed exemptions to enable the ITC to purchase the agricultural produce outside APMC. The experiment has provided the farmer an alternative, a business model for the ITC to shorten the supply chain and a delivery system to the companies to reach the rural areas. It is really a supply chain innovation, which has tremendous potential. It is reasonable to expect other companies to learn, innovate/change as per their requirements and try similar models for reaching the rural areas in future.

5.16.0 The SAFAL System of the NDDB

5.16.1 The National Dairy Development Board [NDDB] has introduced a model for direct sale of vegetables/fruits under SAFAL in Karnataka. Under this system the farmer

associations cover the farmers in a cluster of villages and serve as collection and grading centers. The produce so aggregated and graded is properly packed in plastic trays and supplied at the central auction centre. The Auction Centre operates in a most transparent manner, where premium is on quality. The entire auction system is computerized. In Bangalore, an extremely well laid out market yard with excellent facilities including electronic auction platforms have been developed by the NDDB. The NDDB has also developed a modern retail structure with prices linked to the auction prices, to ensure competition and transparency among retailers. Also in Delhi, there are a very large number of retail outlets for fruits/vegetables etc. under SAFAL model. The APMC Act was amended in SAFAL areas to enable the cooperative sector to take initiative in setting up such producer- oriented markets. The need is however, to develop low cost models for large-scale replication.

5.16.2 These initiatives which in farmers a choice need to be supported and replicated. These could bring competition in agricultural produce marketing and benefit the farmers.

5.17.0 Financial impediments - Negotiable warehouse Receipt system

5.17.1 According to the Report of the Inter-Ministerial Task Force on Agriculture Marketing Reform, micro level studies reveal that the small farm holdings contribute nearly 54 % of the marketable surplus and distress sale by these small farmers account for about 50 % the marketable surplus. The farmers do sell their produce to square off their debts soon after harvesting. It is normal for a farmer to get 10-15% discounted price for spot payment for his produce. The solution partly lies in providing them access to safe and scientific storage and an easy farmer friendly pledge/marketing finance system. The total pledge loans given by the banks to the farmers are not much. The commercial banks do not report this as the present MIS does not provide for it, separately and the total pledge loan extended by the cooperatives to their members is negligible though cooperative system provided well over Rs. 25,000 crore as crop loan during, 2002-03. Linking of credit with marketing could improve the quality and quantum of credit flow. The National Bank for Agriculture & Rural Development (NABARD) could play a role in these developments.

5.17.2 While development of rural godowns would help the farmers in storage of their produce and get a better price, an important area for improving marketing [as we have

moved from scarcity to surplus agricultural production] and bringing liquidity in the system is the encouragement of instrument based or secondary markets by development of negotiable warehouse receipt system. The banks are presently reluctant to advance loans against the warehousing receipts of Central Warehousing Corporation (CWC) when the holder thereof is not the person in whose favour the receipt was originally issued. Transferability of the warehouse receipt is limited by the fact that the original owner cannot transfer it to another person without clearing the banks due. While the State Warehouse Act provide that a warehouse receipt is transferable by endorsement and shall entitle the holder to receive the goods specified therein on same terms and condition on which the person who originally deposited the goods, would have been entitled to receive, due to the above shortcoming the usage of the warehouse receipts as a financial instrument has not picked up.

5.17.3 The need is to establish a more secure system. If the bankers on the basis of prescribed norms could accredit the warehouses and the warehouse could provide certification about the quality and quantity of goods, the receipts would have much more negotiability. However, this presupposes availability of acceptable grading norms & standards of the goods kept in the warehouse (which may be acceptable across the country) and the reliability of the certification system. It is hoped that in due course, with the development of appropriate legal framework, these receipts could be maintained as dematerialized securities in the securities depositories and used for settlement etc.

5.17.4 However, the crucial issues are evolving of commercially acceptable quality standards in respect of different commodities, the accrediting agency working efficiently to improve confidence, having arrangements for gathering appropriate market intelligence about pricing and analyzing it for linkage with quality/standards of the commodities accepted for storage.

Box-7

The Expert Committee on Strengthening and Developing of Agricultural Marketing [Chairman, Shankarlal Guru -2001] had suggested [Para 3.26] as under.

a. To promote development of a national warehousing receipt system for agricultural commodities, as a part of its policy of ensuring that Indian agriculture is globally competitive while enhancing rural welfare and food security.
b. To declare CWC and SWC as Accreditation Agencies for certified warehouses for warehouse receipt.
c. Lay down various standards, specifications for certified warehouses, so also rules and regulations for managing them including fidelity aspects.
d. All licensed warehouses to confirm to the minimum professional standards in order to provide confidence to lenders and public in general. They will be encouraged to develop their own code of conduct for self-regulation.
e. Existing warehousing laws may be suitably amended. A formal regulatory authority may be constituted to enforce standards and protect the interest of those holding warehouse receipt against negligence, malpractices or fraud. The regulatory authority has to be structured to ensure its complete autonomy and freedom form political interferences.
f. To produce latest information system for warehouse receipt to help in identifying ownership of produce, transferors of lien, holder of lien, hypothecation of receipt for loan and trading of the produce in the context of spot delivery.
g. On the negotiability of the instrument i.e., warehouse receipt there may be incidence of various taxes and levies, which should be exempted for five years to begin with, to make these receipts popular.
h. The negotiability of warehouse receipts require amendments to various Acts of Central and State Governments which may have to be looked into

5.17.5 The banking system also needs to develop the credit business potential of financing projects for improving/modernization of markets, storage including cold storage facilities, rural based transport operators etc. NABARD could take the lead in assessing the potential and developing model schemes etc. The ICICIs strategy to look at the entire value chain of a product for exposure could help in reducing risks and improve cash flow trappings both of which are important for a banking institution. The public sector banks also need to innovate and bring some aggressiveness in agriculture credit if they want to take this business away from the informal agencies particularly the traders and commission agents. In this context, it may be appropriate to recall the observation of the Advisory Committee on Flow of Credit to Agriculture under the Chairmanship of Shri V.S. Vyas [RBI-2004] on the potential of credit for marketing, 'In the context of commercialization of agriculture, marketing of agriculture produce has emerged as a challenging area. It requires smooth channels for transport of produce, physical infrastructure such as warehousing, market complex and credit support to producers. The credit needs for the development of market infrastructure for agriculture sector will be enhanced in the context of commercialization and globalization'.

5.18.0 Commodity Forward Trading

5.18.1 The Forward Market Commission regulates forward trading under the Forward Contracts [Regulation] Act [FCA], 1952 with the main objective of guarding against unhealthy speculation in commodities. Forward or futures trading is done in the recognized exchanges registered under the FCA. There are both single and multi commodity exchanges. While India has a long history of futures markets in agricultural commodities, during the mid sixties to 2002 forward trading was banned for most of the commodities. The situation was reviewed from time to time by experts and the Kushro Committee in early eighties and later the Kabra Committee [1994] recommended reintroduction of futures trading in several agricultural commodities. The Govt. of India have permitted futures trading in many commodities now, including wheat, gram, coarse cereals, kharif pulses, peas, rice, paddy, khandsari sugar, sugar, gur, coffee, potato, turmeric, cotton, raw jute, major edible oils, oilseeds and their cakes, rice barn, chillies, cloves, ginger, rubber, pepper, silk etc. At present 3 national level exchanges and 21 regional exchanges are operating. The experts have estimated potential of futures trading of about Rs. 55 lakh crore annually.

5.18.2 **Forward and futures markets enable sellers and buyers to reduce uncertainty and the consequent risk through price discovery ahead of actual production**. By aligning their functioning with spot markets, the forward/futures markets can work as a tool to handle complex situations arising from good and bad harvest through stabilizing supplies and prices. The futures market would give signals to the producers to increase/decrease the area under a particular crop. The processors could hedge price risks and avoid storing of goods. An efficient futures market is essential for development of processing industries. The preconditions for the development of futures market are (a) Free commodity market where price is determined by market forces without too much government interference (b) sufficient fluctuations in prices (c) presence of active players in the market (d) large supply and demand of the commodity (e) standardization of produce to be traded (f) proper storage arrangements and a free movement of commodities.

5.18.3 The Inter-Ministerial Task Force on Agriculture Marketing had among others suggested (a) making the Forward Marketing Commission [FMC] an autonomous body like SEBI and (b) amending FMC Act to enable options trading. These suggestion need to be favourably considered. Further the trading procedures could be improved by introducing time stamping obligation and the monitoring of prices by the Exchange officials on a minute–to-minute basis. These prices also need to be disseminated widely with the help of IT. The length of the trading time should also not be very long which adversely affects liquidity and makes close monitoring of the functioning difficult.

5.18.4 A notable recent development has been the establishment of NCDEX [National Commodities and Derivative Exchange] jointly by NABARD, National Stock Exchange, ICICI Bank and LIC. Later, IFFCO, CRISIL, PNB and Canara Bank have also joined it. It is a national level commodity exchange, set up on modern lines on the pattern of NSE where management and ownership is completely different from the trading members. It is now the largest exchange in Asia after Japan and China. Trading is on line through nearly 6000 terminals covering 33 agriculture commodities. Over 430 cities and towns are covered, in December 2004, it reported average daily volume of Rs. 1619 crore and has about 55% share among all commodity exchanges working in India. The NCDEX has over 50 warehouses accredited and more are likely to be accredited. It is learnt that the NCMSL [an off-shoot of NCDEX] is proposing to have 1,000 warehouses across the country by 2007.

