FAO India Working Documents
1
ISSN 2075-8200

Development Challenges of Indian Agriculture

Background Technical Papers
The National Medium Term Priority Framework
Government of India and FAO

Development Challenges of Indian Agriculture

Background Technical Papers for the Preparation of the National Medium Term Priority Framework for FAO and the Government of India

Editors:
Dr Gopi N Ghosh and Raj Ganguly

December 2008

This compendium consists of ten sector papers commissioned by FAO in 2008, as a precursor to the white paper and finally leading to the development of the FAO-India National Medium Term Priority Framework (NMTPF). These papers are intended to be comprehensive accounts of challenges and opportunities of the sectors thought to be critical for the development of food and agriculture in India.

ISSN 2075 8200

Contents

Abbreviations & acronyms

ACs & ABCs	Agri Clinics and Agri Business Centres
ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AEZ	Agri Export Zone
AfDB	African Development Bank
AgGDP	Agricultural Gross Domestic Product
AGMARKNET	Agriculture Marketing Information System
AGRS	Artificial Groundwater Recharge Structures
AGU	Agricultural Universities
AI	Artificial Insemination
AIBP	Accelerated Irrigation Benefit Programme
AIC	Agricultural Insurance Corporation
AP	Andhra Pradesh
APEDA	Agricultural and Processed Food Products Export Development Authority
APMC	Agricultural Produce Marketing Committee
APMR	Agricultural Produce Markets Regulation
APFAGMS	Andhra Pradesh Farmers Groundwater Management System
APMC	Agriculture Produce Market Committee
APO	Asian Productivity Organization
ARPL	Achievers' Resources Private Limited
ASIDE	Assistance to States for Infrastructure Development of Export
ATMA	Agricultural Technology Management Agency
ATREE	Ashoka Trust for Research on Environment and Ecology
ATIC	Agricultural Technology and Information Centre
AWSs	Automatic Weather Stations
BAIF	Bharatiya Agro Industries Foundation
BASIX	Bhartiya Samruddhi Investments and Consulting Services
bcm	Billion Cubic Metre
BMGF	Bill and Melinda Gates Foundation
BMI	Body Mass Index
BFDA	Brackishwater Fish Farmers Development Agencies
BRGF	Backward Regions Grant Fund
BSE	Bovine Spongiform Encephalopathy
CA	Controlled Atmosphere
CACP	Commission for Agricultural Costs and Prices
CADP	Command Area Development Programme
CAGR	Compound Annual Growth Rate
CAZRI	Central Arid Zone Research Institute
CBD	Convention on Biological Diversity
CBF	Central Board of Forestry
CCI	Cotton Corporation of India
C-DAP	Comprehensive-District Agricultural Plan
CFC	Central Forestry Commission
CFM	Community Forest Management
CFTRI	Central Food Technological Research Institute
CGIAR	Consultative Group on International Agricultural Research
CGWA	Central Ground Water Authority
CIBA	Central Institute of Brackish water Aquaculture

CIAH	Central Institute for Arid Horticulture
CICEF	Central Institute of Coastal Engineering for Fishery
CIDA	Canadian International Development Agency
CIFA	Central Institute of Freshwater Aquaculture
CIFE	Central Institute of Fisheries Education
CIFNET	Central Institute of Fisheries Nautical and Engineering Training
CIFRI	Central Inland Fisheries Research Institute
CIFT	Central Institute of Fisheries Technology
CII	Confederation of Indian Industries
CIMMYT	International Maize and Wheat Improvement Center
CMFP	Comprehensive Marine Fisheries Policy
CMFRI	Central Marine Fisheries Research Institute
CMZ	Coastal Management Zone
CODEX	Codex Alimentarius
CRZ	Coastal Regulation Zone
CSCs	Common Service Centres
CSE	Center for Science and Environment
CSIR	Council of Scientific and Industrial Research
CSOs	Civil Society Organizations
CSR	Certified Shareholder Report
CSR	Corporate Social Responsibility
CSS	Centrally Sponsored Schemes
CSWRCTI	Central Soil and Water Research and Conservation Training Institute
CU	Carcass Unit
cum	cubic meter
cu km	cubic kilometer
CWC	Central Warehousing Corporation
CWC	Central Water Commission
DAC	Department of Agriculture and Cooperation
DAHD	Department of Animal Husbandry and Dairying
DANIDA	Danish International Development Agency
DCCB	District Central Cooperative Bank
DFID	Department for International Development, UK
DIT	Department of Information Technology
DJRC	D.J. Research & Consultancy Pvt. Ltd.
DoAC	Department of Agriculture and Cooperation
DoAH	Department of Animal Husbandry
DoF	Department of Fisheries
DoH	Department of Horticulture
DPIP	District Poverty Initiative Project, Madhya Pradesh
DRDA	District Rural Development Agency
EC	European Commission
EDI	Economic Development Institute (World Bank)
EEIs	Extension Education Institutes
EEZ	Exclusive Economic Zone
EG	Eastern Ghats
EPCG	Export Promotion Capital Goods
EPTD	Environment and Production Technology Division
EPW	Economic & Political Weekly
ERM	Extension, Rehabilitation and Modernization
FAO	Food and Agriculture Organization

FCI	Food Corporation of India
FDA	Forest Development Agency
FDI	Foreign Direct Investment
FFDA	Fish Farmers Development Agencies
FFS	Farmers Field School
FGP	Food-grain Production
FICCI	Federation of Indian Chambers of Commerce and Industry
FIVIMS	Food Insecurity and Vulnerability Information and Mapping System
FISHCOPFED	National Federation of Fishermen's Cooperative
FPR	Flood Prone River
F&V	Fruits and Vegetables
FSM	Food Security Mission
FSI	Forest Survey of India
FSI	Fishery Survey of India
FSSA	Food Safety and Standards Act
FSSAI	Food Safety and Standards Authority of India
FYP	Five Year Plan
GAP	Good Agricultural Practices
GCC	Girijan Cooperative Cooperation
GCF	Gross Capital Formation
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHP	Good Hygiene Practices
GIS	Geographic Information System
GLV	Green Leafy Vegetables
GM	Genetically Modified
GoDE	Government of Denmark
GoI	Government of India
GoJP	Government of Japan
GONL	Georgia Organization of Nurse Leaders
GoUK	Government of United Kingdom
GW	Ground Water
HACCP	Hazard Analysis and Critical Control Point
ha	Hectare
HOPCOMS	Horticultural Producers Cooperatives Marketing and Processing Society
HP	Himachal Pradesh
HRD	Human Resource Development
HTM	Horticulture Technology Mission (for the Northeast & other Hill States)
HYV	High Yielding Variety
IARI	Indian Agriculture Research Institute
IBRD	International Bank for Reconstruction and Development
ICAR	Indian Council of Agricultural Research
ICM	Integrated Crop Management
ICMR	Indian Council of Medical Research
ICFRE	Indian Council for Forest Research and Education
ICRIER	Indian Council For Research On International Economic Relations
ICRISAT	International Crop Research Institute for Semi Arid Tropics, Hyderabad
ICT	Information and Communication Technology
ICC	Indian Chamber of Commerce
ID	Identity Document
IDA	International Development Agency

IFAD	International Fund for Agricultural Development
IFP	Integrated Fisheries Project
IFPRI	International Food Policy Research Institute
IIASA	International Institute for Applied System Analysis
IIM	Indian Institutes of Management
IIT	Indian Institutes of Technology
ILO	International Labour Organization
ILRI	International Livestock Research Institute
IMD	Indian Meteorological Department
IMF	International Monetary Fund
INM	Integrated Nutrient Management
INR	Indian Rupees
INRM	Integrated Natural Resource Management
IPM	Integrated Pest management
IPR	Intellectual Property Rights
IRRI	International Rice Research Institute
ISMR	Indian Summer Monsoon Rainfall
ISOPOM	Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize
IT	Information Technology
ITTO	International Tropical Timber Organization
IWMI	International Water Management Institute
JBIC	Japanese Bank for International Cooperation
JCI	Jute Corporation of India
JFM	Joint Forest Management
J&K	Jammu and Kashmir
JLG	Joint Liability Group
JPC	Joint Parliamentary Committee
JTM	Jute Technology Mission
KCC	Kisan Credit Card
KHDP	Kerala Horticulture Development Programme
Km	Kilometre
KVIC	Khadi & Village Industries Commission
KVKs	Krishi Vigyan Kendras
LAB	Local Area Bank
LFA	Logical Framework Approach
LOP	Letter of Permit
MANAGE	National Institute of Agricultural Extension Management
MAP	Medicinal and Aromatic Plants
MBV	Monodon Baculo Virus
MDB	Multilateral Development Banks
MDG	Millennium Development Goals
MFRA	Marine Fishing Regulation Act
MFI	Micro Financial Institution
MI	Minor Irrigation
MIC	Market Information Centres
MIS	Management Information System
MIS	Marketing Information System
MIT	Minor Irrigation Tank
mm	millimeter
MMA	Macro Management Scheme
MMI	Major and Medium Irrigation

MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MoFPI	Ministry of Food Processing Industries
MoRD	Ministry of Rural Development
MoU	Memorandum of Understanding
MoWR	Ministry of Water Resources
MP	Madhya Pradesh
MPEDA	Marine Products Export Development Authority
MSP	Minimum Support Price
MSSRF	M S Swaminathan Research Foundation, Chennai
MTA	Mid-Term Appraisal
NAARM	National Academy of Agricultural Research Management, Hyderabad
NAAS	National Academy of Agricultural Sciences
NABARD	National Bank for Agriculture and Rural Development
NAEB	National Afforestation & Eco-Development Board
NAFED	National Agricultural Cooperative Marketing Federation of India
NAIP	National Agricultural Innovation Project
NARP	National Agricultural Research Project
NARS	National Agricultural Research System
NATP	National Agricultural Technology Project
NBFGR	National Bureau of Fish Genetic Resources
NCDC	National Cooperative Development Corporation
NCAP	National Centre for Agricultural Economics and Policy Research
NCF	National Commission on Farmers
NCIWRDP	National Commission for Integrated Water Resource Development Plan
NDC	National Development Council
NDDB	National Dairy Development Board
NE	North Eastern
NEC	North Eastern Council
NEH	North Eastern Hills
NER	North Eastern Region
NFDB	National Fisheries Development Board
NFF	National Fishworkers Forum
NFHS	National Family Health Survey
NFSM	National Food Security Mission
NGO	Non-Government Organization
NHB	National Horticulture Board
NHM	National Horticulture Mission
NICNET	National Informatics Centre Network
NIN	National Institute for Nutrition
NIOH	National Institute for Occupational Health
NMTPF	National Medium Term Priority Framework
NNMB	National Nutrition Monitoring Bureau
NPCC	National Project for Cattle and Buffalo Breeding
NPK	Nitrogen Phosphate and Potash
NR	Natural Resources
NRAA	National Rainfed Area Authority
NRCCWF	National Research Centre on Coldwater Fisheries
NREGA	National Rural Employment Guarantee Act
NREGS	National Rural Employment Guarantee Scheme
NRM	Natural Resource Management

NSDP	National State Domestic Product
NSS	National Sample Survey
NTFP	Non-Timber Forest Produce
NW	North Western
NWDA	National Water Development Agency
NWDPRA	National Water Development Programme for Rainfed Area
NWMA	National Watershed Management Agency
NWP	National Water Policy
OBC	Other Backward Classes
OECD	Organisation for Economic Cooperation and Development
O&M	Operation and Maintenance
PAC	Primary Agricultural Cooperative
PACS	Primary Agricultural Credit Cooperative Societies
PDS	Public Distribution System
PEM	Protein Energy Malnutrition
PFDCs	Precision Farming Development Centres
PHM	Post Harvest Management
PIA	Project Implementation Agency
PIC	Prior Informed Consent
PIM	Participatory Irrigation Management
POP	Persistent Organic Pollutant
PPLPI	Pro-Poor Livestock Policy Initiative
ppm	parts per million
PPP	Public-Private Partnership
PRADAN	Professional Association for Development Action
PRF	Portfolio Risk Fund
PRI	Panchayati Raj Institutions
RCCS	Rural Credit Card Scheme
R&D	Research and Development
REDD	Reducing Emissions from Deforestation and Degradation
REGP	Rural Employment Generation Programme
RH	Relative Humidity
RIDF	Rural Infrastructure Development Fund
RIFD	Rural Infrastructure Development Fund
RKVY	Rashtriya Krishi Vikas Yojana
RRB	Regional Rural Bank
RVP	River Valley Projects
SAMETI	State Agricultural Management and Extension Training Institute
SAU	State Agriculture University
SC	Scheduled Castes
SCB	State Cooperative Bank
SDC	Swiss Agency for Development and Cooperation
SDoA	State Department of Agriculture
SEZ	Special Economic Zone
SFHE	Small Farmers Horticultural Estates
SFAC	Small Farmers' Agribusiness Consortium
SFR	State Forest Research
SGSY	Swarnajayanti Gram Swarozgar Yojana
SHG	Self Help Group
SIDBI	Small Industries Development Bank of India
SIRD	State Institutes for Rural Development

SPF	Specific Pathogen Free
SPS	Sanitary and Phytosanitary Measures
SREP	Strategic Research Extension Plan
SRI	Systematic Rice Intensification
SRTT	Sir Ratan Tata Trust
SRR	Seed Replacement Rate
SRI	Systems in Rice Intensification
ST	Scheduled Tribes
SW	Surface Water
SWC	State Warehousing Corporation
SWAN	State Wide Area Network
TBT	Technical Barriers to Trade
TCP	Technical Cooperation Programme
TERI	The Energy Research Institute
TIFAC	Technology Information, Forecasting and Assessment Council
TM	Terminal Markets
TMC	Technology Mission on Cotton
TRIFED	Tribal Cooperative Marketing Development Federation of India Limited
TSI	Technical Support Institute
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNDAF	United Nations Development Assistance Framework
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UP	Uttar Pradesh
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UTs	Union Territories
VAD	Vitamin A Deficiency
VAT	Value Added Tax
VCRC	Vector Control Research Centre
VFPCK	Vegetable and Fruit Promotion Council, Keralam
WB	World Bank
WBCIS	Weather Based Crop Insurance Scheme
WCP	Women Component Plan
WFP	World Food Programme
WG	Western Ghats
WSSV	White Spot Syndrome Virus
WTO	World Trade Organization
WUA	Water Users' Association
WWF	World Wide Fund

Preface

Agriculture in India is passing through a challenging phase. It is receiving renewed attention with an emphasis on accelerating its growth to boost rural sector, mitigating the looming concern for food security and enhancing its contribution to the livelihoods of the majority of people of India. A high growth rate in agriculture is considered a must to promote equity and achieve inclusive growth. Besides the well recognised link between health and agriculture, it is also being considered as part of the solutions to the complex and interconnected problems related to energy and climate change.

In 2008, the Food and Agriculture Organization (FAO) embarked on the preparation of a National Medium Term Priority Framework (NMTPF) with the Government of India (GoI) to outline how FAO can best assist India in meeting its national development goals in agriculture and allied sectors. Conceptually, the NMTPF is a planning and management tool for FAO to prioritize its work in a manner which meets the needs of the GoI. Therefore, the active involvement of the GoI in the process and its ownership of the outcomes were central to achieving the underlying objectives of the NMTPF.

As part of the NMTPF process, FAO commissioned ten papers in agriculture and allied sectors in October 2008. The sectors identified were thought to be critical for the improvement of agriculture with significant relevance to the current development challenges of the nation. Therefore, besides the conventional areas of Crop, Horticulture, Livestock, Fisheries and Forestry, the exercise also attempted to bring in critical inter-sectoral concerns of Water and Natural Resource Management, topping up with over-arching management imperatives such as Agribusiness, Food Nutrition Security and Food Safety and Knowledge Management.

Each paper was intended to synthesize the available information on the development needs of the sector from the GoI and other relevant sources. The basic objective was to scan these documents to present a brief overview of the sector, report on on-going programmes and activities, and focus on current development strategies identifying specific needs and challenges in a prioritized manner.

In this exercise, it was considered critical to garner wider stakeholder involvement to endorse the issues identified, to bring in newer dimensions of the development challenges and to assign priorities. The papers were discussed in a week long stakeholder consultation meeting in December 2008 in New Delhi, with practitioners representing Government, private sector, independent consultants, NGO & civil society, research and academia and bilateral/multilateral agencies. The authors subsequently revised the papers by drawing on the deliberations and guidance received during the consultation meeting.

FAO is publishing a compendium of these ten sector papers to serve both as record of the process used to prepare the NMTPF and as a resource for anyone interested in the development of agricultural sector in India.

Let me take this opportunity to thank all the authors for their painstaking endeavour in preparing these documents. As a lead consultant Dr. Ramesh Chand, ICAR National Professor, New Delhi, provided technical guidance and leadership and Mr. Vijay Sardana ably facilitated the stakeholders' consultations. I wish to place on record

our sincere gratitude to both of them. Our thanks are also due to the distinguished participants, FAO team members and all those behind-the-scene workers without whose support, this endeavour would not have come to fruition.

It is with sadness that I record the passing of Dr. C. L. Trisal who contributed immensely in the preparation of the sector paper on natural resources.

FAO is indeed indebted to the Ministry of Agriculture, GoI, for its active interest, engagement and continued support in conducting the NMTPF exercise and thereby strengthening the FAO-India partnership.

Gavin L Wall
FAO Representative in India and Bhutan.

Crop Production

Prepared by

Damodar Tripathy

About the author

Dr Damodar Tripathy is Managing Director, DJ Research and Consultancy. He is involved in guiding research on development issues in India. Formerly a member of the Indian Economic Service (1971-1995); Division Chief, Agriculture and Rural Development of African Development Bank; and Fellow, EDI World Bank (1983), he has worked for various Ministries of Government of India, including Finance, Agriculture, Water Resources, the Planning Commission, several multilateral institutions (FAO, ILO, UNDP, IFAD, WFP, AfDB) and bilateral agencies as consultant in about 25 countries of Asia, Africa and Europe. He has more than 30 research publications to his credit.

Contents

The crop sub-sector contributes nearly 72 percent to the agriculture and allied sector. The performance of the crop sector has been poor during the last decade and a half. Rate of growth of output in the crop sector in the Ninth Plan was 2.25 percent and in the Tenth Plan slightly higher at 2.46 percent. The performance of cereals was very poor with a growth rate of 1.49 percent and 1.28 percent respectively. In the pulses sub-sector production has been around 14 million tonnes from 1988-89 to 2005-06 despite several schemes supported by a Technology Mission to increase area coverage, production and productivity. Oilseeds have done better with increase in yield specifically after the 1990s. Overall poor performance in the past years can be attributed to several constraints. The declining rate of capital formation in agriculture, hardly any improvement in technology, poor efficiency of resource use including irrigation and fertilizer, low level of adoption of dryland technology, inadequate farming systems approach to crop production were some of the contributing factors. While the price policy has helped a few major crops, in recent years, the terms of trade have been against agriculture.

The major challenge of development of the crop sector is how to increase crop productivity in the face of limitation of land, low resource use efficiency, poor access to credit by small and marginal farmers and declining demand for food grains especially cereals even in rural areas. Declining rate of investment in agriculture specifically in the public sector is a major concern. Although there have been some improvements in the last few years, much needs to be done to accelerate it so that private investment can also increase. Irrigation that shares more than 80 percent of public investment in agriculture has not shown much improvement in its efficiency despite implementation of several programmes with all-India coverage. Technological improvements to suit various agro-climatic zones are a priority area.

Several initiatives taken by the Government of India and the State Governments in recent years have accelerated agricultural growth with a clear break from the past. Priorities and strategies of the governments and the states match and are potent enough to effect adequate growth in the crop sector. But weak organization to coordinate various activities is a major constraint in achieving the sector's growth objective. The multilateral development banks (MDBs), UN agencies including FAO and the bilateral funding agencies have aligned their country strategies to those of the governments but have emphasized on organizational improvements and governance while making policy prescriptions for governments' consideration. NGOs have largely confined themselves to microfinance and local area developments. Governments have recently taken very bold steps to introduce comprehensive district agricultural development planning involving agricultural experts and the people right from the panchayat level to the district level for convergence of all the schemes implemented by various line departments. However, capacity constraints and mindset of government officials limit coordination.

International agencies have over the years made significant contributions by providing guidance to many countries on increasing crop productivity through comprehensive agricultural planning, decentralized administration and economy in resource use. Major areas in the crop sub-sector where there is need for international cooperation are (i) capacity building in sectoral and decentralized planning and (ii) effective coordination at the State, as well as at decentralized levels.

1. Brief overview of the sector

Apart from its impact on livelihoods, food security and employment, importance of agriculture lies in its strategic relationship to country's growth. Approach to the Eleventh Five Year Plan that envisaged agricultural growth rate around four percent showed the high rate at which other sectors must grow in case agricultural growth rate falls to two percent thereby requiring high levels of investment to maintain projected GDP growth rate [a, 14]. Alternatively, if such desired level of investment is not ensured, a fall in rate of growth of agriculture will lead to fall in GDP growth. Experts [3] and planners have expressed grave concern over the decelerating growth of agriculture although they widely differ on their diagnosis.

Crop sub-sector contributes nearly 72 percent to the agricultural GDP generated in agriculture and allied sectors. This sub-sector includes both food and cash crops. The performance of the crop sector has not been satisfactory during the last decade and a half. The rate of growth of output in the crop sector in the Ninth Plan was 2.25 percent and in the Tenth Plan slightly higher at 2.46 percent. The performance of cereals was also poor with a growth rate of 1.49 percent and 1.28 percent respectively. In the pulses sub-sector production has been around 14 million tonnes for the past 15 years despite several schemes supported by a Technology Mission to increase area coverage, production and productivity [30]. From the recent data, it appears that 2007-08 has seen some good results in production of pulses exceeding 15 million tonnes. Oilseeds have done better with an increase in yield specifically from the mid-1990s. As a result, the production of nine major oilseeds has gone up from 22.11 million tonnes in 1995-96 to 28.83 million tonnes in 2007-08. In fibres, cotton has done extremely well due to adoption of new technology; production increasing from 11.53 million tonnes in 1999-2000 to 25.81 million tonnes in 2007-08. During the last two years, sugarcane has done extremely well, from a peak of 299.32 million tonnes in 2001-02 to 340.56 million tonnes in 2007-08. The performance of the crop sub-sector has improved in recent years. Between 2001-02 and 2007-08, production has grown at a compound rate of 3.17 percent, certainly a positive aspect for the sector. Overall, impressive growth rate in agricultural GDP has been experienced in recent years. It increased by 5.78 percent in 2005-06, 3.76 percent in 2006-07, and 4.55 percent during 2007-08 [5]. Food grains production has also gone up to a record 230.67 million tonnes during 2007-08 [b, 11].

Overall low performance of the sector in the past (that can affect future prospects unless corrective actions are taken) was due to several constraints - the most important amongst them being the declining rate of capital formation in agriculture, hardly any improvement in technology, poor efficiency of resource use including irrigation and fertilizer, low level of adoption of dryland technology, inadequate farming systems approach to crop production. While the price policy helped a few major crops, in recent years, the terms of trade have been against agriculture.

To add to the above, monsoon rainfall patterns indicated declining trend and wider fluctuations, more so in recent years. During the period 1998 to 2005, six out of eight years experienced less than normal precipitation and this deficiency was more than 10 percent, a highly critical factor determining

a *Towards Faster and More Inclusive Growth (Draft for Circulation), Approach to the Eleventh Five Year Plan Planning Commission, see table 6, p 13.*

b *4th Advance estimates made by the Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Government of India.*

crop production in rainfed lands [c, 17] and water availability in reservoirs specifically in minor irrigation (flow) projects. In deficit rainfall years, several irrigation projects are not able to store adequate water to provide even for protective irrigation. In such years Rabi irrigated crops are also in high casualty status. With very low percentage of farmers, specifically on dry lands being covered under crop insurance, high fluctuations in rainfall, adversely impacts crop productivity and returns to investment made by farmers in dry land crops. Even with diversification to high value crops and use of the recommended technology, these farmers become indebted forcing some of them to commit suicides [37] to avoid social stigma.

The challenges of development

The major challenge of development of the crop sector is how to increase crop productivity in the face of limitation of land, low resource use efficiency, poor access to credit by small and marginal farmers and declining demand for food grains especially cereals even in rural areas. Further declining rate of investment in agriculture specifically in the public sector is a major concern. Although there have been some improvements in the last few years, much needs to be done to accelerate it so that private investment can also increase. Irrigation that shares more than 80percent of public investment in agriculture has not shown much improvement in its efficiency despite implementation of several programmes with all-India coverage [d].

Technology: Seeds of major food crops including minor millets that can substantially increase productivity at small farm levels are not adequately available. Low fertilizer use efficiency (6.5 in 2000 as against 17.1 in 1970 / 71) and imbalance in use of fertilizers in terms of NPK (actual 7:3:1 as against 4:2:1) are major constraints. Although much is said about several advantages of organic manure, its production and use has not been substantial. Use of organic fertilizers and organo-mineral fertilizers are areas that require urgent attention.

Canal irrigation efficiency is low (30 to 35 percent). How to increase it to overall 45 percent and increase the cropping intensity by another 20 to 30 percent in irrigated area and how to limit ground water to high efficient sprinkler and drip systems to cover more area and avoid water mining are very important challenges both at policy and at implementation level. How to make organizations efficient in managing limited water in watershed areas for ensuring equity, sustainability, higher level of crop output and better livelihood opportunities across various groups need thinking and specific planning and implementation framework for each micro-agro-climatic zone.

Cropping intensity is low at 135 percent despite increase in irrigated crop area coverage. While irrigation efficiency is increasing in some projects funded by external agencies, in other projects it is going down due to poor system as well as distribution management. Crop diversification has also not been up to expectation in irrigated areas.

Over the years farmers have developed innovative technologies and cropping systems to adapt to local situations with positive results on productivity and returns to investment. NGOs too have taken such initiatives specifically in dry land areas and

---

c *Sulochana Gadgil, Siddhartha Gadgil (2006), "The Indian Monsoon, GDP and Agriculture", EPW, Nov. 25. "There is a marked asymmetry in the response to monsoon variability, with the magnitude of the negative impact of a drought being more than that of the positive impact of a surplus. In recent times while the impact of high deficit in ISMR (15 percent) on FGP is 9 percent, that of a surplus of the same magnitude is less than 1 percent. Unless this situation changes, it will not be possible to maintain the growth rate of food grain production at an adequate level for ensuring food security. We estimate that for a drought of moderate intensity (ISMR deficit ranging from 10 percent to 15 percent), at current levels of economy and production, the impact on GDP at current prices is around Rs 50 000 crores or more and FGP deficit of around 10 million tonnes in foodgrain production." P. 4894*

d *For example Command Area Development Programme and Accelerated Irrigation Benefit Programme including Fast-Track projects.*

have developed management systems that improve crop productivity and ensure good rate of returns to farmers investment at all reaches. Systematic rice intensification (SRI) that can substantially increase productivity [e] has been adopted in many upland areas of Eastern region with good results [f]. But institutional promotion of this technology is not taking place on a large-scale to get optimum benefits. Further documentation of improved practices is rarely done at district levels.

There is a declining social esteem *vis-a-vis* farming. Youth are no longer interested in farming as they feel it is not very well regarded by the society. Young agriculture graduates prefer white-collar jobs to farming. In a recent survey it was found that the age of farmers in Orissa varies in the range of 40-45 while 43 years was the mean age. Average age of agricultural labourers was found to be around 40 years. Young people are not interested in farming but in processing, retail trading and helping NGOs and political people to earn their livelihoods [g]. Agricultural labourers do not get the benefit of any training to increase productivity of their labour although farmers on a very limited scale get some opportunity of institutional training.

There is a necessity to involve farmers in processing, packaging and use of logo [h] to improve their income status. Even at the present level of market prices or MSP, farmers can survive and improve their condition if they process and market their commodities. A proportion of additional income generated can go towards savings and agricultural investment to increase crop productivity. Tribal who do not like hybrid maize produced on their own farm sell at low prices. They can, however, use the same maize if processed along with local maize and get a good price [i]. Local processing improves returns to farmers of oilseeds, specifically mustard, in the Northeast where working capital is a major constraint.

Future potential of the sector

A rate of growth of 4 percent in agriculture sector will necessitate crop sector to annually grow between 2.75 to 3 percent without putting a strain on other sub-sectors within agriculture to grow faster than projected for the Eleventh Five Year Plan. Decentralized comprehensive agricultural planning, efficient use of land and water resources, training of farmers and agricultural labourers, technological improvements and appropriate policy measures can increase productivity, reduce cost per unit of production and increase net value added in agriculture. On the demand side rural development with emphasis on non-agricultural ventures such as rural service providers, processors, transporters, producers of non-agricultural items like textiles, arts and crafts can increase rural income and will help increase the demand for agricultural commodities comprising both food and non-food. Overall productivity of major food crops grown

---

e *Upland rice in Sambalpur district has shown higher paddy output by 30-40 percent as compared to the same paddy normally planted. Final returns in SRI are nearly 20 percent higher than in traditional paddy cultivation. Results of crop cutting experiments disseminated in the District Planning Committee Meeting in September 2008.*

f *"System of Rice Intensification (SRI), a new method of paddy cultivation, seems to have borne the fruits in the state, if figures from Ganjam district are to be believed. While a farmer from Baliapada village cultivated 60 quintals per hectare of paddy, another farmer Randha is expected to harvest the same quantity. The productivity has almost doubled after the new method was adopted, claimed farmers". New paddy farming methods bears fruits, The Times of India, Bhubaneshwar – National, Saturday, November 15, 2008.*

g *DJRC survey for Poverty Task - Force Orissa also from a discussion in three Northeastern states of Assam, Arunachal Pradesh and Nagaland it was ascertained that farmers and agricultural labourers are close to forty years, whereas, for retail trade, small business, much younger people are employed.*

h *Ordinary rice from Raipur District of Chhattisgarh and Kalahandi and Nuapada fetches better price in Kolkata than the MSP equivalent.*

i *In Rajasthan, for example, hybrid maize and local maize are mixed for better taste of flour; hybrid maize is used with additives to prepare salted corn-flakes by REGP units having hand demand in the market. The producers of maize get better price because of local processing (Study on KVIC training set up in India by DJRC, 2008).*

in irrigated areas can increase by 20 to 25 percent just by increasing cropping intensity in command areas hitherto not covered, or where crop water stress leads to low productivity, by utilizing water saved through efficient water use even without modernization. This can be achieved by sensitizing people on crop water requirements. Improvements in irrigation efficiency with modernization of delivery system and better irrigated crop water management can boost production by 15 to 20 percent in existing irrigated areas. Water saved can be used for covering more areas in light duty crops, pulses and oilseeds. Organizational improvement can increase productivity by more than 20 percent in watershed areas. Better rainwater management, utilization of ground water recharged by water harvesting structures and farm ponds for cultivation of light duty crops, adoption of cropping systems developed in consultation and active participation of users in watershed development committees can further improve cropping intensity and productivity of crops. So the key to increase in productivity of crops is not just more investment and better policy but appropriate planning and effective implementation coordination of planned programmes and schemes at decentralized levels.

Major programmes undertaken by the Governments

As indicated before, although agriculture is a 'State subject', almost 90 percent of major schemes are initiated by the Centre through Centrally Sponsored Schemes (CSS), each scheme having its own financing pattern, operation guidelines and monitoring format. The Macro Management Scheme (MMA) is a major scheme that included several activities under Centrally Sponsored Schemes to provide flexibility to the States for more effective planning and operations. Despite flexibility, the plans and operational processes did not start from the grassroot (panchayat level) and were completely out of tune with central or state priorities, thrusts and initiatives [12]. Poor inter-departmental coordination was another major lacuna that adversely affected implementation including those of natural resource management as well as cooperative development activities. The importance of MMA as a better development process cannot be over-emphasized and as such it has been retained in the Eleventh Plan with Rashtriya Krishi Vikas Yojana (RKVY) and Comprehensive Agricultural Development Plan (C-DAP) being selected as the major framework to encompass all activities that can converge to provide the impetus for the desired level of agricultural growth.

Among the major initiatives National Food Security Mission (NSFM) has been introduced to step up production of rice, wheat and pulses. The National Policy for Farmers, 2007 with the major aim to focus on the economic wellbeing of the farmers in addition to production and productivity has been approved. Also the National Rainfed Area Authority has been operationalized. The Ministry of Agriculture has also introduced a Weather Based Crop Insurance Scheme (WBCIS) on a pilot basis [13]. In the current fiscal year Comprehensive District Agricultural Plan preparation has been undertaken in large number of districts in several states including all schemes under the Rashtriya Krishi Vikas Yojana (to incentivize the States to invest more in agriculture and allied sectors) and schemes covered by the National Horticulture Mission, emphasizing agricultural planning starting from the panchayat level upwards taking into consideration the resource availability, technology and potential for their use. Guidelines suggest convergence of other programmes like NREGA, Watershed Development, etc. at planning and implementation stages to get optimum results.

Water Resource Development and Management: This strategy [j] includes faster realization of irrigation potential through AIBP and Fast-Track projects to increase water use efficiency for achieving higher cropping intensity, higher level of crop productivity per unit of land, and wherever possible per unit of water [k]. With conjunctive use of surface and ground water, appropriate drainage and equitable distribution of water through active participation of members of Water Users' Association (WUA), quality of irrigation will improve resulting in increased crop productivity.

Credit: Taking note of the constraints of inadequate credit, the government took

j Coming under both agriculture and water resources.

k There is a major constraint in the Ministry of Water Resources itself that it still equates performance with irrigation potential creation and not how effectively this precious water impounding done at high cost increasing every year is utilized. Table 2.8 (p. 77 of Eleventh Plan document shows a caption' Performance of AIBP projects" and provides data on potential created. It should have provided data from evaluation studies conducted through several consultancy organizations by the Ministry of Statistics and Programme Evaluation, GoI. These studies indicate that some of the problems faced by the projects that led to cost-overrun and time overrun are still present in new projects and land acquisition is still a major problem along with contract administration. See, Damodar Tripathy (2007), Performance Evaluation of AIBP Projects, in West Bengal, in Orissa by DJRC.

initiative to double the advance to agriculture within a period of three years. This initiative has yielded positive results at aggregate level, with total advance amount outstanding increasing from Rs 64 009 crores in March 2002 to Rs 2 30 191 crores in March 2007 [l]. However, the farmers of the least agriculturally developed states and specifically the economically weaker communities still have low level of access as compared to the rich farmers. There is sufficient evidence that the well-off farmers specifically in least developed states siphon off large part of this agricultural credit for non-agricultural purposes having higher returns to investment [34]. Inequity in credit advance has among others slowed down growth in the crop sector.

Efforts and approaches by other development partners

Strategic intervention of development partners are more or less aligned to the strategies of the Centre and the States. While the World Bank and ADB have been providing resources for infrastructure, i. e. irrigation and water management [38], power, roads, DFID is busy along with others in watershed development for improving livelihood options, and social sectors. IFAD is concentrating on improving organizations to help improve livelihoods of small and marginal farmers and land-based groups. Resources provided by the World Food Programme are used for building infrastructure that can help marginalized groups to improve their food security status. UNDP also makes targeted interventions, though on a small scale, for improving crop, fisheries and livestock productivity. Empowerment of small-scale producers and inclusive growth are important areas. IFFPRI, in collaboration with other institutions in India has been trying to influence both policy and practice so that the agriculture sector can get a boost. As a knowledge organization FAO has been helping certain initiatives of the Government of India as well as some states under its Technical Cooperation Programme (TCP) to improve food and nutritional security status of the vulnerable population in disadvantaged areas and the people in tsunami affected areas. All these institutions are providing resources for better governance and transparency in project implementation to improve outcomes and enhance development effectiveness. They are also helping governments to develop appropriate policies in their respective priority area [m].

---

l Trends in agricultural Credit by Scheduled Commercial Banks: State-wise and Region-wise (1972 to 2007), Economic and Political Weekly, Vol XLIII No 44, November 1-7, 2008. While the agricultural advances in India increased by 3.6 times during the period, Eastern and Northeastern regions experienced 3.79 times and 3.03 times indicating thereby the poor resource position of the Northeast that needs agricultural advance most.

m Major programmes of development partners include: UNDP – rural livelihoods, CIDA - farm productivity increase, DANIDA - Diversified Agriculture in UP and Uttaranchal, DFID - Rainfed Farming, World Bank – a number of agricultural improvement projects, EU-Minor Irrigation and water resources, ADB – Water Resource Management, primary processing etc.

3. Development strategies

Core development strategies

Core development strategies include comprehensive decentralized planning based on micro-agro-climatic conditions, acceleration of agricultural credit, and convergence of schemes at each level, i.e., panchayat, block, district and zone. Increasing productivity through adoption of technology, e.g. better quality of seeds, both for dryland and irrigated areas and strengthening extension, faster creation of irrigation potential and improvement in efficiency of water use for crops, crop diversification, and efficiency in use of fertilizers are some important areas of intervention.