5.19.0 Use of information Technology (IT)

5.19.1 IT involves the electronic processing, storing and communication of information. Anything, which could be represented in digital form, is covered by the term information. Use of IT in agriculture marketing is becoming increasingly indispensable. **Encouragement needs to be provided to generate and host useful portals, websites database information packages and other software on agriculture marketing**. The farmers would increasingly require more and more information about demand, prices, availability of inputs, quality specification, market and transportation charges, arrivals in market, international prices, forecasts of weather, prices and production, rules and regulation at the destination market, legal provision regarding storage, transportation,

labeling, tracing the origin, phyto-sanitry requirements, research findings etc. A subsistence farmer or one who produces low value output for rural periodic market does not need information on these aspects in such details and coverage. High value, market led production would rest on these details. Benefits of off-season and pre-season or end season production, peak demand and high prices period in domestic and international markets would be important details for the crop and variety to be cultivated by modern farmers. Setting up of information kiosks in the markets should be encouraged to enable the farmers to exploit the opportunities being provided by the information revolution.

5.19.2 Agricultural produce marketing requires connectivity between the markets/exporters/growers/traders/industries/consumers through a network with national and international linkages. There is need of such network through which day-to-day commodity arrivals, prevailing rates, export related information could be available.

5.19.3 For penetration of Information Technology at the grass root level i.e., the farmers, the APMC staff, the extension personnel etc. have to be computer literate. Massive programme for computer literacy may have to be undertaken.

5.19.4 An important barrier to realizing the economic benefits of IT is the initial up-front cost of investing in new infrastructure – both hardware and software, the availability of electric power and training. The initial investment cost is coming down and the ITC's e-choupal business model has shown that the initial cost could be recovered in as short a period as 18 months. While it may not be so in most cases and hence State support may be needed. As regards availability of assured power, battery back ups are partial solution but solar technologies appear to be more promising. Again, ITC's e-choupal has solar power backup and VSAT connectivity. Training of rural kiosk operators and other field personnel is important and would be an on-going process.

5.19.5 Some of the better known IT initiatives in rural areas are Gyandoot in Dhar district of MP which provided a range of e-governance related information, ITC's e-choupal, TARA haat operating mainly in Bundelkhand [UP] and in Punjab with a mix of e-governance services and market price information etc. and the NDDB- Karnataka Govt's SAFAL project which has a completely IT based marketing set up. The above experiments and many other similar initiatives are indicative that there is a potential of

using IT in marketing of agriculture produce or other aspects relating to agriculture and the perceived difficulties of high initial cost, lack of assured supply of electricity or the non-availability of trained manpower etc. can be overcome with imagination and a strong development orientation. The Village Knowledge Centres under the Programme Every Village a Knowledge Centre could impart trade and quality literacy among farm men and women.

5.20.0 Concluding Remarks

5.20.1 The Mid-term Appraisal of the Xth Plan has observed under the Box "The Way Forward' as under

'Change agriculture marketing laws of the States and facilitate contract farming to help develop the marketing links that are necessary for raising the efficiency of agriculture. Link Central assistance to the initiation of market reforms in order to bring about changes in the Agriculture Produce Marketing Committee (APMC) Acts. However, since transaction costs and contract enforcement can work against small farmers, this must be accompanied by steps to empower the cooperatives/Panchayats to negotiate on behalf of such farmers.'

5.21.0 Summary of Recommendations

5.21.1.0 Legal Issues

5.21.1.1 The State Agriculture Produce Marketing Acts need to be amended to provide for among others, encouraging the private sector or cooperatives to establish markets, develop marketing infrastructure and supporting services, collect charges and allowing marketing without the necessity of going though APMC/licensed traders. Further, the market fee and other charges needs to be rationalized. While the Government of India is attaching considerable importance to amendments of the APMC Act and have also circulated a draft of the amended APMC Act, the response from the some of the States is not adequate. [Para 5.9.5 & 5.9.6]

5.21.1.2 There is an urgent need to undertake a review of the Essential Commodities Act and other legal instruments covering marketing, storing and processing of agriculture produce; some of these Acts and Orders appear to have outlived their utility. [Box-1]

5.21.1.3 The complex tax structure and multiplicity of State level taxes distort the process of trade and marketing. Inter-State and Center-State harmonization of tax law and their administrative system could help in simplification of tax regime which in term would facilitate internal trade. [Box – 3]

5.21.2.0 **Markets**

5.21.2.1 The coverage of regulated agriculture markets needs improvement. On All India basis, the average coverage of a regulated market is 459 sq. kms. Some of the States where the coverage is below the all India average are: Assam [2257 sq. kms], H.P. [1600 sq. kms], Orissa [1053 sq. kms], Rajasthan [830 sq. kms] and MP including Chattisgarh [719 sq. kms]. The thin spread of regulated markets in areas where road connectivity is also not good makes it difficult for the farmers to reach the market. In the Karnataka Study of 3408 farmers, nearly 22.15% indicated distance as a reason for not selling their produce at the regulated markets. [Para 5.9.1,Para 5.7.1 & Para 5.8.2]

5.21.2.2 There is a need for focused attention on improving the rural periodic markets, which are the first contact point for the farmers. [Para 5.9.1]

5.21.2.3 The infrastructure facilities at most of the regulated markets are inadequate. There is need for considerable improvement particularly for cleaning/grading/drying/storing of the produce, installation of electronic weighing machines, availability of clean drinking water and other amenities for the farmers. [Para 5.9.1]

5.21.3.0 **Marketing**

5.21.3.1 Auction systems at the regulated markets need to be more transparent so as to avoid any possibility of manipulation of prices by the traders and build the confidence of the farmers. [Para 5.8.1]

5.21.3.2 Professionalisation of the existing regulated markets and restoration of elected boards be given priority. [Box –2]

5.21.3.3 The behaviour/attitude of the Hamals/coolies/weighing men is a source of irritation to the farmers for whom the markets have been developed. Many farmers complain of long delay [necessitating overnight stay] in the markets. [Para 5.8.1]

5.21.3.4 The role of the APMCs/ SAMBs should change from regulatory focus to promotion of grading, branding, packaging and the development of distant and international markets for the local products. [Para 5.9.8]

5.21.3.5 Restructured Land Use Boards supported by a team of experts at the State level should give pro-active advice to the farmers based on meteorological, marketing and managerial information in the matters regarding the choice of crops/ varieties/timing etc. Modern high value agriculture would involve greater risks and the farmer would benefit from information based advice rather than scattered information/hearsay/advice by people without strong technical support. [Para 5.10.1]

5.21.3.6 Commodity based farmer's organizations may be established. These organizations could play an important role in developing market orientation among the farmers and could also articulate farmer's issues on commodity basis. The DMI in the Agriculture Ministry could take a lead in this matter and facilitate establishment and growth of such farmer's organizations. [Para 5.10.2]

5.21.3.7 Initiatives, which provide farmer a choice like the ITC's e-Choupal or NDDB led SAFAL, should be supported and replicated. [Para 5.16.2]

5.21.3.7 Product quality is the key to better prices. Training of farmers in maintenance of quality standards/specification should receive greater attention. The extension agencies/NGOs/PRIs could play a role in this knowledge dissemination. [Para 5.10.1]

5.21.4.0 **Post Harvest Operations**

5.21.4.1 There is need to improve post harvest operations and handling of produce. The losses in harvesting, threshing, farm storage, packing, transportation from farm to Mandi are quite substantial. These need to be controlled and eliminated. The extension staff/PRIs could play an important role in educating the farmers in better post-harvest practices. There is a need for introducing a post harvest technology wing in every Krishi Vigyan Kendra [KVK]. [Para 5.13.1 & 5.13.2]

5.21.4.2 A strong emphasis on grading is necessary. There is need for fixing quality standards for all agricultural commodities and a need for introducing compulsory grading before sale in the regulated markets in a phased manner. [Para 5.9.2]

5.21.5.0 Supply Chain

5.21.5.1 There are too many intermediaries in the supply chain. Their margins as compared to the value addition provided are unreasonably large. Tightening of the supply chain is called for. The role of the cooperatives in marketing needs to be expanded. To begin with, they could aggregate the produce, improve post harvest handling and provide much needed pledge finance to the farmers. [Para 5.13.3]

(iii) The direct marketing by farmers needs to be encouraged by providing them opportunities for direct sale to consumers in the regulated markets, as also by developing special markets/bazaars for the purpose. [Para 5.13.3]

5.21.6.0 Government Interventions

5.21.6.1 Delay in issue of the Minimum Support Price (MSP) particularly in respect of Kharif crops needs to be avoided. [Para 5.12.6]

5.21.6.2 Implementation of MSP across the regions needs improvement. Except Punjab, Haryana, U.P and Andhra Pradesh to some extent, the prices of agricultural commodities covered under MSP in other States often rule below the MSP in absence of any government intervention. Not withstanding the weaknesses, the MSP may have to be continued in the foreseeable future and its implementation improved. The eastern region needs special attention because of the widespread poverty as also the potential to improve productivity provided the farmers get better prices for their produce.

[Para 5.12.5 & 5.12.7]

5.21.6.3 The small and marginal farmers are more concerned about the paid out prices of the purchased inputs. Any decision to reduce subsidies on inputs and allowing compensatory increase in output prices may have to be carefully examined and analysed, as most marginal farmers are net buyer of food grains etc. [Para 5.12.8]

5.21.6.4 The price behaviour of sensitive commodities like milk, potatoes, onions, tomatoes, etc. needs to be closely watched particularly during the glut and off-season for need-based intervention under 'Market Intervention' Scheme of the Government of India.

[Para 5.12.7]

5.21.6.5 The import tariffs on farm products like oil seeds produced in resource poor particularly dryland areas need to be carefully monitored and maintained at level to provide sufficient incentives to the dryland farmers. [Para 5.12.9]

5.21.6.6 In view of the likely expansion of horticulture production under the Horticulture Mission, the Government may consider promoting processing zones in the rural areas by providing them the Income-Tax and other benefits/concessions on the lines of those available to the Units in the export oriented zones. Further, there is also the need to reduce the high packaging costs and development of cost effective packaging/marketing options. [Para 5.13.5]

5.21.7.0 Financial Aspects

5.21.7.1 There is a need for substantial increase in marketing credit. Credit availability for eliminating distress sales is important. Pledge loans to farmers should be liberalized and encouraged. NABARD could play its promotional and developmental role in improving institutional credit flow for developing infrastructural facilities in the markets.

[Para 5.17.1 & 17 5.17.5]

5.21.7.2 There is a need to encourage instrument based or secondary markets of agriculture produce. The constraints in improving the negotiability of the warehouse receipts need to be removed. [Paras 5.17.2 & 5.17.3]

5.21.7.3 Futures trading in commodities is important. It enables sellers and buyers to reduce uncertainty and consequent risks through price discovery and hedging well ahead of actual production. It needs to be encouraged. For better supervision and regulation a SEBI like autonomous body may be created. Option trading also needs to be permitted.

[Para 5.18.3]

5.21.8.0 Contract Farming

5.21.8.1 The Government may work out a farmer centric 'Code of Conduct' for contract farming arrangements, which should form the basis of all contract farming agreements and also encourage development of farmer's groups/organisations to negotiate with the purchasers and take care of the interests of the small farmers. Till such time a cautious approach is needed towards contract farming in India. [Para 5.14.8]

5.21.8.2 While prompt settlement of disputes is crucial to Contract Farming arrangements, compulsory registration of Contract Farming agreements with the APMC may not be insisted upon. [Para 5.14.6]

5.21.9.0. Others

5.21.9.1 Indian agriculture must move from low value agriculture to high value agriculture. There is an urgent need to provide extensive training to the farmers and also creation of quality testing laboratories and other infrastructure for the purpose in rural areas. The concept of 'Farm-Schools' for lateral training of the farmers needs to be pursued. [Para 5.10.1]

5.21.9.2 The permit system for issue of 'national permit' to the transport operators needs to be reviewed. The harassment to which the truck operators are subjected to [insistence on showing the draft paid for obtaining the national permit/or demanding payment at border check posts] need to be curbed. [Box – 3]

5.21.10.0 Use of IT

5.21.10.1 Encouragement needs to be provided to generate and host useful portals, websites, database information packages and other software on agricultural marketing-Organizations including corporates may be supported in their IT based ventures to improve agriculture and agricultural marketing. [Para 5.19.1]

5.21.10.2 Setting up of information kiosks in the markets may be encouraged to enable the farmers to exploit the opportunities being provided by the information revolution.

[Para 5.19.1]

Acknowledgement

The National Commission on Farmers acknowledges the cooperation extended by the Department of Agriculture and the State Agricultural Marketing Boards of Madhya Pradesh and Karnataka in organizing consultations with the officers of the Government of India, State Governments, Banks, NGO's, Industry and farmers on the subject at Bhopal and Bangalore respectively. The sharing of knowledge and experiences by the participants in the above meetings has been of great help in preparation of their note.

Appendix I

S. No.	Name of the State	Market fee	License fee Rs. per annum	Market charges Rs. per unit	Commission Charges	Octroi	Sales Tax	Remarks
1	Andhra Pradesh	All commodities - 1% (Except fish where it is 0.50%)	Traders- 'A'—125 'B'—75 'C'—50 'D'—25	1.Weighing 0.50 to 0.75 2.Unloading 0.50 to 0.75 3.Brokers—nil 4. Hamal—0.50 to 0.75 5.Cleaning 0.75 to 1.00 6.Loading 0.50 to 0.75	F & V-4% Others- 1 to 2%	nil	All commodities (except Maize, Jowar, Ragi, Bajra, coarse grains) 4%	
2	Arunachal Pradesh	All commodities —1%	Traders – 1500 Comm.Ag. —1000 Weighman —200 Hamal—100	1.Weighing —nil 2.Unloading —nil 3. Brokers—nil 4. Hamal—nil 5.Cleaning —nil	F & V- nil Others- nil	nil	nil	
3	Assam	All Commodities —1%	Traders – Rs.10	1.Weighing- 2.Unloading 3. Brokers— 4. Hamal— 5.Cleaning Markets are not in operations*	nil	nil	All commodities (except rice, wheat, pulm, f&v, fish, gur, atta, maida etc.)—4 to 8%	* Not collected as markets are not in operation
4	Delhi	F & V—1% Food grains—1%	Traders – 'A'—100 'B'—100 'C'—100 'D'—100 'E'—50	1.weighing —0.70/bag 2.Unloading —0.70/bag 3. Brokers—nil 4. Hamal—nil 5.Cleaning —0.40/bag	F & V – 6% Food Grains & Pulses- 2.% Chillies- 2.5%	nil	F & V- nil Oilseeds- 3% Methi-7%	
5	Gujarat	All commodities -0.5%	1.Comm.Agents- Rs.100/annu 2. Traders 'A'- 75 'B'-50	1.Weighing 1 to 2.5 depending upon weight of bag 2.Unloading	1. F & V 6% 2. Food Grains 2%	0.2 to 4%	1.Spices —3% 2.Aniseed —2% 3.Cotton —4%	Other agricultural commodity exempted from Sales Tax

			'C'-5 to 30	—2.5 3. Brokers—6 4. Hamal—1/bag 5.Cleaning—nil			4. Isabgol—2% 5. Cummin—2% 6. Ajwain—2%	
6	Goa	All commodities -1%	Traders 'A'-150 'B'- 100 'C'- 50	1.Weighing- 2.Unloading 3. Brokers-- 4. Hamal-- 5. Cleaning 100/Truck	nil	nil	1.Betelnut—2% 2.Cashew nut—2% Coconut, F & V, Cattle & Milk exempted from Sales Tax	Entry fee Cattle- Rs. 10/head Vehicle- Rs. 10/truck
7	Haryana	All commodities -2%	Traders – 'A'—100 'B'—60 'C'—20	1.Weighing—0.55 2.Unloading—0.40 3. Brokers—0.16 4.Hamal—1.0 5.Cleaning—0.65	F & V – 5% Others- 2.50%	nil	F & V- nil Food grains—4% Pulses—4% Oilseeds—4%	
8	Karnataka	1. Food grains-1%(advalorum) 2.Livestock-Cattle-Rs. 5/head Sheep/Goat-Rs.1/head	1.Traders/Comm.Agents Rs. 200 2. Others Rs. 100 3. Retail traders Rs.25	1. Weighing 0.50 to 3 2.Unloading 1 to 3 3. Brokers 0.50 to 10 4. Hamal 1 to 3 5. Cleaning 1 to 3	1. F & V-5% 2. Food Grains-2%	nil	1. Food grains- nil 2. Pulses-2% 3.Oilseeds - 4%	Market fee exempted for Industrial & Export Purchases.
9	Kerala	There is no fix rate	No APMC	1. Weighing 2.Unloading 3. Brokers- 4. Hamal- 5. Cleaning-No APMC	nil	nil	Rs. 4 to 8%	There is no market regulation and hence no prescribed charges.
10	M.P.	All commodities - 2%	Traders-1000/- anum Processor-1000/-anum	1. Weighing 2.Unloading 3. Brokers 4. Hamal 5. Cleaning different rates in each market	nil	nil	NA	Development cess from traders only- 1 to 5%

11	Maharashtra	All Commodities- 0.75-1.0%	Traders- Rs. 3 to200 Rate varies from market to market	1. weighing- 2.Unloading 3. Brokers- 4. Hamal- 5. Cleaning- Various rates in different market	F & V –7 to 8% Others-2 to 4% Spices-7%	nil	All agricultural commodities are exempted from Sales Tax	Entry fee-Rs. 10/truck.
12	Meghalaya	All commodities -11%	As per provision of the Act	1.Weighing-nil 2.Unloading -nil 3. Brokers-nil 4. Hamal-nil 5. Cleaning-nil	F & V- nil Others- nil	Nil	Nil	
13	Nagaland	All commodities -2% Livestock-Rs. 5/head	Traders—100	1. weighing-0.50/Qtl 2.Unloading -5.0/Truck 3. Brokers-nil 4. Hamal-nil 5. Cleaning-1.0/truckload 6. Service charges-0.50/Qtl	F & V-2% Others-2%	Nil	Nil	
14.	Punjab	2%	N.A.	N.A.	2.5%	Nil	4%	Rural Development Cess 2%Infrastructure Cess 1%
15	Rajasthan	All commodities -1.60%	Traders—200 Comm.Ag—200 CA cum Tr.—300	1. weighing-1 to 2 2.Unloading - 0.50 to 1 3. Brokers-2 4. Hamal- 1 to 4 5. Cleaning-1 to 2	F & V-6% Others-2%	nil	F & V—nil Food grains—4% Pulses & Oilseeds-2% Coarse grains-nil	Surcharge on Sales Tax-15%
16	Tripura	All commodities -2%	Traders-Rs. 20 to 50	1.Weighing-2.50 2.Unloading -2.50 3. Brokers- 4. Hamal- 5. Cleaning-5.00	nil	nil	Nil (for all agricultural commodities)	Entry fee Rs. 1/head