More often strategies look like wish lists as implementation becomes a casualty in the absence of requisite manpower specifically at panchayat, block and district levels. Almost all the States are experiencing financial resource crunch at existing levels of revenue collection and cutting down, or keeping vacant, a number of positions of experts and extension workers. Resources for travelling allowance and daily allowances are not adequately available. As more and more assignments are allotted to fewer functionaries in agriculture, they are unable to fully discharge the functions assigned to them. Model ATMA, despite its advantages has not been able to provide adequate support to farmers. Resource-poor farmers who need extension services most are often neglected.

Analysis of overall sector policy

Although agriculture is in the State list and the Union government initiates planning process and the Centrally Sponsored Schemes, mostly on matching basis, there is hardly any conflict between what both the Centre and the States desire to achieve and the strategies they profess to follow. The states, however, do not intend to provide matching funds because of their straight-jacketed financial resource position. Capacity constraints at state levels add to the difficulties as huge funds allocated from the Central Government remain unutilized despite the need for such resources [n].

For procurement of agricultural commodities, the States often argue with the Union government to fix higher prices. They also feel the MSPs recommended by CACP on the basis of which the Union government takes a decision on procurement do not reflect the real cost scenario because of small number of samples on which their estimates are based. Last year the paddy producing states urged the Union government to substantially increase procurement price for paddy. Others feel that while determining MSP factors leading to deteriorating agricultural terms of trade must be taken into consideration.

Review of NGOs and private stakeholders' perspectives

Private sector is highly interested to get involved in public procurement, storage, agro-processing and transport. NGOs are more interested in micro credit, strengthening and capacity building and implementing agricultural programmes through formation of groups. NGO involvement has helped farmers increase productivity of crops in command areas of watersheds where such help has been sought in donor funded projects. NGO involvement in planning for agriculture has been a weak area which hopefully will improve in the current and future exercises in Rashtriya Krishi Vikas Yojana, Horticultural Mission schemes, and the National Food Security Mission initiatives. An area where NGOs can substantially contribute is helping the producers of agricultural commodities to form groups for organizing marketing products, procurement and distribution of inputs, processing of agricultural commodities and effectively participating in planning. This is also the area where FAO can help NGOs to voice their concerns. Farmers, specifically those who are in small and marginal categories, must be organized in groups, associations and federations. This will strengthen their cause.

n Often funds are spent hurriedly towards the year end without much thought about quality aspects.

4. Specific needs and potential areas of international cooperation

Weaknesses, gaps and implementation hurdles

Both the Centre and the State governments express their commitment to the sector in the legislatures, policy documents, and in public pronouncements. However, there is a severe capacity constraint that adversely affects planning and implementation of crop sector schemes at decentralized levels (panchayat, block, district, special areas). Although agriculture is a State subject, the Centre takes most important initiatives of strategic nature by involving top level experts and the States for following up on the recommendations. The outcomes however, are mixed across states. The States and the Centre both desire to have a rapid rate of growth in crop productivity though land and water are limiting factors.

Specific areas of inputs for international cooperation

Major areas in the crop sector where there is need for international cooperation are: (i) capacity building in sectoral and decentralized planning, and (ii) effective coordination at the State as well as decentralized levels. Very few states of India have developed crop production strategies through development of appropriate agricultural policy, and coordinated comprehensive development framework linking sectoral aspects with issues and options available at decentralized levels. Through international cooperation, experts can be provided to demonstrate how additional investments can substantially improve returns in the crop production sub-sector through higher level of coordination both at the state secretariat as well as at decentralized levels. Secondly, the experts can help existing crop production cadre to prepare coordinated plan by providing appropriate training and documenting and disseminating local "best practices" and the potential for their replication in extended areas.

5. Complementary inputs from international agencies

Key development strategies

A three percent growth in the crop sector is achievable despite the land constraint through better coordination in planning and implementation at state, district and lower levels. The level of resources committed under the plan, if available and utilized, can ensure desired growth, through comprehensive participatory planning and high level of coordination at panchayat, block and district level. There is severe capacity constraint at each level. Even most of the so-called Technical Support Institutions (TSIs), currently engaged in planning (including C-DAP), do not have the required expertise.

Top priority should be assigned to build capacity on how to plan, coordinate, implement, innovate and manage risks.

- Ensuring an average growth rate of crop production around 3 percent will need, among others, developing strategies for convergence of programmes or schemes of similar genre at the Central, State, district and panchayat level, and coordination and synergy at each level consistent with micro, intermediate and sector planning.
- At the sectoral level these would include agriculture (crop planning, technology, extension and resource use), water resources (conjunctive and efficient use through improvement in organizational functioning viz. 'Pani Panchayat'), energy (efficient and reliable supply and proper maintenance), rural development (components that aids agriculture), cooperation (storage and distribution), and transport.
- Comprehensive development participative planning for agriculture and allied sector activities at panchayat, block and district levels taking into account special features (land type, soil health, rainfall, water, moisture, bio-mass etc.) of each micro-agro-climatic area with full dissemination of knowledge and consent of the farmers.

Potential contributions from international agencies

International agencies should help the States in assessing capacity required at district and lower levels for better crop production planning and management and in this regard also provide guidance on training courses to be designed and implemented.

- Efficiency in water use and conjunctive use of ground and surface water to increase crop productivity are important areas for which international agencies can provide support.
- Agencies like FAO should provide technical assistance to the States for introducing Food Insecurity and Vulnerability Information and Mapping System (FIVIMS) [8] and its integration to planning process for ensuring better food security.
- Accelerating organic farming for increasing production is the fourth area where documentation of 'best practices' and its dissemination across States will be a priority item for international agencies to help India.
- International agencies can help the States in organizing small scale producers in processing and supply chain management.

Exploring possible sources of funds

Multilateral institutions (WB, AfDB, ADB, FAO, IFAD, WFP, UNDP) have been coming together to forge alliance and taking advantage of the presence of bilateral funding agencies (DFID, USAID) for adding to their efforts in the field of agricultural planning and food security in several countries. These agencies through their joint involvement and interaction with International Cooperation division of the India's Ministry of Agriculture can help in

areas identified in the previous section. The resource requirement, if the above suggested programmes are taken up over a medium term period of next 3-5 years, will be of the order of US$ 4-5 million which can easily be provided from the resources on current level of commitments. UNDP is currently providing funds to some of the State Institutes for Rural Development (SIRD) for capacity building of Panchayati Raj Institutions (PRIs). This is a major attempt to associate people from the grassroot level to be involved in planning, implementation, and social audit and performance evaluation of programmes. As C-DAP initiative of the Ministry of Agriculture insists on district agricultural planning to start from the panchayat level this becomes an ideal situation for international agencies to help build capacity starting from base level. A portion of the resources available to panchayat and intermediate levels from various sources could be identified, and placed with the international cooperating agencies to augment their grant resources for capacity building.

Acknowledgements

The author is grateful to Dr Gavin Wall, Dr Gopi Ghosh, Ms Renuka Taimni, Ms Meeta Punjabi of FAO, Messrs A K Tripathy, S P Nanda, Dr R V Singh, and R K Sharma of Government of Orissa, Dr V Sadamate, Senior Adviser, Planning Commission, Dr S M Jharwal, Principal Adviser, Ministry of Agriculture, Dr Karmakar, MD NABARD and large number of administrators, district planners, experts, farmers and agricultural labourers specifically in the East, North and Northeast regions for discussion on policy, priorities and process of implementation of various programmes and their outcomes. Dr Gopi Ghosh and Mr Vijay Sardana deserve special thanks for their guidance.

References

1. **Archana S. Mathur *et al.*** 2006. *Status of Agriculture in India, Trends and Prospects.* EPW, Dec 30.
2. **Chand Ramesh, Dayanand Jha & Surabhi Mittal.** 2004. *WTO and Oilseeds Sector, Challenges of Trade Liberalisation*. EPW, February 7.
3. **Chand Ramesh, S. S. Raju & L. M. Pandey.** 2007. *Growth Crisis in Agriculture: Severity and Options at National and State Levels'.* EPW, June 30-July 6.
4. **Chand Ramesh.** 2008. *The Global Food Crisis: Causes, Severity and Outlook.* EPW, June 28 - July 04.
5. **Chand Ramesh.** 2008. *Prospects for Achieving a 4percent Growth in Agriculture during Eleventh Plan,* NASS News, Vol. 8, No.3, July - September 2008.
6. **Dixon John, Aidan Gulliver & David Gibbon.** 2001. *Farming Systems and Poverty: Improving Farmers' Livelihoods in a Changing World.* FAO and World Bank.
7. **Fan Shnngenn & Ashok Gulati.** 2008. *The Dragon and the Elephant: Learning from Agricultural and Rural Reforms in China and India.* EPW, June 28.
8. **FAO/DJRC.** 2007. *Food Insecurity and Vulnerability Information and Mapping System (FIVIMS),* Orissa.
9. **Government of India.** 2007-08. Ministry of Agriculture, Department of Agriculture and Cooperation, Annual Report, 2007-08.
10. **Government of India.** 2007. National Development Council on Agriculture and Related Issues on Region/Crop Specific Productivity Analysis and Agro-Climatic Zones, Planning Commission, February 2007.
11. **Government of India.** 2008. Ministry of Agriculture, Department of Agriculture and Cooperation. 2008, Agricultural Statistics at a Glance.
12. **Government of India.** Planning Commission, Eleventh Five Year Plan (Three volumes)
13. **Ghosh, Gopi N.** 2008, compiled observations in Solution Exchange: An Initiative of UN Country Team in India specifically views of P K Thampan.
14. **Gustafson Daniel J.** 2004. *Building a Hunger Free India from the Ground-Up: The Importance of Small-holder Agriculture for Poverty Reduction and Food Security.* National Food Security Summit, 2004, Selected Papers WFP, FAO, IFAD.
15. **Gulati Ashok & Tim Kelley.** 1999. T*rade Liberalization & Indian Agriculture,* Oxford University Press.
16. **Gadgil Sulochana & Siddhartha Gadgil.** 2006. *The Indian Monsoon, GDP and Agriculture.* EPW, November 25.
17. **Janakarajan S. & Marcus Moench.** 2006. *Are Wells a Potential Threat to Farmers' well-being? Case of Deteriorating Ground Water Irrigation in Tamil Nadu.* EPW September 16.
18. **John H. Sanders, Barry I. Shapiro & Sunder Ramaswamy.** 1996. T*he Economics of Agricultural Technology in Semiarid Sub-Saharan Africa.* The John Hopkins University Press, Baltimore and London.
19. **Mohan Rakesh.** 2006. *Agricultural Credit in India, Status, Issues and Future Agenda.* EPW, March 18.
20. **Medrano Pedro.** 2003. *The Experience with Food Safety Nets in India.* International Conference on the Right to Food and Cost of Hunger, Rome.

21. **Mujumdar N. A.** 2006. *Centrality of Agriculture to India's Economic Development*. EPW January 7.

22. **Narayanamoorthy A.** 2006. *State of India's Farmers.* EPW February 11.

23. **National Accounts Statistics.** 2008. (New Series), Central Statistical Organization, Ministry of Statistics and Programme Implementation, New Delhi.

24. **Parthasarathy P. Rao, P. S. Birthal & P. K. Joshi.** 2006. *Diversification towards High Value Agriculture, Role of Urbanisation and Infrastructure.* EPW, June 30.

25. **Patnaik Prabhat.** 2007. *A Model of Growth of the Contemporary Indian Economy.* EPW June 2.

26. **Punjabi Meeta & Vijay Sardana.** 2007. *Emergence of Organized retailing in Fresh Fruits and Vegetables in India: Policy Perspective,* FAO, New Delhi

27. **Reddy V. Ratna & P. Prudhvikar Reddy.** 2005. *How Participatory is Participatory Irrigation Management? Water Users' Association in Andhra Pradesh.* EPW, Dec 31.

28. **Raghavan M.** 2008. *Changing Pattern of Input Use and Cost of Cultivation.* EPW June 28.

29. **Sathe Dhanmanjiri & Sunil Agarwal.** 2004. *Liberalisation of Pulses Sector, Production, Prices and Imports.* EPW July 24, and GoI. Agricultural Statistics in India-several years

30. **Singh Sukhpal.** 2006. *Credit, Indebtedness and Farmer Suicides in Punjab, Some Missing Links.* EPW July 29

31. **Tripathy Damodar.** 2004. *Poverty and Hunger in India: Some Current Perspectives.* National Food Security Summit, 2004 Selected Papers, WFP, FAO, IFAD.

32. **Tripathy Damodar & J K Misra.** 2004. *Poverty Reducing Growth Strategies: Desirable Pattern of Sectoral Investment to Maximize Equity Oriented Growth, Poverty Task Force.* Govt. of Orissa.

33. **Tripathy Damodar.** 2006. Evaluation of AIBP in Orissa and West Bengal Reports prepared for Ministry of Statistics and Programme Evaluation.

34. **Tripathy Damodar.** 2007. *Agricultural and Horticultural Planning and Implementation Constraints and Capacity Building Requirements - A Quick Survey* - Orissa Report for FAO, DJRC.

35. **Tripathy Damodar.** 2007. *Evaluation of Watershed Development and Coffee Plantation in KBK Districts under Revised Long-Term Action Plan (RLTAP).* Government of Orissa, Planning and Coordination Department, Orissa

36. **Vaidyanathan A.** 2006. *Farmers' Suicides and the Agrarian Crisis.* EPW September 23.

37. **World Bank.** 1998. *India Water Resources Management Sector Review- Report on Inter sectoral water Allocation.* Planning and Management, Report No. 18322.

Annexure

TABLE 1: Growth rate in output of various sub-sectors of agriculture
(Gross value of output at 1999–2000 price)

Period	Cereals	Pulses & oilseeds	Fruits and vegeta-bles	Other crops	All crops	Livestock	Fishery
1951-52 to 1967-68	4.19	2.98	2.67	2.42	3.00	1.02	4.68
1968-69 to 1980- 81	3.43	0.97	4.82	2.98	3.00	3.26	3.08
1981-82 to 1990-91	3.52	5.41	2.84	1.71	2.97	4.78	5.74
1991-92 to 1996-97	2.36	2.92	6.07	2.18	3.09	4.00	7.05
Ninth Plan 1997-98 to 2001-02	1.49	-1.43	4.11	3.82	2.25	3.53	2.63
Tenth Plan 2002-03 to 2006-07	1.28	4.29	2.97	3.58	2.46	3.69	3.23
Tenth Plan 2002-03 to 2004-05	-1.27	5.95	0.30	1.57	0.42	3.32	1.77
Tenth Plan 2005-06 to 2006-07	3.52	1.61	6.97	6.59	5.53	4.23	5.49

Source: New series of National Accounts Statistics, Central Statistical Organization, Ministry of statistics and Programme Implementation, New Delhi; Eleventh Five Year Plan (2007-12), Volume-III, Planning Commission, Government of India, Table-1.3, Page No. 5, Agriculture.

TABLE 2: Investment in agriculture
(Rs in Crore at 1999–2000 Price)

Year	GDP from agriculture	Gross Capital Formation (GCF) in agriculture			GCF in agriculture as percent of GDP from agriculture		
		Public sector	Private sector	Total	Public sector	Private sector	Total
1980 – 81 to 1984 – 85	239678	12007	13132	25139	5.0	5.5	10.5
1985 – 86 to 1989 – 90	274034	9601	14370	23971	3.5	5.2	8.7
1990 – 91 to 1994 – 95	325957	7915	19348	27263	2.4	5.9	8.4
1995 – 96 to 1999 – 2000	383330	7724	22631	30354	2.0	5.9	7.9
2000 – 01	407176	7155	31872	39027	1.8	7.8	9.6

Contd.

Contd. from page 17

TABLE 2: Investment in agriculture
(Rs in Crore at 1999–2000 Price)

Year	GDP from agriculture	Gross Capital Formation (GCF) in agriculture			GCF in agriculture as percent of GDP from agriculture		
2001 – 02	433475	8746	39468	48215	2.0	9.1	11.1
2002 – 03	398206	7962	38861	46823	2.0	9.8	11.8
2003 – 04	441360	9376	35457	44833	2.1	8.0	10.2
2004 – 05	441183	12273	36835	49108	2.8	8.3	11.1
2005 – 06	468013	15006	39899	54905	3.2	8.5	11.7
2006 – 07	485939	17749	43013	60762	3.7	8.9	12.5

Source: National Accounts Statistics 2008 (New Series), Central Statistical Organization, Ministry of Statistics and Programme Implementation, New Delhi; Eleventh Five Year Plan (2007-12), Volume-III, Planning Commission, Government of India, Table-1.5, Page No.8, Agriculture.

TABLE 3: Region-specific factors causing low productivity

Agro-climatic region	States	Region-specific constraints
Western Himalayan region – I	Jammu & Kashmir, Himachal Pradesh, Uttarakhand	Severe soil erosion, degradation due to heavy rainfall/ floods and deforestation, low SRRs, poor road, poor input delivery, inadequate communication infrastructure and marketing.
Eastern Himalayan region – II	Northeastern States (Sikkim, Assam)	Aluminium toxicity and soil acidity, soil erosion and floods, shifting cultivation, low SRRs, non-availability of electricity, poor road, poor input delivery system and communication infrastructure.
Lower and middle Gangetic plains regions – III and IV	West Bengal, Bihar, Eastern Uttar Pradesh	Flood/ water logging, improper drainage, salinity/ alkalinity, arsenic contamination, low SRRs, non-availability of electricity, high population growth, poor road and communication infrastructure.
Upper and trans-Gangetic plains region - V and VI	Western Uttar Pradesh, Punjab, Haryana	Groundwater depletion, decreasing total factor productivity, micronutrient deficiency, non-availability of electricity, and high population density.
Eastern plateau and hills region - VII	Orissa, Jharkhand, Chhattisgarh	Moisture stress, drought, and soil acidity, iron toxicity, low SRRs, non-availability of electricity, high population growth, poor road, poor input delivery and communication infrastructure.

Source: Cited in Report of the Working Group of Sub-Committee of National Development Council on Agriculture and Related Issues on Region/Crop Specific Productivity Analysis and Agro-Climatic Zones, Planning Commission, Government of India (February 2007); Eleventh Five Year Plan (2007-12), Volume-III, Planning Commission, Government of India, Table-1.6, Page No.9, Agriculture.

Horticulture

Prepared by

S P Ghosh

About the author

Dr S P Ghosh was born in Calcutta (Kolkata) on 5 January, 1941. He did his Masters in Horticulture from P. G. School, IARI, New Delhi in 1963 and Ph. D. in Agriculture from Timiriazev Agricultural Academy, Moscow in 1970.

Dr Ghosh worked as a University teacher (Horticulture) over a period of eight years and as a research scientist and research manager in ICAR over a period of 28 years. Subsequently, he was with FAO, UNDP, World Bank and ADB as expert/ consultant for about six years. Dr Ghosh has received the ICAR National award twice for outstanding research contributions. He has authored seven books in the field of horticulture and over 200 research and technical papers. Presently, he is engaged in an ADB supported Crop Diversification Project in Bangladesh as Team Leader and Agriculture Project Management Specialist.

Contents

Globally India is the second largest producer of fruits and vegetables, next to China. During 2005-06, fruits and vegetables (F&V) alone covered 12.67 million hectare with a total production of 167.78 million tonnes. Compound annual growth rate [3] in F&V during 1992-93 to 2002-03 has been six percent. The income elasticity [4] for fruits and vegetables are reported to be 0.42 percent and 0.35 percent respectively, against only 0.05 percent for rice and -0.06 percent for wheat. With the rise in per capita income, demand for fruits and vegetables will continue to grow. Annual growth rate in domestic demand for fruits and vegetables is estimated at 3.34 percent and 3.03 percent respectively [4]. Estimates [2] show that about 76 percent of fruits and vegetables are consumed fresh, whereas 22 percent is lost or get wasted in the marketing chain.

Horticulture developmental activities through perennial fruit orcharding have already paid high dividends both in terms of upliftment of socio-economic status of poor hill farmers as well as in bringing stability in a fragile ecosystem, e.g., apple in Himachal Pradesh. Similarly, horticulture based land use is being increasingly considered in developmental plans both in arid and semi-arid regions, where the climatic conditions are conducive for production of quality produce. Coastal areas are already utilized for plantation crops and spices and further growth is possible in coastal eco-region with technology backstopping.

The Horticulture Technology Mission (HTM) for the Northeast (subsequently covering all hill States in the Western region also) and the National Horticulture Mission (NHM) launched by the GoI are two well funded projects to boost horticulture industry in the entire country. The NHM launched during 2005 as a central sector scheme in 18 states and two UTs (340 districts) aims to record 300 million tonnes production by 2012.

The success story [6] of Konkan region of Western Ghats in commercialization of mango, cashew, black pepper and others clearly demonstrates how desirable research-extension linkage made it possible to convert the once barren hilly tracts into economically viable regions. Both Himachal apple and Konkan mango and cashew showed that marginal lands are not a constraint to productivity if appropriate technological choices are made. Agri-horti system has been recommended as an alternative to shifting cultivation in the NEH region.

In the area of R & D, strong research base has been created and with proper technology transfer fast track development of established crops should be possible. Remarkable achievements in certain crops like onion and grapes venturing to successful export have been recorded. Similar potential for mango, potato, litchi, certain vegetables and cashewnut exist where basic R & D works have provided the leads for the last leg of commercial exploitation.

In India, the level of processing has been low being only 2 percent for fruits and vegetables. As processing is becoming increasingly important to help farmers to realize a better price, there is a need to reduce excise duty on products manufactured from fruits and vegetables or their parts. Certain indigenous value added products like fruit drinks from lesser known fruits including health drinks have been developed.

To reduce the post harvest loss, awareness building on post production management and knowledge upgradation on post harvest handling technology will be of utmost importance. Under the NHM, provision for funding support for creation of post harvest infrastructures including pack house, cold storage, mobile processing units, Reefer vans etc., exists for the identified project

clusters. There is a need to further upscale existing programmes and initiatives. Organic production of horticultural crops has been gaining considerable importance. Basic standards of production, documentation, inspection and certification guidelines have been prepared for a good number of high value horticultural crops, including spices. Organic farming strategy should cover a holistic approach involving integrated nutrient management (INM) and IPM. Synthetic pesticides can be avoided but exclusion of chemical fertilizers may not be advisable under all situations. The 'Green Agriculture' (permitting use of minimum essential fertilizers and chemical pesticides) will suit perennial fruit orchards better.

As agriculture is getting diversified, there is a need not only to augment but also restructure the pattern of investment in agriculture. It is recommended that immediate steps be taken to improve capital formation for agriculture in both public and private sectors [16].

Shift of small farmers to horticulture would require putting in place physical and institutional infrastructure, knowledge transfer, institutional development for group marketing, contract farming, credit linked marketing system and investment in public goods. The food hygiene standards already adopted by the Bureau of Indian Standards (BIS) must be practiced.

Community driven development approaches will be critical to build social capital in the poorest areas. Direct support to Self Help Groups (SHGs), user's associations, thrift and credit groups can provide the initial push to move organizations to higher level and access to new economic opportunities. Innovative programmes for (i) integrating small holder horticultural farmers with commercial horticulture (ii) development of modern value chain for horticultural crops, and (iii) integrated horticulture and nutrition development for malnourished population, have been suggested as potential areas of international cooperation.

Sector performance wise, India is globally the second highest producer of fruits and vegetables. According to a National Horticulture Board source, during 2005-06, fruits and vegetables alone covered 12.67 million hectare with production of 167.79 million tonnes [7]. FAO data however show much lower values with 43.03 million tonnes fruits (excluding melon) and 85.40 million tonnes vegetable (including melon) production with a total of 128.43 million tonnes for the year 2006. During 2005, the area under vegetables, fruits, plantation crops, and others was 59.73 percent, 29.03 percent, 7.75 percent, and 3.49 percent, respectively. Some estimates [5] show that currently the horticulture sub-sector's contribution is nearly 29 percent of the GDP in agriculture from a cultivated area of 8.5 percent. Under the National Horticulture Mission (NHM) India plans to double the horticultural crops production to 300 million tonnes by 2011-12. Only 1.7 percent in vegetables and 0.5 percent in fruits are in the export trade. It is reported that about 2 percent horticultural produce is processed, while about 22 percent is lost or gets wasted in the marketing chain. India exported processed fruits worth Rs 3 460 million and processed vegetables worth Rs 3 400 million during 2004-05.

India is a major producer of banana, mango, papaya, coconut, cashewnut and spice crops and about 40 percent of world's mango and 11 percent of world's banana are produced in the country. Productivity of grapes is highest in India, while the country is the single largest producer of cashewnut with a production of about 0.55 million tonnes. During 2006-07, India produced 27.23 million cut flowers and 0.67 million tonnes of loose flowers. Several spice crops, namely, black pepper, ginger, turmeric, chilli, cumin and others are grown commercially and are important export items. The Spices Board expects to export organic spices worth Rs 2 400 to Rs 2 600 million by 2012.

Still horticulture is dominated by the unorganized segment, which is composed largely of micro- and small horti-enterprises. Since cultivation of horticultural crops requires assured irrigation for maximization of production, horticulture faces tightening competition among the multiple users of water, including agriculture and other sub-sectors. Drip irrigation in certain states, mainly, Maharashtra has largely helped in maximization of productivity of crops like grapes, banana and others.

The challenges of development

The strategy for agricultural growth, including horticulture, would have to be small holder farming. However, small and marginal farmers shifting to high value horticultural crops are facing increased risk of fluctuations in yield, price and income. Direct marketing by farmers to consumers still remains negligible; of the 27 294 rural periodic markets, where small and marginal farmers bring their produce, 85 percent lack facilities for efficient trade [1]. Collapse of the extension systems and poor control limit the ability to implement large scale programmes like HTM and NHM.

In the area of export promotion, APEDA has worked out and harmonized standards of organic produce with the USA and EU. It has also done harmonization of quality standards of several fruits and vegetables. In the domestic market some transformation in the traditional sector is going to be influenced due to amendments of the APMC act. But due to lack of infrastructure, technology and credit, small farmers can hardly avail such opportunities.

Future potential of the sector

Demand projections through 2020 show that the effects of increased per capita income, urbanization and globalization will influence diversification in food consumption towards high value commodities, including fruits

and vegetables. Estimates [4] indicate that at population growth rate of 1.45 percent and 4.50 percent growth rate in per capita expenditure, the growth rate in domestic demand will be 3.34 percent for fruits and 3.03 percent for vegetables. In the domestic market, fresh consumption will remain in focus and ensuring availability at reasonable price will be most crucial for sustainability in horticultural development.

Gross returns from fruits and vegetables are much more than most other crop groups. Crop diversification even in small holder agriculture has been witnessed in the last decade (during 1992-93 to 2002-03 the compound annual growth in fruits and vegetables has been 6percent , against the growth of 1.4 percent in foodgrains [3]), resulting in reduced rural poverty and better nutritional security. Fast track expansion will be mainly in assured irrigation areas, while hills and mountains, arid and semi-arid regions and coastal areas do offer opportunities for area expansion with horticultural crops. Higher income and enhanced employment generation through increased productivity and value addition of horticultural commodities will have positive impact in rural and agricultural development of the country.

Major programmes and activities by the Government

(A) Horticulture production and policy initiatives

The Government of India has already declared horticulture industry as a priority area, providing a number of fiscal reliefs thereby, encouraging commercialization and value addition to the horticultural products. Financial incentives were started in the Eighth Plan with an outlay of Rs 1 000 crores in the Central budget. This pace was continuously upgraded to 50 percent and 100 percent increase during Ninth and Tenth Five Year Plans, respectively. The Horticulture Technology Mission (HTM) for the Northeast (subsequently covering all hill states in Western regions also) and the National Horticulture Mission (NHM) launched by the Government of India (ending in 2012), are two well funded programmes to boost the horticulture industry in the entire country. The NHM programme will be taken up in 340 districts of the country and by 2006-2007 already 262 districts were covered. Under NHM, State governments are contributing 15 percent of the outlay w.e.f. 2007-08. Till December 2007, an amount of Rs 24 755 million was released to 18 states, 2 UTs and 11 national level agencies for implementation of the scheme. During the period, 1 549 new nurseries were set up and 0.76 million hectare was brought under new plantations of various horticultural crops. Under PHM component, 463 pack houses, 31 cold storages, one wholesale market and 33 rural markets were set up [11].

The Technology Mission for seven Northeastern states, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand; capital investment subsidy scheme of the National Horticulture Board (NHB) and the integrated development of coconut also aimed at a holistic development of the horticulture sector in the country. Some of the thrust areas covered are: nursery production of quality planting materials, area expansion, rejuvenation of old orchards, organic farming, IPM, protected cultivation and pack house market infrastructure development as planned activities.

For improving marketing efficiency and augmenting modern storage, handling and transportation infrastructures, special schemes have been formulated by NHB, APEDA and others. In the GoI budget of 2006-07, food processing has been shown as a priority sector for bank credit.

Some of the policy shifts in favour of horticulture enacted in the recent past are:

- de-licensing of almost entire food processing sector
- automatic approvals for foreign investments upto 100 percent except in few cases and also for technology transfer
- zero duty import of raw material for 100 percent export oriented units
- exemption of export earnings from corporate tax and full repatriation of profits and capital
- exemption of value addition and marketing of horticultural products from central excise duty
- Government grants for setting up commercial projects
- full duty exemption on all imports for products in the export zones
- liberalization in marketing, private sector participation through contract farming, land leasing

(B) Export and marketing support

The Department of Agriculture and Cooperation (DAC) of GoI identified some of the fruits (mango, grapes, litchi, mandarins, kinnow, cashew, walnut, pomegranate, aonla), vegetables (potato, onion, chilli, bitter gourd, okra), spices (black pepper, ginger, turmeric, cumin, large cardamom) and floriculture crops / items (rose, cymbidium orchid, anthurium, cutgreens and dry flowers) for export promotion. In the processed products

sector, mango pulp, canned mushroom and gherkins, banana puree, tomato puree, tomato paste, aonla, bael, cashew and apple juice are identified as having good export potentials. Export of some comparatively newer export items like chilli (chilli accounted for 47 percent in volume and 25 percent in value of the total export of spices and spices products from the country) show potentiality of new products and newer markets.

Agri Export Zones (AEZ) are being developed at 60 places for identified commodities, out of which 45 AEZs in 19 states focus on horticultural crops. The initiative is supported by APEDA, including development of much needed infrastructures. Similarly, APEDA also supported establishment of Centers for Perishable Cargo (CPC) at selected airports for export promotion.

Based on Model Act circulated by DAC of MoA, 2004, all major states enacted APMR legislation. With the revision of APMC Act, private investment in market development is expected.

In addition, Terminal Markets (TM) are being developed at selected locations under public-private partnership. Eight cities have already been identified for this purpose. Such TMs will have collection centres in villages operated by private sector, self help groups, cooperatives or state agencies.

Of late, corporate houses are increasingly getting interested in retail marketing. Direct marketing by the farmers to the consumers has also been experimented through Apni Mandis in Punjab and Haryana, Rythu Bazars in Andhra Pradesh, Kutumbashree in Kerala and Uzhavar Santhaigal in Tamil Nadu. Today the organized food retailing covers only 1percent and this situation is bound to change with entry of corporate houses (e.g. Reliance, Bharti and others) affecting the economy in the days to come. Contract farming of different types for selected crops under a buy back agreement has also been tried in different parts of the country with varied degree of success.

Presently, several Ministries of GoI take decisions affecting the process of agricultural marketing. Important among them are: Agriculture, Commerce, Food and Public Distribution, Consumer Affairs and Health. Also institutions like NCDC, TRIFED, NDDB, NHB, APEDA, etc. are directly involved in implementing programmes to strengthen agricultural marketing. Besides, there are commodity boards and export promotion councils for specific commodities to promote export.

Efforts and approaches by other development partners

i) Three World Bank supported projects, namely, the National Agricultural Research Project (NARP); National Agricultural Technology Project (NATP) and National Agricultural Innovation Project (NAIP) have been executed since 1972 till date with the Indian Council of Agricultural Research (ICAR) as the lead implementing agency. Among others, horticulture sub-sector was covered under all the above three WB projects. In addition, several state governments (U.P., Assam, M. P.) had agricultural support projects with WB financing.

ii) Asian Development Bank (ADB) supported project on agribusiness promotion including value addition and agri-enterprise development of horticultural crops/commodities.

Core development strategies

(A) Horticulture Production

Small and marginal farmers engaged in traditional crop agriculture lack both knowledge and skill in commercial horticulture. Promotion of capacity building and knowledge upgradation should be the first step for decentralized planning and implementation of techno-based developmental programmes like in NHM. Intensive group based training on crop production and post production management, will be essential. Simultaneously, the advanced technologies need to be demonstrated in the fields of farmers on a selected basis involving the local R & D institutions. A paradigm shift from unskilled to skilled work and access to GAP (including SPS measures) and trade (price, market etc.) literacy with reference to home and external markets are essential.

For remote areas group extension through formation of Self Help Groups (SHGs) is perhaps the best option and it should be easier to organize training of the members of the SHGs. Formation of SHGs, their skill upgradation through training in Krishi Vigyan Kendra (KVK) and similar knowledge centre, microfinance support and formation of "Small Farmers Horticultural Estates (SFHE)" are steps in the right direction as proposed by the National Commission on Farmers.

At a time when climate change impacts are increasingly being felt and when even the agriculturally advanced fertile crescent area of Punjab, Haryana and Western U.P. is facing serious ecological and economic problems resulting in unfavourable cost risk return structure, conservation farming and 'Green Agriculture' (permitting use of minimum essential fertilizer and chemical pesticides) could be attempted for perennial tree cropping.

The 'clusters' under NHM should eventually become "sustainable intensification area" as proposed [10] under land use strategy for promoting an ever-green revolution leading to advances in productivity in perpetuity, without associated ecological harm. To promote knowledge based horticultural development, close involvement of R & D institutions in developmental planning, in refinement of technologies to suit local conditions, transfer of technologies through organizing participatory field demonstrations and training and retraining of beneficiaries should be focused in developmental strategies.

Eco-region based development, focusing on hills and mountains, arid and semi-arid and coastal areas need thrust in future horticulture development.

- **Hill horticulture**
  The hill agro-ecosystem covering the Himalayas (composed both of North Western (NW) and North Eastern (NE) flanks in the North), the Western Ghats (WG), Eastern Ghats (EG). Vindhyas and Deccan Plateau are yet to be exploited fully. The Northern hills enjoy certain competitive advantages particularly for temperate fruits, off season / out of season vegetables, certain flowers and medicinal and aromatic plants. For example, NW region is famous for its apple, nuts, saffron, potato seed, whereas NE region enjoys niches for high quality orange, ginger, cymbidium orchids, large cardamom, tea, and others.

  Perennial fruits orcharding has already paid high dividends both in terms of upliftment of socio-economic status of poor hill farmers as well as in bringing stability in the fragile ecosystem in Himachal Pradesh (HP). Apple accounting for 76 percent of states total fruits production has helped in alleviating poverty and today more than 86 percent of the population of HP is literate. It is amply demonstrated that the niche potential of marginal mountain lands if properly nurtured can bring fortunes and can convert subsistence farming

into economically viable farming. In the North Eastern Region (NER) horticulture remained neglected for long and the Horticulture Technology Mission (HTM) was perhaps the first planned regional effort to boost horticulture production. This region is contributing more than 55 percent of total tea production of the country, while the rubber cultivation with about 45 thousand hectares in the region, particularly in Tripura, is yet another success story. The 'Small Holders Tea' cultivation in Assam and parts of Nagaland is a highly promising venture, having potentiality for converting to 'Organic Tea' production.

Citrus (mandarin orange) should be declared as the most potential and valued fruit crop for all the states of NER, including Sikkim. The demand elasticity of orange is very high and other than 'Nagpur Orange', there is no major market competitor. The potential markets of Bangladesh and certain other South East Asian countries need to be kept in mind and border trade needs to be promoted with neighbouring countries.

The Western Ghats (WG) covering an area of 1 87 144 sq km (5.7 percent of the country's geographical area) from the States namely, Maharashtra, Karnataka, Kerala, Tamilnadu and Goa, also offers good opportunity for development of horticultural crops. The famous 'Alphonso' mango and cashewnut of export quality come from the WG region. Under the Western Ghats Development Programme (WGDP), one of the major objectives was to bring vast stretches of drylands under perennial crops. In the Konkan region, about 0.2 million hectare fallow land was brought under fruits crops, mainly mango and cashew, during 1990 to 2000.

The Eastern Ghat (EG) region is a broken chain of hills that extends from Orissa to Tamil Nadu. The EG is much less developed in horticulture compared to that in the Western Ghats. Mango, jackfruit, ginger, turmeric and good number of medicinal and aromatic plants are highly potential crops of the EG region.