17	Uttar Pradesh	All commodities -2% +0.50% Development Cess	Traders- Rs. 250 Retailers- Rs. 100	1.Weighing-0.50/Qtl 2.Unloading -0.50/Qtl 3. Hamal-1.0/Qtl 4. Cleaning-1.00/Qtl 5. Brokers-0.50%	F & V-3% Others-1.50%	nil	Food grains-4% Pulses-2% Oilseeds & Others-4%	
18	West Bengal	Cereals—0.50% Others—1%	Traders-150 Comm.Ag.-200	1. weighing-2.Unloading 3. Brokers-4. Hamal-5. Cleaning-No fixed rates, varies as per local charges for other activities	No fixed rates	nil	NA	Purchase Tax on Jute—4%

Appendix II

Progress of Reforms in Agricultural Markets (APMC Act) as on 03.05.2005

S. No.	Stage of Reforms	Name of States/Union Territories
1.	States/UTs where there is no APMC Act and hence not requiring reforms	Kerala, Manipur, Andaman & Nicobar Islands, Dadra & Nagar Haveli, Daman & Diu and Lakshdweep
2.	States/UTs where APMC Act already provides for the reforms	Tamil Nadu
3.	States/UTs where reforms to APMC Act has been done as suggested	Madhya Pradesh, Himachal Pradesh, Sikkim and Nagaland (Gazette Notification under issues), Andhra Pradesh (ordinance under issue)
4.	States/UTs where reforms to APMC Act has been done partially	Maharashtra, Rajasthan, Haryana, Punjab, Karnataka, Gujarat and NCT of Delhi
5.	States/UTs where administrative action is initiated for the reforms	Orissa, Assam, Mizoram, Arunachal Pradesh, Tripura, Chattisgarh, Meghalaya, J&K, Uttranchal, Goa, West Bangal, Uttar Pradesh, Pondicherry and Chandigarh
6.	States/UTs where there is no progress	Bihar and Jharkhand

Status of Agricultural Marketing Reforms in different States/UTs as on 3.5.2005

S. N.	State/UT	Whether APMC Act amended, if so required to provide for			Remarks
		Direct Marketing	Contract Farming	Setting up of market in private/coop. sectors	
a. States/UTs where there is no APMC Act and hence not requiring reforms					
1.	Kerala	Yes.	Yes.	Yes.	There is no APMC Act in the State. As such there is no legal bar to direct marketing, contract farming and for setting up of markets in private and cooperative sectors. State Govt. has also prepared a draft Bill on the lines of the Model Act to be introduced in ensuing session of Legislative Assembly.
2.	Manipur	Yes.	Yes.	Yes.	There is no APMC Act in the State. As such there is no legal bar to direct marketing, contract farming and for setting up of markets in private and cooperative sectors.
3.	Andaman & Nicobar Adm.	Yes.	Yes.	Yes.	There is no APMC Act in the UT. As such there is no legal bar to direct marketing, contract farming and for setting up of markets in private and cooperative sectors. Drafting of a new APMC Act to provide for direct marketing, contract farming and setting up of markets in private/cooperative sectors is in progress.
4.	Dadra & Nagar Haveli	Yes.	Yes.	Yes.	There is no APMC Act in the UT. As such there is no legal bar to direct marketing, contract farming and for setting up of markets in private and cooperative sectors.
5.	Lakshadweep	Yes.	Yes.	Yes.	There is no APMC Act in the UT. As such there is no legal bar to direct marketing, contract farming and for setting up of markets in private and cooperative sectors.
6.	Daman & Diu	Yes.	Yes.	Yes.	There is no APMC Act in the UT. As such there is no legal bar to direct marketing, contract farming and for setting up of markets in private and cooperative sectors.
b. States/UTs where APMC Act already provides for the reforms					
7.	Tamil Nadu	Yes	Yes	Yes	The existing Tamil Nadu Agricultural Produce Marketing (Regulation) Act, 1987 does not prohibit direct marketing, contract farming and setting up of markets in private and cooperative sectors in the state.

c. States/UTs where reforms to APMC Act has been done as suggested					
8.	Madhya Pradesh	Yes. Section 36 of the APMC Act provide for sale of notified agricultural produce outside the market yard.	Yes. Section 37-A of APMC Act amended to provide for contract farming.	Yes. Corporate houses/big traders have been allowed under Section 37(3) of the APMC Act to establish purchase centers outside market yard. E-chaupals of ITC which are in the nature of real time market have become a reality due to this amendment.	Requisite reforms in APMC Act completed.
9.	Himachal Pradesh	Yes	Yes	Yes	The Amendment in the APMC Act has been passed by the State Assembly which include direct marketing, contract farming and setting up of markets in private and cooperative sector. The Gazette Notification is awaited.
10.	Sikkim	Yes	Yes	Yes	Sikkim State Agricultural produce Marketing (Development and Regulation Act), 2005 has been passed in the Sikkim Legislative Assembly during February, 2005. The gazette notification is awaited.
11.	Andhra Pradesh	Yes	Yes	Yes	The Bill for Amendment of Marketing Act could not be introduced in the last Assembly Session due to some reasons. However, for issue of Ordinance on amendment of AP Market Act has been sent to the Hon'ble Governor of AP on 15.4.2005. The Amendment Bill covers provisions for Direct Marketing, Contract Farming and setting up of markets in private/cooperative sectors.
12.	Nagaland	Yes	Yes	Yes	The Nagaland Agricultural Produce Marketing (Development and Regulation) Act, 2005 has been passed in the Nagaland Legislative Assembly on 17th March, 2005. The Gazette Notification is awaited.

d. States/UTs where reforms to APMC has been done partially					
13.	Maharashtra	Not yet. Amendment Bill to provide for establishment of direct markets (farmers/consumers) proposed to be introduced in the ensuing Session of Legislative Assembly.	Not yet. Amendment Bill to support contract farming proposed to be introduced in the ensuing Session of Legislative Assembly.	Yes. A new Chapter I-A under Section 5-A inserted in APMC Act to provide for establishment of integrated produce market for fruits, vegetables and flowers in private and cooperative sectors.	Requisite reforms in APMC Act partially completed.
14.	Rajasthan	Yes. Already allowed under the APMC Act. ITC, for instance, permitted to directly purchase from farmers in 8 market areas.	Yes. No restriction under the APMC Act on contract farming. The farmer and the company can enter into agreement for contract farming.	Not yet. While cooperative marketing sector is allowed to set up markets, private sector is not so permitted. Amendment Bill is likely to be placed in the Legislative Assembly in the ensuing Session.	Requisite reforms to APMC Act partially complete.
15.	Haryana	Yes. Direct marketing by the producers is already allowed under the APMC Act	Not yet. State Government has approved amendment to the APMC Act to provide for contract farming. The amendment is awaiting assent of Central Government before its introduction in the State Legislative Assembly.	Not yet. State Government has approved amendment to APMC Act under which business premises of a sponsor company under the contract farming agreement is deemed as a market yard, thus, paving way for setting up of markets in private sector. The amendment is	Requisite reforms in APMC Act partially completed.

				awaiting assent of Central Govt. before its introduction in the State Legislative Assembly.	
16.	Karnataka	Yes	Not Yet	Not Yet. Only NDDB is permitted	Requisite reforms in APMC Act partially completed. The proposal for amendment of APMC Act is being examined in consultation with the Director of Agriculture Marketing.
17.	Gujarat	Not Yet	Yes	Not Yet	The matter has been discussed in the State Cooperative Council. The draft amendment is being processed by Legal Department. However, the government of Gujarat has passed resolution for contract farming on 30th March, 2005.
18.	Punjab	Yes. Already permitted under the APMC Act under Rule 24(1) and widely practiced.	Yes. Already permitted under the APMC Act under Rule 30(B)(ii)(iii) and widely practiced.	Not yet. Requisite amendment to APMC Act has been drafted and is in advance stage of enactment.	Requisite reforms to APMC Act partially completed.
19.	NCT of Delhi	Yes. Farmers' market established by the Govt.	Not Yet	Not yet. State Govt. has said that the APMC Act already provides for setting up of market in private & Cooperative	Requisite reforms to APMC Act partially completed.

					Sectors with the consent of area Marketing Committee. But this is not in consonance with the provisions made in the model law.	
e. States/UTs where administrative action is initiated for the reforms						
20.	Orissa	Not Yet	Not Yet	Not Yet	Requisite reforms to APMC Act not completed. The amendment proposal for establishment of private markets and contract farming Amendment Bill has been placed in Orissa Assembly on 6.4.05 but the same could not be passed due to opposition from some of the members as the proposed amendment in APMC Act violates some provision of Gram Panchayat Act. The Bill has been deferred to future period.	
21.	Assam	Not Yet	Not Yet	Not Yet	The amendment of the APMC Act is under consideration of the Govt.	
22.	Mizoram	Not Yet	Not Yet	Not Yet	The amendment of the APMC Act is under consideration of the Govt.	
23.	Arunachal Pradesh	Not Yet	Not Yet	Not Yet	The amendment of the APMC Act is under consideration of the Govt.	
24.	Tripura	Not Yet	Not Yet	Not Yet	The amendment of the APMC Act is under consideration of the Govt.	
25.	Chattisgrah	Not Yet	Not Yet	Not Yet	The amendment of the APMC Act is under the review of Prawar Sammiti and will be put up before the next State Legislative Assembly.	
26.	Meghalaya	Not Yet	Not Yet	Not Yet	The amendment of the APMC Act is under consideration of the Govt.	

27.	Jammu & Kashmir	Not Yet	Not yet	Not Yet	The amendment of the APMC Act is under consideration of the Govt.
28.	Uttar Pradesh	Not Yet	Not Yet	Not Yet	Amendment proposal in APMC Act is under consideration of the Government which includes provision for contract farming, direct bulk purchase from the farmer and establishment of private sector market.
29.	Uttaranchal	Not Yet	Not Yet	Not Yet	The State has drafted the new APMC Bill largely on the lines of Model Law circulated by Government of India, which will be put up before the State Legislative Assembly in 2nd fortnight of March, 2005.
30.	Goa	Not Yet	Not Yet	Not Yet	The process to amend the APMC Act to bring the suggested reforms has already been started and is in progress.
31.	West Bengal	Not Yet	Not Yet	Not Yet	High Powered Committee set up to study existing system of functioning of regulated Market Committee has submitted reports to Government and the same is under active consideration of the concerned Ministry.
32.	Pondicherry	Not Yet	Not Yet	Not Yet	Amendment proposal was discussed in the meeting held on 19.04.05 under the chairmanship of the Director Agriculture. Final decision will be taken in the month of May, 2005.
33.	Chandigarh	Not Yet	Not Yet	Not Yet	The Punjab State APMC Act is being implemented in UT and the amendments to APMC Act being made by the State of Punjab will be adopted.
f. States/UTs where there is no progress					
34.	Bihar	Not Yet	Not Yet	Not Yet	No progress made
35.	Jharkhand	Not Yet	Not Yet	Not Yet	No progress made

Annexure-1

Annexure I A : Suggestions sent by NCF relating to National Rural Employment Guarantee Bill, 2004

Recommendations for the Amendment of the Proposed National Rural Employment Guarantee Bill, 2004

Sl.No.	Reference	Description in the Bill	Recommendation
1	Chapter I Point (2) (u)	Clause to be added	**In the text, "he/him/his" may be construed to include "she/her/her"**
2	Chapter II Point 3 (I)	Save as otherwise provided, the State Government shall, in such rural area in the State and for such period as may be notified by the Central Government, provide to **every poor household** whose adult members volunteer to do unskilled manual work not less than **one hundred days** of such work in a financial year in accordance with the Scheme made under this Act.	Save as otherwise provided, the State Government shall, in such rural area in the State and for such period as may be notified by the Central Government, provide to **every household** whose adult members volunteer to do unskilled manual work not less than **one hundred and eighty days** of such work in a financial year in accordance with the Scheme made under this Act, provided that at least 50 percent of the person days of employment should be reserved for women.
3	Chapter III	Clause to be added	Thirty days of compensation (including prenatal & post natal periods) for loss of wages for pregnant & lactating women should be paid, when the women is the sole bread winner of the household. She should be allowed to return to work when she requires work to complete the quota of the stipulated number of days.

4	Chapter III Point 6 (1) Point 6(2)	Not-with-standing anything contained in the Minimum Wages Act, 1948, the Central Government may, by notification, specify the wage rate for the purposes of this Act: Provided that different rates of wages may be specified for different areas. Until such time as a wage rate is fixed by the Central Government in respect of any area in a State, the minimum wage fixed by the State Government under Section 3 of the Minimum Wages Act, 1948 for agricultural labourers shall be considered as the wage rate applicable to that area.	The minimum wage fixed by the State Government under Section 3 of the Minimum Wages Act, 1948 for agricultural labourers shall be considered as the wage rate applicable to that area.
5.	Chapter III point 7 (3)	The liability of the State Government to pay unemployment allowance to a household during any financial year shall cease as soon as x x x x	It would be responsibility of the State government to pay unemployment allowance to eligible house hold if the Central Government has placed the necessary resources with the State government. The liability of the State Government to pay unemployment allowance to a household during any financial year shall seize as soon as x x x x x x
6.	Chapter IV Point 17 (2) Point 17 (3)	The Gram Sabha shall conduct regular social audit to all the projects under the 10 scheme taken up within the Gram Panchayat. The Gram Panchayat shall make available all the relevant document including the muster roles, bills, vouchers measurement books, copies of sanction orders and other connected books of accounts and papers of Gram Sabha for the	The Gram Sabha shall conduct regular social **and gender** audit to all the projects under the 10 scheme taken up within the Gram Panchayat. The Gram Panchayat shall make available all the relevant document including the muster roles, bills, vouchers measurement books, copies of sanction orders and other connected books of accounts and papers of Gram Sabha for the

		purpose of conducting the social audit.	purpose of conducting the social **and gender** audit.
7.	Schedule I Clause 1	The focus of the Scheme shall be on the following works in their order of priority: a) water conservation and water harvesting; b) drought proofing (including afforestation and tree plantation); c) irrigation canals including micro and minor irrigation works; d) provision of irrigation facility to land owned by households belonging to the Scheduled Castes and Scheduled Tribes; e) renovation of traditional water bodies including desilting of tanks; f) land development; g) floor control and protection works including drainage in water logged areas; h) rural connectivity to provide all-weather access; and i) any other work which maybe notified by the Central Government	The focus of the Scheme shall be on the following works in their order of priority: a) water conservation and water harvesting; b) drought proofing (including afforestation and tree plantation); c) irrigation canals including micro and minor irrigation works; d) provision of irrigation facility to land owned by households belonging to the Scheduled Castes and Scheduled Tribes; e) renovation of traditional water bodies including desilting of tanks; f) land development; g) development of bio-shields along coastal areas and in Islands (i.e. planting of mangroves, calnarina, etc.) **h)** Raising community nurseries for afforestation and social fore**stry.** i) floor control and protection works including drainage in water logged areas; j) rural connectivity to provide all-weather access; and any other work which maybe notified by the Central Government Further preferred work will include activities which could contribute to human resource development, directly or indirectly or which could enhance quality of life or render public

			service eg. education, child care, health care, sanitation, provision of drinking water and other community services in consonance with felt needs of the community.
8	Schedule I Clause 7	When wages are directly linked with the quantity of work, the wages shall be paid according to the schedule of rates fixed by the State Government for different types of work every year, in consultation with the State Council	When wages are directly linked with the quantity of work, the wages shall be paid according to the schedule of rates fixed by the State Government for different types of work every year, in consultation with the State Council. **It must be ensured that this does not work to the disadvantage of women.**
9	Schedule II Clause 13 (A)	A new work under the Scheme shall be commenced only if (a) at least fifty labourers become available for such work	A new work under the scheme shall be commenced **at the discretion of the local authority responsible for the work, depending on local needs.**
10.	Schedule II Clause 20	The Gram Panchayat shall prepare and maintain or cause to be prepared and maintained such registers, vouchers and other documents in such form and in such manner as may be specified in the Scheme containing particular of job cards and passbooks issued, name, age and address of the head of the household and the adult members of the household registered with the Gram Panchayat.	The Gram Panchayat shall prepare and maintain or cause to be prepared and maintained such registers, vouchers and other documents in such form and in such manner as may be specified in the Scheme containing particular of job cards and passbooks issued, name, age and address of the head of the household and the adult members of the household registered with the Gram Panchayat and this **shall be verified and approved in the Gram Sabha meetings.**
11.	Schedule II Section 27	The facilities of safe drinking water, shade for children and periods of rest, first aid box with adequate material for emergency treatment for minor injuries and other health hazards connected with the work being performed shall be provided.	The facilities of safe drinking water, **hygienic latrines for men and women separately, shade for men and women workers, safe shelter for children with temporary boundary fencing,** periods of rest, first aid box with adequate material for emergency

			treatment for minor injuries and other health hazards connected with the work being performed, shall be provided **at the worksite.**
12	Schedule II Clause 28	In case where at least twenty women are employed at a work site, provision shall be made for one of them to be deputed to look after any children under the age of six years who may be brought to the work site, if need arises.	**Provisions for child care should be made for all children of women working on the site. The women caring for the children should be paid the same EGS wages and may be selected from among those who apply for work, the number required for childcare being related to the number and age composition of children on the site. They may receive brief orientation from the nearest ICDS worker/health worker/ or other crèche worker in the area. In addition, a safe shelter, safe drinking water, minimum equipment for sleeping, cleanliness, hygiene and play, and recurring expenses for adequate nutrition per child per day should be provided as part of the scheme in this regard. Norms shall be worked out by the appropriate Ministry in consultation with experienced childcare professionals and notified.**
13	Schedule II Clause 31	The wages under a Scheme may be paid either wholly in cash or in cash and kind provided that at least one fourth of the wages shall be paid in cash only.	The wages under a Scheme may be paid either wholly in cash or in cash and kind provided that at least **half of the wages** shall be paid in cash only.

Annexure-1

Annexure-I B :Rationale for the recommendations in Annexure-IA

1. In order to increase the gender sensitivity of the Act, it is necessary to clarify that the term `his' wherever it appears in the Act shall include the term 'her'.