Parts of Deccan plateau including Raichur and Bellary in Karnataka and Anantapur in AP, horticultural crops, namely, grapes, pomegranate, citrus (acid lime, sweet orange), mango, sapota, okra, chilli, cucurbits are commercially grown with supplementary irrigation. Watershed based planning including water harvesting and micro-irrigation practices are important to harness full potential of horticulture in the region.

- **Arid horticulture**

Arid region receiving less than 450 mm rainfall and semi-arid region with annual rainfall varying between 450-850 mm occupy large part of geographical area of India. The arid eco-system is spread over 31.7 million hectare under the hot arid and 7 million hectare under cold arid region. Hot arid and semi-arid region mainly covers Rajasthan, Gujarat, Punjab, Haryana and small pockets of Andhra Pradesh, Karnataka and Maharashtra.

The cold arid region is spread in the states of J & K (Ladakh-Leh area) and HP (Lahul-Spiti area). Long winters with large (40^{o}c to - 40^{o}c) variation in temperature and with very little (about 90 mm annually) to no rains are experienced.

Horticulture based land use is being increasingly considered in the developmental plans both in the arid and semi-arid regions. Marked fluctuations in night and day temperatures, bright sunshine and low RH help in development of better quality fruits and in minimizing losses due to disease and insect pest attacks. In hot arid, semi-arid regions a good number of fruit crops (date palm, pomegranate, ber, custard apple, tamarind, aonla, fig, citrus with little irrigation), seed spices (cumin, fennel, coriander, fenugreek), vegetables (cucurbits, peas, melons, onion, chilli, brinjal etc.) and medicinal and aromatic plants (isabgol,

safed musli, senna, guggal, henna etc.) are economically important crops. Multi-tier cropping model/ Horti-silvipastoral system as worked out by CAZRI, Jodhpur and CIAH, Bikaner of ICAR needs large scale field testing.

For cold arid zone, fruits (apricot, walnut, chestnut, pistachio and raisin grapes), vegetables (cole crops, carrot, capsicum, peas, seed production) and spices (black cumin - kalazeera) need to be expanded by setting up a goal to cover at least 30 percent of cultivable area under these crops over a period of ten years.

- **Coastal zone horticulture**
  India has a long coastal line both in the mainland (nine coastal states) and in two islands systems, namely, Andamans & Nicobar and Lakshadweep, Nearly 250 million people live in the area, within a distance of 50 km from the coast. Plantation crops (palms, cashew and spices) fit well in the coastal area. Vegetables and tuber crops like cassava and sweet potato are secondary staples in certain coastal pockets of Kerala, Orissa and AP. A few horticultural crops of high economic value, namely, coconut, cashewnut, arecanut, cocoa, spices (black pepper, ginger, turmeric, clove), tuber crops (sweet potato, cassava, yams) and many MAP need to be promoted with technology support.

  Under irrigated agro-eco system and AEZs of APEDA, major development thrusts should be enhancement of quality through adoption of good agricultural practices. Micro-irrigation, protected cultivation, IPM-ICM practices should receive focused attention.

(B) Export and Marketing Support

India produces nearly 11 percent of all vegetables and 15 percent of all fruits in the world. Yet its share in global exports of vegetable is 1.7 percent only and 0.5 percent in fruits. Also, Indian prices for vegetables is 53 percent and for fruits 63 percent of world prices (2001-03) showing lower cost of production. The major factors impending India's exports are (i) high cost of delivery between the farm gate and the retail foreign market and (ii) tariffs abroad, quality and standards. It is also a fact that during 2006-07, import of fresh fruits and nuts exceeded export by more than Rs 500 crores.

Analysis of export status of Indian mango reveals our weakness in fresh fruit export. India with 40 percent of world's mango production contributed about 19 percent of the world export (in 2004), whereas Mexico with about 5.7 percent of world's production has been contributing 23-29 percent of world's mango export. India has the richest germplasm of mango as mango has always received priority research attention. In the recent past, mango production increased by about one percent and Indian mango could be exported to new markets like North America in a very limited scale. Our exports to the biggest mango market i.e., North America has been almost negligible. In recent years, the use of SPS regulation to restrict import of Indian mangoes has been very high. In spite of sustained follow-up by the Indian government, mango export to China, Japan and USA has been very limited. The main destination for Indian mango export is confined to Middle East countries and to a certain extent, Europe. Strict quarantine standards, vapour heat treatment (VHT) requirements, and high freight cost are some of the major constraints in mango export.

The export scenario of mango is not an isolated example. Similar constraints are experienced in export of other fresh fruits and vegetables as well. The major cost of export is freight cost, which varies with distance. The costs by sea freight are low but there is a great degree of risk of spoilage of fruits, if not exported properly. For enhancing export of fresh fruits, improvement in quality standard as well as in post harvest handling is essential.

In recent years, some new initiatives have been taken in horti-marketing / horti-business.

They are:

i) Terminal Markets (TM), focusing horticultural commodities, are being developed at selected locations (eight cities for the present) under public-private partnership. It was envisaged that TMs will operate in "Hub and Spoke" model, with collection centres in villages to be operated by private sector, self help groups, cooperatives or state agencies working as spokes and TMs as hubs. TM is likely to serve as an assembly and training place for horticultural commodities and will help farmers to sell their produce quickly and efficiently with greater transparency.
ii) Direct marketing of farm produce through Apni mandis (Punjab & Haryana), Rythu Bazars (AP), Kutumbashree (Kerala), Uzhavar Santhaigal (Tamil Nadu), Safal (Delhi), HOPCOMS (Karnataka) have been experienced with varying degree of success. Studies conducted in Maharashtra (mango and banana) and Gujarat (sapota) showed that cooperatives are best channels of marketing. Cooperative like KISSAN in Jalgaon (Maharashtra) has been successful in banana marketing mainly because of right market planning (distant market sale, grade based pricing, linking credit with marketing, incentives for participation and maintaining overheads proportional to the turn over).
iii) Organized retailing is spreading, including fresh fruits and vegetables (F&V) and processed products, in which big corporate houses are also showing interest. Food retail outlets in South India with focus on Chennai, Hyderabad and Bangalore are already in place. Although, 'Mandis' and 'Hawkers park' are mainly involved in F & V retailing, organized retailing has also made a beginning with required logistics.

Analysis of overall sector policy

In India nearly 80 percent farm population operate small holdings with average farm size being 1.41 hectare [10]. Integration of small farmers in the horticulture production system is, therefore, a big challenge. As drivers of diversification, while in the demand side urbanization and income levels are important, in the supply side relative profitability and infrastructures are more important. The reform of the policy environment is likely to benefit growing horticulture sector, especially in the interest of the small farmers.

Initiatives to create agricultural infrastructures by investment in packaging centres, value added centres, irradiation centres and agribusiness clinics, organic farm produce certification facility have been witnessed in different parts of the country. The NHB and APEDA support, SFAC venture capitals and others have significant impacts on development of value chain and processed food sector. Integrating production with marketing through processing (including intermediate products like mango pulp, tomato concentrate, fruit squash, dried vegetables etc.) will largely help in covering the price risk. The processed food sector has registered a growth of 8.5 percent during 2006-07 [9]. All these initiatives will enable small and marginal farmers to do remunerative marketing of their produce.

Prohibition of tenancy or rigidity of tenancy laws in many states, absence of devolution of greater powers to rural local bodies in different states, absence of legal and regulatory system for contract farming and others are often experienced. Without significant administrative reforms within the State governments, many of the reforms suggested by Central government cannot be implemented.

Review of NGOs and private stakeholders' perspectives

As per the National Agricultural Policy of the GoI, private sector participation in agriculture through contract farming and land leasing arrangements has been encouraged. Some of the established agro-processing players are already showing interest in procuring

raw materials directly from farmers through such arrangements. Opinions, however, differ greatly on contract farming and in the final analysis it is found that contract farming may remain only as a "fragment of production process" in Indian agriculture. Both the NCF and the working group of the Planning Commission for Eleventh Plan (2007-2012) on land related issues suggested that the states should create appropriate farmer centric legal and regulatory system for contract farming [12]. Need for involvement of small and marginal farmers in modern value chains has largely been accepted by all stakeholders.

Weaknesses, gaps and implementation hurdles

Small land holders give prime place to cereals, particularly rice and wheat, in the cropping system on consideration of (i) food security, (ii) low risk, and (iii) easy market access. Small farmers are handicapped due to small and fragmented land holdings, meagre market surplus and the perishable nature of horticultural produce. Shift of small farmers to horticulture, therefore, depends much on knowledge transfer, development of physical and institutional infrastructure, marketing linkages and credit support. Such programmes need to be strengthened and dovetailed with trade policy. The heterogeneity of production conditions and non-involvement of small and marginal farmers in modern value chain are commonly experienced in large parts of the country. Social mobilization and collective action involving small farmers can only make a breakthrough.

Productivity rise and quality enhancement are two major concerns for making Indian horticulture competitive and remunerative. Contract farming, organic farming, agribusiness promotion, value chain developments, Good Agricultural Practices (GAP) etc. are certain initiatives made to address these concerns. Risk mitigation measures to make these initiatives effective and sustainable are not in place and complementary inputs will be therefore essential. It is opined [5] that in the contingent on domestic reforms, there is enormous potential for fruits, vegetables and processed foods. Also, barring isolated sectors, India can be cost competitive in horticultural products. The following areas need attention.

(A) Contract farming

Strong policy and regulatory mechanism supporting contract farmers as primary stakeholders in agricultural value chain are likely to bring faster success in contract farming systems. There is a need to develop comprehensive, transparent, equitable agreements with specific clauses dealing with (i) quality standards, (ii) withdrawal conditions, (iii) pricing standards, (iv) paying arrangements, and (v) arbitration mechanism. Also, a code of conduct needs to be developed for building much needed mutual trust among different stakeholders of contract farming. Care must be taken so that contract farming is not mixed up with corporate farming.

(B) Quality standards

APEDA, with a primary focus on export promotion, had prepared a document on package of Good Agricultural Practices titled as 'India GAP' on the pattern of Europe GAP for adoption under NHM. Similarly, the Bureau of Indian Standards (BIS) has already adopted CODEX, HACCP and food hygienic standards. Enforcement of such standards to unorganized sectors, including private food processing units, through trade literacy and mass campaign programmes is essential. Presently, no harmonized quality standard exists at ground level and it is expected that in the near future a streamlined framework for the entire country will be developed.

(C) Organic farming

The cost of certification of organic produce and GAP for small and marginal farmers being quite high and group certification cost being comparatively low, institutional mechanism for certification needs to be strengthened as an alternate to organic farming. 'Green Agriculture' may be promoted with the application of ecologically sound techniques like IPM, INM, crop-livestock integration and use of most appropriate crop and variety. As suggested by NCF, there should be separate certification procedures for the products of organic and green agriculture.

(D) Value chain development

The central government has provided venture capital funding to develop terminal markets (TM) at selected centres [13]. As per design,

the TMs would be operated professionally in a manner that integrates farm production with food processing industries, retail chain and emerging global markets, offering premium price to farmers based on quality in a competitive environment and transparent manner. The TMs operate via collection centres at production sites to allow farmers easy access at their doorstep.

Several states have since liberalized the APMC Act, the participation of states in the equity of the project by direct funding or providing land and infrastructure will be necessary to expand TM facility in larger areas. Since establishment of TM system entails a high investment cost and efficient management skills, they can be infused by inviting private sector participation as complementary inputs.

Areas of international cooperation

(A) Integrating small holder horticultural farmers with commercial horticulture

The National Commission on Farmers (NCF) of MoA, Government of India developed the concept of organizing "Small Farmers Horticulture Estates (SFHE)" covering an area of 200 to 400 hectare each, to capture the economies of the scale for involving small farmers in organized horticulture production and marketing systems. Such innovative institutional arrangements will help in transformation from manpower to technology driven horticulture development and in integrating small farmers into the markets. Usually poor market orientation and low value addition capacity, give them low margins leading to low risk-taking abilities. Thus, small farmers enter a vicious circle and find it difficult to break out. Strengthening such village institutions for the poor farmers will enable promoting community based rural development. The SFHE programmes are to be undertaken by commodity specific SHGs. Based on market research and agro-ecological considerations, the horticultural crop species are to be identified and promoted.

The group approach to extension through SHGs should aim at improvement of production system of the niche crops and associated support services such as marketing, primary processing, and reduction of post harvest loss of target beneficiaries. For faster growth of SHG movement and organizing SFHE following action plan is suggested:

- Group formation: Each SHG will be formed with 15 to 20 members interested in a set of horticultural crops/ commodities. The SHG will have few elected office bearers, who will organize periodic meetings to finalize production and marketing plans and other items of common interest. There should be a provision of group savings. The state department of agriculture / horticulture and reputed NGOs operating in the locality will be responsible for formation of groups based on local needs and agro-economic considerations.
- Group development: Training and follow-on extension support including provision of limited non-repayable micro-capital grant to the SHGs through making suitable provisions in various horticulture sector schemes will be essential. The micro-capital grants will be provided to the groups for adopting modern technology to improve production and marketing.
- Group capacity building: To promote group based extension, group capacity building will be crucial and structured support and participation of technical personnel both in public and private sector will be required. Services of SAUs, R&D units, KVKs, ATMA and others may be rendered for organized training of trainers as well as farmer beneficiaries. Assisting in developing skills in raising a nursery of quality planting material of horticultural crops and in handling (grading, sorting, packaging, storing) of perishable horticulture produce need to be focused to women group members. Training focusing women friendly technologies / messages favoured by women in the area need to be organized.
- Group marketing: Once a number of SHGs are formed and developed in a village, locality based networks or "village forum"

may be planned for organizing marketing on group marketing concepts, involving producers directly in produce marketing for better returns. The micro-capital grant support for post harvest management should be integrated with production practice, and community based post harvest management facilities needs to be encouraged more. Through farmers training on marketing and awareness building about price differentials including market price differences, the trained marketing groups should be encouraged to avail funding support for improved marketing of local produce. Seasonal storage as marketing function for off-seasonal selling may very well be organized with little capital support. To promote marketing functions, market linked credit and setting up of 'Thrift and Credit' unit within a group of nearby SHGs may be considered. The Thrift and Credit Societies may eventually take the shape of informal banks.

Being a new concept, field testing of SFHE model may be planned for different agro-climatic settings for different sets of horticultural crops, namely (i) arid fruits (pomegranate, custard apple, ber, aonla etc.) in Andhra Pradesh (ii) vegetables in West Bengal (Hybrids/ HYVs with GAP) (iii) seed spices (cumin, fenugreek) and MAP (isapgol, guggal, henna) in Rajasthan/Gujarat, particularly in the areas where SHG movement is already strong. Group mobilization, group development activities may be entrusted to NGOs/voluntary organizations, while the capacity building and training activities both for production and post production activities may be organized by nodal governmental departments. Funding for such activities as grant or as credit should be possible from central sector project like NHM from international funding agencies. A workable research/ extension linkage mechanism at district or zonal levels (agro-climatic zone basis) need to be established. The arrangements of research-extension linkages through Zonal Research Extension Advisory Committees (ZREAC) developed under NARP may be reintroduced for transfer of horticultural technology to the growers.

The adaptive research components of NHM now proposed in the revised scheme may well be entrusted to the Zonal Research Stations (ZRS) of the SAUs. Since such a model combining group extension, capacity building, technology transfer and micro financing will be a new one international knowledge and experience sharing will be rewarding.

(B) Development of modern value chain for horticultural crops

From the developmental perspective, three critical issues for inclusive and equitable growth have been suggested [9].

(i) Involvement of small and marginal farmers in modern value chains. Contributions of government agencies, NGOs and private players, including donor groups, in linking farmers to markets are very important and sustainable partnership development will be crucial for desired success.
(ii) To meet the requirements of new food safety laws, the unorganized food processing sector to be linked to modern systems.
(iii) Balanced regional growth is important so that far flung regions of Northeast and other developing states are not left out of modern value chains.

R & D efforts to develop value chains in potato, seed spices etc., have recently been initiated by ICAR under the World Bank funded NAIP programme. The value chain on potato and potato products includes (i) production and supply of quality seed at reasonable price, (ii) augmentation of production of high quality produce to cater to the needs of processing industry (focusing French fry), and (iii) developing entire chain in "speciality potato" (including low sugar, nutritionally superior, salad and baby potatoes) for retail outlets like mega mart, modern shopping outlets etc. The programme on value chain of major seed spices focused mainly on production of quality seeds, demonstration of Good Agricultural Practices for quality production and enhanced profitability for the growers. The value chain in seed spices will address domestic and export markets.

Building the entrepreneurial competences and skills of farmers and linking them to markets and services, defining the roles of GoI, NGO and private players to develop mutually beneficial sustainable partnership may be aimed under the international cooperation programme. Mobilization of farmers marketing groups, their capacity building both in terms of knowledge upgradation and logistic support in different production zones (one may be located in less developed but potential Northeastern state like Sikkim / Nagaland and the other in horticulturally prosperous state like Maharashtra, where grower associations/cooperatives are in better shape, may be considered. Awareness building on post harvest management, GAP, food safety, pro-poor value chain systems and their management are important activities to be focused in action plans. The European Union (EU) experience [14] in developing 'European Single Market' may also be taken into consideration for market integration under the project. At least a fair trial can be given for development of a common market (and eventually a single market) for the North Eastern Hills (NEH) region through funding supports of HTM of DAC and North Eastern Council (NEC) of Government of India. The hill states of Northeast have commonality in production and marketing systems (crops, production practices, fragmented markets, inaccessibility and transportation difficulties, jhuming etc.) and in consumption pattern of food (large tribal populations with traditional food habits). Limited external donor support for TA component of the project, particularly for capacity building in food safety and market integration and other logistic support from running national government funded projects (e.g. HTM, NHM) should be possible for implementing such a project.

(C) Integrated horticulture and nutrition development for malnourished population

Recognizing the special features like heterogeneity of production conditions in different states and widespread malnourishment in certain regions, a bigger scale donor supported project with components like (i) empowerment of small holder horticultural farmers, (ii) food based nutrition for landless, women and children, (iii) support service, and (iv) project management may be developed. The project may aim to identify best possible ways for social mobilization, capacity building, transfer of technology, women empowerment, awareness building and enhancement of dietary diversity through use of horticultural crops. The operational plan of the project will include (i) identification of the areas of intervention by the government, NGOs and other development agencies / organizations in improvement of small scale horticulture production systems and associated support services such as reduction in post harvest loss, primary processing, marketing and empowerment of women (ii) nutrition education and capacity building of poor villagers through group based training and demonstration (iii) mobilizing small, marginal and landless farmers, particularly women through formation of SHGs and (iv) assessment of likely impacts of such new initiatives on livelihood improvement and food and nutritional security of the malnourished population, particularly women and children.

Such a project may cover 5-6 States with diverse agricultural policies (land reform, land tenancy, women empowerment, Panchayati Raj Institutions, public-private partnership, input support service, contract farming, SHG movement, micro finance in agriculture, retail marketing of produce etc.) to assess the applicability of common policies for horticulture sector development under different socio-economic settings. The implementation experience from such network projects may help in narrowing down the differences and eventually focus the commonalities in developmental approach for the entire country.

5. Complementary inputs from international agencies

(a) Production related issues

Low productivity, high post-harvest losses and poor quality standards are hindering the growth of commercial horticulture and they are often linked with problems of small farmers. Small holder horticulture is handicapped because of small and fragmented land and meagre market surplus of the commodities. The economies of scale in procurement, technology adoption and marketing are better attained if small farmers combine together as producer groups [14]. Programmes namely, (i) organizing Small Farmers Horticulture Estate (SFHE) as an innovative institutional arrangement, and (ii) enhancing productivity and quality standards by developing regionally differentiated strategies, with a strong focus on developing States, will complement the existing efforts. Specific areas of input have been focussed in the previous chapter.

(b) Marketing related issues

Programmes namely, (i) quality control and development of harmonized standards across Indian States (ii) involvement of small and marginal farmers in modern value chain through building the entrepreneurial competences and skills of farmers and linking them to markets and services, and (iii) identifying best possible forward and backward linkage mechanism for connecting small farm produce with terminal markets and organized retail markets will improve domestic trade and improve investment climate in horticulture marketing.

At the instance of NCF, FAO India [14] has also made a study 'Towards an Indian Common Market'. Studies conducted in Maharashtra showed that cooperatives are the best channels of marketing of horticultural produce. Complementary input in reforming producer cooperatives and in developing pro-poor value chains linking perishable horticultural commodities with terminal markets and exporters will be desirable. There is already a government policy to link SHGs with banks and stimulating demands for market-linked credit by activating SHGs will help in opening parallel markets for fresh horticulture produce. Assistance of international agencies in development of pro-poor value chain development for perishable horticultural crops will be desirable.

(c) R & D related issues

Horticultural research needs reorientation through targeting resources on priority issues based on market signals and to avail emerging opportunities created due to climate change and price surges of recent times.

To meet the challenges of (i) sharply rising input prices, (ii) environmental degradation, (iii) water and land scarcity, and (iv) global warming and climate change research programming must be revised / modified. Complementary inputs in upscaling research capacities of national institutions through international cooperation will be essential for improving technology delivery system. For pursuing collaborative research and undertake study visits abroad limited funding support may be required from international sources.

Exploring possible sources of funds

For production related programmes like (i) empowerment of small holder horticultural farmers, and (ii) enhancement of productivity and quality standards for improving competitiveness and rural growth, credit supports from WB and ADB should be possible. Also, the WB financed projects may assist in infrastructure development, particularly for backward areas and developing States. Larger scale multi-state integrated horticulture and nutrition development projects may be financed by organizations like IFAD. The WB [15] may also be willing to support projects for strengthening community based institutions for the poor, including SHGs to

access new economic opportunities and promoting rural livelihood. For strengthening research system and for improving capabilities for researchers in frontier science the FAO may play a very significant role by suggesting research networking and organizing advanced training through funding support of international agencies.

References

1. **Acharya S. S.** 2006. *Agricultural marketing and rural credit for strengthening Indian agriculture.* Indian Resident Mission: Policy Brief 3, ADB, New Delhi.
2. **Acharya. S. S.** 2007. I*ndia's current agrarian distress: Intensity and causes,* NAAS News 7 (3), July-September, 2007. NASC Complex, New Delhi.
3. **Birthal et. al.** 2007. *Growth of different crop commodities in Indian agriculture.* National Centre for Agricultural Economics & Policy Research (ICAR), New Delhi.
4. **Chand Ramesh.** 2008. *Domestic and global environment for high value agriculture in India.* Paper contributed for the brainstorming session on "High Value Agriculture-Prospects and Policies" held at National Academy of Agricultural Sciences, New Delhi, 28 April 2008.
5. **Debroy, Bibek and Laveesh Bhandari.** 2006. *Rapid growth of selected Asian economics.* Part II. Indian Agriculture and Scenario for 2020. FAO Corporate Document Repository, FAO-RAP, Bangkok.
6. **Ghosh. S.P.** 2008. *High value crops of India: Prospects and Policies.* NAAS News, 8 (I) January-March, 2008, NASC Complex, New Delhi.
7. **Indian Horticulture Database.** 2005. National Horticulture Board, Gurgaon, Haryana.
8. **Mattoo. A, Mishra. D, and Narain,** A. 2007. *From competition at home to competing abroad: A case study of Indian Horticulture Sector.* The World Bank, New Delhi.
9. **Punjabi, Meeta.** 2007. *Emerging environment for agribusiness and agro-industry development in the way forward.* FAO, New Delhi.
10. **Swaminathan, M. S.** 2007. *India's tryst with destiny in Agriculture,* NAAS News, 7 (1), January-March, 2007, NASC Complex, New Delhi-110012.
11. **Presentation by Mission Director,** NHM at 4th meeting of the General Council of National Horticulture Mission held at Krishi Bhavan, New Delhi on 20 March, 2008.
12. **GoI.** 2007. Report of the sub-group of the Planning Commission for 11th Plan on Land Related Issues, Planning Commission, January 2007, pp.126-27.
13. **GoI.** 2006. *Terminal Markets: The physical commodity exchange for perishables. In: World Agro Trade Scanner* (WATS), vol 1, No. 1, 15-31 March, 2006, Published by the National Institute of Agricultural Marketing, GoI, Jaipur.
14. **FAO.** 2005. *Towards the Indian common market: Removal of restrictions on internal trade in Agriculture commodities.* Report submitted to the National Commission on Farmers, MoA, GoI, New Delhi.
15. **World Bank.** 2008. *India: Priorities for Agriculture and Rural Development* (under 'Priority Areas for the World Bank support'), New Delhi.
16. **GoI.** 2003. Report of the Committee on 'Capital Formation in Agriculture', Directorate of Economics and Statistics, Dept. of Agriculture & Cooperation, MoA, GoI, March 2003.

Livestock

Prepared by

Anjani Kumar

About the author

Dr Anjani Kumar is a Senior Agricultural Economist at the National Centre for Agricultural Economics and Policy Research (NCAP), New Delhi. He has also served as Senior Agricultural Economist in the Asia Office of International Livestock Research Institute, Nairobi. He has led a number of research projects of national and international importance. His work includes: trade liberalization and its impact on livestock and fisheries; food safety issues and their implications; cost of compliance of food safety measures, technological change and agricultural growth. He has made important contributions to agricultural economics and policy research and his findings have been widely used by policy makers, planners and experts. In recognition of his outstanding contribution to social science research, he was conferred with Lal Bahadur Young Scientist Award (biennium 2003-04) and NAAS Young Scientist Award (biennium 2001-02). Besides, he received several awards for his scholarly research works. He has been nominated as NAAS Associate Fellow w.e.f. 1 January 2008.

Contents

Executive summary

FAO India is working with the Government of India to prepare a National Medium Term Priority Framework (NMTPF) for identifying overarching issues and challenges pertaining to food and agriculture in India. This paper on livestock is an input to the preparation of NMTPF. The paper assesses the strengths, weaknesses and gaps in the development strategies for livestock sector in India and pinpoints the opportunities for strategic intervention by international agencies.

The role of livestock sector for poverty reduction, promoting income equity, ensuring nutrition security, and employment generation has been well documented in the Indian context. India has several programmes for the livestock sector. These programmes have been historically led by the public sector. But now the presence of the private sector and civil society organizations in the livestock sector is expanding. Different models of livestock development have been tried and some of the interventions have been quite successful. However, a single unified model cannot be equally effective throughout the country.

The challenges, as well as opportunities, of livestock development still remain. The paper identifies the major weaknesses in the delivery systems of inputs and services. Further, most of the programmes and projects lack involvement and ownership of people at the grassroots level. The paper emphasizes that the livestock development policy should focus on enhancing smallholders' competitiveness and enables them to tap the emerging market opportunities. It emphasizes on implementation of the programmes in a participatory framework and that human resource development at each level should be at the core of development strategies. Finally, a few strategic intervention points have been identified in the paper.

1. Brief overview

Livestock sector plays a significant role in the rural economy of India. It contributes about five percent of the total GDP and more than one-fourth of the agricultural GDP (AgGDP). Livestock activities provide between 15 percent and 40 percent of household income to nearly 70 percent of rural households [1]. The sector is unique in terms of employment opportunities as two-third of female workforce in rural India is engaged in livestock rearing. Livestock is an integral part of mixed farming systems that characterize Indian agriculture. Livestock manure is a major source of nutrients for crop production and for sustaining soil fertility. Livestock wealth is more equitably distributed than that of land in India and the importance of livestock for the poorer households is even more so. Besides contributing food and inputs for crop production, livestock is important as savings or investments for the poor household and provides security or insurance through various ways in different production systems [2]. Further, livestock rearing contributes to on-farm diversification and intensification, which could be one of the strategies for poor households to escape poverty and to maintain some stability in their earnings. The importance of livestock is much greater in marginal areas like arid and rainfed regions because of higher concentration of poor, limited benefits of Green Revolution technologies, climatic uncertainties etc. However, the nature of contribution of livestock has been changing over time and it varies from place to place.

As per the livestock census [3] carried out in 2003, India had 185 million cattle, 98 million buffaloes, 124 million goats, 61 million sheep, 14 million pigs and 489 million poultry birds. Cattle always dominated the livestock production systems in India. Priority of maintaining a sufficient number of draught animals for use in crop production and transportation led to dual-purpose breeds of cattle that could produce milk and quality draught males. Other species like buffaloes, sheep, goats, pigs and poultry have been traditionally maintained for food production [4]. However, the composition of cattle is changing in favour of milch animals largely because of increasing mechanization of agricultural operations.

Milk group is the major contributor to the livestock output and its share hovered around 66 to 68 percent in recent years. Considerable diversification towards poultry products has been observed over time. The share of meat and meat products exhibited a reasonable stability and hovered around 10 to 11 percent. The share of dung witnessed a sharp drop in the livestock output, and is presently contributing about seven percent to the value of livestock output. Rapid growth in application of inorganic fertilizers, stabilization of livestock population due to increasing mechanization of agriculture might have contributed to its declining share in the livestock output.

The livestock sector has emerged as the growing sector of the agricultural economy. The growth registered by livestock sub-sector was modest till 1970. An upsurge in the growth rate of livestock output was witnessed during 1970s and it rose to 3.9 percent per annum during 1970s. In fact, the growth in the livestock sector has always been higher than the growth in the crop sector since 1970. This was the case even during the hey-day of the Green Revolution in1970s and 1980s; when the policy emphasis was largely focused on the crop sector. The growth of livestock products in the country has been comparable to that achieved by other important sectors of the economy since 1970. The acceleration in growth continued during 1980s (4.9 percent) but the growth rate slackened during 1990s (3.8 percent) and after 2000 (3.7 percent). However, it was able to maintain a respectable growth rate of about four percent per annum during 1990s and after 2000.

The growth pattern varied among various components of the livestock sub-sector. Milk output witnessed spectacular growth of about five percent per annum during 1970s and 1980s. The growth rate declined during 1990s (4.3 percent) and after 2000 (3.4 percent). Growth of meat picked up substantially in 1980s and registered an annual growth of more than five percent. Its growth rate declined during 1990s (2.2 percent) but accelerated after 2000 (4.2 percent). Poultry continued to grow at more than four percent per annum during 1990s and after 2000. It is interesting to observe that, unlike dairy, growth in the poultry sector is attributed to the organized private sector, which controls 80 percent of the total poultry production in the country.

Rapid growth in livestock output could be attributed to technological change, better feeding, and improvements in animal health. The spectacular growth of the livestock sector is attributed to effective government interventions and rising demand for livestock products in response to rising incomes in urban and rural areas. The efforts of the government, particularly the departments concerned with dairying, animal husbandry and veterinary services, have played a key role in raising the productivity of our national milch herd [5]. The contribution of the cooperative sector has also been of great importance, both in creating a market and in supporting farmers with technical inputs, viz., feed, breeding and veterinary services. Improvement in herd quality, artificial insemination, spread of cooperatives, area under fodders, veterinary facilities are the direct outcome of the development programmes of the government and have been empirically shown to positively affect the performance of the livestock sub-sector. In a recent study [6] per capita income, rural road network, and terms of trade were observed to have significant influence on the livestock output. Further, the expenditure elasticities for livestock products were high with the tilt in favour of rural areas, averaging 1.47 and 1.01 for milk in rural and urban areas, respectively and 1.04 and 0.75 for the eggs / meat groups, respectively [7]. Further growth in per capita income and changing consumption patterns would lead to acceleration in the demand for livestock products and this is expected to give a further boost to this sector.

Rapid growth in the livestock sector is desirable not only to boost agricultural growth but also to reduce rural poverty and promote rural equity. The distribution of livestock is more egalitarian than that of land. The smallholders and the landless together control 75 percent of the livestock resources. Livestock is thus an important source of livelihood for smallholders and the landless and the sector's rapid growth benefits the poorest households the most. Evidence shows that livestock contributes nearly half of the total income of the smallholders [8]. The livestock sector also seems to promote gender and social equity. About 60 percent of the total workers engaged in the livestock sector are women. The participation of women in other activities including agriculture is low compared to that of animal husbandry. Further, majority of workers engaged in the livestock sector belongs to socially and economically backward communities. Scheduled Tribes (STs), Scheduled Castes (SCs) and Other Backward Castes (OBCs) together constitute about 70 percent of the persons employed in the livestock sector.

The challenges of development

The livestock sector's vigorous growth and its concomitant structural changes have resulted in a range of significant challenges that require to be addressed for sustainable and pro-poor growth of the livestock sector in India. These challenges are linked to the role of the livestock sector in economic development and rural poverty alleviation in India, the emergence of diseases affecting animals and humans, the climate and the natural resource base used in animal production i.e. livestock environment interactions, livestock products marketing and access of livestock holders to livestock inputs and service delivery. Specifically, the challenges of livestock development include

i) The development and implementation of holistic pro-poor livestock policies aimed at enhancing the productivity of livestock sector, reducing regional disparities, enabling small holders to be more competitive and promoting sustainable use of natural resources.
ii) Establishment of need based livestock delivery systems especially for small holder livestock farmers at reasonable cost for ensuring an adequate supply of livestock inputs and services. In particular, balancing feed supply and demand is a major challenge for the sustainable development of the Indian livestock sector.
iii) Increasing marketing efficiency and support small holder livestock farmers in improving their income through better market access.
iv) Adaptation/re-orientation of livestock development strategies in view of the looming threat of climatic change would be a major challenge for livestock development.

Future potential of the sector

A sustainable and efficient growth of the livestock sector is important for reducing poverty, ensuring nutritional security, generating employment opportunities and promoting equity in rural income at the national level. The livestock sector also needs to tackle the new challenges emerging from climate change, increasing integration with global economy, growing awareness about quality and food safety, emerging new marketing institutions, emerging and re-emerging diseases (having cross-border impacts) and looming bio-security threats. However, the demand for livestock products is growing rapidly, which offers considerable scope to increase rural income through accelerated growth of the livestock sector. For ensuring acceleration in livestock growth, increasing productivity, sustainable use of resources, enhancing competitiveness, value addition, creating efficient marketing system and ensuring smallholders' improved access to markets would be critical.

Major programmes undertaken by the Government

Agriculture including animal husbandry, dairying and fisheries is a State subject. However, the GoI supplements the efforts of the State governments in development of the livestock sector. Further, currently most of the livestock development programmes have either been centrally sponsored or in operation as a central sector scheme. These programmes encompass a vast gamut of livestock development issues. These include genetic improvement, feed and fodder development, prevention and control of animal diseases, clean milk production, processing of livestock products etc. Some of the major programmes for development of the livestock sector in India are enumerated below.

Centrally sponsored schemes -

- National project for cattle and buffalo breeding
- Central herd registration scheme
- Project for dairy development (including clean milk production)
- Poultry development
- Project of slaughter houses and CU plants
- Conservation of threatened livestock breeds
- Project for feed and fodder
- Livestock insurance
- National livestock disease control programme
- Livestock extension and delivery services

Central sector schemes -

- Livestock census
- Integrated sample survey
- Small ruminant development
- Piggery development
- Salvaging and rearing of male buffalo calves
- Food safety and traceability
- Poultry venture capital fund
- Establishment of livestock food corporation
- Special feeding programme for raising heifers
- Resource mapping in 100 potential districts and promotion of entrepreneurial programmes in small ruminants and pigs
- Assistance to cooperatives
- Delhi Milk Scheme
- Dairy Venture Capital Fund

The implementation strategies for the above development programmes have undergone significant changes over time. However, the efficiency and effectiveness of these programmes exhibited considerable regional variations. The constraints for effective implementation have been studied and well documented by several independent agencies. Several measures have been initiated to overcome those constraints, still considerable efforts have to be made to achieve the desired outcome.