2. (a) The benefit of Employment Guarantee Act should not be restricted only for the poor households but should extend to every household, especially since the Common Minimum Programme also does not speak of Employment Guarantee only for poor households but promises it for rural/urban poor and lower middle class households.

   (b) It is felt that an Employment Guarantee for 100 days per household is too low to make a meaningful dent on poverty, especially since both on farm and off farm employment availability and growth continues to be low.

   (c) It is considered desirable to provide for a 50 percent reservation for women. It is actually noted that Tenth Plan also provides for a Women Component Plan stipulating <u>at least</u> 30 percent resources allocation for women. However, since minimum wages are being offered under the proposed Act, there is a strong possibility of male members of a household cornering the employment potential available and hence the need for a 50 percent reservation for women, thereby freeing the men to undertake other activities in the rural areas. Empowerment of women and sensitivity to their role of as a housewife and a mother as well as their social and biological constraints etc have to be kept in mind by the Proposed Act.

3. The problems of pregnant and lactating women are sought to be recognized by proposing this clause.

4. If the Central Govt. specifies the wage rate, there is risk of social tension and discord if the Central wage rate and State wage are different. Workers working on a project under the Employment Guarantee Act and those working on state

projects nearby may get paid differently although they would put in the same work and face the same financial and social difficulties. This would be iniquitous. It is best to rely on the State Minimum Wage Act which take into consideration the local income and price levels.

5. There have been examples where the State Govt. have not passed on the benefits under various schemes to eligible beneficiaries inspite of release of funds from the Central Govt. It is, therefore, proposed to spell out the responsibility of the State Govt. towards the eligible households clearly and at the same time protect them if they are made pay the eligible households without release of adequate resources from the Central Govt.

6. While providing for social audit for the works under the Act it is equally important to spell out the responsibility of the Gram Sabha for Gender Audit also in order to protect the interest of women workers specially with regard to provision of amenities for them.

7. It is necessary <u>but not sufficient</u> to focus on works creating physical assets. It is well recognized that investment in human resource development and social sector are equally important and yet these sectors have suffered due to inadequacy of resources. Employment Guarantee Act can be used to provide a major push to activities relating to childcare, health care, sanitation etc. which are important for the quality of life and well being in the rural areas.

   Some examples of desirable community service in the rural areas which could provide employment to women and which could be funded through wages under the Employment Guarantee Act are:

1. Sweeping the roads,
2. Collection and disposing of garbage,
3. Clearing the clogged drains,

4. Helping for cattle grazing to reduce school drop outs
5. Helping facilitate 100 percent immunization
6. Helping in cooking and distributing mid day meals
7. Helping in providing ICDS services
8. Helping to look after the young children of working women.

8. It is often being observed that Piece Rate System works to the disadvantage of women and they end up getting less for their efforts. It is necessary to protect women workers through the stipulation that piece rate should not work to the detriment of women.

9. Availability of at least 50 persons for starting a work would perhaps be a too rigid requirement. Depending on local population density, lack of availability of other forms of employment and overall hunger and malnutrition, it should be left to the discretion of the local authorities to start a work even if the number of persons available for work is less than 50. In any case such numbers tend to vary on the basis of seasons/festival etc also.

10. Transparency and responsibility can be achieved only if the records maintained in the Gram Panchayats, in this regard are verified and approved in the Gram Sabha meeting also.

11. Gender sensitivity demands separate hygienic latrines and shade for men and women. Further, a women worker cannot work to her potential unless her child is safe at the worksite, protected by a fenced shelter.

12. One of the major reasons for women not coming forth for work is the existence of infants below 2 years of age. Interests of lactating mother who particularly require food and other financial resources for supplementary nutrition can be protected only if adequate child care is available to them at work site. This may require more than one worker for looking after infants depending on the number of worker on the

work site. The child care workers can be provided orientation training to enable them to look after the children at the work site properly. More importantly norms for nutrition for each child per day must be provided in consultation with child care professionals. Considering that 80 percent of the development of the brain of a child takes place during the first eighteen months of child's life, the need for employment for its mother and adequate child care and nutrition for the infant at the work site is too obvious to need elaboration.

13. Considering that the public distribution system does in many case provide for foodgrains, it is necessary to increase the proportion of cash in the wages so that other requirements of a poor family, particularly health care and nutrition are adequately taken care of .

Annexure II: Suggestions sent by NCF relating to The Seed Bill, 2004

The non-availability of quality seed in adequate quantity at right time and at the right place has emerged as a serious constraint to enhanced and profitable agricultural production in the country. The various stakeholders - public and private sectors and farmers must coherently address this serious problem. In this context, the need for an effective farmer-centric, unambiguous, functional, unbiased and easily implementable Seeds Act to ensure smooth flow of quality seed from the "breeder" to the farmer in the desired quality, at the right time and at reasonable price can hardly be overemphasized.

The interest of all sectors of the society and needs, aspirations and vulnerabilities of farmers, especially small farmers, must be adequately addressed. In India, this assumes prime importance as the country accounts for 25 % of the world's farmers (115 million farm families against hardly 1 million in OECD countries as a whole). Moreover, 80 % of the Indian farmers are small and resources-poor.

The Government of India has formulated a draft Seeds Bill 2004, which is being examined by a Standing Committee of the Parliament before its enactment during 2005. Comments have been invited from concerned corners on the Draft Bill. Seed being one of the foremost issues in the priority areas of the work of the National Commission on Farmers, the Commission offers the following comments on this Bill.

1. Object of the Bill:

The Seeds Bill must be farmer–centric. The objective as stated in the Draft Bill does not reflect the role of this Bill in serving Indian farmers and agriculture. This major omission needs to be rectified. Hence the following formulation is suggested:

"To provide for regulating seeds standards and production, processing, sale, export and import of quality seeds to facilitate timely availability of high quality seeds and planting

material in required quantity to farmers at reasonable price for accelerated agricultural development in the country and for matters connected therewith or incidental thereto."

2. Judicious Congruence of the Seeds Bill with other Related Acts:

The Draft Bill does not seem to be in congruence with the National Agricultural and National Seeds Policy. It is also not harmonized with the Protection of Plant Variety and Farmers' Right (PPVFR) Act (2001), Biodiversity Act (2002), TRIPS, CBD and FAO Gene Treaty. Some of the important concerned developments, such as the increasing role of farmers in participatory breeding, traditional seed systems operated by a majority small holders, seed villages, seed banks etc have not been internalized in the Draft Bill, and this omission should be corrected. The Harmonization process, however, must not reduce the overall economic and ecological benefit, especially the interests of majority of the small farmers, as sometimes the attainment of uniformity of standards may be dictated by the strict but not so relevant procedures of one or the other sister Act. The proposed Central Seed Committee (Sec. 4 of Draft Bill) should pay special attention to this aspect.

The proposed Seeds Act, alongwith the other above mentioned Acts or conventions and Treaties, when implemented, is bound to bring significant changes in plant breeding and production and distribution of seed. Their influence on priorities and products, including public goods and improvement of vital 'orphan' commodities, seed pricing and availability to small farmers, the realization of Farmers Rights and benefit sharing, especially with the tribals and the grassroot conservers and farmers breeders is yet to be felt and known. Therefore, under the guidance of the Principal Technical Advisor (See item no. 9 below), provisions in some of the Articles of the Seeds Bill, viz. Nos 21, 22 and 46, should be kept in a dynamic phase and should evolve to be more inclusive, equitable and participatory. The enabling mechanisms should likewise be adjusted.

3. Protection of Farmers' Traditional Rights on Seed and Strengthening Farmers'

Seed Systems:

Sections 13(1), 21(1), 22(1), 23(1) and 43, notwithstanding their accent on quality assurance, deny the traditional rights of farmers to sell their home-produced seed in their neighborhood. High seed replacement rate with quality seed in all crops is beneficial to both farmers and national agriculture. **But, the fact remains that nearly 75 % of the current seed replacement is done by the informal traditional farmer seed system**. No seed industry now or in near future can satisfactorily saturate the national seed system in all crops. Moreover, seed industry is generally not interested in supplying quality seed in several 'orphan' crops, which do not offer profitable business. Therefore, a law that restricts the farmer seed system can neither be realistic nor truly implementable. The Seeds Bill should therefore proactively promote the informal system of seed production and distribution through enhancing quality literacy and awareness of farmers, improving their skills for quality seed production and retooling the nonformal sector to be as good as the formal seeds sector. The private seed industry generally concentrates on the production and marketing of hybrid (F_1) seeds. The Farmers' Seed System and the Commercial Seed System should become mutually reinforcing.

4. Registration Requirements of Variety:

Compulsory registration of variety for its commercial production, processing, sale and export, as detailed in Section 14, is welcome. It is most desirable to safeguard the interest of farmers and national interest, when devised and implemented to serve these ends. But there are certain ambiguities in the Bill. The Process and consequences of registration of variety under Seeds Bill should in principle be made legally consistent with existing national laws such as the PPVFR Act, 2001; the Biological Diversity Act, 2002 and the Patent (Amendment Act) Act, 2002.