Efforts and approaches by other development partners

Different national and international development agencies have been supplementing the efforts of livestock development in India. These include international bodies like World Bank, IFAD, DFID, ADB, FAO and SDC. National NGOs like BAIF, JK Trust, Pradan etc. are also active in the livestock sector. Initially World Bank assistance concentrated on dairy development. However, of late it has covered other species and sub-sectors also. For instance, UP Diversified Agricultural Support Programme and Assam Agricultural Competitiveness Project have a strong component of livestock development, which include poultry, piggery, small ruminants apart from dairy development. World Bank supported state-level agricultural development projects in areas such as social forestry, watershed development and area development also had livestock development and fodder production components.
The Swiss Agency for Development and Cooperation (SDC) has been supporting livestock based livelihoods in India for over

four decades. The Indo-Swiss project in Kerala in fact revolutionized the livestock development in Kerala and revolutionary institutional changes were brought out. Similar striking changes in cattle development took place in varying degrees across the country, particularly in Andhra Pradesh and Rajasthan, under Indo-Swiss collaborations. Together with the Government of Kerala and the NDDB, it also supported the north Kerala dairy project to establish an efficiently managed and economically viable cooperative dairy in the State. This is important as north Kerala was considered unsuitable for dairy development. The other programmes supported by SDC include Breed Conservation and Development, Para-Vet Programme, Community Based Livestock Health Workers of Orissa, Multi-utility Animal Health Workers of Sikkim, Livestock Development Policy of Chhattisgarh, Participatory Livestock Service Reforms in Andhra Pradesh, and Reforms in Veterinary and Animal Husbandry Education. Similarly, livestock is an integral component of the DFID supported project on Improving Rural Livelihoods in India. This has been mainly operationalized in Andhra Pradesh, Orissa, Madhya Pradesh and West Bengal. Some programmes on Animal Health and Improving Value Chains in livestock have also been supported by DFID. FAO has been instrumental in supplementing the livestock development efforts particularly under Pro-Poor Livestock Policy Initiative (PPLPI). Recently, its efforts were laudable in reducing the threat of Avian Influenza. It played a pro-active role in coordinating the cross-country efforts in minimizing the threats of the emerging livestock diseases. A number of programmes aimed at improving rural livelihoods have been supported by IFAD which include livestock. These programmes include - Mitigating Poverty in Western Rajasthan Project; Women's Empowerment and Livelihoods Programme in the Mid-Gangetic Plains; Tejaswini Rural Women's Empowerment Programme; Post-Tsunami Sustainable Livelihoods Programme for the Coastal Communities of Tamil Nadu; Livelihoods Improvement Project in the Himalayas; Orissa Tribal Empowerment and Livelihoods Programme; National Microfinance Support Programme; Jharkhand-Chhattisgarh Tribal Development Programme; North Eastern Region Community Resource Management Project for Upland Areas; Livelihood Security Project for Earthquake-Affected Rural Household in Gujarat; Rural Women's Development and Empowerment Project; Mewat Area Development Project; Andhra Pradesh Participatory Tribal Development Project; Maharashtra Rural Credit Project; Andhra Pradesh Tribal Development Project; Tamil Nadu Women's Development Project; Second Uttar Pradesh Public Tubewells Project; Madhya Pradesh Medium Irrigation Project; Sundarban Development Project; Rajasthan Command Area Development and Settlement Project; and Bhima Command Area Development Project.

The development efforts by international agencies places the people at the centre of development, and programmes based on this approach help people build their assets and develop and upgrade their skills to enable them to access new opportunities for income generation and employment. These programmes have supported the formation of self help groups and producer groups and significantly increased access to microfinance on fair terms, to veterinary services, to inputs such as improved breeds, feeds and to markets. A capacity building programme at all levels - from State to village - was inherent and instrumental in the success of the programmes. Particular attention was paid on sustainable use of natural resources.

3. Development strategies

Core development strategies

Livestock has been recognized to play a strategic role in promoting rural growth and reducing rural poverty in India. Promoting growth and increasing efficiency in production and marketing of livestock products has remained an overarching concern of the GoI. During 1970s livestock was considered an important means to counteract adverse effects of land-based Green Revolution on rural income distribution. The poor were provided credit assistance to build up livestock assets under poverty alleviation programmes. Major support to the livestock sector came in the form of 'Operation Flood' programme, which was launched in 1970 to link rural milk production with urban consumption centres through the network of dairy cooperatives. Besides, the dairy industry was protected from cheap imports through licensing, quotas and tariffs.

After the initiation of process of economic reforms, several initiatives were taken to improve growth and efficiency in livestock production and processing. The entry of the private sector into dairy industry was freed from regulations and meat processing industries were encouraged to modernize and expand. Processing of livestock products was further encouraged by lowering excise and corporate taxes. The Agricultural Produce Market Committee Act (APMC), which prohibited sale/purchase of agricultural commodities outside state designated markets, has been amended recently to procure produce directly from producers through institutional arrangements like cooperatives, contract farming and producers associations or by establishing their own markets.

The development strategy for livestock sector in India for the Eleventh Five Year Plan also revolves around growth. The goals of the Plan are as follows -

i) to achieve an overall growth of 6 to 7 percent for the livestock sector
ii) benefits of growth should be equitable among class and regions
iii) growth should generate additional employment opportunities particularly for rural female.
iv) should contribute as a major source of rural income crop-livestock production system
v) improvement in the environment through livestock growth

An overview of the programmes of the livestock sector in India reveals that the development programmes have been largely based on public initiatives. With the increase in coverage, these programmes have overgrown in size which led to inefficient management and effectiveness got eroded. Their institutional structure has changed over time but could not keep pace to suit the changing requirement and fast changes in technology. Different mechanisms have evolved for implementation of livestock development programmes and delivery of livestock services in India. Traditionally, the public sector (Central or State governments) has dominated with only minor presence of NGOs and the private sector. However, recently there has been greater involvement of NGOs and the private sector in the implementation of livestock development programmes and delivery of livestock support services. The approaches, efficiencies and effectiveness of different mechanisms differ. The strengths and weaknesses of different models and approaches are summarized in the Table1 on page 51.

Review of livestock development policies

Agriculture, including the livestock sector, is a State responsibility and the State governments are primarily responsible for development of the sector. Central government supplements the efforts of the State governments through various schemes for achieving accelerated growth of the sector. India had implemented ten Five Year

TABLE 1: The characteristics of different models of livestock development programmes

Implementing system	Implementing actors	Responsible to	Resources depending on	Strengths	Weakness
Public services	Frontline staff in government department	Government	National and State budget	Assured budget, strong base of infrastructural support, focus on promotion of social and regional equity, consistency and continuity, public support and faith.	Supply driven, uniform spread approach, inefficiency in the delivery, rigidity for local adaptation, lack of incentives for performance, lack of accountability, long gestation period between planning and execution, bureaucratic procedures constrains effectiveness.
National and international NGOs	NGO frontline staff	Donor	Donor policy and funding	Efficient delivery, greater focus on small and marginal sections, flexibility for local adaptation, short gestation period between planning and execution, participatory approach, builds ownerships among stakeholders, greater focus on needs and aspirations of the people, closer monitoring and evaluation, field based development expertise, process oriented approach to development.	Driven by donor's agenda and priorities, compromise of agenda for seeking funds, long term sustainability in question after withdrawal of interventions, small scale interventions, lack of inter-organizational communication and /or coordination.
Local NGO	NGO staff	Donor	Donor policy and funding	Efficient delivery, greater focus on small and marginal sections, flexibility for local adaptation, short gestation period between planning and execution, participatory approach, builds ownerships among stakeholders, greater focus on needs and aspirations of the people, closer monitoring and evaluation, field based development expertise, process oriented approach to development.	Driven by donor's agenda and priorities, greater compromise of agenda for seeking funds, long term sustainability in question after withdrawal of interventions, threat of emergence of NGOs of suspicious reliability, lack of capacity for quality delivery, limited financial and management expertise, limited institutional capacity, small-scale interventions, lack of understanding of the broader social or economic context.

Contd.

Contd. from page 51

TABLE 1: The characteristics of different models of livestock development programmes

Implementing system	Implementing actors	Responsible to	Resources depending on	Strengths	Weakness
Private agencies	Individuals, staff, or owners of private enterprise	Enterprise owner and users	Economic capacities and priorities of users	Demand driven, higher prospects for long term sustainability and expansion, efficient delivery, flexibility for local adaptation.	Poorest may be left out, threat of monopsony particularly in more backward and remote areas, profit motivated, problems in quality assurance in absence of effective regulatory mechanism, some services which do not have higher prospects of profit generation may be left out, legal obstacle for service providers like para-vets.
Cooperatives	Staff of cooperatives members	Board of cooperatives / members	Government support / economic capacities / priorities of members	Strong network, infrastructures, capable manpower, capable of delivering integrated services, strong backward and forward linkages, support of government funding.	Supply driven, practically quasi-government bodies with a top-heavy hierarchial structure, inability to replicate the work rate, functioning captured by elite, lack of business acumen and social capital to compete with private sector, motivated by assured procurement, cross-subsidization, uniform approach, rigidity in local adaptation, stark regional variation in performance,
Government-NGO-small scale private delivering agents	Community based worker	Government, community and users	Government support, economic capacities and users/community's priorities	Demand driven, greater participation of community, long term sustainability, flexibility for local adaptation, local capacity building, participatory methodologies and tools, convergence of business acumen, financial and social capital, greater ability to innovate and adapt.	Threat of Government interference, potential for conflicts between stakeholders.
Informal service systems	Traditional institutions, informal user groups	Users	Economic capacities and priorities of users	Demand driven, availability in the vicinity, strong grassroots links.	Lack of modern facilities, lack of higher skills, less prospects for scaling up of the service delivery, lack of understanding of the broader social or economic context.

Plans which include the development of livestock economy. However, it does not have a unified livestock development policy. Even at the State level, this is lacking in most of the States. The policy tilt is reflected by the development programmes undertaken and the investments made for the development of the sector. Policy reforms have also been operated as a consequence of the reforms/ initiatives undertaken in the process of economic reforms. By looking at the initiatives undertaken over the years, it is clearly evident that the livestock sector has not received policy attention commensurate with its contribution to generation of income and employment and reduction of rural poverty. The livestock sector remains under-invested and also there is not much institutional and market support for livestock production except milk and to some extent poultry. Public expenditure in livestock as a proportion of GDP from livestock has declined continuously from 1990-91 (3.55 percent) to 2004-05 (2.06 percent) [9]. Further, the overall objective of the livestock development policy revolved around increasing milk and meat production without much appreciation for its role in poverty reduction. The livestock policies have been operated mainly through the direct action by Government and a multitude of departmental institutions and public sector initiatives have dominated the Government presence in the sector both at the Centre and the State level. However, of late some measures have been initiated to create space for NGOs and the private sector particularly in the delivery of inputs and services for the development of the livestock sector.

The livestock policies as reflected in different programmes and initiatives can be broadly described as follows:

i) **Production enhancing policies:** Production enhancing policies include public actions that enable smallholder producers to have adequate access to inputs such as improved breed, feed, grazing lands, animal health services, credit and insurance. The provision of breeding services focuses on the setting up of breeding farms/centres for production of semen and promoting breeding programmes through Artificial Inseminations (AI) for genetic improvement of livestock. The emphasis has been on breed improvement through cross-breeding with little attention to within-breed improvement. These breed improvement programmes have been tilted towards large ruminants and pigs while small ruminants could not get the same attention. In the commercial poultry sector, private producers have developed their own support systems and breeding infrastructure. But, the support services for backyard poultry have been by and large ignored. The feed insecurity in India is acute in spite of having programmes for feed and fodder development for long. Both public and private sector intervention in development of green fodder resources is limited. The Central fodder production farm, seven regional stations and about 80 State fodder seed production farms are mandated for production of high yielding varieties of fodder seeds and transfer of scientific fodder production technologies to the farmers. Besides, distributions of fodder seed mini kits, establishment of fodder banks and assistance to fodder making units have also been undertaken to improve fodder production. The production of fodder seeds however meets only 15 to 20 percent of the requirement. The performance evaluation of the Government fodder development institutions and programmes carried out by the Centre for Management Development, Thiruvanthapuram does not show encouraging results [10]. The impact of the activities of these institutions on the farming community was barely discernible, especially when compared to the extent of funds spent. The R & D to identify and develop new varieties and develop package of practices suitable to the region remained neglected. The private sector's intervention in augmenting green fodder production is virtually non-existent. However, it plays an important role in the compound feed segment, particularly

for commercial poultry. Animal feed production is carried out in both organized and unorganized sector. Feed produced by unorganized sector account for 80 percent of all feeds consumed by the livestock population in India, though these feeds suffer from many deficiencies and imbalances [9, 11, 12].

Credit is provided to the livestock sector by both the institutional and non-institutional agencies. The institutional credit agencies provide credit facilities in the form of term loans for various livestock activities such as dairy, poultry, sheep and goat rearing, piggery etc. However, the share of the livestock sector in total term loans to the agriculture sector is less than 10 percent; though it accounts for more than 25 percent of AgGDP. Because of inadequate credit provided by the institutional sources, heavy reliance on the non-institutional sources continues to exist. In recent years, a few models of delivering credit services to the livestock sector have been initiated, such as finances under the Rural Infrastructure Development Fund (RIDF) to establish veterinary dispensaries and livestock aid centres and the venture capital fund for dairy and poultry sector to promote new entrepreneurs and the National Credit Fund for Women. Also a large number of micro-credit institutions have emerged and a number of private sector banks are entering the micro credit sector with several innovative products. However, there is no umbrella scheme to promote and regulate microfinance in the livestock sector.

Insurance coverage for the livestock sector is dismal. Even the agricultural insurance scheme has not performed well. The Department of Animal Husbandry and Dairying, Government of India has formulated a new pilot scheme in 100 districts of the country, where the National Project for Cattle and Buffalo Breeding (NPCC) is in operation. The scheme is restricted to high yielding cows and buffaloes, where 50 percent of the cost is borne by the farmers and the remaining 50 percent and the administrative charges including cost of the ear tags are borne by the GoI. Until recently livestock insurance was in the domain of the public agencies, but now private players have entered the market. In 2002, BASIX, a livelihood promotion institution collaborated with Royal Sundaram to provide livestock insurance to poor livestock keepers and their spread has been increasing over time. They have implemented control measures to reduce adverse selection and moral hazards in claims. These measures have allowed the company to reduce the premium rate from 4.5 percent to 3.9 percent in subsequent years. The rapid scaling up by BASIX and product replication by other insurance companies is the testimony of the viability of such a product as well as existence of demand. These types of initiatives need to be replicated on a wider scale and microfinance institutions and private sector players should be encouraged to increase the outreach of livestock insurance.

There are over 52,000 veterinary hospitals/dispensaries and aid centres (comprising stockmen centres and mobile dispensaries) under the State Animal Husbandry Departments, and some cooperatives, NGOs and private practitioners also provide animal health services. Despite this vast network of veterinary institutions, the incidence of diseases and epidemics is very high and one rough estimate puts annual national losses due to animal disease at 10 percent of the annual value of the output of the livestock sector - other estimates are even higher. The poor status of animal health stems from the extremely limited attention paid to preventive health care services (only 3.5 percent of the total staff engaged in livestock health institutions are involved in disease investigation and control) and inefficiencies in provision of curative health services. The majority of villages are within 5 km of a veterinary centre in nearly all the States but the

proportion of households accessing these centres ranges from 6 to 70 percent in different States with an all India average of only 28 percent; this suggests a major problem with the quality of services rendered by the institutions. The service is free at the centre, but farmers have to pay for doorstep services and for the cost of drugs, but availability of drugs can be a problem. Empirical studies show that there is a willingness to pay for good quality services.

The public extension services have played a major role in technology and knowledge transfer in the crop sector, but in the livestock sector extension service delivery has been very weak. Livestock extension activities are by and large the responsibility of the State Animal Husbandry Departments, but they do not have the resources and expertise to conceive and operate technology transfer packages. The services are mainly run by veterinarians who operate from veterinary dispensaries to treat animals rather than approaching farmers to educate and inform them about feed, fodder and animal health. The evolution of a comprehensive nationwide extension service in the livestock sector has not been attempted. Some of the State Agricultural Universities, ICAR institutes and Krishi Vigyan Kendras (KVKs) provide extension but this does not constitute a national extension service comparable to the nationwide extension support available for crop production. Only about five percent of households access any information on animal husbandry. The ATMA (Agricultural Technology Management Agency) approach for the coordination of agricultural extension initially piloted in a number of districts has now been adopted in more than half the districts in the country. This involves establishing a society of key stakeholders associated with agricultural development in the district, including line departments, research organizations, non-governmental organizations and other agencies. Under this model the public sector operates down to the Block level with frontline services below that level being provided by private service providers, community-based organizations, farmers' cooperatives, agri-businesses and agri-clinics. However, a few of the ATMAs have embraced livestock extension.

India has a large network of institutes under different organizations to carry out research in the livestock sector, including the ICAR with seven specialized livestock research institutes, five research centres, and six All-India Coordinated Livestock Research Projects. Research in livestock is also carried out by 40 State Agricultural Universities, seven of which are fully dedicated to livestock. Other organizations supporting or conducting research on livestock include Department of Animal Husbandry and Dairying, Ministry of Commerce, Ministry of Food Processing, Council of Scientific and Industrial Research (CSIR), University Grants Commission, Central Agricultural University, National Dairy Development Board, Ministry of Science and Technology, Department of Biotechnology, Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs), NGOs and the private sector. Such a multiplicity of institutes and organizations creates problems for coordination and there is little cross-disciplinary research on livestock.

ii) Marketing and value addition: The role of markets, value addition and trade facilitated growth is more important in perishables like milk, meat and eggs, which require immediate transportation from farm consumption centers or storage or conversion into less perishable forms.

- *Live animals:*
  Markets for live animals are not well developed. A considerable proportion of live animals, mainly ruminants, are exchanged amongst livestock producers themselves and between producers

and itinerary traders. Itinerary traders assemble animals from the producers for sale in the regulated markets to larger traders as well as to others buyers. Bulk of the trade in small ruminants takes place between producers and itinerary traders. Large producers generally sell directly in the markets. Another important marketing channel for small ruminants is their direct sale to slaughterhouses and butchers. Sometimes, small producers assemble their produce and sell collectively to the slaughterhouses. Butcher-cum-retailers in small towns too procure live animals directly from producers. Markets for poultry are well developed and organized. Bulk of trade in broilers and eggs takes place between producers and traders directly or indirectly through commission agents in the designated markets or at the farm gates. Retail traders procure broilers either directly from producers or from wholesale traders. Direct sale between producers and consumers/ retail traders is limited. In some States poultry cooperatives also facilitate marketing, but on a limited scale.

- *Meat:*
  There are over 4 000 registered and 30 000 unregistered slaughterhouses in India, producing almost an equal amount of meat. Most of the slaughterhouses are overcrowded, unhygienic and lack essential services like water, drainage, waste disposal and effluent treatment. Slaughtering practices are traditional, resulting into low recovery rate, and wastage of byproducts like blood, skins, tallow etc. However, in recent years there has been significant increase in meat processing capacities and a number of modern meat processing plants have come up.

- *Milk:*
  Nearly 45 percent of milk produced in the country is marketed, and the producer households consume the rest [13]. Milk markets are largely informal. About two–thirds of the marketed surplus is sold in informal markets. Organized markets comprising of cooperatives and the private sector share the rest almost in equal proportion. Vendors and milk dealers dominate the informal market. Vendors operate on a small scale. Dairy cooperatives are an important component of organized milk markets and their network has expanded considerably since the launch of the Operation Flood Programme in 1970. Dairy cooperatives have grown in a protective environment. They were protected from both internal and external competition. The external competition was restricted through high import tariffs and quantitative restrictions. Until 1994, dairy imports were canalized through the National Dairy Development Board (NDDB). Internal competition was regulated by restricting the entry of the private sector in dairy business under the Industries Development and Regulation Act 1951. The programme of economic reforms initiated in 1991, however it exempted the dairy sector from the Act and opened entry for private sector companies including multinationals primarily with an aim to improving efficiency in production, marketing and processing. De-licensing attracted considerable private investment and a number of new processing plants were established.

iii) Livestock trade policy: Agricultural exports and imports, which encompass livestock products also, were regulated through quantitative restrictions, such as quotas and licenses or were channelled through a state trading organization or some combination of both till the early-1990s. In a sequence of implementation of economic reform measures, the GoI introduced major trade policy reforms in April 1995 that encompassed livestock products. The policy measures introduced during this period include -

- Canalization of agricultural trade, including livestock, was almost dismantled. The role of canalizing

agencies in livestock trade was made limited.

- Quantitative restrictions (QRs) on export and import of livestock products were removed. Licensing requirements for all the products, except those on the banned or restricted, were abolished. Even the list of prohibited / restricted items was pruned considerably.
- Decanalization of livestock trade was followed by rationalization in tariff structures. Minimum export price restrictions were also removed.

Liberalization offers both opportunities and challenges to the policymaker and other stakeholders. For instance, the recent lifting of restrictions on dairy and poultry meat might have adversely affected producers if these were not coupled with structural changes in the processing and marketing sectors to reduce marketing costs and margins.

The quantitative restrictions on import of agricultural products, including livestock commodities were abolished from April 2001. Tariffs on most of the milk products were brought down considerably, as consequent to domestic reforms and WTO agreements. The import tariff was 60 percent for dairy products, hides and skins, and 100 percent for live animals, meat and eggs during the pre-reform period. It has been gradually reduced and brought down to 30 percent for all the livestock products [14]. The Sanitary and Phyto-Sanitary (SPS) standards are governed and enforced through a number of laws and agencies in India. The Prevention of Food Adulteration Act, 1954 is the main law on food safety and food quality, and it takes account of livestock commodities also. The multiplicity of laws and regulations leads to overlapping and lack of coordination among implementing agencies. Therefore, to streamline SPS procedures and their enforcement, the Food Safety and Standards Act was passed by the Indian Parliament in August 2006, although it is yet to be enforced. This Act consolidates 13 laws and establishes a Food Safety and Standards Authority (FSSA). The regulations and rules to implement the Act are under formulation.

The issues being raised during the period under review in the WTO Committee on Sanitary and Phytosanitary Measures include maximum levels for certain aflatoxins, maximum residue limits (MRLs) in animal products for imports into the European countries, and geographical Bovine Spongiform Encephalopathy (BSE) risk assessment requirements maintained by the European countries, import requirements on meat and eggs maintained by Switzerland etc.

4. Specific needs and potential areas of international cooperation

Livestock development should be seen as an enterprise driven approach to livelihood enhancement and as an instrument of rural poverty reduction. Rural poverty still remains a major concern in India and the rural urban income disparities are increasing. This poses difficult challenges for the Government in providing livelihood opportunities for rural populations especially to marginal areas with poor infrastructure and access to markets. But at the same time the demand for livestock products is growing rapidly due to increasing incomes and rising human population coupled with increased urbanization. The tendency to consume less grain-based foods and greater amounts of milk, eggs and meat increases with the increase in the income. These changes in dietary patterns are not confined to urban areas but are also widespread among the rural population [15]. This 'Livestock Revolution' has the potential to open up new pathways for poor people to escape poverty by meeting the rising demand for livestock and livestock products [16]. For sustainable growth and development of livestock sector, a multi-pronged strategy would be required. This will include concerted efforts to strengthen the production enhancing policies including breeding, feeding, credit, insurance and extension system, better bye-products utilization, reforms in the delivery systems of livestock services and changes in the regulatory framework wherever required. However, all the interventions cannot be initiated simultaneously and to make international cooperation more effective and complementary to the ongoing efforts of the Central and State governments, priority areas need to be identified. These priority areas should be guided to accelerate the growth of livestock sector by improving efficiency in production, marketing and processing, access for trade opportunities, and service delivery systems. The ultimate goal should be to build-up a self-sustained livestock economy that boosts income and employment opportunities, and food and nutrition security and absorbs risks of crop failure. These should enable small livestock holders to maximize their livestock incomes through appropriate technologies and self-help approach to problem solving. The emphasis should be to promote and nurture grassroots level organizations and encourage participatory decision making at each level. Further, the issues of climate change are becoming important and the environmental concerns surrounding livestock production have been brought into sharp focus. The growing intensification of livestock production systems is reducing the costs of production but often entails high environmental costs [16]. Inappropriate disposal of animal wastes is polluting air, water and soils in many parts of the country. However, small scale livestock production can provide environmental benefits if innovative ways of rewarding producers for environmental good can be developed. However, in any discussion on the environmental impacts of livestock production in India, the livelihood benefits of livestock production to millions of livestock producers and others in the livestock value chain have to be taken into account. Keeping all these issues in view, a few specific strategic areas are tentatively indicated below:

- Location specific programmes for improvement in feeding management. This should apply participatory methods and action research and should consider the specificity for ethnic and social groups. Women's participation should be ensured.
- A study on implications – both positive and negative - of climate change on the livestock sector in India should be initiated. There is lack of understanding of the relationship between climate change and livestock. Understanding on climate change and its implications on sustainable growth of livestock sector is urgently required.
- The breeding programmes should take into cognizance the preference of the local producers and should ensure

the availability of quality semen either through AI or by natural service. Natural service can be encouraged by fee-paying mating system.

- Innovative community based systems can be developed for sustaining the crossbred/improved livestock population. At the same time in situ conservation of indigenous breeds should be ensured. Here too, participatory methods would be crucial.
- Innovative community based systems for early clinical diagnosis and control of emerging and re-emerging livestock diseases should be developed through participatory methods.
- The training of fee-earning technicians for the provision of veterinary services in the community based schemes should be supported and strengthened. The training and involvement of para-vets has been successful in some States.
- Some of the private initiatives, e.g., S K Sinha c/o Patna Animal Development Pvt. Limited, Patna Saheb, Patna, Bihar for AI and veterinary care, in providing breeding and veterinary services should be encouraged and upscaled. Lessons from their successes should be learnt and such models should be replicated elsewhere.
- A comprehensive risk assessment along the value chain should be carried out. This will help in identifying the critical intervention points for improving hygiene and food safety of livestock products.
- In order to improve hygiene and food safety, training for quality assurance system to address the deficiencies in the management of livestock, handling and processing of the intermediate and the end products should be supported.
- A study of consumer preferences and perceptions of product quality, including aspects of taste, appearance, composition and attributes of food safety should be carried out to inform private investment and public planning.
- Emphasis should be given to human resource development and knowledge management. Particularly, a programme of capacity building in participatory and action research methods should be strengthened.
- Training of local NGOs in credit lending, insurance and financial management to facilitate the provision of micro credit and insurance to small scale livestock producers and traders should be supported.
- Support mechanisms for smallholder participation in markets e.g., contract farming. In some cases where smallholders are commercializing, contract farming with private processors offers assured and remunerative markets. Such efforts should be encouraged. However, policy makers should evaluate the conditions and barriers to small scale farmers' entry into such contracts.
- Traditional markets should be addressed constructively. Continued dominance of traditional markets is expected in the foreseeable future hence it is prudent to address these markets constructively. The increased attention to quality by growing middle class and evolution of supermarkets and retail chains may adversely affect the competitiveness of these markets. To retain their competitiveness till integration with formal markets, training and certification programmes can be introduced for small scale producers, traders and processors.
- Pursue trade opportunities: Studies have shown that India is competitive in production of most of the livestock products in comparison with other countries. While the domestic market may provide the largest engine for growth, support should be given to identifying and tapping into export markets.

Areas of international cooperation

In view of the changing development paradigm, capacity building at each level should get due attention. The following can be stressed upon specifically:

- Up-gradation of skills and expertise in the frontier areas of science and technologies by training and handholding

- Study on climate change vis-a-vis livestock sector growth
- Capacity building in the participatory risk assessment for improving food safety
- Advocacy at the global forum for mitigating adverse publicity about diseases, compliance with food safety measures etc., to promote trade opportunities
- Bringing success models for livestock development from other countries and replicating it in the Indian context
- Value chain analysis for selected livestock commodities / products especially of small ruminants, which have greater implications for marginalized sections.

Requirements of the Government

The need for technological and institutional innovations has been explicitly articulated in several policy documents. As mentioned earlier livestock is a State subject, while the Centre has considerable influence on supporting and reforming the livestock development agenda. Any new initiatives for new technologies and new frameworks for livestock development would be welcome. However, it would be prudent to engage selected States and organizations right from the inception of the programme. This will bring ownership to the new initiatives and will be critical to the success of the programme. It will discourage the State level perception of any donor programme as being yet another opportunity for augmenting the State resources.

5. Complementary inputs from international agencies

Strategies for complementary input

A review of policies, programmes and development strategies brings out several issues for useful interventions by international agencies to contribute to the sustainable pro-poor livestock development. However, all the issues cannot be addressed simultaneously.

Therefore, a few issues have been identified where international cooperation can potentially contribute for greater impact and bridge the gaps for development of the livestock sector in India. The major themes and strategies for complementary input to the livestock sector have been given in Table 2.

TABLE 2: Types of activities that international agencies can support

Major themes	Support to and / or collaborate with on-going activities	Support development of new initiative
Breed improvement	Department of Animal Husbandry, Dairying and Fisheries' sponsored projects on cattle and buffalo breeding. International agencies can bring international experience and strategies to make it more effective and help in expanding it for small ruminants and pigs.	Conduct to understand the constraints and help designing better strategies for making it more effective and efficient.
Animal health	Ongoing programmes on disease control. International agencies can help in bringing latest developments internationally. It will be quite helpful in controlling trans-boundary diseases like avian influenza etc.	Initiate pilot project for control of important diseases and help in replicating successful interventions.
Food safety and risk assessment	Ongoing programmes of ensuring food safety across the livestock value need inputs especially from developed countries. International agencies can promote linkage for sharing knowledge and expertise to enable India to adapt those strategies as per the Indian context. The training programme on quality assurance system for market chain participants can be supported by international agencies and can also help in tackling certification issues efficiently. International agencies can partner with DFID sponsored Research Into Use Project for upscaling.	Conduct risk assessment study in participatory mode across the value chain for some important commodities in a few specific locations.
Feed and fodder improvement	Several programmes are going on. International agencies can help to bring synergies among various programmes. International agencies can help influence in bringing fodder quality attributes in crop breeding/improvement programmes.	Support crop improvement programmes to develop good quality fodder attributes in developed variety for a particular crop.

Contd.

Contd. from page 61

TABLE 2: Types of activities that international agencies can support

Major themes	Support to and / or collaborate with on-going activities	Support development of new initiative
Institutional and policy issue	Development of new institutional framework for delivery of inputs and services (NGOs, PPP, Privatization); promotion of producer companies, contract farming, micro-financing, livestock insurance International agencies can associate with these initiatives to draw lessons and influence policies and programmes through advocacy and consultation.	Initiate some action research to evolve pro-poor livestock development policy in specific states.
Climate change and livestock sector	Study on implications of climate change on growth of livestock sector. International agencies can associate with the initiatives of the Prime Minister's Office (PMO) on climate change.	Initiate some studies on this theme for creating better understanding and awareness among the stakeholders.
Value chain analysis	Recently greater emphasis is being given by National Agricultural Research System (NARS), government departments and international development agencies for studying the value chain of different agricultural system and commodities. However, there is still a substantial conceptual and contextual gap. Initiate selected value chain studies for important livestock commodities in selected regions.	International Agencies can align with on-going National Agricultural Innovation Project (NAIP) on value chain.

Possible sources of funds

- Own funds for country level technical assistance
- Collaborating with some of the initiatives supported by national and international studies (WB, DFID, IFAD, ACIAR, CIDA, Bill and Melinda Gates Foundation, USAID, SRTT etc.)
- Raising new resources by funding seed money for scoping study and proposal development for getting funds from national and international donors.

Acknowledgements

The author is grateful to Dr Ramesh Chand, ICAR National Professor, NCAP, for his advice, support and guidance in preparation of the paper. The help and support rendered by Dr Gopi Ghosh and Mr Raj Ganguly from FAO India during various stages of the study is duly acknowledged.

References

1. **Birthal, Pratap S., A. K. Jha & Dhiraj K. Singh.** 2007. Income diversification among farm households and its effects on inequality and social welfare. *Working Paper 7*. National Centre for Agricultural Economics and Policy Research, New Delhi.
2. **Kitalyi Aichi, Louis Menga, John Morton, Anni McLeod, Philip Thornton, Andrew Dorward & M. Saadullah.** 2005. *Why Keep Livestock If You Are Poor?* In Kitalyi et al., eds Livestock and Wealth Creation, Nottingham University Press, Nottingham.
3. **GoI.** 2006 *Basic Animal Husbandry Statistics,* Department of Animal Husbandry, Dairying and Fisheries, Ministry of Agriculture.
4. **Birthal, P.S. & V.K. Taneja.** 2006. Livestock Sector in India: Opportunities and Challenges for Smallholders. In Birthal et al. (eds). Smallholder Livestock Production in India: Opportunities and Challenges, Proceedings of an ICAR-ILRI International Workshop.
5. **Kumar, Anjani & U.K. Pandey.** 1999. Growth Performance of Livestock Sector in India. *NCAP Policy Paper (9),* National Centre for Agricultural Economics and Policy Research, New Delhi.
6. **Chand, Ramesh, & S. S. Raju.** 2008. Livestock sector composition and factors affecting its growth. *Indian Journal of Agricultural Economics,* 63 (2): 198-210.
7. **Bhalla, G.S. & P. Hazell.** 1997. Foodgrains Demand in India to 2020: A Preliminary Exercise, *Economic and Political Weekly,* 32(. 52): A150 –A154.
8. **Shukla, R.K. & Brahamanker SD.** 1999. Impact evaluation of Operation Flood on the rural dairy sector. *National Council of Applied Economics Research.* New Delhi, India.
9. **Sirohi, S. Anjani Kumar, Suresh Gokhale, K Elumalai, Gitesh Sinha & Iain Wright.** 2008, Livestock Support Services in India Draft Report to submitted to World Bank.
10. **GoI.** 2007. *Report of the Working Group on Animal Husbandry and Dairying for the Eleventh Five Year Plan (2007-2012)*. Planning Commission, Govt. of India, N.Delhi.
11. **Vaidya,** S.V.1999. Presidential address. *In* Proceedings 41st National Symposium on Animal Production in the Next Millennium", held on 3 September 1999. Compound Livestock Feed Manufacturers Association of India, Mumbai.
12. **Pathak, N.N. & Garg, A.K.** 1999.Role and Expectations from Indian Livestock Feed Industry in the Next Millennium, In: *Proceedings 41st National Symposium on Animal Production in the Next Millennium,* held on 3 September1999, Compound Livestock Feed Manufacturers Association of India, Mumbai.
13. **Kurup, M.P.G. (Ed.).** 2003. *Livestock: The Socio-economic Perspective in Orissa*. Manohar Publishers and Distributors, New Delhi.
14. **Kumar, Anjani, Steven J. Stall, N.P. Singh & Dhiraj K. Singh.** 2007. Livestock Sector Trade of India: Surging Momentum in the New Liberalized Regime. Indian Journal of Agricultural Economics 62(3): 395-410.
15. **Joshi PK, Gulati A & Cummings R Jr.** 2007. Agricultural Diversification in South Asia: Beyond food security, In: Joshi PK, Gulati A and Cummings R, Jr. (eds), *Agricultural diversification and smallholders in South Asia.* Academic Foundation, New Delhi, India.
16. **ILRI** 2007. Livestock Asia: A strategy and action plan for research for poverty reduction, International Livestock Research Institute, Nairobi, Kenya.

Fisheries & Aquaculture

Prepared by

Maroti A Upare

About the author

Dr Maroti A Upare has forty years experience in fisheries management. He is former General Manager, National Bank for Agriculture and Rural Development. Before joining NABARD he worked as Managing Director, Regional Fishermen Cooperative Federation, Nagpur and Project Manager, Maharashtra Fisheries Development Corporation, Mumbai. He has wide international experience and has worked as International Fisheries Management Expert in Sierra Leone, Malawi, Vietnam, Bangladesh and Uzbekistan in FAO and UNDP funded projects. He studied Fisheries Management at Hull University, U.K. He is presently working as Fisheries Consultant for FAO, World Bank and IFAD.

Contents

Executive summary

The paper is intended to identify areas of international cooperation in the fisheries and aquaculture sector in the medium term period, 2008-12, and the means required for this purpose. To begin with an overview of the sector is presented with challenges and potential for the development of the sector, followed by a brief description of the important schemes included in the Eleventh Five Year Plan. Subsequently, development strategies and need of international collaboration for development of the sector are focussed upon. Based on discussions with stakeholders, activities were prioritized for international inputs in accordance with objectives and outcomes identified in the United Nations Development Assistance Framework (UNDAF), for the period 2008 to 2012. The final section is devoted to exploration of resources needed to implement the selected activities.

1. Brief overview

The fisheries sector is a source of livelihood to over 14 million people engaged fully or partially in activities pertaining to the sector, with an equal population engaged in ancillary activities associated with fisheries and aquaculture. Potential of fish production from marine and inland resources has been estimated at 3.9 million tonnes and 4.5 million tonnes respectively. However, inland fisheries have more potential than estimated and there is scope for growth by enhancing productivity and by bringing more area under improved aquaculture practices [1].

The total fish production in 2005-06 reached about 6.57 million tonnes comprising 3.76 million tonnes from inland and 2.82 million tonnes from marine fisheries. The average annual growth rate is reported as 4.23 percent with significant growth of 6.52 percent in inland and 1.33 percent in marine sector.

There has been steady growth in the export of fish and fish products over the period. Efforts are being made to boost the export potential through diversification of products for export. The country has also started export of frozen squid, cuttle fish and variety of other fin-fishes. The export of fish and fish products increased from 4.24 lakhs tonnes valued at Rs 6 310 crore in 2000-01 to 5.51 lakhs tonnes valued at Rs 7018 crore in 2005-06.

The Gross Domestic Product (GDP) from fisheries sector is reported at 1.07 percent and share of fisheries in agriculture and allied sectors at 5.84 percent which shows potential of the sector in development of the national economy [1].