A separate clause may be added in the Bill as 14.4 describing the eligibility criteria for the variety to be registered, which should read as "A new variety should be registered under the Act based on VCU (Value in Cultivation and Use) testing conducted

by the CSC accredited centres. This test should be mandatory for all sectors. The existing All India Coordinated Crop Improvement Project (AICCIP) model, which has played a significant role since its existence in multilocation testing of varieties not only for yield but also for adaptation, reaction to insect pests and diseases, providing farmers with widely as well as locally adapted superior varieties, should be adopted by the CSC for VCU testing. However, to make the system more efficient and transparent, the CSC may like to accredit appropriate centers also from private sector in addition to those from SAUs and ICAR.

Disclosure about the pedigree of the variety / hybrids to be registered should be made mandatory to discourage the unauthorized use of PGR and to enable the benefit sharing.

To harmonize the Seed Bill with PPVFR Act, particularly with respect to Farmers' Rights, a clause on benefit sharing as per the provision of PPVFR should be added. This would help protection of the interest of the public sector institutions as well as of the farmers. It would be adequate if the Bill contains a provision stating that all the rights of farmers provided for in the PPVFR Act will be safeguarded.

Registration for sale should be acquired only for new varieties as in the Seed Act of 1966 which limits the requirement to notified varieties. No registration should be required for extant varieties and landraces.

To ensure transparency, a process for pre-grant opposition to registration of a seed variety must be included in the Seed Bill, like it is in the PPVFR.

5. **The Seed Bill should not Facilitate Biopiracy by Promoting Unregulated Seed Export**

Although Section 37 on "Export of Seeds" has provisions to regulate and restrict seed trade in the interest of the nation, it should be explicit in context of safeguarding and benefiting from our bioresources. While seed export should certainly be promoted to enhance income and employment, it should be conferred to those varieties which are registered under PPVFR Act, and only to those countries which recognize plant breeders' rights. Such exports will then be linked to export oriented production with pre-identified export destinations. Export for research should be dealt separately with stringent regulations and liability conditions to exclude abuse of such transfer or on reciprocity basis, as stipulated under the Biodiversity Act.

6. **Labeling on Performance, Compensation and Consumer Protection**

Section 6, 19 and 25 stipulate suitable labeling on the container of seeds intended for sale. Expected Performance of the seed based on specified agronomic performance evaluation is one of these labeling contents. Further, Section 20 says that when a registered seed is sold to farmer, a disclosure should be made to farmer on its expected performance and conditions for realizing such performance. But, this will be possible only when the VAC testing, as mentioned under item 4 above, is made compulsory under the authority of the CSC. The compensation for non performance of seed must be regulated through the National Plant Variety Authority and not through the Consumer Protection Forum or the District Consumer Courts as in the present Draft Bill.

7. **Provision of Registration of Transgenic Variety:**

Section 15 (1) affirms requirement to obtain clearance under Environment (Protection) Act to receive registration for a transgenic variety. However, a provisio is added for granting provisional registration for a period not exceeding two year for transgenic varieties. This implies that a transgenic variety can secure a provisional registration for seed production and sale before it is officially recommended for general cultivation on the basis on biosafety and environment evaluation by the competent authority under the EPA. This provisio on all counts is against public interest and violates

the EPA regulations. The damage done to the environment by the commercialization of the transgenic variety (if any) during the period of provisional registration cannot be undone if later denial of clearance by the EPA comes. The procedures for the release of GM (genetically modified) varieties, already in force, should be strictly followed.

8. **Offences and Punishment:**

The small token penalties for violations contained in the Seed Bill must be revised. When the declared source of registered material has been accessed illegally, registration would be cancelled and criminal and civil liability will be determined.

9. **Management of the National Seed System**

Necessary institutional and financial supports should be provided to establish and operate a world-class enabling mechanism to capture the various national and international opportunities consistent with the national agricultural goal. While the Chair (Secretary DOA) of the Central Seed Committee, in consort with the Provincial Seed Committees, will ensure implementation of the programme, an eminent expert in this highly specialized area should be the Principal Technical Advisor, with a tenure of at least five years, who should be responsible for harmonization and coordination between Central and State Governments and among States in all technical matters. A national grid of well-equipped seed testing laboratories operated by highly skilled human resources should be established. Seed, gene and quality literacy should be promoted at all levels, from farmers to policy makers, by organizing training programmes.

10. **Conformity with existing Acts and Procedures**

The Seeds Bill should not try to undermine the farmer/primary conserver friendly provisions
of the PPVFR and Biodiversity Acts. It should not also undermine the existing procedures for the assessment and release of genetically modified crop varieties. Its main

aim should be to strengthen the integrated growth of farmers and commercial seed systems, so that every farm woman and man has access to high quality seed/planting material at the right time and place and at appropriate prices.

In order to adequately address farmers' concerns, the membership of the Central Seeds Committee (CSC) may be enhanced from seven to twelve which should include atleast five farmers/farmers' representatives. Representation of women farmers, horticulturalists and farmers from disadvantaged areas should be ensured in the Committee to enhance the inclusiveness.

Annexure III : Suggestions made by NCF relating to: Agriculture Credit - Some Issues

The Chairman, National Commission on Farmers along with the members met the Hon'ble Union Minister for Agriculture and Food on 6th April, 2005. The Secretary, Agriculture & Cooperation, Secretary, Food & Public Distribution, Secretary, Animal Husbandry & Dairying, Secretary Department of Women & Child Development, Govt. of India and other senior officers from different departments were present. During the discussions, the Union Minister indicated that while the flow of agricultural credit during 2004 - 05 was likely to reach about Rs.1.08 lakh crore, showing nearly 30% increase over the 2003-04 level, some issues including the rate of interest charged by the Cooperative Banks and the arrangements for providing relief to the farmers in the case of damage to the crops due to natural calamities were causing concern. He desired to have a note covering the above aspects. These issues are discussed in the following paragraphs.

2. With a view to providing the benefit of declining interest rates to agriculture and particularly to the small farmers, the Indian Bank Association had advised the public sector banks in 2003 to reduce their lending rate to not more than 9 percent per annum on crop loans up to a ceiling of Rs.50,000. While the Commercial Banks have by and large, been providing loans to the farmers at low rate of interests, the Cooperative Banks are finding it difficult.

3. The rate of interest charged to the ultimate borrower by the cooperative system in general is in the range of about 11 to 12% per annum. However, in some States like Andhra Pradesh, Karnataka etc. where the State Government is subsidizing cooperative banks, the rate charged to the final borrower is even lower than the rate of interest charged by the Commercial Banks. In other States, where such subsidies are not available, the rate of interest charged by the Primary Agriculture Credit Societies (PACS)

to their members is higher than that charged by the Commercial Banks for agricultural loans.

4. This is mainly due to higher costs of funds and the cumulative impact of the margins retained by the different tiers in the cooperative credit system. One has to remember that the co-operative credit system reaches the ultimate borrowers (nearly 12 crore members of which about 50% are borrowing members[*]) through 1,12,309 PACS located at the village level, while the Scheduled Commercial Banks had about 32,640 rural branches (as on 31.03.2001) with a total of only 1.96 crore rural borrowing accounts. The reach of the cooperatives is much deeper and it also has a larger network, which enables it to deliver financial services to the members nearly at the doorsteps thus, reducing the borrower's transaction cost, which he would incur if he were to approach the branch of a commercial bank or the RRB. However, this adds to the transaction cost of the cooperative credit delivery system. As regards the cost of funds, on a macro basis the working funds of the cooperatives consist of deposits (about 80%) and refinance (about 20%[**]). The cooperative banks offer a higher interest to the depositors and the bulk of their deposits are term deposits, which attract higher interest. The slight concessionality available to them on NABARD refinance is not enough to provide them adequate leverage to dispense credit to the ultimate borrower at the rate of interest comparable to the commercial banks. It may be recalled that earlier, refinance from (NABARD/RBI) used to form over 50% of the total working funds of the cooperative banks and the interest charged by RBI on this line of credit was 3% below the Bank Rate, which provided better leverage to the cooperative banks to lend at lower rate of interest.

5. The interest rate on loans would primarily depend on (a) the cost of funds, (b) transaction cost and (c) risk cost. With the southward trend of the interest rate, the cost of

[*] Report of the Task Force under the Chairmanship of Prof. A. Vaidyanathan
[**] The Advisory Committee on the flow of credit to Agriculture under Chairmanship of Prof. V. S. Vyas

funds of Commercial Banks has declined. At present the rate of interest on term deposits is in the range of 5 to 6 percent or so while saving deposit rate is 3.5 percent p.a On the other hand, as stated earlier, the Cooperative Banks have been offering a slightly higher rate of interest to their depositors and bulk of their deposits are in the nature of term deposits. The impact of the declining interest rate has therefore been less in the case of Cooperative Banks, than in the case of Commercial Banks. It is only when the fixed deposits accepted at the higher rate of interest mature, the benefit of low interest rates would have full impact on the overall cost of their funds. Over time, the cost of funds of the Cooperative Banks would decline but it would take comparatively longer time to register the full impact of the downward trend in interest rate.

6. The transaction cost of the banks includes the establishment cost and the cost of management/manpower. There is a need for all banks to keep the transaction cost to the bare minimum by use of IT, innovations in operations and reduction in expenditure on establishment/manpower etc. Further, as the volumes increase the transaction cost tends to come down. While there is scope for the Cooperative Banks to reduce the transaction cost and work more efficiently, the paucity of resources is a constraint in greater use of IT, ATMs and other innovative systems, etc.