The challenges of development

While presenting the programmes for the Eleventh Five Year Plan the Planning Commission identified the challenges facing fisheries development. These pertains to -

- water availability and allocation
- biodiversity loss and depletion of fish stocks
- excess coastal fishing, enhancing fish productivity in all cultivable waters
- fishing in oceanic and deep sea fisheries
- impact of climate change on fisheries
- transboundary fisheries issues, inland and coastal pollution
- large scale sedimentation of rivers and lakes/wetlands
- effective compliance of code of conduct of responsible fisheries
- increasing input costs of water and power
- high marine fishing cost and low profitability
- cold chain and hygienic fish handling
- quality assurance issues in exports
- overseas market fluctuations
- disaster management
- credit and insurance, and
- inadequate database and poor linkages in domestic markets

There is need to address these challenges to build greater resilience and sustainability.

Future potential of the sector

The country has a long coastline of 8 118 km and an equally large area under estuaries, backwaters, lagoons etc. After declaration of the Exclusive Economic Zone (EEZ) in 1977, the marine area available to India is 2.02 million sq km, comprising of 0.86 million sq km around the west coast, 0.56 sq km on the east coast and 0.60 sq km around the Andaman and Nicobar Island in addition to the free access to the international waters. In the marine sector fish production reached a plateau in coastal waters. Fish production during 2005-06 reported around 2.82 million tonnes contributing 72.30 percent against a potential of 3.90 million tonnes. The scope for increasing fish production now lies in the deep sea as reported by Government of India [1].

The inland fishery resources include 1.96 lakhs kms stretch of rivers and canals, 29.07 lakhs hectare reservoirs, 24.14 lakhs hectare ponds and tanks, 7.98 lakhs hectare of beels, and

derelict water bodies which have potential of 8.4 million tonnes fish production. The fish production achieved during 2005-06 was to the level of 3.75 million tonnes against the potential of 4.5 million tonnes in the inland sector. However, there is considerable scope for increasing production and productivity by sustainable exploitation of the resources. The potential of fishery development in East and North-eastern States is immense and fish is an important constituent of the diet of majority population of the States in this region and there is scope for enhancing per hectare fish production. With about 1.8 lakhs hectare area brought under culture against 12.40 lakhs hectare suitable cultivable area, the utilization of brackish water resources is around 14 percent. Further, there is scope for diversification and composite farm practices for overall growth of this agriculture sector.

Demand for fish and fishery products is increasing considerably, both at the domestic and the export fronts. As per the Planning Commission the projected demand for fish in the country by 2012 is 9.74 million tonnes. Development of fisheries can go a long way to support livelihoods, food security, and reduction in poverty as well as providing employment in the rural areas [2].

Major programmes and activities by the Governments

The main objectives of the Government of India and the State governments with regard to development programmes in fisheries and aquaculture during the Eleventh Five Year Plan are as follows:

- enhancing the production of fish from Indian waters, both marine and inland, on an environmentally sustainable and socially equitable basis
- addressing the hitherto unexploited potentials of Indian fisheries such as island fisheries and non-food fisheries
- conservation of aquatic resources and genetic diversity, as also preservation of health of ecosystems
- increasing profitability of fishers and aqua-farmers through an integrated approach from production to consumption
- promoting fish as health food and meeting the changing requirements of both domestic and exports markets to make the sector globally competitive
- strengthening of infrastructure in harvest and post harvest
- upliftment of fisher and aqua-farmer communities with gainful employment opportunities and capacity strengthening

Based on the lessons learnt from implementation of various schemes and in order to have comprehensive and focused approach, the schemes in the Eleventh Five Year Plan were brought under two umbrella schemes, i.e. development of inland fisheries and aquaculture and development of marine fisheries infrastructure and post harvest operation.

Development of inland fisheries and aquaculture

The inland macro scheme covers all aspects related to inland fisheries such as reservoirs, lakes, canals, rivers, aquaculture in ponds, brackish water area, and use of waterlogged areas. The main objectives of the scheme envisages to encourage leasing of water area, expand aquaculture by construction of new ponds, create a cadre of trained fishers, popularize shrimp/fish farming, utilize vast available brackish water land for brackish water aquaculture, and provide suitable technology packages for promotion of cold water fisheries. The emphasis is to increase fish production in inland waters as well as to involve Fish Farming Development Agencies (FFDA) and Brackish water Fish Farming Development Agencies (BFDAs) fully for development and delivery of sustainable aquaculture throughout the country.

Development of inland fisheries and aquaculture has the following activities:

- development of freshwater aquaculture
- development of brackish water aquaculture
- development of cold water fisheries and aquaculture in the hilly regions
- development of water-logged areas into aquaculture estates
- utilization of inland saline / alkaline soils for aquaculture
- inland capture fisheries (reservoirs, rivers etc.)

Through the network of 429 FFDAs and 39 BFDAs covering all potential districts across the country, about 6.98 lakhs hectare water area was brought under improved fish farming practices and 8.28 lakhs fish farmers / fishermen were imparted training in scientific fish farming till 2005-06 in various States / UTs under the scheme.

Development of marine fisheries, infrastructure and post harvest operations

The Centrally sponsored schemes for development of marine fisheries, infrastructure and post harvest envisaged improving production and productivity in the marine fishing thereby to improve food security, export earning and livelihood of coastal fishing communities.

Development of coastal fisheries is supported by four major schemes. These are introduction of intermediate crafts of improved design; motorization of traditional crafts; fishermen development rebate on diesel; safety of fishermen at sea. The Central Government also provides assistance for development of fishing harbours and landing centres.

As per the Eleventh Five Year Plan Report the multi-spices fishery comprises over 200 commercially important fish species. Currently 2 251 traditional landing centres, and 33 minor and six major harbours serve as base for operation of 1 04 270 traditional non-motorized crafts, 75 591 small scale beach landing motorized crafts and 58 911 mechanized crafts (mainly bottom trawlers, drift gill netters and purse sinners).The sector-wise marine fish landing reported major share from the mechanized and motorized boats 93 percent of total marine fish catch (mechanized around 68 percent ; motorized 25 percent; non-mechanised 7 percent).

The deep sea fisheries resources are poorly exploited. There are about 490 vessels operating against recommended 725 vessels for sustainable exploitation of harvestable resources 1.36 million tonnes. Therefore, the GoI has introduced a scheme for introduction of fisheries resources specific to deep sea fishing vessels.

As per the Planning Commission report, as on 2005 availability of post harvest infrastructure is as shown in the table below. The emphasis will be on improving minor fishing harbours and providing new landing centres as well as new model retail fish markets in the Eleventh Plan.

TABLE 1: Fisheries post-harvest infrastructure available in India

Infrastructure facility	Numbers	Capacity (tonnes per day)
Freezing plant	366	10 359
Canning plant	6	18.5
Ice plant	210	4 116
Fish meal plant	13	428
Cold storage	503	13 942
Other storage	236	11 051
Peeling sheds	477	4 646

Source: Planning Commission Report 2006 [2]

National Fisheries Development Board (NFDB)

National Fisheries Development Board (NFDB) has been set up in September 2006 with its headquarter at Hyderabad under Andhra Pradesh Society Registration Act 2001. NFDB has initiated various development activities such as intensive aquaculture in ponds and tanks in ten states with financial assistance of Rs 437.42 lakhs, establishment of hatcheries for fish seed production in three states, assistance for imparting training to 22 827 beneficiaries in 26 States, and Rs 733.13 lakhs financial assistance given for development of reservoirs in eight States. Other activities undertaken are establishment of Feed Mill for trout feed in Jammu and Kashmir, seaweed cultivation coastal aquaculture and for improving quality of fish by establishing fish dressing canters and solar dryers.

Marine Products Export Development Authority (MPEDA), Cochin

The MPEDA was constituted in 1972. The major role played by MPEDA includes increasing export of fish and fishery products, specifying standards, processing, marketing, extension, and training for promoting fishing industry. The major schemes of MPEDA are as follows:

- financial assistance for Turtle Excluder devices
- to encourage mechanized fishing vessels to go for multiday fishing
- to encourage diversification of fishing
- assistance for setting up new shrimp farms, hatchery, scampi farm and hatchery, ornamental fish farming etc.
- introduction of new technology, moderation of processing plants, development of infrastructure facilities
- financial assistance for market promotion

Welfare Programmes

- The Centrally sponsored national scheme for welfare of fishermen comprises the following broad components:

- development of model fishermen villages, i.e. housing
- group accident insurance for active fishermen
- saving-cum-relief scheme

As on 2007, assistance was provided for construction of 54 264 houses of fishermen to cover around 14.65 lakhs fisher, under saving scheme-cum-relief scheme, insured 49.87 lakhs fishers against Group Accident Insurance for active fishermen. Insurance companies are reluctant to insure fishing as well as aquaculture assets, i.e. craft, gear, pond and inputs.

Training

In order to promote the fisheries sector the Government of India has four institutes. These institutes help in providing technical manpower to the sector:

i) **Central Institute of Fisheries Nautical and Engineering Training (CIFNET), Cochin.** The main objective of the institute is to train operators for fishing vessels and technicians for shore management such as mate, marine fitter, vessel navigator etc.
ii) **Integrated Fisheries Project (IFP), Cochin.** This project envisages processing, popularization and test marketing of unconventional fishery products
iii) **Fishery Survey of India, Mumbai.** The Fishery Survey of India is responsible for survey and assessment of marine fishery resources of the Indian EEZ. The FSI has seven operational bases at Porbunder, Mumbai, Mormugao, Cochin, Chennai, Visakhapatnam and Port Blair. A total of 13 fishing vessels are being deployed for fishery resource survey and monitoring.
iv) **Central Institute of Coastal Engineering for Fishery (CICEF), Bangalore.** The objective of the institute is to conduct engineering and economic investigation, preparation of techno-economic feasibility report for development of fishing harbours along the Indian coast and brackish water fish farms.

Legislation and policy initiatives

Fishing and fisheries beyond territorial waters is a Union subject. Fishery is a state subject and implies that within territorial waters and inland, fisheries are within state jurisdiction. The key issue is coordination between Centre and State. The recent important legislation is the Coastal Aquaculture Authority Act, 2005 and Comprehensive Marine Fishing Policy, 2004. Suitable measures need to be taken by states to implement these policies. The Government of India must persuade the States for longer lease period of inland waters to attract investments from financial institutions for aquaculture. Some States have started adopting such practices, but others are yet to take initiatives in this regard.

Fisheries cooperatives

Fisheries Cooperatives are operating at three levels. National Federation of Fishermen's Cooperative Ltd. (FISHCOPFED) is the national apex organization of fishermen cooperatives in the country. It is reported that about 17 State level federations, 108 Central societies and 11 847 primary fishermen cooperatives with 19 17 305 members are engaged in the fisheries sector. Substantial numbers of societies are not operating at an optimum level due to weak management skills, lack of adequate infrastructure, human and financial resources.

Credit and insurance

The credit flow to fisheries sector is poor. It is less than 2 percent in total refinance supported by the National Bank for Agriculture and Rural Development. The lending institutions are commercial banks, cooperative banks and regional rural banks. Insurance support for fisheries and aquaculture is inadequate from all four national general insurance companies.

Research and education

Indian Council of Agriculture Research (ICAR) is the apex body for fisheries research and education in the country. The thrust areas of fisheries research are:

- stock assessment and monitoring of commercially important marine fishery resources
- development of fuel-efficient fishing crafts and gear for deep sea fishing
- prevention of post harvest losses
- development of value added products for domestic and export markets, and upgradation of fishing technologies
- mariculture of fish and shell fish
- introduction of HACCP in sea food processing
- environmental impact assessment of open waters with regard to different development protocols
- utilization of inland saline water for aquaculture
- enhancement of productivity from reservoirs rural aquaculture, integrated fish farming
- development of vaccines for fish diseases
- brackish water aquaculture
- aquatic biodiversity and conservation of endangered species
- organic farming and genetic characterization of aquatic animals of commercial importance and development of coldwater fisheries

The above research aspects are being addressed by eight specific fisheries research institutes:

1) Central Marine Fisheries Research Institute (CMFRI), Kochi conducts research on marine fisheries resources and their exploitation.
2) Central Inland Fisheries Research Institute (CIFRI), Barrackpore, West Bengal has research, extension and training in inland open waters rivers, reservoirs, wetlands / lakes and estuaries.
3) Central Institute of Freshwater Aquaculture (CIFA), Bhubaneshwar deals with freshwater aquaculture.
4) Central Institute of Brackish water Aquaculture (CIBA), Chennai deals with brackish water aquaculture.
5) Central Institute of Fisheries Technology (CIFT), Kochi looks after design of fishing craft and gear, processing, preservation, quality control etc.
6) National Research Centre on Coldwater Fisheries (NRCCWF), Bhimtal carries out research on cold water fisheries.
7) National Bureau of Fish Genetic Resources (NBFGR), Lucknow conducts research on classification, cataloguing of fish genetic resources, their genetic characterization, strategies for conservation of endangered fish species.
8) Central Institute of Fisheries Education (CIFE), Mumbai, a deemed fisheries University involved in post graduate level education, conducts specialized training programmes.

The Department of Biotechnology under the Ministry of Science and Technology, GoI also supports fisheries research.

Gender in fisheries

India has about four million fisherwomen engaged in various fisheries activities such as fish marketing, drying, net making, curing, peeling, fish or shrimp seed collection, aquaculture etc. It is reported that there are gender inequalities in the fishing community. These gender inequalities include the low value attached to their work, limited access to essential resources such as ponds, technology, education and skills. However, GoI is emphasizing on gender development [6].

Climate Change

Global climate change is not only nearer home but also inside the homes of the coastal fishers in tsunami affected coastal Tamil Nadu, Kerala. Some of the Sundarbans islands are threatening an ecological disaster in the Bengal basin. Many islands have been inundated and lost, forcing people to leave their homesteads. It is reported that Sundarbans has risen at an average rate of 3.14 cm a year over the past two decades which is much higher than the global average of 2 mm a year.

In the past two decades four islands namely, Bedford, Lohachara, Kabasgadi and Suparibhanga have sunk and 6 000 families have been made homeless. Two other islands,

Ghoramara and Mousuni, are fast disappearing under the sea. Sagar, the biggest island in the Sundarbans has already lost 30 sq km. Many residents are moving out and these islands are becoming uninhabited [5].

Efforts and approaches by other development partners

World Bank

The World Bank works in close partnership with India's Central and State governments, aligning its strategies with the country's own development agenda. It lays emphasis on investing in people through better health and education, empowering communities to participate in their own development, improving the effectiveness of the government, and promoting private sector-led growth to achieve the country's development goals.

The country strategy focuses on lending for infrastructure, human development and improving rural livelihood. The Bank is increasingly focusing on providing analytical reports on the country's major development challenges and extending practical advice to policy makers by sharing good practices and experiences from within and abroad.

As the marine fishery is facing challenges of overcapitalization, overexploitation and loss of livelihoods, the Bank has initiated marine fisheries study of four States, namely, Orissa, Andhra Pradesh, Tamil Nadu, Karnataka and recommended reforms for improving marine fisheries in India. The Bank has also supported fisheries and aquaculture activities as one component in following projects.

- Orissa rural livelihood project
- Karnataka community based tank management project
- Orissa community based tank management project
- Andhra Pradesh community based tank management project
- MP water sector restructuring project

The Bank has supported the Emergency Tsunami Reconstruction Project as a consortium of international organizations.

Asian Development Bank (ADB)

The key strategy of ADB for India is to assist in reduction of poverty through infrastructure led programmes. The Country Partnership Strategy (CPS) will support the Government's efforts towards promoting broad based and inclusive growth, catalyzing investment, and improving the effectiveness of development interventions. As per strategy the Sustainable Coastal Zone Protection and Management Project worth US$ 200 million is under implementation in the fisheries sector.

International Food Policy Research Institute (IFPRI)

In many river floodplain and lowland areas, the rainy season brings floods that last several months and make crop production impossible. However, enclosing parts of the floodwater areas can give rise to an alternative form of agricultural production: fish culture, which has the potential to provide more high quality, nutrient-dense food production and farm income for all rural stakeholders, especially the poor. Therefore, IFPRI's Environment and Production Technology Division (EPTD) is working in India to examine the potential of community based fish culture.

Strategy paper prepared by IFPRI senior management team for consideration of the policymakers of GoI recommended exploring new opportunities to participate in the production and marketing of high value fishery products.

International Fund for Agriculture Development (IFAD)

As per Country Strategic Opportunities Paper of IFAD the development programmes will be driven by three strategic thrusts: (i) grassroot institution building and institutional strengthening of support agencies, (ii) promoting and securing the access of marginalized groups to resources, and (iii) promoting the diversification of livelihood opportunities within the on-farm and off-farm sectors.

The IFAD has focused on improving livelihood in coastal fishing communities which is among the poorest groups. The strategies include resource management, institutional development, support for small scale processors and traders, techno-economic research and employment diversification. Accordingly the West Bengal Coastal Area Development Project is under an advanced stage of formulation.

Bay of Bengal Programme, Chennai

The Bay of Bengal Programme, an Inter-Governmental Organization has evolved from the erstwhile Bay of Bengal Programme of the Food and Agriculture Organization of the United Nations. It is mandated to enhance cooperation among member countries, other countries and organizations and provide technical and advisory services for sustainable coastal fisheries development and management in Bay of Bengal region. It is focusing on helping the member countries in sustaining fisheries production and ensuring livelihood security for millions of fishers in the region.

Core development strategies

Demand for fish and fishery products are increasing considerably, both at domestic and export markets. As per Planning Commission Report 2006 the projected demand for fish in the country by 2012 is 9.74 million tonnes that can be met by the projected supply of 9.60 million tonnes by 2012 with major share of 6.45 million tonnes from inland fisheries and aquaculture, followed by 3.15 million tonnes from marine fisheries. In order to achieve the projected fish production the following development strategy has been planned by the States and Government of India.

- enhancing the production of fish from Indian waters on an environmentally sustainable and socially equitable basis
- address the unexplored potentials of Indian fisheries, e.g. deep sea fishery resources, island fisheries and non-food fisheries
- conservation of aquatic resources and genetic diversity
- preservation of health of the ecosystem
- increasing profitability of fishers and aqua-farmers through integrated approach from production to consumption
- promoting fish as health food and meeting the changing requirements of both domestic and export markets
- strengthening of infrastructure in harvest, post harvest, value addition and marketing
- up-liftment of fishers and aqua-farmer's communities with gainful employment opportunities and capacity strengthening
- analysis of overall sector policy (and sub-sector and inter-sector linkages wherever applicable)

Analysis of overall policy and linkages

Marine fisheries

The coastal marine fisheries are stagnant. About 2 41 720 fishing boats are in operation which is about 28 percent more than the estimated 67 984 optimum number of boats [7]. Therefore the scope for enhancing fish production is marginal in the coastal area. However, presently fisheries of island systems, Andaman and Lakshadweep as well as deep sea resources are under-exploited. Considering the over-capacity of fishing boats and over-exploitation of coastal resources and available deep sea fisheries resources the development strategy for sustaining and augmenting marine fish production adopted are as follows.

- changing over from an open access to a regulated regime
- adoption of fishery management regime supported by required information
- up-grading the technologies and capabilities of artisan and small mechanized sector for diversification
- reduction in excess capacity of fishing boats from 2 41 720 number of boats to 67 948
- freezing the entry of new coastal mechanized fishing crafts
- establishment of oceanic tuna and squid fishery and introduction of resource specific deep sea fishing vessels
- promotion of mariculture for fin fishes, edible bivalves, sea weeds etc.
- effective enforcement of Marine Fishing Regulation Acts (MFRAs)

Inland fisheries

Inland fisheries resources in terms of rivers, canals, reservoirs, floodplain wetlands and estuaries offer a major opportunity for fostering fish production and enabling livelihoods of lakhs of people. The development strategy focuses on survey, assessment and evaluation of inland aquatic resources, improving productivity of inland open water resources including reservoirs, Magur breeding, hatchery establishment and seed production, seed certification, certified brood banks for food and ornamental fishes.

Freshwater aquaculture

Freshwater aquaculture that had a share of 46 percent in inland fisheries in mid 1980s has increased to about 80 percent in recent years. It is one of the fast growing enterprises in agriculture and allied activities. The development strategy includes extending the coverage of freshwater aquaculture area, optimizing productivity of existing waters, diversification of species and intensification of culture practices, promotion of integrated farming, quality seed production and certification, and greater reliance on air-breathing fish and backyard fisheries.

Brackish water aquaculture

Brackish water aquaculture has emerged as an important food production sector playing a vital role in export of marine products. The area under shrimp production had increased from about 50 000 hectares in 1989-90 to 1 84 115 hectares in 2005-06. Shrimp production increased from about 30 000 tonnes in 1989 to 1 85 990 tonnes by 2005-06. Cultured shrimp contributed 45 percent of the total shrimp exported and accounted for 60 percent foreign exchange earning. Shrimp farming will expand to 2 26 000 hectares by the end of Eleventh Plan. The development strategy proposes revision of voluntary code of practices for hatchery operators, establishment of aqua-estate along the coastal areas, with proper effluent treatment plants arrangement, diversification of culture practices and to remove dependence on one species for brackish water aquaculture.

Harvest and post harvest infrastructure

The projected annual growth rate of fisheries sector during the Eleventh Plan is 5 percent, with 2.5 percent in marine fisheries and 8 percent in inland aquaculture, with a projected annual fish production to the tune of 9.6 million tonnes. In order to ensure this, the fisheries sector would need strengthening of infrastructure in a big way. The strategy is directed towards creation of new harbours, modernization of existing harbours, cold chain facilities etc.

Marketing

About 75 percent of fish produced in the country is marketed domestically through wholesale, major and minor retail markets. This however is highly unorganized, with some planned development only in the export sector. The development strategy suggested measures to promote and monitor exports and domestic marketing. These are as follows:

- collection of complete details of cases coming before the Appellate Panel of WTO
- setting up of national data centre
- necessary support to trade to fight antidumping
- setting up a network of cold storages, refrigerated outlets and small training centres
- exploring domestic markets for a variety of value added products
- to set up model market in major landing centres
- to set up solar driers at landing centres

Value addition

Value addition is one of the major components in increasing quality and value of fish. Value addition in fish and fishery products has great scope for improvement in our country. To facilitate increased value addition the following strategy is proposed (i) improving fish handling and preservation facilities on board of fishing vessels, (ii) encouraging fishing vessels to have insulated and refrigerated fish holds, (iii) imparting training to workers of pre-processing plants on various aspects connected with hygiene and sanitation, handling of raw materials, and production of value added products, (iv) market promotion steps through benefits under schemes like brand equity fund, joint ventures for production and marketing of value added products, (v) adequate facility for catch handling at fisheries, harbours and landing jetties, (vi) setting up of small scale projects for production of semi processed ready-to-cook fish products from low valued fishes, fish pickles, quality dried products etc.

Welfare programmes

Holistic people centred development approach is kept in mind while devising the welfare programmes. To empower fishing communities schemes have addressed issues such as, education, health, housing, drinking water, communication, life and assets insurance, access to information and support services.

Fishery legislation and policy issues

The public-private-community participation is the approach for overall development of the fisheries sector. A National Fisheries Development Policy framework is needed to guide State governments to formulate their policies suited to the local needs to encompass the fishing regulations in the marine and freshwater bodies and aquaculture management practices in the marine, coastal, brackish water as well as freshwater sector including the effective strategies to address international issues such as WTO matters on fisheries; illegal, unregulated and unreported fishing; quality control; sea safety measures with the inclusion of FAO code of conduct for responsible fisheries.

Human resources development

Institutional strengthening and reorientation / reorganization to face the emerging challenges are the focus of HRD programmes for the Eleventh Five Year Plan. The State should encourage formation of Fish Farmers' Association to promote collective fish farming. The strategy for capacity building at the State level is as follows.

- establishment of training centres at State and district level
- training of in-service State department officers and staff
- Central Government support for the participation of State officials in seminars, workshops and cross country visits
- capacity building of Fisheries Cooperative Associations and NGOs by organizing hands-on training, pilot scale demonstrations and on-site interventions

Research

Depending upon the success of different schemes, demand driven research may be carried out in public-private partnerships like alternate species-culture practices, improvement in fish marketing and for promotion of export etc.

Review of private stakeholders' perspectives

National Fishworkers' Forum (NFF)

The NFF is a trade union of fish workers representing the rights and interest of the fishing community, dedicated to articulating the aspirations of the fishing community of India. They have submitted a Charter of Demands to the Government in July 2008. The demands are as follows:

- Recognize inalienable traditional and customary rights of fisher people over coastal land and water.
- The NFF demands that Government of India should scrap the proposed Coastal Management Zone (CMZ) and implement Coastal Regulation Zone (CRZ) Notification of 1991. The CMZ dilutes coastal protection, denies housing rights to fishing community and leads to displacement of fishing community.
- Save the coast - no SEZs, no nuclear power plants, no polluting and destructive projects on our coast, no destruction of mangroves and other coastal environmental features.
- Enact national legislation for conservation of coastal and marine biodiversity that *inter alia* protects traditional fishers.
- Develop comprehensive fisheries legislation for the EEZ waters.
- Reform Marine Fishing Regulation Acts of the States to improve fisheries management and to develop coordination mechanism for peaceful inter-state fishing.
- Develop regional mechanism to facilitate reciprocal access to adjacent maritime waters of neighbouring countries.

- Recognize rights of women in fisheries.
- Waive all debts of poor fishermen along with the farmers.
- Provide sufficient cheaper fuel for sustainable fishing.
- Lift all bans on fishing by traditional small scale fishermen using sustainable gears and techniques.
- The GoI should take measures to ban the import of those fish and fish products that could affect the livelihood and food security of fishing communities.
- The current "Letter of Permit" (LOP) scheme introduced in 2002-03 by GoI that allows bringing in foreign vessels for fishery resource specific fishing. The NFF strongly objects to this scheme as there is no effective system to monitor the operations of LOP vessels.
- Re-work and implement the unorganized workers' social security bill.
- The International Labour Organization's (ILO) "Work in Fishing Convention 2007" provides a framework to look at issues of working and living conditions in fishing. It calls for national laws ensuring comprehensive social security protection for fishers. Therefore, the NFF demands to enact National and State legislation to extend the benefits of ILO Work in Fishing Convention to all fish workers.
- Protect rights of inland fishermen to water bodies and protect inland fish resources.

Weaknesses, gaps and implementation hurdles

Marine fisheries

1. **The current policy, legal and administrative systems are not able to support more progressive fisheries management, but can serve as a partial foundation for further development.**

   Central government policy on fisheries in India is informed by two key policy documents - the Five Year Plans developed by the Planning Commission, defining fiscal contributions to fisheries, and the Comprehensive Marine Fisheries Policy (CMFP) 2004 developed by the Ministry of Agriculture, defining various desired goals and identifying schemes on which the funds are spent. Fiscal processes that direct funds from the centre to coastal states tend to support subsidies and welfare schemes for fishers rather than reward good fisheries management performance. While improving the welfare of coastal fishers is an important social policy objective, some of the schemes such as fuel, boat and gear subsidies, may be encouraging participants to remain in a sub-sector that is already highly overcapitalized. Some estimates suggest that the 2 42 000 fishing vessels currently registered within Indian waters represent more than 2.5 times the optimal number of fishing vessels relative to available fish stocks.

   Five major legal instruments and several related pieces of legislation from the central government are used to administer marine fishing at the national level. In all states, policy and legal implementation is weak with no effective administrative systems in place to support improved fisheries management performance. The ineffective coordination between national laws and authority, outside the 22 km territorial boundary, and state laws and authority, within the 22 km boundary, is an issue that needs attention.

2. **The biological and economic sustainability of marine fisheries stocks in India are at risk.**

   Strong economic growth in India over the past several years and increasing global markets for fish products have contributed to an unprecedented expansion of fishing capacity and changes in the composition of fish being harvested. While fishing capacity has been increasing, marine sub-sector catch levels are stagnating and fish stock health is showing some alarming signs.

3. **Small scale fishers are losing their livelihoods and opportunities for development and there is little wealth being created to improve livelihoods.**

   Along with the massive modernization processes over time, the current situation with marine fishing is affecting fishers through declining catches, reduced profits and incomes, and increasing conflicts, particularly for smaller boat owners and crew who are unable to protect their resource access effectively or shift to newer fishing areas. The rapid growth of the mechanized trawler fleet has increased competition for catching fish with smaller inshore vessels in many areas. Trawlers now account for an estimated 20 percent of the fishing labour force but 60 percent of the catch. Small scale fishers lack access to low cost credit and technology that could help them market higher quality fish products into the growing Indian economy and the rising domestic demand for fish. Small scale fishers lack access to national policy debate on marine fisheries, nor do they have easy access to programmes that could help them sustain their livelihood

both from fishing and non-fishing sources. Educational levels tend to be low, making it difficult for fishers to take advantage of alternative employment opportunities in a growing national economy.

4. Fisheries management is weak.

Fisheries management objectives in India are largely based on conventional approaches around biological criteria. Reflecting the complex and fragmented legal framework, the roles and responsibilities between the centre and state and among a range of agencies within states are not clearly articulated. For waters under the authority of the Government of India, between 22 km (12 nautical miles) and the 370 km (200 nautical miles) Indian EEZ, there is no effective mechanism for management of fisheries other than the granting of licenses and these rules only apply to foreign, not Indian vessels. For waters within the 22 km limit, states generally provide only a basic and often incomplete regulatory and licensing regime for fisheries management, augmented by seasonal fishing bans, regulating mesh size, and zoning. Most state fisheries departments lack working patrol vessels, making enforcement of even these basic kinds of regulations quite weak. There is increasing conflict as smaller inshore vessels and larger offshore mechanized trawlers compete for fish on both sides of the 22 km boundary.

5. Market channels particularly for small scale fishers are inefficient.

While Indian fish products exports (mainly shrimp) passing through European Union certified processing plants meet tough international health and safety standards, the cost of adjusting to these standards has been very high for small scale Indian processors. In contrast, domestic marine fish market chains in India are characterized by unhygienic conditions, poor handling of fish and loss of quality (from the boat to the final market), and a subsequent reduction in profits. High levels of product losses through wastage (up to 15 percent of harvest) are common. While new developments in marketing channels such as mega-grocery stores are emerging in some larger cities with modern fish handling practices and facilities, small scale fishers are often unable to gain access to these marketing channels due to the poor quality of their product. Major contributors to this problem are the lack of easily accessible and low cost credit, and the affordability of basic infrastructure such as ice, cold storage, and cold transport that would enable fishers to maintain better quality and obtain higher prices. While demand for fish products in India is expected to rise significantly in the future, small scale fishers and traders appear to lack adequate information about market requirements and emerging market opportunities.

Inland fisheries

6. Weak inland fisheries management causing considerable economic loss to the country.

The riverine system in the country comprises 14 major and 44 minor rivers with innumerable tributaries and streams, harnessing significant biodiversity. However, due to various stresses, they have come under serious threat of loss in ecosystem properties and loss of fish stocks causing considerable economic loss.

With increasing emphasis on irrigation the canal network is becoming a resource for cultivation even to serve as supplementary resource to riverine fisheries. Fish culture in enclosures with the canals as also in the submerged area along the canals is a possibility that deserves attention and investment. Issues that need to be addressed are ownership and harvesting rights, leasing, duration of water retention and suitable practices.

Estuaries being important breeding grounds for a variety of fishes require special attention in terms of regulated discharge of freshwater, reduced fishing efforts of mechanized fishing vessels, controlled collection of natural fish/ shrimp seed collection and mangrove conservation.

The vast reservoirs are potential resource for enhancing fish production. The fish yield is in the range of 12-15 kg per hectare in case of large and medium reservoirs while it is 50 kg per hectare in small reservoirs. But scientifically managed reservoirs recorded higher yields. The present production is 9.37 million tonnes which can be enhanced to the level of 24.52 million tonnes. This potential can be harnessed by providing enabling policy and technology support to improve overall productivity of reservoirs in the country and enhance production. Special efforts are required to reach productivity level in other countries, i.e., 800 kg per hectare fish production achieved in China.

The resources around 0.35 million hectare of flood plains and associated wetlands are significant in the States of Assam, Bihar, West Bengal and Uttar Pradesh. These wetlands have significant fish biodiversity and are providing livelihoods to large number of people along with food security. The fish production is around 50 thousand tonnes against a potential of 307 thousand tonnes, recording a gap of 257 thousand tonnes fish production. These resources need restoration of habitat through desilting dyke construction, removal of aquatic weeds, integrating fisheries with agriculture and animal husbandry, cage and pen culture, community based fisheries management, and seed supply and market linkages.

Aquaculture

7. Freshwater aquaculture needs area expansion.

Freshwater aquaculture made spectacular impact and raised fish production significantly with a growth rate of several fold ahead of agriculture, animal husbandry, poultry and marine fisheries. It could benefit only fish farmers having water bodies to practice. The support is provided in the form of subsidy for inputs and repairs of tanks on a limited basis. However, neither any marketing infrastructure nor any incentives for marketing is given. As reported in Policy Elements for Aquaculture Development [8] use of land is restricted for aquaculture. The irrigation department supply water for agriculture on a priority basis and for aquaculture water is supplied when it is surplus for agriculture and as and when available.

Aquaculture potential is immense as technology is proven purely indigenous and easily adoptable as shown by progressive fish farmers in Andhra Pradesh, Haryana and Punjab. They need expansion support and basic inputs like water in ponds, quality certified seed, marketing infrastructure and service centres and appropriate leasing policy to promote growth.

A major policy support is required to release large track of unproductive or non- remunerative agriculture land for development of aquaculture. This can be done by releasing forest and other lands. Integrated fish farming with agriculture/ horticulture/livestock is becoming popular. Farmers need technical support for sustainable integrated fish farming. Linking aquaculture at par with other farming practices by policy backed decision has a great potential for enhancing fish production.

8. Need for expansion of brackish water aquaculture and enabling effort for sustainable production.

Brackish water aquaculture has emerged as an important production sector playing a vital role in the export of marine products. The sector has given employment to more than three lakh people. The major bottlenecks in the growth of aquaculture are the non-availability of disease-free seed and dependence on a single species (*Penaeus monodon*). This needs to be addressed by developing culture of Vennamae shrimp and finfish sea brass. There are about 320 shrimp hatcheries in the country with an annual installed capacity of 12 billion post larvae. There is however a drop in the requirement for shrimp seeds due to recurring diseases like White Spot Syndrome Virus (WSSV), loose shell syndrome and Monodon Baculo Virus (MBV) disease. The urgent need is to domesticate the shrimp and produce Specific Pathogen Free (SPF) seed to overcome the problem. The mechanism of quarantine to screen the imported seed needs to be strengthened with centres at major port cities like Chennai, Kolkata, and Mumbai. Lack of appropriate voluntary code of conduct for hatchery operators need to be established. Aqua-estate along the coastal area needs to be established on the pattern of industrial estate, with proper effluent treatment. There is need to provide technical support and reduction in time lag for granting permission from Aquaculture Authority of India for undertaking brackish water aquaculture.

Marketing and processing

9. Poor fish marketing.

As reported in Planning Commission Report a study in the Ernakulum district of Kerala and West Godavari district in Andhra Pradesh indicated that the post harvest losses in fish are to the extent of 15percent , amounting to over Rs 2 700 crores annually on a national basis. The marketing system is very complex as from the producers level the product changes hands to the whole sellers, retailers and at the vendor level. Consequently, the primary producer gets a very small share from the consumers. There should be a mechanism for eliminating middlemen and fixing of floor prices by government agencies, cooperative societies etc. for ensuring fair price to fishermen. There is no mechanism to monitor and document fish-borne diseases. It is needed to prevent outbreak of any diseases, as is done in developed nations. The railway vans, air transport, containers, and cold chain are essential components for efficient fish marketing.

Processing industry needs diversification of products.

Export is estimated to grow at 12.5 percent growth rate in the Eleventh Five Year Plan to earn Rs 1 500 million of foreign exchange. To increase export, the existing infrastructure needs to be upgraded and there is need for introduction of new lucrative products like sashimi tuna, oceanic squids etc.

10. Need for value addition.

In order to increase income from fish catch there is need for value addition and to provide the following facilities - (i) improving fish handling and preservation facilities on board of fishing vessels, (ii) encouraging fishing vessels to have insulated and refrigerated fish holds, (iii) imparting training to workers of pre-processing plants on various aspects connected with hygiene and sanitary aspects, handling of raw materials, and production of value added products, (iv) market promotion steps through benefits under schemes like Brand Equity Fund, joint ventures for production and marketing of value added products, (v) adequate facility for handling fish at fisheries harbours and landing jetties, (vi) setting up of small scale projects for

production semi processed and ready–to-cook fish products from low valued fishes, fish pickles, quality dried products etc.

11. Need to address welfare of fishing community.

The fishing community has poor access to social safety, i.e. housing, electricity, civic facilities and health support, insurance for life and fishing assets etc. The social safety nets need to be addressed for overall development of the fishing community.

12. Research needs.

Improved management of fisheries is critical. The condition of open access in marine and inland capture fisheries is the major reason for depletion, economic waste and conflict among user groups. Without adequate control over access, these consequences will become increasingly severe. Research is fundamental for the formulation of management practices suitable for the specific situation. With regard to the further expansion of aquaculture, the critical constraint is the lack of effective and equitable leasing policies and arrangements.

The rise in the real prices of fish products due to scarcity of supplies has important implications for low-income consumers as well as for fisheries management. This calls for research on national food policies including policies with regard to exports and subsidies for export commodities. The social and economic consequences of alternate policies need to be examined.

Identification of areas of international cooperation

After analyzing constraints, gaps and implementation hurdles the following areas have been identified as potential areas for interventions of international agencies.

- Lack of appropriate marine fishing policies at the State / Union Territory level is affecting fisheries management. The support of international agencies will be useful for preparation of a single comprehensive legislation on marine fisheries addressing the complexity of these different mandates of different legislation.
- The coastal fisheries area is characterized by excess fishing fleet capacity, over-exploitation of coastal fishery resources, unregulated open access whereas deep sea fisheries resources are underexploited. Therefore, Government of India laid emphasis on exploitation of deep sea fishery resources. FAO can assist the Indian government in formulation of appropriate deep sea fishing policies and operation.
- Government of India is considering introduction of open sea aquaculture known as mariculture for enhancing fish production from the marine sector. In light of global experience, the international organizations can provide assistance for setting pilot projects and formulation of policy based on good practices of countries adopting mariculture.
- The coastal fisher is challenged by loss of livelihood due to over-capacity, over-exploitation, un-regulated fishing, ineffective regulatory measures and declaration of wild life sanctuary, closing seasons etc. They are forced to migrate for livelihoods. At present there is no programme for access to alternative livelihoods for fishers. In order to arrest such situations in Bangladesh, UNDP has funded the project 'Empowerment of Coastal Fishing Communities for Livelihood Security'. Scope exists for formulation of such a project for India with support from international funding agencies.
- Market channels, particularly for small scale fishers, are inefficient. The domestic fish market chain is characterized by unhygienic conditions. The smaller fishers are unable to gain access to the new developments in market channels such as mega-stores in some larger cities, and preparation and marketing of value added products. International agencies

can assist in product development and for enabling small fishers to improve market channels and for access to emerging market opportunities.

- Inland fishery is incurring considerable economic losses due to poor management of river, wetland, reservoir and canals resources. There is need for technical assistance in management of these resources on eco-friendly and sustainable manner.
- Freshwater aquaculture made spectacular impact and raised fish production significantly with a manifold growth rate. There is vast scope for diversification of aquaculture activities by integrating with agriculture, horticulture, livestock. The international agencies can assist in expanding these activities by using their experience of best practices from other countries, i.e. China and Vietnam etc.
- There is need in brackish water aquaculture for diversification of shrimp species, culture of fin fishes and disease control etc. which needs to be addressed by international organizations for providing technical support.
- The fishing community has poor access to social safety, such as, housing, electricity, civic facilities and health support, insurance for life and fishing assets etc. The social safety nets need to be addressed in collaboration with international and national agencies and donors. A further need is felt for assisting pilot projects for guiding fishing assets insurance.
- There is a need to conduct research on open access fisheries, economic and social aspects of freshwater and brackish water aquaculture including inland fisheries.

5. Complementary inputs from international agencies

Key development strategies

The fisheries development strategy of the Government includes enhancing fish production and productivity, generating employment, improving socio-economic conditions of fishers, increasing marine products for export, and increasing per capita availability of fish to about 11 kg per year. These objectives are to be achieved through well-defined development strategy of the Indian Government [2] such as (i) ensuring adoption of responsible and sustainable fishery practices, (ii) enhancing fish productivity in all cultivable waters, (iii) establishing agro-aqua farms, aqua-shops and fishery estates, (iv) spreading fish quality literacy among fisheries and aqua-farmers, (v) improving infrastructure facilities, (vi) introducing aquarium reforms, with regard to leasing and management of waters, ownership and community management, and (vii) training in different aspects of fisheries and aquaculture.

Strategy for complementary inputs

International organizations have responsibility for development of field programmes in India. Accordingly they will provide assistance to the activities identified in the NMTPF.

Priority strategy

After analyzing various development programmes in implementation, potential, constraints and prospects the following thematic priorities over the NMTPF cycle 2009-12 have been proposed.

- To formulate policies and undertake activities to enhance growth of individual fisher so as to allow for growth in rural incomes and poverty alleviation.
- Management of natural resources with an emphasis on sustainability and prevention of disaster.
- Improve governance and regulation of the sector for achieving development goals.
- In addition, the NMTPF strategy for field programme development and resource mobilization should consist of the following operational priorities.
- Building more effective partnerships with major development partners under the leadership of the UN through joint programmes.
- Strengthening working relations with government institutions through capacity building activities.

Priority programmes to complement current efforts

Taking into account the above NMTPF strategy the following activities are proposed to complement existing efforts to develop the fisheries sector.

- To support preparation of comprehensive legislation on marine fisheries.
- To assist in formulation of deep sea fishing policies and operation.
- To support formulation and funding of the project 'Empowerment of Coastal Fishing Communities for Livelihood Security' [3].
- To assist in setting up of pilot projects for mariculture and preparation of policy document for promoting open sea mariculture.
- To study fish market value chain, assist in product development and enable small fishers to improve market channels for access to emerging market opportunities.
- To provide technical assistance in effective management of inland fisheries resources, i.e. rivers, canals, reservoirs and wetlands.
- Diversification of aquaculture activities by integrating with agriculture, horticulture and livestock. International agencies can assist in expanding these activities by using experience of best practices from other countries.
- To assist in improving credit and insurance support for various investments in the fisheries sector.

- To assist in addressing issues of women in fisheries by identifying key constraints and providing necessary support for development of women in fisheries.
- The coastal fisher is affected due to climate change. Therefore, projects should be formulated for funding climate change projects.

The priority programmes / activities identified under the NMTPF need technical and financial support from various international agencies and donors.

Acknowledgements

I express my thanks to Dr Gavin Lindsay Wall, FAOR India & Bhutan, for initiating participatory exercise of preparation of National Medium Term Priority Framework for India and assigning the task of the fisheries sector report to me. My thanks to Dr Gopi N Ghosh and Mr Raj Ganguly for continuous support in the process of report preparation. I gratefully acknowledge the support of Mr Vijay Sardana, for providing report framework and guidance.

References

1. **Government of India.** 2006. *Hand book on Fisheries Statistics.* Ministry of Agriculture, Department of Animal Husbandry, Dairying and Fisheries, Krishi Bhavan, New Delhi.
2. **Government of India.** 2006. *Report of the Working Group on Fisheries for the Eleventh Five Year Plan (2007-2012),* Planning Commission, December 2006.
3. **FAO.**2001. *Technical Progress Report* - July-December, 2001. Project Empowerment of Coastal Fishing Communities for Livelihood Security in Cox's Bazar District, Bangladesh.
4. **World Bank** Technical Paper Number 147. Fisheries and Aquaculture Research Capabilities and Needs in Asia.
5. ***Solution Exchange.*** 2007. *Climate Change and Food Security,* Solution Exchange, Food and Nutrition Security Community, July 2007, New Delhi.
6. **U. Tietze, S. Siar, Suchitra M. Upare & M. A. Upare.** 2007. *Livelihood and Micro-enterprise development opportunities for women in coastal fishing* - FAO, 2007, Rome.
7. **World Bank.** June 2008. *India Marine Fisheries; Issues, Opportunities and transitions for Sustainable Development.*
8. **Dilip Kumar** et. al. 2008. *Policy Elements for Fisheries and Aquaculture Development.* 2008. ICAR, New Delhi.

Forestry

Prepared by

K D Singh

About the author

Dr K D Singh is a forester by profession and has specialized in the field of forest resources assessment and monitoring. He served in varying capacities in the Indian Forest Service (1959-79), and at FAO HQ, Rome (1979-98). He coordinated FAO Global Forest Assessment (1985-95), and was Director of FAO Country Capacity Building Programme on Planning, Assessment and Evaluation of Forest Resources, (1995-98). After retirement from FAO, Dr Singh joined the Center of International Development, Harvard University, USA, (1998-2002). After returning to India in 2002, he is leading a long term research initiative on conservation of forest biodiversity combined with sustainable development of forest communities in Orissa.

Contents

Executive summary

The paper is intended to identify areas of international support to the forestry sector of India in the medium term (2008-2012), and the means required for this purpose. To begin with, an account is presented of the current state of the forest sector, followed by a brief description of important forest sector schemes included in the Eleventh Five Year Plan.

These schemes have been then prioritized in accordance with objectives and outcomes identified in the United Nations Development Assistance Framework (UNDAF) for the period 2008 to 2012. The final section is devoted to identification of actionable projects in the sector and the benefits from international cooperation in implementing them.

1. Brief overview

Current status

According to the Forest Survey of India (FSI) Report 2005, the legally constituted forest was 76.5 hectares forming 23.3 percent of the geographic area of the country. The forested portion, with crown cover more than 10 percent, was 67.7 million hectares, of which 38.7 million hectares was classified as dense forest, with crown cover more than 40 percent, and 29.9 million hectares as open forests, with crown cover between 10-40 percent . The shifting cultivation, mostly located in the Northeast region and included in the open forests, was 1.7 million hectares.

The entire forests of the country are Government owned except in the Northeast region, where a part of the forest area is under the control of Community and District Councils and managed on a sustainable basis following a working plan code in existence for more than 125 years and updated on a ten-yearly basis. Constitutionally, forests are in the concurrent list, i.e., the Central Government is responsible for policy, planning and education, while State Forest Departments are responsible for management, harvesting and regeneration of forests and implementation of various programmes, plans and schemes.

The forests of the country are rich in biological diversity as they extend in three bio-geographic realms, the Indo-Malayan, Euro-Asian and Afro-tropical and contain 75 000 described animal and 45 000 plant species, which make the country among the 12 most biologically diverse nations of the world. The FSI 2005 assessment, compared to that in 2003, shows a decrease of forest and tree cover in the country by 72 800 hectares. This is explained due to factors such as heavy withdrawals of forest products more than the carrying capacity, forest fires, heavy grazing and diversion of forestlands for non-forestry purposes. Forest plantations in an area of 31.20 million hectares were raised during 1951 to 1999 [2].

Several institutions, both government and non-government, are currently working to meet the objectives of conservation and development of forests and wildlife. Examples of government institutions are: Ministry of Environment and Forests' national level institutions like Indian Council for Forest Research and Education (ICFRE), Forest Survey of India, Wildlife Institute of India, Indian Institute of Forest Management, Indira Gandhi National Forest Academy and State Forest Service Colleges. Many reputed non-governmental organizations contribute to R&D such as the Energy Research Institute (TERI), Swaminathan Foundation for Sustainable Development and Ashoka Trust for Research on Environment and Ecology (ATREE). The private sector has also launched important bio-technology research programmes and is providing extension services to farmers.

At an individual level, farmers in all the States have taken the initiative to grow trees with agriculture crops and thereby add to their income as well as contribute to greening of the country. In percentage terms, the tree cover amounts to about 3.2 percent to the forest cover of the country. Farm forestry has become the main source of supply to wood based industries and fuelwood for cooking.

Development challenges

The National Forest Policy 1988 assigns highest importance to environmental functions of forests including conservation of biological diversity, soil and water. This great heritage is, however, under great threat not only from unplanned collection, but also from rampant grazing, fire and trampling by animals. According to a recent estimate of Forest Survey of India, the regeneration, in general, is lacking in more than 50 percent of forests of the country.

Nearly 1 73 000 villages (about 28 percent of the total) are located along the forest fringe. Forests support grazing of nearly 60 percent

of the livestock (270 million out of about 450 million) and provide firewood to most of head loaders for sale in the market [10]. The forest dwellers are among the poorest of the poor and depend significantly on forests for their livelihood. Their sustainable development is a major challenge to the sector and the nation.

On account of limited forest area and growing demand, the supply is progressively falling short of requirements. In respect to industrial wood, the deficit in the year 2000 was of the order of 29 million cubic meters. This is expected to exceed 43 million cubic meters by 2020 [14]. The withdrawal of fuel wood from forests in the year 2000 was estimated at 86 million tonnes annually against the sustainable level of 17 million tonnes [18].

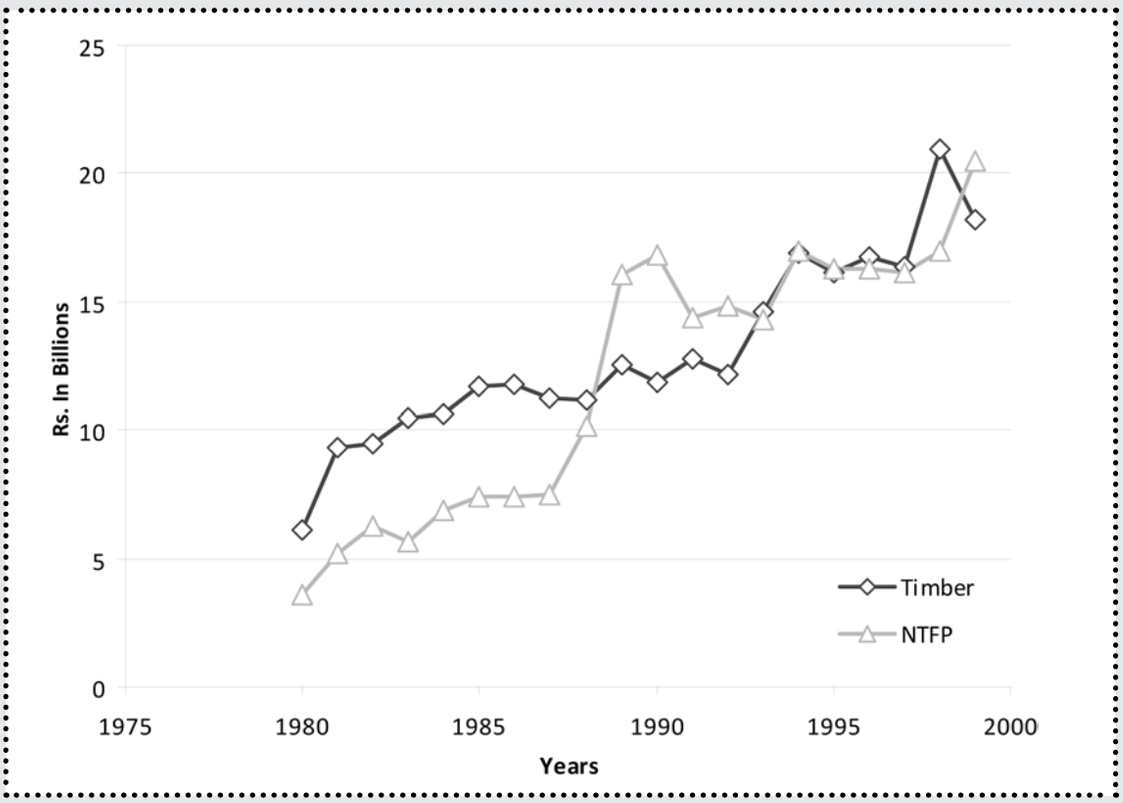
The import of wood, in particular pulp and paper products, registered a four-fold increase during the last decade. The total imports during 2000-01 were to the tune of 144 million US$. According to a global study, undertaken by a leading international company, the largest consumption growth in pulp and paper products during the next decade is expected to be in the Asian region to account for nearly 34 percent of the world's paper consumption by 2010. India is listed among countries with the largest increase in consumption growth in the coming decade.

Future potential of the sector

Contributions to inclusive growth could be the most important contribution of the sector to the nation. The Non-Timber Forest Produce (NTFP) could be an important basis for poverty alleviation programmes. The NTFP export has been growing between 5 to 15 percent annually (average 11 percent); the state revenue from non-timber resources has crossed levels to that fetched by timber (see Figure 1).

However, not even a fraction of this boom in NTFP trade trickles down to poor forest

FIGURE 1: Value of production of timber and NTFP used in GDP estimates



Source: Ministry of Environment and Forests

fringe dwellers. A way to improve the situation could be by infrastructure development (micro credit and transport facility), training and value addition of NTFP. Cultivation of medicinal plants is another promising area for investment in view of the steadily growing international demand which exceeded US$ 12.5 billion in 1994 and US$ 30 billion in 2000, with annual growth rates averaging 5 percent and 15 percent, depending on the region [1]. Outside forest areas, agro-forestry has the potential for the economic development of small farmers and landless poor, whose economic condition is deteriorating. Trees outside forests have already become an important source of industrial raw material and income to farmers practicing agro-forestry. The pulp and paper industry is shifting procurement of fibrous raw materials from natural forests to farm forests due to unavailability and higher cost of transport. It is estimated that more than 80 percent of the industrial raw material is presently received from farm forestry sources [10].

The potential role of forests in the context of climate change as well as soil and water conservation is widely accepted. Many international instruments are being finalized to compensate developing countries for their efforts in Reducing Emissions from Deforestation and Degradation (REDD). India's proposal for compensating forest conservation has been included in the Bali Action Plan of COP 13 of UNFCC held in Indonesia in 2007 [7]. Forests located in the upper river catchments play a critical role in conserving soil and ensuring ground water supply downstream. An integrated land use planning, taking into account land capability, farmer needs and market demands (and micro-financing), is expected to result in prosperity of farmers in the entire river basin.

2. Current programmes and activities

Development activities in the sector are being implemented as follows:

- The GoI (under the FYP) provides catalytic funds for development activities to the Central and State institutions.
- States with their own planned and unplanned budget allocations, in addition to GoI inputs, take care of recurring expenses such as staff salaries, survey and demarcation of forests, enumerations, preparation of working plans and development of infrastructure like roads, buildings, vehicles, communication, etc.
- The private sector has been making investments in industrial plantations following the logging ban.
- Farmers make major contributions through tree planting outside forests. This has become the single most important source of industrial raw material and domestic energy supply.

In the following section, the focus will be on the Eleventh Five Year Plan activities, which set the direction for development of all sectors including forestry. A synoptic view of major approved schemes is presented in Table 1. The allocation to wildlife conservation and support to GoI R&D institutions are other important activities promoted by the Central government.

There are four institutional capacity building schemes.

- **Scheme 1:** Support to forestry and wildlife institutions: one scheme of Rs 450 crores.
- **Schemes 2, 4 and 5:** Capacity building and forest management strengthening: three schemes with a total of Rs 810 crores.

TABLE 1: Outlay / expenditure in forestry & wildlife sector by the Planning Commission in the Eleventh FYP (INR crores).

Sl. No.	Name of the scheme	Approved outlay	
		Xth Plan	XIth Plan
1.	Forests & wildlife institutions	290.00	450.00
2.	Capacity building in forestry sector	46.00	110.00
3.	Gregarious flowering of bamboos in NE	60.00	42.00
4.	Intensification of forest management	445.00	600.00
5.	Strengthening Forestry Divisions	69.00	100.00
6.	Strengthening of Wildlife Division	87.50	150.00
7.	Integrated development of wildlife habitats	350.00	800.00
8.	Project Tiger	154.00	615.00
9.	Project Elephant	60.00	81.99
10.	National Afforestation & Eco-Development Board (NAEB)	155.00	250.00
	1. NAEB	80.00	180.00
	2. Eco task force	75.00	70.00
11.	National Afforestation Programme	1 115.00	2 000.00
12.	Afforestation through PRIs	0.10	900.00
13.	Animal welfare	175.00	120.00
Total forestry & wildlife		3 006.60	6 218.99

Source: MoEF Budget Coordination Unit (personal communication)

There are five schemes related to wildlife **(Schemes 6 to 9 and 13)** and one (Scheme 3) for bamboo rehabilitation in the Northeast.

There are three major **Schemes (10-12)** for increasing the forest cover and linking that with creation of livelihood opportunities in the forest fringe areas and for strengthening of participatory processes in the protection and development of degraded forests:

- **Scheme 10:** National Afforestation & Eco-Development Board, Rs 250 crores, for ecological rehabilitation.
- **Scheme 11:** National Afforestation Programme, Rs 2 000 crores, in forested areas, in particular, for rehabilitation of degraded forests.
- **Scheme 12:** Afforestation through Panchayati Raj Institutions, Rs 900 crores, essentially in non-forested areas.

National Afforestation Programme, popularly called Joint Forest Management (JFM), has been a major on-going Forest Department activity in all the States of the country since 1993. By end 2006, out of the total 1 73 000 villages at the forest fringe, JFM had been implemented in 1 25 000 villages and JFM committees formed in 99 868 villages [11].

The States have started innovative mechanism of decentralization of power not only for forest protection but also in forest development or expansion of forest cover through the mechanism of Forests Development Agencies (FDA) created at the forests division level. There are around 800 forest divisions in the country and the States have already covered around 500 of them in the last two years. All money for plantation activities, under FDA, is passed on to communities or JFM committees directly. To reduce the demand on wood, one of the steps taken is the supply of cooking gas to the forests and forest fringe dwellers free of cost in the beginning.

Two more institutional innovations deserve mention. Afforestation and Eco-Development Board (NAEB) is intended for promoting afforestation, tree planting, ecological restoration, and eco-development. The NAEB pays special attention to the regeneration of degraded forests and tree planting is the main focus, particularly through the National Afforestation Scheme and Greening India programmes. Efforts are being made to ensure that weaker sections of society and women emerge as major beneficiaries of the activities of NAEB.

The Eco-Development Programme is intended to support wildlife management. The objective is economic development of the people residing in and around sanctuaries and National parks in order to reduce their dependence on forest products and improve the ecological health of the protected areas. The scheme aims to increase land and forest resource productivity so that alternative avenues of employment and income are made available in the forest fringe areas. The Programme provides support to a package of activities including developing agriculture, improving land productivity and developing minor irrigation, raising fodder and fuel plantations, providing livestock care and improvement, introducing fuel saving devices, providing medical care including family planning, and creating environmental awareness. It is increasingly thought that the eco-development concept should not be limited to protected areas.

The industry is also promoting farm forestry over more than 40 000 hectares annually. Another possibility is public-private partnership in plantation projects accompanied by an adequate system of audit and certification and the provision that the initiative contributes to social development. Through farmers own initiative, trees outside forests are playing the most important role in meeting of industrial and non-industrial wood supply.

The Eleventh FYP document has a full chapter on environment and climate change. All the forestry activities, contributing to greening like afforestation, agro, farm and social forestry, get added support due to their role in sequestering carbon and mitigating adverse effects of climate change.

India is a party to and a strong advocate of most of the international conventions such as United Nations Convention on Biological Diversity (CBD), United Nations Convention to Combat Desertification (UNCCD), United Nations Framework Convention on Climate Change (UNFCCC), Ramsar Convention on Wetlands etc. It has also taken concrete steps to develop national instruments like Biological Diversity Act 2002 and monitoring of pollution and emissions and implementation of international commitments to Framework Convention on Climate Change.

The bilateral and multilateral funding agencies are supporting forestry programmes, in particular, parts of the rural livelihood and environmental conservation programmes. JBIC (Japan Bank for International Cooperation) is presently the main partner with World Bank and DFID playing a minor role. In the recent past, however, the international assistance to the sector has declined substantially except for JBIC.

Poverty alleviation in the forested regions

The Planning Commission Eleventh Five Year Plan document "Towards Faster and More Inclusive Growth" as well as Millennium Development Goals (MDGs) set broad directions for the choice of forest sector strategies and priorities. The foremost objective in both cases is poverty alleviation and in particular achieving 2015 targets. The forest sector is ideally suited to this task, because forest regions suffer from chronic poverty. All indices of human development continue to be the lowest in the forested regions including literacy, medical care, banking, and post and tele-communications. The market is far away and the infrastructure is poor.

There are serious problems of governance and absenteeism of the government staff. As a result, institutions do not function effectively. For example, 85 percent of villages in Adilabad have schools, but literacy is only 14 percent. Medical dispensaries are there, but no doctors. An integrated programme with empowerment (viz. access to primary resource) and value addition are essential requirement for accelerated development [15].

The recently passed Scheduled Tribes Forest Rights Act (2006) is expected to open a Pandora's box regarding land entitlement, which needs to be expeditiously sorted out. As per the FSI (2003) Report, 23.8 hectares of land in the forested region is classified as "unclassed" and 13.6 hectares as "protected" forests. The process of settlement, started before Independence, seems to be going on endlessly. There is still no proper map of these classes of forest lands; nobody knows who is doing what on the ground or who owns what, though title deeds are supposedly maintained by the Revenue Department. Even in the case of "reserved forests", currently 40 hectares in size, records of boundary and changes are not available in many States. The situation has worsened to some extent on account of terrorism.

The first requirement in the transfer of forest rights is to ensure that forests are sustainably managed. This, however, is not sufficient in itself. Marketing and value addition must become a part of the production process, to make a dent on poverty. Necessary institutional infrastructure and financial investment needs to be ensured and must go hand in hand with tribal empowerment.

The Girijan Cooperative Cooperation (GCC) in Andhra Pradesh was established as an autonomous corporation in 1980 to get rid of the middlemen and thereby increase the share of benefits to the tribal people. The GCC was able to eliminate middlemen, provide essential commodities, including food and medicine, even in the interior area and extend credit facilities for "agricultural activities" as shown in the following statistics [17].

- **Forest area:** 3.2 million hectares
- **Number of forests districts:** 25 (on an average 1 30 000 hectare per district)
- **Beneficiaries:** 2.5 million tribal people
- **Number of depots:** 817
- **Processing units:** 8
- **Annual turnover:** US$ 25 million

However, GCC fell short of promoting integrated development by excluding sustainable forest management from the scope of their involvement. A comprehensive approach is necessary to conserve forest resources [17].

Promoting agro-forestry in rural areas

The National Agriculture Policy 2000 states: "Agriculture has become a relatively unrewarding profession due to generally unfavourable price regime and low value addition, causing abandoning of farming and increasing migration from rural areas. Farmers will be encouraged to take up farm/ agro-forestry for higher income generation by evolving technology, extension and credit support packages and removing constraints to development of agro-forestry".

By the end of the millennium, agro-forestry was producing more industrial and non-industrial wood than forestry proper. It was also improving the productivity of the farm environment and providing additional income and employment in the rural areas. The achievement of the minimum forest cover targets, enshrined in the Eleventh Five Year Plan document, to a great extent depends on the success of agro-forestry.

A key requirement to enhance farmers' income is to make trees grow as a part of the value chain. This calls for advance planning of future use, when trees will mature, their prices and use. The ideal would be for a tie-in between industrial location and tree growing in terms of quality and quantity. This would also help in getting R&D investment and even buy-back arrangements. The following case study of Yamuna Nagar, Haryana, conducted in 2006 illustrates the point [17].

- **Annual wood supply:** 2.3 million cubic metre
- **Price of unprocessed wood:** 3 500 million Indian rupees
- **Price of processed product:** 17 000 million Indian rupees
- **Employment generated:** 1 50 000

The demand for additional wood by 2020 is estimated at 150 million cubic metres, of which the share of industrial wood is 50 million cubic metres and non-industrial wood 100 million cubic metres [10]. Agroforestry could meet these production goals in a cost effective manner, provided a far-sighted policy and institutional mechanism can be put in place.

Protected areas and wildlife management

The track record of forest protection, particularly tigers has been poor. There is a strong emerging consensus that, if forest conservation is to succeed, conservation efforts need to go beyond protected areas and cover all forests. Even the most ambitious exponents of biodiversity protection only hope to achieve around 10 percent of the geographic area of the country under parks and reserves. It is presently (4.75 percent) of the land area. Obviously, the fate of most of biodiversity will depend upon what happens to rest of forests under sustainable forest management [16].

Achieving an effective protected area system is a difficult task, as is obvious from the current concern about tiger protection in the country. A number of questions emerge from discussions such as - what minimum number of tigers - from a genetic perspective - should one aim to have in a park; what can be done to increase the number of tigers in two parks which are among the largest but contain among the lowest number of tigers? Can conservation and forest management be integrated to increase the effective size of the parks? What could be the role of intensive forestry practices, to reduce the pressure on protected forest areas?

Forestry and climate change

There is a lot of talk about benefit to the forest sector and eventually to the local community resulting from international agreements like Reducing Emission from Deforestation and Degradation (REDD) and Compensated Conservation proposed by India at the recent Conference of Parties to the UN Framework Convention on Climate Change (UNFCCC) [6]. These statements seem to be still an expression of intent. Much needs to be done to negotiate a proper mechanism for monitoring and implementation and with binding commitments. Hopefully, world leaders will put in place a proper mechanism at the next conference.

Overall strategic considerations

From the fore-going presentation, it may be evident that the forest system in the country has a major contribution to make towards inclusive growth and environmental conservation, both of which form an important part of the Eleventh Plan and MDG. The demand on forests is also getting very diversified and rising much faster than

the capacity of forests to supply them on a sustainable basis. This widening gap is the main cause of forest degradation and forest biodiversity loss taking place on an unprecedented scale. It is also eroding rapidly the very basis of livelihood of forest dependent communities and thus contributing to their increased poverty.

The rising demand for forest goods has positive implications too and offers new opportunities to enhance sector contribution to the national economic growth and poverty alleviation, in particular, the latter through development of NTFP and trees outside forest, which are of direct concern to estimated 300 million tribal and rural poor. The supply gap of nearly 95 million cubic metre of industrial wood by 2020 could be met from forest plantations in non-forest areas through private and public partnership, which would also create substantial new employment opportunities to the rural poor and add value through processing by a ratio of 1:3. The greening of the country will also have positive impact on climate change, perhaps, one of the most important global concerns.

The move towards a more comprehensive and multiple-use forestry would involve (i) inclusion of both timber and non-timber produce and environmental services in the forestry planning and administration (ii) adding a complete new initiative like agro-forestry, which may be as big as forestry itself. Managing such a change would call for a major policy change and an orientation of the forestry department and its strengthening in terms of relevant technology, information and knowledge. This is a major change as the present structure and functions, planning and control methods, research and training are all geared towards management of forests mainly for production of timber species. A mismatch between the changing societal demands on forests and non-changing forestry institution and organization could result in stagnation, worse decline of the sector, and acceleration of the process of forest degradation. In the following section, five actionable programmes are identified and briefly presented.

Programme 1: Conservation and sustainable livelihood in the forest fringe areas (excluding Northeast)

This programme targets very poor households living in the forested regions (excluding Northeast), who depend for survival partly on forests (about 50 hectares) and partly on agriculture (about 30 hectares). In this region (say 1-2 km belt around forests), tribal population forms a majority, who according to the Constitution enjoy special rights to manage and market non-timber forest products. The objective is to promote community based management and marketing of non-timber forest produce, support organic cultivation of high value medicinal plants (say on 5 hectares of agricultural land) and combine NTFP production with pre-processing and processing by the community, to an extent which makes economic sense. These measures would benefit about 50 million households in 10 years' time-frame or 5 million households per year. It is estimated that an annual investment of Rs 100 million would be required for establishing sustainable NTFP management and marketing regime. Investments of the order of Rs 12 500 million annually for 10 years will be required for medicinal plants cultivation and enterprises development, to be secured mainly through private-public partnership. The programme is expected to double the household income of forest fringe dwellers from the current level of Rs 10 000 to Rs 20 000 per year and, most important, make a lasting contribution to Conservation of Biological Diversity and ITTO 2000 Sustainable Forest Management Objectives.

Programme 2: Sustainable forest management and land use strategy for the Northeast

The Northeast calls for a special strategy on account of geographic location, natural and social-cultural endowments. The region is more than 60 percent forested and tribal communities form a majority. They are economically better off than the non-tribal counterparts and also educationally more advanced. Geographic location and infrastructure development are major bottlenecks, which need to be taken into account in an integrated manner along with needs of human development and natural resources conservation. Separate Constitutional provisions exist for developments in the region. Forests are mostly private or community held. Bamboo is an important resource in the region and offers possibilities of development under the GoI Bamboo Mission. An effective forestry organization, combined with private-public partnership for forest resources conservation, management, sustainable utilization and marketing of the produce, could make a significant difference for the economy, peace and prosperity in the region.

Programme 3: Integrating perennial with annual cropping with focus on small and marginal farmers

A National Sample Survey conducted in 2002-2003 found that annual cultivation income of average farmer was Rs 11 628 and annual cultivation expenditure Rs 8 791, both expressed on household basis, which give an agricultural surplus of Rs 2 837 per year. This was not large enough to cover rising household expenses, which leave the farmer indebted by Rs 7 860 annually. Crop-diversification is a well-known technique to enhance farm income. A survey of agro-forestry in Haryana shows that benefit to medium and large farmers was by Rs 4 200 and Rs 11 600 respectively; whereas benefit to marginal and small farmers was only by Rs 2 500 and Rs 4 500 respectively and percentage of farmers practicing agro-forestry was also much less. There seems, however, an untapped opportunity for increasing the benefit to small and marginal farmers by forming Tree-Growers Cooperatives, technical backstopping in the choice of species and tree crops management, provision of micro credit for buying high yielding planting stock and minimum price on maturity by promoting partnership with the wood based industries. These measures could be effectively promoted by a professional organization. The investment in creating such an organization including working capital is estimated at Rs 100 million per year for 10 years; and the potential for private sector investment is estimated at Rs 5 000 to Rs10 000 million per year during the 10 year period. The programme is expected to enhance the level of agricultural income from agro-forestry of about 90 million small and marginal farmers from the current Rs 2 500 to Rs 5 000 per year; contribute to alleviation of poverty, national self-reliance in industrial wood production and associated environmental benefits.

Programme 4: Private-Public Partnership in cultivation, management and marketing of wood and non-wood products

The demand for industrial wood in the country has been growing 7 percent annually since 1990; while the indigenous supply is growing at a much slower rate requiring substantial import of raw material worth Rs 450 million annually. Agro-forestry is already providing more than 60 percent of the supply and there are new possibilities for increasing the production at costs much lower than imported products or supplies from the national forests. A study conducted at Yamunanagar in Haryana shows that 2.3 million cubic metre of wood, valued at Rs 3 500 millions, produced Rs 17 000 million worth of processed products annually, in other words a five-time value addition. This shows an excellent opportunity for private-public partnership and a win-win situation for both partners and the national economy at large. Likewise, the national and international demand for non-timber forest products, including medicinal plant products, has been growing steadily over the last 40 years on an average rate of more than 10 percent annually. Both sub-sectors are, however, characterized by almost a complete absence of an effective "management and marketing regime". Therefore, an urgent need exists to establish some "formal structure or mechanism" to provide technical and financial support to producers, monitor market demand and prices and facilitate long term agreements between producers and consumers. Investments required for creating an effective organization in the two cases have been indicated under the respective programmes. Public-Private Partnership (PPP) in the forest sector is already taking place informally and on a small scale. In view of the size of opportunities open in the future and the associated outputs, PPP along with the professional organization recommended to support the respective programmes deserve a special consideration.

Programme 5: Strengthening of forest sector capabilities to plan and implement the programmes

Now more than ever there is a need for "a more representative forest sector institution to take into account emerging public communal and private interests" throughout the country. The peace and prosperity issues in the Northeast are similar in many ways to problems confronting forest fringe communities and their elected officials in Chattisgarh, Jharkhand, Andhra Pradesh and elsewhere. The forest sector in the country is fortunate to have a cadre of professional foresters in the form of All-India and State Forest Services, who can be trusted to plan and implement the change in a professional manner, provided a clear responsibility in a mission mode is assigned to them for future re-orientation of the sector including overall goals, restructuring of organization and functions, re-definition of the existing terms of reference and suitable retraining to meet emerging national needs in a cost effective and time bound manner.

Potential areas

The following section will present two specific proposals for International Technical Cooperation, which are of cross-cutting nature and intended to strengthen forest sector capacity to effectively meet the emerging national demands on the forest sector. The first proposal is concerned with strengthening policy analysis and strategic planning capabilities at the National / State levels; and the second idea relates to establishment of grassroot level institutions with the twin objectives of sustainable forest management and poverty reduction.

Proposal 1: Support to institution building for continuing forest sector policy analysis and strategic planning at the National and the State levels

The TIFAC (Technology, Information, Forecasting and Assessment Council) of the Department of Science and Technology and IIASA (International Institute for Applied System Analysis) in cooperation with the Forestry Department of Ministry of Environment and Forests, organized a workshop on 25-27 April 2007, to discuss the dynamics of escalating demands on the Indian forest sector. Based on workshop recommendations, 25 papers were commissioned for making in-depth review of forest sector development in a comprehensive manner covering various issues. The papers have been recently published as a special issue of International Forestry Review (November 2008). Nearly all commissioned papers identify a lack of reliable and comprehensive 'data and inventories' with respect to functions, management and impact of the Indian forest sector. The situation is primarily due to the fact that there is no strategic planning institution or process in place in the country to steer and synergize sector development in the most effective manner. The focus so far has been on management planning at a Forest Division level using Working Plans as the main instrument. The change towards a comprehensive and multiple-use forestry coupled with a rapidly growing National economy urgently calls for strengthening the Central and State Forest Departments' capacity to undertake comprehensive policy analysis and strategic planning on a regular basis. It would also be necessary to establish needed inventories or improving the on-going ones making use of integrated and systems view approaches so that integrated assessment is possible from those inventories.