7. As stated earlier, the increase in volume reduces the transaction cost of per unit of money lent. While in the case of Commercial Banks, their direct agriculture loans form only around 11 percent of the net bank credit, in the case of Cooperative Banks the percentage may be as high as 60 to 70 percent in some cases. The direct agriculture loans are smaller in size and hence the transaction cost per unit of money lent is higher. While the Commercial Banks have considerable scope of cross subsidization because of a very diverse portfolio, such cross subsidization is extremely limited in the case of the Cooperative Banks.

8. The risk cost is another important component of the total cost of operations of banks. The risk cost emanates from a host of factors including failure of investments, inadequate

returns due to weather/market risks, defaults due to improper appraisal of loans, diversions of loans, poor follow up and inability to realize the securities available to the bank. If the credit risks caused by climatic factors, price fluctuations, poor health/death of the borrower could be covered by appropriate financial instruments (insurance, futures etc), the total risk for the lending institution would be reduced and interest rate on loans could decline. In absence of availability/use of the financial products covering these risks, the banks have to add a component of risk cost based on their past experience and perceptions.

9. The Report of the Advisory Committee on Flow of Credit to Agriculture, under the chairmanship of Prof. V.S. Vyas (2004) had examined the question of reduction in the interest rate on agricultural loans by banks. The Report has provided some details of cost/margins and the impact of reduction in interest rate on agriculture loans by 2% on macro basis by the Commercial Banks and the Cooperative Banks. The details based on the aggregate position of the commercial banks for 2002-03 was as under

	Percentage to the total assets	
A	Actual	At revised rate of interest
Cost of funds	5.44	5.44
Transaction cost total	2.25	2.25
Risk cost	1.36	1.36
(Provision total)		
	9.05	9.05
B		
Returns on loans etc	8.34	8.20*
Misc. Incomes	1.66	1.66
	10.00	**9.86**
C		
Net Margin (B-A)	0.95	0.81

(*on the basis of the percentage of direct agriculture credit outstanding as a percentage of net bank credit.)

10. The position of the District Central Cooperative Banks (2002) was as follows:

	Percentage to the total assets	
	Actual	If interest on agriculture loans was reduced by 2%
A		
Cost of funds	7.14	7.14
Transaction cost total	1.69	1.69
Risk cost (provision total)	1.91	1.91
	10.74	**10.74**
B		
Returns	10.13	9.58*
Other Income	0.60	0.60
	10.73	**10.18**
C		
Net Margin (B-A)	-0.01	-0.56

*(Assuming 50% of the total outstanding were direct agriculture advances)

11. It would be seen that the commercial bank's margin was to go down slightly with the reduction of interest rate due to reduction in interest rate on agriculture loans by 2% but in the case of the cooperatives (DCCBs) the reduction would lead to a substantial negative net margin.

12. Interestingly, the transaction cost plus risk cost in the case of both the commercial banks and the cooperative banks was nearly the same (3.61 in the case of commercial banks and 3.60 in the case of cooperative banks). The risk cost at DCCB level at 1.36% was low but it needs to be remembered that the DCCB's do not lend directly to the individual farmers but the credit is routed through the PACS etc, which primarily absorb the credit risk of lending to the ultimate borrower.

13. Presently, the interest rate charged by the DCCBs to the PACS in some of the States is not more than 9% p.a., which is charged by the commercial banks to their clients. However, PACS add about 2 to 2.5 percentage points as their margin, which increases the interest rate, which the ultimate user of credit pays. The PACS have an important role in the cooperative credit system. As a matter of fact, this is the level, which needs maximum attention and support but rarely gets it. Improvement in the financial health of the cooperative credit delivery system on a sustainable basis would be possible only if the PACS were to become more efficient, transparent and fmancially stronger.

14. While there is a need to improve the efficiency of the cooperative credit system and all efforts need be made to encourage minimizing overhead costs, cost effective usage of IT etc, the items, which offer greater scope of cost reduction are the prevailing high cost of funds and the risk costs. The Advisory Committee on Flow of Credit to Agriculture (Prof. V.S. Vyas Committee) has observed, " considering the fact that old high cost deposits will be retired in a couple of years there appears to be the possibility of the cost of funds going down by 0.5% to 1% across the banks. The decline would be more pronounced in the case of DCCBs and the RRBs, given their large share of high cost deposits." These banks, particularly the cooperatives also need to improve their 'Funds Management' to reduce the cost and improve their earnings. The important issues are whether for a short to medium term period there could be a special dispensation to improve the proportion of NABARD refinance in the total funds of the cooperatives [according to V. S. Vyas Committee, the ratio is 1:4 on a macro basis] and also a reduction in the interest rate charged on the refinance amount. As stated earlier, at one time, the RBI refinance to cooperative banks for crop loans used to be at 3% below the Bank Rate and the proportion of RBI refinance and deposits in the working funds of the cooperatives was about 1:1. While it may not be possible to go back fully to the earlier dispensation for all times, but it could it be tried as a carefully worked out scheme to provide relief particularly to the small/marginal and the dryland farmers who are facing considerable financial stress. This could help.

15. As stated earlier, the matters concerning credit risks in agriculture financing are important and these impact the rate of interest. The present level of recoveries and the prevailing credit discipline under the cooperative credit system are not sustainable. The recoveries at the PACS level have to be much higher. A small-localized institution working at the village level, which has complete information about the investment, state of the crop, credit history of borrowers etc. should have 'no tolerance' to willful defaults. There is a need for considerable improvement in the recovery system, the environment and also introduction of a system of incentive to encourage on time payment.

16. Then, there are the sectoral risks both at the individual level as well as the systemic risks. Efforts to reduce individual risk (by selling stored produce, taking up a group of economic activities etc.) and dissemination of information regarding improved technologies and practices to reduce production risks have to be continued as an on going process. The systemic risks i.e. common to a large group of farmers could be minimized by an effective crop insurance system. Though the recent efforts to introduce new products and to improve the crop insurance schemes are praiseworthy, the system of settlements/verification and delays etc. cause certain amount of resentment and uncertainty in the minds of individual farmer. An insurance cover should fully assure the insured that if a particular event takes place he/she would be compensated for the loss. The present crop insurance does not provide such. assurance to the insured farmer/the financing bank. This impacts the credit flow and perception of risk both from the view point of the farmer and the banker. Any improvement in mitigation of crop risks due to climatic factors would help in overall reduction in the interest rates.

17. While interest rate is an important aspect of credit, timeliness and adequacy of credit are also equally important. The ultimate borrower is concerned about the total expenses involved in getting a loan and servicing it. A paper of Anita Gill published in Economic & Political weekly [14-20 August, 2004] based on experience of certain districts of

Punjab observes "Then there are additional costs involved like frequent visits to the institution, fee, submission of documents (which more often than not require payment for services to someone who can fill the forms of the illiterate farmers) etc. All expenses can be added up in the rate of interest and the institutional rate of interest then is almost at par with the informal rate of interest".

18. A rural financial access survey (RFAS 2003) conducted by the World Bank and NCAER in UP and AP has also pointed out about considerable time gap in sanction of loans and substantial expenditure which the small borrower incurs in availing institutional credit in rural areas.

19. It is important that all aspects of the delivery system are looked at closely and improved so that credit to the farmers is adequate, timely, hassle free flexible and at reasonable costs.

Provision of Relief to the Farmers in case of Natural Calamities

20. As regards the relief to the farmers in case of loss of crop due to flood/drought etc., farmers in the areas covered by the crop insurance are much better placed. Restructuring/ conversion of short-term crop production loans into term loan provides temporary relief to the farmers. The ability of the cooperative banks to provide this temporary relief largely depends on the financial support of NABARD. In the case of the commercial banks which have all India coverage, the flood/drought etc. are likely to impact only a small percentage of their direct agriculture loans as these natural disasters are likely to be localized. Further, since direct agriculture loans form only a small part [around 11 %] of their total loan outstanding, these banks can take care of such restructuring/conversion from their own funds and the impact on their funds flow/liquidity is very marginal. However, the position of the localized DCCBs in this regard is different. Many of the DCCBs have 60 to 70% of their total outstanding loans for crop loans and a drought/flood in the district could impact most of their crop loan portfolio. If these banks were to provide moratorium on interest/principal and convert these loans into term loans,

their income flow and liquidity would be seriously impaired unless these banks were to get similar relief from NABARD. For obvious reasons, NABARD insists on declaration of 'annawari' and State Government guarantee before it extends conversion facilities to the banks. These are cumbersome and take a time. As a result, conversion of loans gets delayed and the farmer becomes defaulter and ineligible for fresh finance. Another issue is that the total balance under the National Rural Credit Stabilization Fund with NABARD [which is used for converting short-term loans into term loans] as on 31.03.2004 was only about Rs.1104 crore. This need to be strengthened to enable NABARD to have adequate resources for meeting a situation where large part of the country were to be affected by droughts/floods etc in successive years. NABARD on its part has also to look into its procedures /systems/ instructions etc to make them more user friendly and to ensure that the conversion facilities are extended expeditiously.

21. While conversion/restructuring provides temporary relief to the farmers [by way of postponement of repayment obligation], it is also necessary to have a long-term remedy to take care of the impairment of the repaying capacity of the farmers due to successive calamities like floods/droughts etc. The V.S. Vyas Committee [referred to earlier] has recommended setting up of an 'Agri Risk Fund' with equal contribution from the Central and State Governments and the banks. Such a 'Fund' could help in mitigating risks of the lending banks and the hardships of the farmers. The suggestion needs consideration.

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