It may be noted that policy analysis and strategy development require integrated assessment and appropriate analysis. Generally speaking, assessment for such purposes should go far beyond the traditional forest sector to be meaningful and deal with real issues causing the degradation of the Indian forest resources, like sustenance and livelihood pressures. The strategic plan implementation might require restructuring of the existing governance and institutions within the forest sector. The governance and institutions, in the future, have to operate in tandem with strategy taking crosscutting issues on board in order to address the real problems of the sector and to interlink more

efficiently in governance between States and Central Governments.

During 1950-84, when the Forest Department was a part of the Ministry of Agriculture, the functions of policy analysis and strategic planning were performed by the Central Board of Forestry (CBF), which included the Central and State Forest Ministers and other key stakeholders of the sector as members. The CBF was assisted by a secretariat called Central Forestry Commission (CFC), supporting CBF with up-to-date data and appropriate analysis in a very effective manner. Since 1984, with the transfer of the forest sector responsibility from the Ministry of Agriculture to Ministry of Environment and Forests, the CBF seems to have been forgotten. The statistical data collection and reporting on the sector has also become incomplete and very irregular [7]. A body like CBF along with an effective data collection, analysis and reporting unit like CFC, seems to be very relevant and urgently needed in the current context of the sector for maintaining continuity as well as guiding changes in the sector in consultation with the State Governments, other key stakeholders and the public at large.

Proposal 2: Organization of a grassroot level institution and technical support for sustainable management of timber and non-timber produce

There are three reinforcing processes, which together are endangering the sustainability of forest resources and biodiversity and contributing to chronic poverty in forest regions: (i) the continuing increase of population in the forest fringe areas without corresponding increase of amenities, (ii) steady rise in demand for NTFP and timber in the national and international markets, and (iii) continuing forest degradation and deforestation. Some indirect processes like fires and grazing year after year make a bad situation only worse. Comparison of ground flora inventory taken in well protected forest areas and forests in general, shows a very alarming degradation and indicates urgency of action to conserve the biodiversity heritage and start sustainable management to ensure livelihood support to local communities. A well established example is the remaining number of tigers in the country.

It may be noted that the Forest Department is traditionally designed mainly for timber management. NTFP and agro-forestry have been only minor issues, outside the traditional scope of forest research, planning and control system. Moreover, both of them are local and annual in nature. Therefore, annual record keeping in all the compartments is essential, compared to timber species, which have a long rotation of almost 80-100 years involving harvesting at the end of the rotation period and silvicultural operations say once in 10 years in a particular compartment. For NTFP and agro-forest management, a de novo system of planning and control and provision of support services has to be designed keeping in view their specific nature; appropriate control has to be in place to ensure that removals are within the carrying capacity of the area and followed by regeneration of the produce as soon as possible, almost every year. Our seers realized it well, as is evident from the verse 35 in the Hymn to the Earth (Atharveda XII): "Whatever I dig from thee, Earth, may that have quick growth again. May we not, O purifier, injure thy vitals or thy heart."

Key planning issues

In the NTFP context, new knowledge has to be developed to determine sustainable level of production viz., the annual yield in terms of quantity and species that can be taken out in an area on an annual basis so as not to cause irreversible changes in the biological diversity. Need is also for an accounting system to keep record of what has been taken out, a plan to guide as to what can be taken out and interventions to ensure that balance between removals and new growth is maintained. Finally, forest protection needs to be legally and physically enforced in order that unplanned exploitation does not take place. In the earlier times, the fear of the government served to self-regulate the process. In the present times, an effective governance system needs to be in place, which can take

care of monitoring of growth and removals. Effective laws need to be framed in order to achieve the same goals viz., sustainable forest management.

New institutional architecture

The local use forestry, to be sustainable, must have a scientific basis, empirical or observation based, embedded in the local governance. The community must ensure protection, participate in the planning process and maintain a database on what is growing, how much has been actually removed in the past, what can be removed in the future at different time intervals and what needs to be regenerated. Without such plans / controls, sustainable management is not possible. We have made some feasibility studies on a cost effective institution design for above purposes, as indicated in Figure 2 and 3 with special reference to NTFP management. The institutional needs for agro-forestry are comparable to NTFP.

In Figure 2, two categories of institutions are proposed. The one consists of local community based institutions and the other is based on more specialized Forest Department staff with 6-8 months formal training in NTFP management.

NTFP protection, planning and management is proposed to be implemented at the village / hamlet level (shown as the lowest box) as per plans based on data provided by "Community Support Group", proposed to be established say one centre for 8 to 12 villages / hamlets, which will closely work with village units and assist in conducting inventory, maintaining records of production, consumption and sales, and support local use planning. A feasibility study on the subject has been carried out and found to be very cost effective.

At the next higher level, Market Information Centres are suggested, which would be a very important input to sustainable NTFP management, ensuring fair prices to community and taking further steps regarding pre-processing and processing, and value addition in general. At the professional level, the Forestry Extension Officer will review effective provisioning of knowledge and information services to Community Support Group and Market Information and Sales

FIGURE 2: Local institutional infrastructure for NTFP management

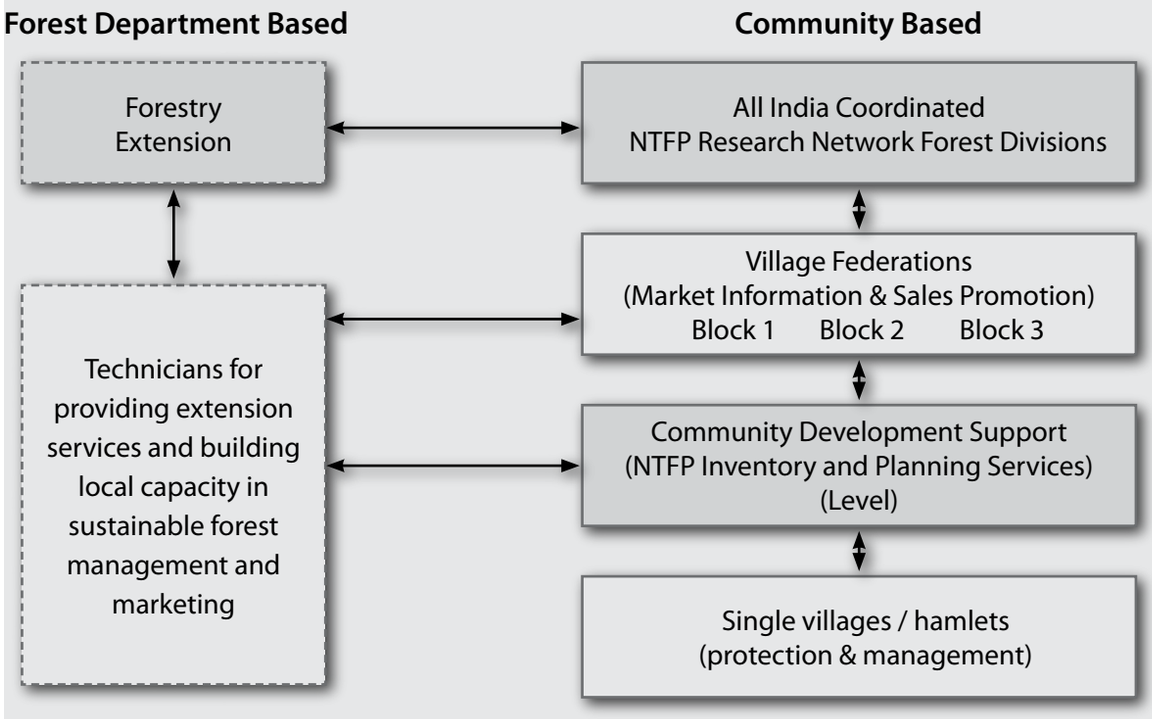
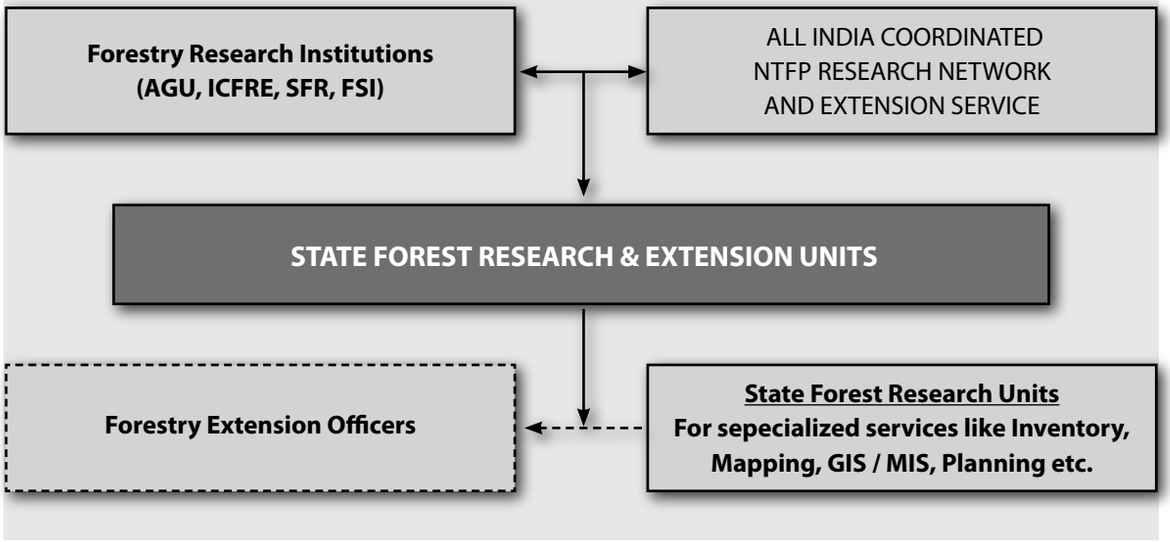


FIGURE 3: All-India coordinated NTFP research network and extension services



Promotion. Suitable training curricula for the Extension Staff will be developed. The Forest Department Extension Staff, working closely with Community Centres, will organize NTFP planning on a five year cycle, oversee correct annual recording of production, consumption and sales data.

Knowledge support

These are two related issues. The first is development of an All-India Coordinated NTFP Research Network (see Figure 3). ICFRE, in close cooperation with other Central and State research organizations, is expected to take a lead role in developing a strong NTFP knowledge basis to guide the process. The second is establishing a communication system for the knowledge and information to percolate to the community level. States are expected to assume a lead role in establishing an effective communication system, as part of a national network, to provide enabling environment for the effective sharing and use of the knowledge (see Figure 3).

In Figures 2 and 3, a forest department professional has been visualized and named as Forestry Extension Officer serving in all districts (or Forest Divisions) in network with State and Central Forest Research Institutes. The main function of the person will be to provide knowledge and technology support to Market Information Centres and Community Support Groups and guiding the planning process.

On-going country programmes

The Central Government under the Eleventh Five Year Plan has two schemes (see Table 2), which directly connect with securing of local inputs in the recommended area of technical cooperation with FAO. Major components of these schemes are also presented for planning budgeting of the proposals.

Intensification of forest management (Scheme 4 listed in Table 2) includes

- Modernization of the management planning (Working Plan) units with equipment, infrastructure, and manpower. This may include forest inven¬tories, training and satellite imagery processing, and GIS facilities. This will also include professional services such as ecologists and sociologists.
- Forest Land Information System for land records, with modern and empowered survey, and land record maintaining mechanisms for documenting the legally recognized individual rights, concessions, ownerships including those under the Scheduled Tribes and other Forest Dwellers (Recognition of Forest Rights) Act.
- Forest boundary demarcation by providing assistance for the state-of-the-art infrastructure, train¬ing / outsourcing survey work, axing permanent boundary pillars, updating the forest block indices and compartment histories.
- Installation of forest fire surveillance and warning systems, along with fire management planning in participatory mode. This fire management system will also be integrated with a national network for forest fire surveillance and monitoring.
- Assistance for general infrastructure for accommodation in remote areas, communication, improvement of road network etc., will also be a part of this programme.

Scheme 5: Strengthening of forest management including

- National Forestry Information System
- National Coordinated Programme for Assessment of Non Timber Forest Product Resources
- Certification Programme for Wood & Non Wood Forest Resources

TABLE 2: Outlay / expenditure in forestry & wildlife sector, Ministry of Environment and Forests

(Rs. in Crores)

Sl. No	Name of the Scheme	Approved outlay	
		XIth Plan	Xth Plan
1.	Capacity building in forestry sector	0.00	110.00
2.	Foreign training of forestry personnel	0.00	30.00
3.	Training of other stakeholders	0.00	5.00
4.	Intensification of Forest Management Scheme	445.00	600.00
5.	Strengthening Forest Management Scheme	0.00	100.00
6.	National Forestry Information System	0.00	13.50
7.	National Coordinated Programme for Assessment of Non-Timber Forest Product Resources	0.00	7.70
8.	Certification Programme for Wood & Non-Wood Forest Resources	0.00	18.00

Source: 11th Five Year Plan document

TABLE 3: Project Costs as Estimated by World Bank (2008)		
Component	**Cost (INR) ('000)**	**Cost (USD) ('000)**
Strengthening CFM Support at National Level		
1.1 National (continuing) Strategic Forest Assessment	7,610	200
1.2 Strengthening Capacity of MOEF for Policy & Planning	22,190	584
1.3 National M&E INFO System and Forest Statistics	9,666	254
1.4 Forest Products Marketing Support for Community Forestry	6,890	181
1.5 Enhanced Knowledge Sharing Systems	21,600	568
1.6 Review and Restructure National Forestry Research	10,780	284
Component Total	78,736	2,072

Source: World Bank (2008)

International inputs

The World Bank has recently carried out an appraisal of the need of international support to on-going activities in the country. The activities identified match rather well with the specific areas identified in the present report. The following table shows indicative total cost estimates, including internal and external, for each of the components and sub-components identified by the World Bank. The total funds required are estimated at INR 78.7 million (US$ 2.1 million). These cost estimates represent reasonable figures for preliminary planning. Funds allocated in the Eleventh FYP schemes are adequate to accommodate this level of projects by GoI.

Recommendation

The ideal action seems to be to initiate a national / international dialogue on international cooperation in the forestry sector of India using the World Bank priority list as the basis. This phase should also explore the preparatory assistance for the two priority issues identified in chapter four viz., (i) support to institution building for continuing forest sector policy analysis and strategic planning at the national and state levels, and (ii) organization of a grassroot level institution and technical support for sustainable management of timber and non-timber produce.

References

1. **Chauhan K.V.S., Sharma A. K. and Kumar R.** 2008. *Non-timber Forest Products Sustenance and Commercial Uses, Trends and Future Demands.* International Forestry Review, Special Issue 2008, London.
2. **FSI.** 1999. *State of Forest Report 1999,* Forest Survey of India, Ministry of Environment and Forests, Dehradun.
3. **FSI.** 2003. *State of Forest Report 2003,* Forest Survey of India, Ministry of Environment and Forests, Dehradun.
4. **FSI.** 2005. *State of Forest Report 2005,* Forest Survey of India, Ministry of Environment and Forests, Dehradun.
5. **GoI** 2006. *Towards faster and more inclusive growth:* An approach to the 11th Five Year Plan, Planning Commission, New Delhi.
6. **Rawat V. R. S. and Kishwan Jagdish.** 2008. *Forest conservation-based climate change-mitigation approach for India. International Forestry Review,* Special Issue 2008, London.
7. **Kishwan Jagdish, Sohal H.S., Nautiyal Raman, Kolli Ramesh and Yadav Janardan.** 2008. *Statistical Reporting in the Indian Forest Sector - Status, Gaps and Approach. International Forestry Review,* Special Issue 2008, London.
8. **MA.** 2005. *Serving farmers and Saving Farmers.* National Commission on Farmers, Ministry of Agriculture, New Delhi, India.
9. **MoEF.** 1988. *National Forest Policy 1988.* Ministry of Forests and Environment, New Delhi, India.
10. **MoEF.** 1999. *National Forestry Programme, Volume I and II with Executive Summary,* Ministry of Forests and Environment, New Delhi, India.
11. **MoEF.** 2008. *Asia Pacific Forestry Sector Outlook Study,* Ministry of Forests and Environment, New Delhi, India.
12. **Nilsson Sten.** 2008. *The Indian forestry system at crossroads: An Outsider's View.* International Forestry Review, Special Issue 2008, London.
13. **Pandey Devendra.** 2008. *India's Forest Resource Base,* International Forestry Review, Special Issue 2008, London.
14. **Pandey C.N. and Rangaraju T. S.** 2008. *India's Industrial Wood Balance. International Forestry Review,* Special Issue 2008, London.
15. **Singh K. D.** 2002. *Influence of Geography on the Socio-economic Conditions in the Tribal Regions of India & Implications for Development Planning,* Biology Department, University of Massachusetts Boston, Boston, USA.
16. **Singh K. D.** 2005. *Forest Biological Diversity,* WWF, New Delhi.
17. **Singh K.D.** 2008. *Forests, Farms and Trees: Recent Trends and Future Prospects,* International Forestry Review, Special Issue 2008, London.
18. **Singh K.D.** 2008. *Balancing Fuelwood production and Consumption in India,* International Forestry Review, Special Issue 2008, London.
19. **Singh K.D.** and Nilsson N. E. 2008. *Institutionalizing Strategic Forest Planning in India,* International Forestry Review, Special Issue 2008, London.
20. **Singh Shekhar.** 2008. Forest Rights Act 2007: *Implications for Forest Dwellers and Protected Areas.* International Forestry Review, Special Issue 2008, London.
21. **World Bank.** 2008. *India- National Forest Livelihoods Support project, Draft Concept Note,* National Grant-Financed Technical Support Programme, World Bank, Washington.

Water Management for Agriculture

Prepared by

Mihir Maitra

About the author

Dr Mihir Maitra started his career as a water specialist in Action for Food Production (AFPRO), a non-profit technical service agency established for production of more food in the country. Later, he joined Indo German Bilateral Project-Watershed Management (IGBP-WSM) to promote hydrological monitoring of watersheds in seven States. This was followed by working with Eco-Tech Services (ETS) a technical consultant group assisting in formulation of water resource and watershed projects in the States of Gujarat and Uttar Pradesh on behalf of the Royal Netherlands Embassy. In 1998, he joined India Canada Environment Facility (ICEF) where he managed twelve projects from land and water sectors with capacity building objectives. He has authored books on watershed management, groundwater management, participatory irrigation and lift irrigation. Presently, he is a freelance consultant.

Contents

Executive summary

With more than one billion population and 0.27 hectare per capita land, India faces a serious challenge of meeting the food requirements of its growing population. Almost 80 percent of farmers are small and marginal and more than 90 percent of them are dependant on rain for their crops. Specific attention is therefore required for field level management of land and water. Other agricultural sectors like fishery, livestock, and horticulture also need attention not only for producing supplementary food but also for creating higher income generating opportunities.

Major and medium irrigation projects, considered vital for providing irrigation played their role in supporting accelerated food production in the past few decades but are fast losing their ability to meet the future challenge of increasing food production. Most of these projects are known to operate at a sub-optimum level primarily due to inherent physical limitations and difficulties in mobilizing funds for their operation and maintenance. Future emphasis should therefore be laid more on efficient operation and maintenance of the existing irrigation projects than on constructing new ones. It is well known that even if the entire irrigation potential of the country is developed as planned, more than 50 percent of cropped area would still remain rainfed.

According to the National Commission for Integrated Water Resource Development Plan 1999, if the country has to meet the food requirement of its growing population by 2050, it would be required to produce almost double the present level of foodgrain. The estimate also suggests that by 2050 the water requirement of the country would exceed the water availability. Irrigation sector which at present consumes more than 80 percent of water cannot continue to increase its share of water depriving other agricultural sectors like livestock, fishery, horticulture and non-agriculture sectors such as domestic, industrial and ecological needs.

To remain food secure in the medium term, the country has to remain obsessed with water use efficiency following the dictum "more crop per drop". More attention is required to develop rainfed areas through community based watershed development projects integrating soil and water conservation, livestock, fishery, horticulture and crop production with focus on improving livelihoods. Maintaining the balance between food production and crop diversification would be a serious future challenge demanding clarity at the policy level. While production of the main crops in the command areas is to be increased through on-farm development, larger crop diversity can be achieved in rainfed areas.

Owing to rising population, erratic rainfall and growing water shortage, conflicts centred around the access and control over water have increased in recent years. Water has multiple uses and hence requires a holistic approach. Improved policy frameworks and appropriate institutional arrangements are necessary to manage water at both the macro and micro levels.

As time is running out, necessary sector reforms are to be pursued vigorously. The country should look for opportunities to draw strength from the experiences of other international development agencies active in the country. Identified Good Practices working well in other countries should also be studied for adaptation in India after necessary fine tuning. Importance of capacity building should be understood in perspective and effective methodologies to achieve the objectives should be developed for producing sustainable project results. Capacity building inputs particularly to farmers would go a long way in meeting the future challenges of crop production and climate change adaptability of farmers.

1. Brief overview

Agriculture and food production

With 16 percent of world's population, 2.4 percent of world's land area and 4 percent of available fresh water, India needs a concerted effort to manage its land and water, if it has to meet amongst others, the food requirements of its growing population in the future. Almost 80 percent of Indian farmers are small and marginal whose land holding is less than 2 hectare and more than 90 percent of them are dependant on rain for their crops.

From a meagre 51 million tonnes in 1951, the foodgrain production in India increased to nearly 217 million tonnes in 2007 while the net cropped area in the corresponding period increased marginally from 119 to 143 million hectares. Production of oil seeds, sugarcane and cotton also increased during this period reaching 24 million tonnes, 355 million tonnes and 23 million bales respectively. The increase in food production is attributed more to the increase in crop yield and cropping intensity than increase in net cropped area. However, productivity of many crops in India is still considerably lower than some of its neighbours' indicating further scope for improvement. To avoid a reduction in the existing crop lands through competitive land use, hills and coastal areas are to be used increasingly for future expansion of horticulture, agro-forestry and other crops.

India has a livestock based farming system where farmers, rich and poor depend on a supplementary livestock based economy. With nearly 25 percent of world's cattle of 193 million heads and 75 million buffaloes, India ranks number one in milk production (53.5 million tonnes per annum). Goats and sheep are to the order of 110 million and 44 million respectively. More scientific development and management of livestock could further enhance economic benefits to small farmers, supplement their food intake and support export. Per day water consumption for large animals (cattle) could be as high as 70 litres, the average being 35 litres. Smaller animals (goats, sheep, pigs) consume 10-20 litres per day. Most livestock are comfortable to drink water with higher salinity level extending upto 3 000 ppm.

Production of fish has also increased steadily. While in 1980-81 the marine fish production (1.55 million tonnes) was more than that of inland production (0.89 million tonnes), in 1999-00 the production level from these two sources equalled at around 2.8 million tonnes. In 2004-05, inland fishery production (3.53 million tonnes), was considerably higher than marine production (2.78 million tonnes). Export of fish products touched 4.37 million tonnes in 2004-05 wherein 50 percent of shrimp came from brackish water aquaculture from coastal regions. Food processing industries requiring good quality water in large quantity has also grown rapidly with large potential remaining untapped particularly in northeast India. While the cultured fishery in the private sector has been growing at a satisfactory rate, the production from large water bodies like reservoirs and rivers is at a dismal level. Water quality deterioration, absence of institutional arrangement for stocking and preventing unauthorised fishing, restriction in fish movements due to dams and other hydraulic structures are some of the reasons for poor fish production in large common water bodies.

With 76 million hectare forest cover [1] and much of the marginal wastelands covered under social forestry, there is a great pressure on land for competing use. Forest lands which extend to more than 50 percent of net sown area need to be managed more holistically to create additional natural resource base and biodiversity. Management of forest as the generator and regulator of water resource needs to be understood and included in future planning processes.

Utilizable water resources

Annual rainfall in India varies widely, average being 1 170 millimetres. More than 70 percent of rainfall occurs during June to September in about 15 rainy days, the remaining occurs as winter rain and western disturbances. Parts of south India that receive return monsoon have a more distributive rainfall. Total annual precipitation of 4 000 billion cubic metres in the country [2] gets distributed through the natural process into surface run-off (1 780 billion cubic metres), evaporation (1 320 billion cubic metres) and sub-surface infiltration (900 billion cubic metres). Considering topographical, technical, socio-political and other constraints, utilizable quantity of fresh water has been estimated as 1 123 billion cubic metres [2] comprising of both surface (690 billion cubic metres) and groundwater (433 billion cubic metres).

Distribution and occurrence of Groundwater (GW) in the country is also highly variable both in time and space. The alluvial tracts of Gangetic and Brahmaputra plains are rich in groundwater with multiple aquifer system that calls for large scale development. Sandstone, limestone, schist and other semi-consolidated aquifers of the central and western regions are moderately yielding and need selective development. The weathered and fractured basalt and granitic formations of Maharashtra and south India are poor aquifers. Hill regions are generally poor in groundwater occurrence as the sub-surface water tends to flow away as springs but the foothill regions comprising of piedmont deposits are rich in GW usually at deeper zones. Fresh and saline water in the coastal aquifers occur under a delicate hydrostatic balance, the interface of which can be disturbed easily inviting salinity ingress by over-pumping the fresh water.

India has more than 6 million water bodies of size larger than 0.5 hectare. In addition to groundwater recharge, these water bodies serve numerous other functions such as providing water for irrigation, drinking, bathing, washing, fish rearing, recreation etc. Many urban water bodies are also used conveniently for disposal of waste water. Wetlands that provide a variety of ecological services need conservation as rapid urbanization is leading to encroachment of many of these water bodies including flood plain areas, for housing and other land uses.

Irrigation development

The country has been categorized into regions receiving average annual rainfall less than 750 millimetres (30 percent), 750 - 1 250 millimetres (42 percent), 1 250 – 2 000 millimetres (20 percent) and above 2 000 millimetres (8 percent). Consequently, farmers of a region tend to select crops as per availability of water and end use of the crop. In rainfed areas, the time and amount of rainfall matching to the water requirement of crops are more important than the total annual precipitation per se. Development of local water sources therefore play an extremely useful role in providing protective irrigation in rainfed areas.

Starting with 22.6 million hectares in 1951, total irrigation potential created in the country by the end of the Tenth Plan period (2002-07) has been 102.77 million hectares [3] which includes 42.35 million hectares from Major and Medium Irrigation (MMI) projects and 60.42 million hectares from Minor Irrigation (MI) projects. Irrigation development from MI projects constitutes mainly the use of irrigation tanks (14.31 million hectares) and groundwater (46.11 million hectares). A considerable gap exists between the potential created and utilized. The present utilization has been estimated as 87.23 million hectares of which 34.42 million hectares is attributed to MMI projects and 52.81 million hectares to MI projects (Annexure - I).

An area of 7.56 million hectares is affected annually by flood of which 3.55 million hectares is cropped area [4]. The annual loss is estimated as Rs 13.47 billion. So far, the attempts to mitigate the effects of floods have been made by constructing embankments (33 630 km), drainage channel (37 904 km) and raising 4 706 villages above flood level [4]. Early warning system helps to a certain

extent but the answer to moderate flood occurrence and its effects lies in afforestation and creating water storage structures in the catchments areas, including judicious land use of the flood plains. Joint action plans with the neighbouring countries are required while dealing with Transboundary Rivers.

Future concerns

All is not well with Indian agriculture. The days of early growth are now a matter of the past. Saturation and stalling in production patterns have started emerging. Foodgrain production in the Tenth Plan period was less than that of the Ninth Plan period. Per capita foodgrain production is now at the level of 1970s. The country appears to be on the verge of becoming net food deficit in the near future from food surplus till recently. Urgent measures are required for enhancement of productivity in the entire agriculture sector.

Despite huge public investment, the gross irrigated area under MMI projects (42.35 million hectares) is still less than the area being irrigated from groundwater (46.11 million hectares). Common public criticisms about large irrigation projects are that these are environmentally degrading, have poor return on investment, cause large scale wastage of water, cause loss of soil fertility and crop diversity, and require expensive repair and maintenance. Cost of developing irrigation potential under MMI projects has been increasing steadily and is estimated presently at Rs 1 75 000 per hectare [4]. A review of the prevailing irrigation policy and priorities has become imperative.

Water resources in 24 major river basins have been assessed as 1 952.87 billion cubic metres (Annexure - II). Population in 4 river basins is already facing water scarcity and in 5 basins there exists a water stressed condition [5].

Water conflicts have already started being manifested in different forms within and between States.

Based on analysis in 5 723 blocks (excluding the hill areas) in the country, groundwater utilization has been found to be over-exploited in nearly 15 percent, critical in 4 percent, semi-critical in 10 percent and safe in 71 percent blocks [3]. Owing to uncontrolled extraction, more blocks are joining the rank of over-exploited category. Annual draft in 2004 was 53 percent of the total utilizable groundwater resource (433 billion cubic metres) which since then is likely to have increased considerably. The above statistics somehow do not reflect the field level realities in perspective. Over-extraction of groundwater has led to an alarming decline in water level rendering millions of shallow dug wells dry in hard rock areas that cover nearly two-third of the country.

National Commission for Integrated Water Resource Development Plan (NCIWRDP) [6] has adapted the figures of 1 581 and 1 346 million as the high and low projected population of India by the year 2050. Total food requirement for the population works out to be 449 million tonnes and 382 million tonnes as the high and low estimates. Therefore, total food requirement in 2050 would be nearly double the present production. In order to achieve this kind of target, food production needs to be increased at the rate of 5 million tonnes per year. NCIWRDP has also predicted that at the prevailing rate of water utilization practices, by 2050 India's water demand will exceed all available sources of supply. The country, therefore, cannot afford to continue with business-as-usual and must undertake urgent steps to judiciously manage its land and water resources to meet its future challenges of food production, poverty reduction and economic growth.

Although water is a "State subject", the Planning Commission and the Ministry of Water Resources play a key role in policy formulation in general and management of Inter-State River water in particular. A large number of financial institutions, development agencies, policy and research institutions, universities, corporate sectors and NGOs are also involved directly or indirectly in the development of this vital natural resource. Major programmes of the concerned Ministries and contributions from international agencies in management of water for the agriculture sector are briefly discussed below.

Ministry of Water Resources

As the nodal agency, the Ministry of Water Resources (MoWR) is responsible for overall planning, policy formulation, coordination and guidance on all aspects of water resource development and management. The National Water Policy (NWP) [7] formulated under the National Water Resource Council in 1987 and updated in April 2002 is the first comprehensive public document laying down policy guidelines for future management of water by the States and others.

For the Eleventh Plan period (2007-12), the MoWR has proposed [4] a target of creating 9.0 million hectares of irrigation potential under MMI and 7.0 million hectares under MI. The MI would comprise development of surface water (1.5 million hectares), groundwater (4.5 million hectares) and restoration of water bodies (1.0 million hectares). In addition, 10.25 million hectares of command area development activities including development of culturable command area (3.5 million hectares), correction of conveyance deficiencies (6.25 million hectares), reclamation of water-logged area (0.5 million hectares) and flood protection works (2.18 million hectares) would also be undertaken.

A total outlay of Rs 2 31 800 crores (Rs 1 82 050 crores in State sector and Rs 49 750 crores in the Central sector) has been proposed for this Plan period. Proposed allocation for MMI, SW, GW and restoration of water bodies are Rs 1 53 000 crores, Rs 13 500 crores, Rs 20 250 crores and Rs 11 000 crores respectively. Important "issues" like repairs, renovation and restoration of water bodies, groundwater recharge, dam safety measures, and better coordination and management of water related activities have also been included.

The Working Group has also expressed concern over the large number of incomplete projects taken up earlier during various Plan periods. The number of cumulative incomplete projects by the end of the Tenth Plan period works out to be 447 including 166 major, 222 minor and 89 extension, rehabilitation and modernization (ERM) projects. The project spillover resulted due to various factors like Inter-State disputes, cost escalation, change in design, pending issues with other agencies, and resistance from affected communities etc.

Considering the number of incomplete projects, the Planning Commission had advised the States earlier not to take up too many new projects but to concentrate on completion of the incomplete projects and also to bridge the utilization gap in the existing projects. The Accelerated Irrigation Benefit Programme (AIBP) was also launched with Central assistance for completion of selected incomplete projects under Bharat Nirman. Presently, the State governments are in a huge financial stress to maintain their existing irrigation infrastructure on the one hand and undertake new projects on the other. If the status quo continues then the irrigation infrastructures in many States could soon be collapsing at a faster rate than being built.

Ministry of Agriculture

The Department of Agriculture and Cooperation (DoAC) is responsible for the formulation and implementation of national policies and programmes aimed at achieving rapid agricultural growth through optimum

utilization of the country's land, water, soil and plant resources. The Indian Council of Agricultural Research (ICAR) provides research, training and extension support.

Major programmes of the DoAC related to soil and water conservation are River Valley Project (RVP), Flood Prone River project (FPR) with the primary objective of reducing siltation of major reservoirs. The department launched the National Watershed Development Programme for Rainfed Agriculture (NWDPRA) during the Seventh Plan period. The revised NWDPRA was launched officially in 1991-92 together with a set of guidelines for implementation. The department has established a National Rainfed Area Authority (NRAA) in 2007 with the objective of facilitating and harmonizing different Central government efforts and offer expert advice to States on how to integrate these in their agricultural plans for developing rainfed areas.

The department through 19 of its divisions provides wide ranging services to farmers including timely and adequate supply of inputs such as fertilizer, seeds, pesticides, agricultural machinery, processing units etc., at subsidised rate mostly via cooperatives. It also provides support for agricultural extension, credit, crop insurance, animal husbandry, fishery, horticulture, trade, crop procurement etc. The Steering Committee on Agriculture for the Eleventh Plan has proposed a four percent growth in the agriculture sector by adapting broad strategies to improve service delivery mechanisms, extension services and gradual reduction of subsidies. The department undoubtedly holds the key to further improvement of the Indian agriculture sector.

Ministry of Rural Development

The past programmes of the Department of Land Resources, MoRD with regard to land and water management are the Drought Prone Area Programme (1972-73), the Desert Development Programme (1977-78) and the Integrated Wastelands Development Programme (1985-86). These programmes were later combined to form a single Watershed Development Programme in 1991. Formal watershed development guidelines were released in 1995 allowing both State governments and NGOs to implement this centrally sponsored programme. The guidelines were later modified in 2003 restricting participation of Non-Government Organizations (NGOs) as Project Implementing Agency (PIA). Following the suggestions of the Parthasarathy Committee report, the guidelines was further revised in 2008.

World Bank

Until 1992, India was the biggest borrower of World Bank in water related investments. In the post 1992 period the Bank undertook some visible efforts at public sector reforms in electricity, irrigation and water supply sectors. The National Water Policy, 1987 was used to create reform debates within India which helped in transforming the issues from technically oriented priorities to the policy level. Overall policy dialogue on water in India was in the line of the Bank's general water policy which is equally relevant to India. Since 1991, the Bank has also been making substantial contribution in Rural Water Supply and Sanitation projects with good progress which culminated in to its commitment to the Millennium Development Goals (MDG). The recently introduced Participatory Irrigation Management (PIM) modules covering both canal and tank irrigation projects in Andhra Pradesh, Madhya Pradesh, Orissa, Karnataka and Tamil Nadu have opened up new water management opportunities. World Bank reports also advocate the need for moving away from subsidy based regimes to build a strong foundation for a highly productive, internationally competitive and diversified agriculture sector in India.

Department for International Development, UK

Department for International Development (DFID) provides mostly grant-in-aid to selected programmes in India. Almost the entire funding of DFID is committed towards achieving the Millennium Development Goals (MDG) related to drinking water and

poverty alleviation which are implemented through the concerned State governments. Future focus of DFID is expected to shift more towards technical cooperation. The on-going programmes having relevance to the agriculture sector are the Rural Livelihood Projects being implemented in Karnataka, Andhra Pradesh, Madhya Pradesh, Orissa and West Bengal. Although funding support of DFID in India is quite substantial, it does not enjoy commensurate visibility in the country. DFID also supports programmes in partnership with other funding agencies such as WB and IFAD and has scope for adding new partners.

Asian Development Bank

Following the stakeholder consultations for identifying priorities for the period 2008-10, the Asian Development Bank (ADB) acknowledges the need for providing greater development assistance for sectors such as agribusiness, rural finance, rural roads, irrigation and improved water resource management. Priority regions identified are States such as Assam, Chhatisgarh, Jammu and Kashmir, Uttarakhand, and Northeastern states where greater assistance in capacity building is required. The water resource projects funded for the period 2008-10 include irrigation management transfer in Orissa and Chhatisgarh following the PIM approach. ADB also plans to support integration of small farmers in Bihar and Maharashtra for supporting larger agricultural value chains through investment in infrastructure, market information and capacity building.

Others

Many international development agencies like Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), International Water Management Institute (IWMI) and The European Commission's Delegation to India, to name a few have been generating, through their on-going programmes, valuable lessons useful for improving water management in the agriculture sector. FAO has supported execution of seven projects related to community based management of land and water in Andhra Pradesh, Karnataka, Uttar Pradesh and Tamil Nadu. FAO assistances are focussed more in supporting the on-going development efforts of the country through capacity building, gender empowerment, research, training, documentation, sector reform etc., than supporting development of physical infrastructure.

3. Development strategies

National Water Policy

Water resource development strategy of the country should essentially flow from the National Water Policy. For this, the policy document should be updated from time to time based on the assessment of situations. The need for improving the present National Water Policy (2002) has already been suggested by various agencies.

While reviewing the NWP-2002, a World Bank publication [8] advocates, amongst other, the urgent need for enactments of legal and institutional changes in India to enable the Union Government to perform its regulatory responsibilities with regard to monitoring the water sector and management of Inter-State basins. It suggests further that while the Government remains the main actor in the primary sector such as irrigation, private sector players could be allowed in the secondary and tertiary sectors of water use. Pricing of water in command areas also needs to be decided not by an administered mechanism but through market dynamics.

Some civil society organizations [9] consider the NWP-2002, a lost opportunity, as it was formulated as an internal document in the Ministry without consulting outside agencies. It did not deal with important controversies relating to water as a "commodity" versus "common good" and the desirability of water markets while including private sector participation. Also, decentralized water harvesting and community management of water found no mention in the document. The document certainly took note of the emerging environmental concerns, priority of drinking water, need for financial and physical sustainability but perhaps not adequately. Despite the intention of shifting focus from projects to integrated water resource management, it continued to encourage large irrigation projects. While the need for a well developed information system has been highlighted in the policy, the need for open access to this information has not been mentioned.

Water policy frameworks

More than 90 percent river basins in India are Inter-State. As per Constitutional provisions, the regulation of water in an interstate basin is within the ambit of the Union provided the Parliament indicates through an enactment that such regulation is in national interest. In the absence of any specific enactment empowering the Union, the decisions are vested with the States. So far the Parliament has enacted very few Acts empowering the Union to take executive action about the regulation of interstate basins.

Surface water is a State property which is developed and provided to various users who do not have well defined rights. When a State wants to execute a project within an Inter-State basin, usually it tries to reach a negotiated agreement with the contending State, often the Union acting as an honest mediator. In case of serious disputes, a State can refer to the Union to resolve the dispute through adjudication by a water dispute tribunal. The tribunal award is not subject to an appeal.

Groundwater to the contrary is a property of the person underneath whose land it occurs having its origin in the Transfer of Property Act, 1882 and Land Acquisition Act, 1894. Since environment as a "subject" does not find a mention in the Constitution, the Union has initiated an attempt to control groundwater extraction through the Environment (Protection) Act (1986). Following the direction of the Supreme Court of India, the MoEF in 1997 constituted a Central Ground Water Authority (CGWA) to regulate and control groundwater extraction under this Act. Consequent to the directive, any person drilling a new borewell would require technical clearance from the authorized groundwater department of the State. The Act by itself without necessary empowerment of the Ground Water Authority has so far not been very effective in controlling groundwater over exploitation.

It is generally felt that water being a limited resource of such vital importance, its use can no longer be left to the judgments of respective State governments with differing capacities and priorities. The suggestion that water be included in the "concurrent list" of the Indian Constitution does not go well with the State governments. As the large infrastructure based irrigation projects have been generating large financial liabilities, the need for urgent policy reforms can no longer be ignored. Considering Indian socio-political realities, reforms should encourage more decentralized community projects.

Multi-sector demand and allocation

More than 80 percent of present water use is for irrigation. Although the NWP-2002 has attributed highest priority to drinking water but has not set any specific percentage of allocation. Many practitioners feel that at least 20 percent share of water should be kept reserved for other non-irrigation use such as domestic, industrial and ecological services. It has, however, become apparent that irrigation cannot continue to consume more and more water.

There may be a case for de-linking drinking water from domestic water in the future. While the per capita requirement of drinking water is just about 4 litres per day conforming to an acceptable quality standard, domestic water requirement varies from 200 litres per day to 350 litres per day of untreated raw water per family of four members. The demand for domestic use of water would keep increasing in India due to increasing wastages associated with improving quality of life. In future while bottled water and desalination would be the main sources of drinking water, roof water harvesting would play a considerable role in meeting domestic water requirements.

Conflicts over the access and control over water have aggravated in recent years owing to rising populations, erratic rainfall and growing water shortages. These conflicts can be best addressed by developing suitable frameworks, policies and mechanisms for this purpose. To begin with, multi-stakeholder forums are to be established and river basin management is to be planned centrally in the context of flood mitigation and Inter-State allocations. The basin level committee would also be required to lay down guidelines in water management taking into account the needs for agriculture, drinking water, environment, ecology, climate change adaptation etc.

Interlinking of rivers

The concept of interlinking of rivers is based on the premises that instead of allowing the excess water in the north Indian rivers to flow to the sea, the surplus water can be transferred to south India to add to its prosperity. One part of the proposal suggests connecting Brahmaputra with Ganga and transferring Ganga water by pumping over Vindhyachal hills to Narmada. The other part proposes connecting the peninsular rivers interlinking (i) Mahanadi-Godavari-Krishna-Penner-Cauvery, (ii) interlinking of West flowing rivers, (iii) Ken-Chambal link, and (iv) diversion of West flowing rivers.

The opponents of the concept view the proposal a step towards committing stupendous national disaster. First of all, there is no guarantee that any donor State would come forward with an objective assessment of "excess water" as some water is also required for maintaining the flow to the sea to meet the environmental flow requirements. Secondly, arriving at an agreement on the share of each State for the huge construction and pumping costs would be a task by itself. It has been pointed out by others [10] that even after transfer water will not reach a large part of dry areas due to topographical constraints.

NCIWRDP has observed that there seems to be no compelling necessity for massive water transfer. The country cannot take a hasty decision on a project which has huge ecological, economic and social stakes. The manner in which the proposal is being propagated is unprofessional. In the absence of an impartial and cautious approach right from the pre-feasibility studies, the proposal will be unacceptable on social, economic and

ecological grounds. Although the National Water Development Agency (NWDA), MoWR has been working for many years on developing this proposal, there is a need for an independent evaluation to look into the prospects and problems of this proposal even for an adaptation to a limited scale.

Conservation of water

Irrigation water can be saved in a number of ways. At the farm level, instead of flood irrigation, ridge and furrow and border method of irrigation save more water. Use of portable pipes and sprinklers is ideal for decreasing both the transmission and application losses. Use of drip irrigation in horticulture and row crops is extremely useful in growing cash crops with limited water. Improved agronomical practices like mulching, zero tillage, Integrated Pest Management (IPM), use of compost etc., are important water saving measures through conservation of soil moisture. Recent trials have shown that rice grown following the System of Rice Intensification (SRI) technique consumes much less water while producing higher yield [11] thereby opening up new opportunities for growing rice in rainfed areas.

Government policies like providing free electricity to groundwater farmers and maintaining low water pricing for command area farmers are intended to assist them to grow more food. However, these policies become counter productive as far as water saving is concerned. Availability of excess water at no additional cost tends to make farmers to over irrigate ignoring water requirement of crops. Over irrigation or tendency to store large volume of water is also common amongst groundwater farmers especially when electric supply is irregular with prolonged gaps. Farmers in rainfed areas where each farmer cannot afford his own water well, resort to purchasing water from a neighbour - a well researched practice known as "water market". Although water markets allow exploitation of poorer farmers but this is an effective mechanism in encouraging optimum water utilization by a cluster of farmers. Creation of awareness about the limitations in water availability and market driven water pricing mechanisms are considered useful tools to encourage field level conservation of water.

Pollution control and mitigation

Pollution control and wastewater treatment and recycling deserve much more attention than they get at present. The actual quantity of water used consumptively by most industries and households is much less compared to the large quantity of effluents they produce with various degrees of pollution. In fact, water polluted is water lost from the fresh water system as far as certain uses are concerned. More than 90 percent of all water in urban areas is used non-consumptively generating large volumes of sewage and wastewater. Recycling of domestic water at household level linking it ultimately to the kitchen garden helps both in reducing water consumption and pollution. Farmers living around large cities are known to grow vegetables by pumping water directly from drains carrying sewage. The practice no doubt is harmful for the consumers particularly of raw vegetables. But there is still some unexplored scope for reusing this wastewater for agricultural use by quality improvement through engineered wetlands and / or recharging of shallow dug wells using soil as the filter materials.

Untreated effluents discharged directly into rivers cause untold damages to the aquatic lives and their entry to groundwater makes it unfit for human and animal consumption. The Central and State Pollution Control Boards have the unenviable task of monitoring and controlling water pollution by industries. An ideal situation for industrial use of water would be to achieve "zero pollution water use" whereby the industries would treat their effluent back to its original quality by installing cleaner technologies and better treatment facilities. In future, every industry would be required to prepare a quantitative and qualitative water use balance sheet to be used as the framework for monitoring its water use.

Large tracts of agricultural lands have already been lost along the coastal regions due to

increased saline water intrusion resulting from over pumping of fresh water in the vicinity. Large scale expansion of brackish water shrimp culture in coastal regions is an indicator of this phenomenon. Unless serious technical and management interventions are planned, salinity is likely to intrude further inland rendering more agricultural lands unfit for crops on one hand, and making the existing shrimp culture unviable on the other. Conservation of the natural mangroves along the coast is known to control salinity ingress inlands.

Artificial groundwater recharge

Groundwater reservoirs are known to have a much larger storage capacity than all the water that can be practically stored in surface reservoirs. Lowering of water table due to over pumping offers an additional opportunity to store more water in the sub-surface formations. While on an average, about 10 percent of annual rainfall joins groundwater as natural recharge [12], another 10 to 20 percent of rainfall can be stored in groundwater reservoirs through site specific Artificial Groundwater Recharge Structures (AGRS). Water bodies, irrigation canals and paddy fields are also known to contribute to recharge to various degrees depending upon the soil profile and depth to the water table.

The Working Group on Water Resource for the Eleventh Plan period has proposed a large allocation of fund for groundwater. Predictably, the fund would be used by the State governments for providing subsidy for tube wells and pumps in the alluvial tracts and for construction of AGRS in hard rock areas. However, to make the recharge programme effective, these AGRS are to be constructed and maintained properly. Surface run-off diverted through a dug out field drain with a silt pit connected to an abandoned dug well should not pass as an AGRS. In order to prevent groundwater pollution, only good quality silt free water should be allowed to flow into the AGRS to finally join the groundwater reservoir. The State and Central Groundwater Boards therefore have to play a greater role in preparing region specific designs as per site conditions such as geology, soil type, depth of water table, rainfall, quantity and quality of source water at site, water use pattern etc. These agencies would also be required to oversee the construction, monitoring and reporting on these structures. The programme of constructing large scale AGRS should be done in phases; these structures should be rather not constructed at all than constructed poorly. Beneficiaries under each structure are to be identified in advance and mobilized to ensure future maintenance and quality control.

Improving irrigation efficiency

The priority laid on construction of large dams by the State Irrigation Departments against effective utilization of the available water in the existing command areas is rather apparent. Official records show a gap to the order of 20 percent between the irrigation potential created and utilized, but field evidences in some command areas suggest that the extent of the gap may be as high as 50 percent. Command areas need to improve their present level of irrigation efficiency which on an average is estimated at 36 percent [3] or less [13]. Even a 10 percent improvement in irrigation efficiency would be equivalent to adding some 14 million hectares [14]. More attention needs to be focused on operation and maintenance (O&M) of the existing projects rather than constructing new ones. Command Area Development Programme (CADP) with On Farm Development (OFD) measures are known to increase water supply particularly to the tail-ends. Also release of water should be controlled as far as possible to ensure that no part of the command area receives more water than it requires.

For the purpose of irrigation, water should be considered as an economic and not a social good. The NWP-2002 has recommended fixing of water charges in command areas in such a way that it covers at least the O&M charges. Present water rates are considerably low which do not provide any incentive to the farmers to save irrigation water resulting in poor application efficiency. Lot more research is required to understand and improve efficiency at all stages of water storage, transmission and application. Tank based minor irrigation is generally considered more efficient and manageable than MMI projects. Objective cost benefit studies are required to ascertain if the country should lay more emphasis on large number of smaller projects than a few large projects.

Amongst the international agencies, the World Bank has wide ranging experience in supporting large irrigation projects. Present priority of the Bank in the country is to support more capacity building and sector reform projects than creation of irrigation infrastructure. This offers the country a great opportunity to undertake a few pilot operation research projects to fine tune the irrigation sector.

Participatory Irrigation Management (PIM)

The WB and ADB funded projects on transfer of irrigation management to the Water Users Association following the PIM Acts is a good beginning. Initial experiences of PIM have been encouraging in Gujarat and Madhya Pradesh as most projects managed to extend water to the tail-end farmers through selective repairs and construction of new field channels thereby increasing irrigated area by more than 10 percent. The most daunting challenge of mobilizing sufficient funds for regular O&M, whether raised through collection of water charges or provided by the State government, has remained unresolved.

Rehabilitation of old and dilapidated Minor Irrigation Tanks (MIT) involving the local user groups and establishment of a community fund for O&M are the potential future models for sustainable tank based irrigation management. The valuable lessons being generated in the WB and ADB funded projects need to be gathered objectively and the "good practices" shared with the policy makers for further fine tuning before upscaling. Introducing an element of simultaneous research and documentation by an external agency in close partnership with the funding agencies of these on-going project initiatives would of mutual benefit.

Demand side management of groundwater

While pursuing the supply side management approach through artificial groundwater recharge, there is also a need to develop

mechanisms for promoting demand side management to dissuade groundwater users from over-use. Under the prevailing political environment, many field practitioners including the scientists of Central and State groundwater boards are at a loss about how to go ahead with the promotion of this concept. Application of the concept has been successfully demonstrated in the Andhra Pradesh Farmer Managed Groundwater Systems (APFAGMS), a project managed by FAO, India.

The concept of demand side management of groundwater involves providing sufficient information about rainfall, seasonal availability, draft and groundwater balance amongst the user communities within a hydrological unit. Further capacity is built by involving individual well owners to monitor water level and pumping data from their own wells. A larger committee at the hydrological unit level prepares the post monsoon groundwater balance which is shared amongst all farmers. This helps farmers to make an informed decision about what crops are to be grown to what extent in the ensuing Rabi season based on whether the groundwater balance is positive or negative. The ultimate objective of the exercise is to gradually bring negative groundwater balance to positive levels over a period of few years. Application of the approach could be further strengthened by using the concept of water-energy nexus. Demand side management approach needs appropriate community institutions and works well when the common resource base has reached a critical stage which in fact is the case of most common natural resources in the country.

Development of rainfed areas

Even if the entire irrigation potential of the country is developed in the public sector, more than 50 percent of arable lands would still remain rainfed. While irrigated areas contribute to nearly 50 percent of the foodgrain production mostly rice and wheat, the remaining 50 percent contribution mainly sorghum, millet, pulses and oilseeds come from rainfed areas. Rainfed areas are increasingly using groundwater and local water sources through tanks, check dams etc. Watershed management approach integrating soil and water conservation, livestock, forest, fishery, renewable energy and income generating activities so far has produced encouraging results. Use of local water sources for protective irrigation not only stabilizes crop production but also enhances yield. Expansion of Rabi crops is becoming increasingly common in well treated watersheds.

The MoA and MoRD need to intensify their on-going watershed development programmes allowing meaningful innovations and larger participation of communities and NGOs. The advisory agencies like National Rainfed Area Authority (NRAA) and / or the National Watershed Management Agency (NWMA) have to play a vital role in improving watershed project delivery mechanisms. The prevailing practice of monitoring and evaluation of the on-going projects need to be made more effective using technically competent, independent, well respected individuals and agencies. Although a substantial quantity of soil and water conservation works could be undertaken at large through National Rural Employment Guarantee Schemes (NREGS), however, these works should be seen more as complementary inputs rather than being directly linked as an integral part of a well designed watershed development project.

It is often argued that an increased number of decentralized water harvesting structures in watersheds, cause a reduction in water storage to the existing projects downstream. This is undoubtedly true but such change should be acceptable since it does not violate any natural justice whereby people in the upstream only use their own water. Increased use of a part of harvested water in the upstream would help to improve their agriculture based livelihoods, moderate flood effects and bring about larger equity. Reduction of water in the existing storage structures downstream would eventually lead to an improved water use efficiency in these projects.

Improving soil health

Substantial crop lands within some command areas particularly in the Ganga canal area have already been affected by soil sodicity. Chemical amelioration of these lands has been producing satisfactory results but due to lack of drainage, more lands are becoming sodic than being reclaimed. The technical solution for providing drainage is not easy as this requires a regional approach. Large scale soil erosion and land degradation have also been taking place in the arid and semi-arid regions primarily due to shortage of humus in the soil usually derived from biomass. Excess rainwater erosion has turned a large tract in central India into ravine land. The MoA needs to undertake on a priority basis, programmes to reclaim these degraded lands for productive uses. In order to improve soil health, application of Farm Yard Manure, vermin-compost and IPM techniques are to be enhanced gradually to reduce the use of chemical inputs.

Climate change monitoring and adaptation

Climate change leading to overall global warming is an impending reality. Prediction models suggest the possibility of an average rise in global temperature by 3^0C sometime between the year 2050 and the turn of the century depending on how the emission of the green house gases is managed. However, the likely effects in various parts of the globe are still a matter of conjecture. Rapid melting of glaciers resulting in an overall increase of flow in the north Indian rivers and erratic rainfall increasing the frequency of flood, drought, and shift in major crop areas are predicted. Present strategy to meet this threat to the agriculture sector emphasizes on regular monitoring of the changes, increasing water storage facilities and enhancing capacity of farmers to cope with the changes.

At the national level, focus should remain on monitoring climate changes on the one hand and strengthening adaptation capabilities of the farming communities on the other. The Space Research Institutes, Indian Meteorological Department (IMD), Central Water Commission (CWC), Universities and other related agencies are well endowed to carry out the task of monitoring and research. Global collaboration of a certain nature would also be required.

Storage however does not necessarily mean large dams. A large number of smaller surface water storage facilities harvesting rainwater can bring more distributive benefits compared to a few large storage structures. Substantial storage is also possible within the existing groundwater reservoirs through artificial recharge. While construction of more surface storage structures may be considered for north India, large scale artificial groundwater recharge would be required for south India. Coastal areas would require regeneration of mangroves and engineered bio-sand dune stabilization for protection of the shore line.

Capacity building of farmers in climate change adaptation would be the best insurance against vulnerability rather than making many large scale infrastructures of doubtful benefits. Creation of pertinent awareness amongst the direct consumers of major natural resources would be the first line of defence against future threats. In order to address unpredicted setback in our food production, scientific information associated with rainfall, water requirements of crops, use of soil moisture, groundwater occurrence, effects of temperature, flood etc., are to be imparted to farmers in their own language after necessary demystification of scientific terminologies.

Trading in virtual water

It is being increasing realized that India would eventually reach a stage wherein the carrying capacity of its natural resources like land and water would no longer be able to support the demands of its burgeoning population. The immediate challenge facing India is to increase the productivity of its land and water. The concept of "water foot print" which is the quantum of water used to produce a particular product would have to be understood in perspective. At present, rice and wheat - the staple food, and sugarcane - the cash crop,

have a very large "water foot print" in many command areas. India may require in the long future to trade with other countries in "virtual water". Future trading in virtual water by India under the existing WTO regime however may not be easy. Conducting some early research studies at this stage could provide some future directions.

5. Complementary inputs from international agencies

It is being increasingly realized that the future of Indian agriculture is in trouble unless some drastic steps are taken to sustain the requisite growth. Efficient utilization of natural resources, particularly land and water, improved project delivery mechanism and development of community based institutions to sustain the created benefits are some of the areas that need further strengthening. Since the challenge is multi-dimensional, the on-going efforts both at the macro and micro levels are to be addressed in right earnest. Capacity building inputs for improving the knowledge, attitude and performance at the institutional, managerial and technical levels are to be identified and actualized. In addition to using the available internal expertise, the Government should also draw strength from the many International Development Agencies (IDA) active in the country. A broad outline of the existing opportunities and possible areas of cooperation with IDAs is presented below.

Sector reforms

In the context of holistic approach to water resource management, it is being increasingly suggested that water sector policy reforms be initiated at the basin level wherein a central agency makes water allocation for each State necessitating the States to contain their water demands within their entitlements. Such sector reforms would require establishment of water assessment committees, policy framework, institutional arrangements, guidelines etc. An IDA with global experience can help looking into the existing policy gaps, provide advisory and follow-up services in designing institutional arrangements and sector policy frameworks. Orientation programmes, for various State and Central agencies in broadening their understanding on water issues in the global perspective would be useful. The effectiveness of past initiatives, e.g. that of the World Bank in the water sector and of FAO in fishery sector reforms needs to be revisited for further building up on these efforts.

Multi-sector coordination

The largest share of available water goes to irrigation sector with an ever-increasing demand. This would eventually lead to shortage of good quality water for domestic, livestock, fishery, food processing, industrial, ecological and other sectors. Multi-sector negotiation and coordination are usually fraught with political exigencies. Services of an independent IDA would therefore be beneficial to gather an objective and balanced view on multi-sector water needs *vis-à-vis* the country's food policy. International agencies can also support development of a common information sharing platform for multi-sector players to develop integrated water use strategies for inculcating a better sense of management within each sector.

Transboundary negotiations

Many Indian River basins are transboundary in nature, management of which involves its neighbours, e.g. flood control measures for Koshi river. Consensus on water sharing, flood control measures etc. in such rivers require multi-country joint action plans under common understanding and follow-up. Since each country wants the best deal, such negotiations are best achieved with the participation of an independent intermediary; a role that could be provided by an international agency acceptable to both the parties and have access to data base from both sides. This would also provide a frame of reference for the international tribunals making its task relatively easy in the event of future disputes.

Transfer of international Good Practices

International agencies come across several commonalities of specific problems in the agriculture sector and their solutions in many countries. Many international agencies also capture the lessons learnt through follow-up evaluation activities of projects funded by them. These international agencies could

therefore act as a conduit for transferring selected Good Practices to India for adaptation after necessary fine tuning through necessary policy change initiatives.

Project formulation and technical assistance

Preparing project proposals as per the guidelines of some multilateral funding mechanisms are considered cumbersome by many local agencies preventing them from accessing such funds, e.g., Climate Change Fund of GEF. As international development agencies have a better understanding of international prerequisites, some of them could act, to the advantage of all concerned, as an interface to help potential project proponents to access these funds through assistance in project formulation, inception, monitoring and evaluation. State governments seeking WB, ADB, DFID, EC, JBIC and other credits can benefit in establishing strategic partnership with an international support agency in accessing these funds.

Improved delivery mechanisms

It is being increasingly realized that "guidelines" alone are not adequate for successful implementation of the centrally sponsored programmes unless the grassroot level project delivery mechanisms are made more effective. The approach and strategy commonly used to design and implement many projects in the country are far from sustainable and hence have wide-ranging scope for improvement. The quality of a project is known to improve by several times simply by adopting the internationally recognized Logical Framework Approach (LFA) in project design. Establishing partnership with local NGOs is known to bring out sufficient transparency in delivering project results. It is also time to consider the possibilities of promoting selective public-private partnership (PPP) models in water resource management. While the policy and planning of the primary sectors would remain within the public domain, secondary sectors, e.g. design, construction, water distribution, operation and maintenance, revenue collection etc. could be transferred to private players with strategic regulatory supports. Several well-tested models are available with many IDAs that could be used as pilots to specific advantage.

Research and documentation

A number of States have formed Water Users Associations (WUAs) – a formal three-tier structure under the Participatory Irrigation Management (PIM) Act aiming to gradually transfer the responsibilities of managing the irrigation water along with necessary controls and resource mobilizing authoritiy to the water users. Initial experiences of these projects being implemented with financial assistance from WB and ADB in India are encouraging. These projects are expected to generate valuable lessons some of which could be upscaled. Similarly, DFID has been supporting implementation of a number of poverty alleviation and livelihood improvement projects with the watershed approach. These experiences which would otherwise remain confined within the ambit of the concerned State government departments are to be shared with the larger communities in the country. The concerned State Government departments should be encouraged to organize national level experience sharing workshops with financial support from the project funding agencies. ICAR and other interested agriculture universities could undertake similar operation research projects with assistance from IDAs.

Training and capacity building

Effective capacity building and training are valuable inputs necessary at all levels including those dealing with water management policies. Capacity building for improving the motivational level and ability to deliver better results is a common requirement for many of the line departments. Development of special training modules for irrigation engineers to improve their performance as water managers could be another area to look at. Partnership opportunities with appropriate IDAs should be

sought to address specific advanced capacity building needs of Ministries, State government departments and other autonomus agencies. Capacity building of the State government departments through tailor-made training course on subjects like community mobilization, sustaining community institutions, gender mainstreaming etc., within the Panchayati Raj Instituion (PRI) framework would also go a long way in improving implementation of Centrally sponsored projects.

Promotion of demand side management models

The Food and Agriculture Organization (FAO) has demonstrated recently, the efficacy of appropriate institutional and capacity building models for demand side management of groundwater through Andhra Pradesh Farmers Managed Groundwater System (APFAMGS). FAO has produced extensive documentation for replication of this model of management. The demand side management model is also applicable for community based management of other common property natural resources. Special initiatives should be undertaken to replicate this approach in other parts of the country.

Improving climate change adaptability of farmers

Collaboration with FAO can be established in accessing updated global climate data base that would be of immense value to continue with the necessary monitoring activities by the national agencies. The FAO experience can also be accessed in designing specific modules in imparting demystified scientific knowledge to farmers on climate change and its effect on natural resource endowments that would enhance their abilities to cope with these changes. Learning through peer group facilitation in Farmers Field School (FFS), an informal way of learning tried by FAO in several other countries has proved highly effective in imparting scientific knowledge to farmers. The agriculture extension machinery which needs extensive reactivation can also learn a great deal from these experiences.

In conclusion, it may be stated that there is little doubt that the country is fast moving towards a turbulent water future which shall have serious repercussions in the agriculture sector. The business-as-usual approach is no longer tenable. Apart from getting the medium term priority framework on agriculture right, the government machinery would also have to improve on policy formulation and field level delivery mechanisms. The internal expertise available in the country also needs further strengthening. Establishing collaboration with appropriate international agencies would be of advantage in furthering the cause of Indian agriculture.

References

1. **MoEF.** 2002. *Joint Forest Management – A decade of partnership,* Ministry of Environment and Forests, New Delhi.
2. **GoI.** 1993. *Reassessment of Water Resources Potential of India.* Central Water Commission. New Delhi.
3. **GoI.** 2007. *Report of the Steering Committee on Water Resources for Eleventh Five Year Plan. 2007-2012.* May, 2007. Government of India, Planning Commission.
4. **GoI.** 2006. *Report of the Working Group on Water Resources for the Eleventh Five Year Plan.* (2007-2012). Ministry of Water Resources.
5. **World Bank.** 1998. India - *Water Resources Management Sector Review: Report on Inter-sectoral Water Allocation,* Planning and Management, Volume II: Data and Case study.
6. **GoI.** 1999. *Integrated Water Resources Development: A plan for action,* Report of the National Commission for Integrated Water Resource Development Plan, Ministry of Water Resources. New Delhi.
7. **GoI.** 2002. *National Water Policy,* Government of India, Ministry of Water Resources.
8. **Briscoe, J. & Malik, R. P. S. (eds.).** 2007. *Handbook of Water Resources in India,* Development, Management and Strategies, The World Bank, Oxford University Press.
9. **Iyer Ramaswamy.** 2002. *Economic and Political Weekly,* New Delhi.
10. **Singh, S. R. & Shrivastava, M. P.** 2006. *River Interlinking in India - The dream and reality.* Deep & Deep Publications Pvt. Ltd., New Delhi.
11. **Uphoff, N.** 2002. *Presentation, The System of Rice Intensification (SRI): Opportunities for meeting Food and Environmental Security,* Ministry of Agriculture.
12. **GoI.** 1984. *Ground Water Estimation Methodology.* Report on the Ground Water Estimation Committee, Ministry of Irrigation.
13. **Vaidyanathan, A.** 2006. *India's Water Resources, Contemporary issues on Irrigation,* Oxford University Press, New Delhi.
14. **Chopra, K., Hanumantha, Rao & Sengupta, R. (eds.).** 2003. *Water Resources, Sustainable Livelihoods and Eco-System Services,* Indian Society for Ecological Economics, Concept Publishing.

Annexures

ANNEXURE I: Irrigation potential created and utilized in India

In Million Hectare (m ha)

Sector	Ultimate irrigation potential	Potential created			Potential utilized		
		Till end of Ninth Plan	Projected in Tenth Plan	Total	Till end of Ninth Plan	Projected in Tenth Plan	Total
MMI	58.47	37.05	5.30	42.35	31.01	3.41	34.42
SW	17.38	13.60	0.71	14.31	11.44	0.56	12.00
GW	64.05	43.30	2.81	46.11	38.55	2.26	40.81
Sub Total	81.43	56.90	3.52	60.42	49.99	2.82	52.81
Total	139.90	93.95	8.82	102.77	81.00	6.23	87.23

Source: NCIWRDP, 1999

ANNEXURE II: River basin wise water distribution in India

River basin	Catchment area, million hectares	Average annual SW availability, billion cubic metre	Replenish able GW resource, billion cubic metre	Estimated population (1991), million	Per capita availability, Cubic metre
Indus	32.13	73.31	26.55	41.90	2383.29
Ganga	86.15	325.02	171.0	356.8	1950.73
Brahmaputra & Barak	23.61	585.60	35.07	35.24	17612.66
Godavari	31.28	110.54	40.6	53.98	2799.93
Krishna	25.89	78.12	26.4	60.78	1719.64
Cauvery	8.12	21.36	12.3	29.33	1147.63
Subarnarekha	2.92	12.37	1.8	9.46	1497.89
Brahmani-Baitarani	5.18	28.48	4.05	9.77	3329.58
Mahanadi	14.16	66.88	16.5	26.6	3134.59
Penner	5.52	6.32	4.93	9.7	1159.79
Mahi	3.48	11.02	-	10.48	1051.53
Sabarmati	2.37	3.81	-	10.58	360.11
Narmada	9.88	45.64	10.8	14.70	3839.46
Tapi	6.51	14.88	8.27	14.80	1564.19
West flowing rivers	-	-	28.9	-	-
(a) Tapi-Tadri	5.59	87.41	-	25.80	3387.98
(b)Tadri-Kanyakumari	5.62	113.53	-	32.6	3482.52
(c) Kutch, Sabarkanta, Luni	32.19	15.10	-	22.1	683.25
East flowing rivers	-	-	18.2	-	-
(a) Mahanadi-Godavari	8.66	22.52	-	23.60	954.24
(b) Penner-Kanyakumari	10.01	16.46	-	45.2	364.16
(c) Inland drainage in Rajasthan	6.0	-	-	7.1	-
Minor rivers flowing into Myanmar and Bangladesh	3.63	31.0	-	2.1	-

Source : CWC, modified by World Bank, 1998

Natural Resources Management

Prepared by

C L Trisal

About the author

Dr Chaman Trisal was a renowned natural resource management expert with experience of over three decades on conservation and sustainable management of natural resources. He led regional and national conservation initiatives on wetlands, rivers, forests and biodiversity in several parts of India. He also played an instrumental role in developing national wetland programme and promoting conservation of wetlands in Asian region through international treaties particularly Convention on Wetlands (Ramsar Convention) and Convention on Biological Diversity. His areas of expertise include integrated river basin management; landscape conservation planning; wetlands conservation and management; communication, education, participation and awareness; monitoring and evaluation and institutional development. He worked on a large number of conservation assignments for the National and State governments as well as projects funded by the international development agencies including the World Bank, the Asian Development Bank, Ramsar Convention, India Canada Environment Facility, DGIS, Department for International Development etc.
Dr Trisal headed the South Asia Programme of Wetlands International, an international organization dedicated to conservation and wise use of wetlands globally.

Contents

Executive summary

Natural Resources broadly include forests, agriculture, livestock, grazing lands, water, soil, and air as well as ecotonal systems like wetlands. They play a cross cutting role in sustaining economic development through their ecosystem services. However, most of developmental planning focuses on the provisioning functions of natural resources while ignoring other services and their underlying processes that sustain these services. The main challenges in natural resources management is conservation and sustainable resource utilization for livelihood security of dependent communities. The critical linkages between resource degradation and poverty emphasizes on taking a landscape approach for natural resources management. The current programmes and activities in the sector are primarily focused on watershed management with development focus implemented through government, non-government and development agencies. Emerging trends within the sector indicate focus on decentralization of governance, water as a common theme, regional focus on natural resources - poverty linkages, knowledge base development, and technology development. Despite a huge and diversified portfolio, the sector has languished in terms of conservation as well as development outcomes, primarily attributed to sectoral and structural approaches, polarized institutional and governance arrangements, absence of adequate natural resource baselines, underassessment of contribution into economic development, and ineffective capacities. International agencies could make potential contribution to the sector by promoting natural resource management within priority river basins, inventory and assessment, mainstreaming natural resources into Climate Change adaptation policies and strategies, capacity building, and promoting innovative financing mechanisms. As a programmatic approach, the natural resources management programme could be organized along four broad themes (i) integrated river basin management, (ii) Climate Change, (iii) capacity building, and (iv) policy and governance.

1. Brief overview

Natural Resource Management – context and scope

Natural Resources (NR) broadly refer to the geophysical resources of water, soil and its productive capacities, intermediate and long term carbon stocks, biodiversity, and stability and resilience of ecosystem of which agriculture forms a part [1]. The sector includes forests, agriculture, livestock, grazing lands, water, soil, and air as well as ecotonal systems like wetlands, mangroves, and coral reefs. These form the primary life support systems, and provide the basis of all productive sectors of the economy. The natural resources play an important role in determining livelihoods of the poor and vulnerable sections of the society which derive sustenance from their endowment of natural capital and associated ecosystem services.

Integrated Natural Resources Management (INRM) aims at simultaneously reducing poverty, increasing food security and achieving environmental protection. The three key factors are inextricably linked with the health of ecosystems in which people live and work. INRM reflects these broad interactions and focuses on ecosystems rather than commodities; on underlying processes (both biophysical and socio-economics) rather than simple relationships; and on managing effects of interactions between various elements of an ecosystem directly or indirectly (ibid).

Natural resources profile of India

India has a rich array of natural resources confined within its four broad geographic regions – the Himalayan mountains, the Gangetic river plains, the Deccan plateau and the islands of Lakhshadweep, Andaman and Nicobar. Traditionally, the land use statistics have been maintained from an agricultural perspective and do not reflect the diversity of land resources in the country. The total reported land use in the country is for 304.88 million hectares, of which 142.82 million hectares is net sown area (87.68 million hectares being rainfed). Alluvial soils cover about 78 million hectares (24 percent) of the total land area and occur in the great Indo-Gangetic plains, in the valleys of Narmada and Tapi in Madhya Pradesh and Cauvery in Tamil Nadu. The black cotton and red soils cover 51.8 million hectares each, whereas less productive desert, laterite and lateritic soils are present in 37 million hectares and 12.6 million hectares respectively.

Forests form an integral component of the natural resources of the country. The country supports a rich range of forests ranging from the evergreen tropical rain forests in the Andaman and Nicobar Islands to dry alpine scrubs in the Himalayas. Between the two extremes are semi evergreen rain forests, deciduous monsoon forests, thorn forests, subtropical pine forests in the lower montane zone and temperate montane forests [2]. The State of Forest Report (2005) assesses the forest cover of the country to be 67.71 million hectares, which is 20.60 percent of its total geographical area [3]. As per assessments carried by the World Bank, roughly 275 million rural poor of the country depend on the forests for at least part of their subsistence and cash livelihoods, which they earn from fuel wood, fodder, poles, and a range of non-timber forest products [4]. Seventy percent of the India's rural population depends on fuelwood to meet domestic energy needs. Half of India's tribal population lives in the forest fringes with close cultural and economic links with the forests.

India is also bestowed with rich water resources. The country, located within the tropics, receives mean annual rainfall of 1 170 mm, which leads to an annual precipitation of 4 000 cu km [5]. The country has 14 major river systems and 20 river basins. The average annual water resources potential of the country has been estimated to be 1 869 bcm. The total utilizable water resources of the country have been estimated to be 1 123 bcm (ibid). The country, with its varied topography and climatic regimes

also supports and sustains diverse range of natural and constructed wetland habitats. Natural wetlands in the country consist of high altitude Himalayan lakes, followed by wetlands situated in major floodplain systems, saline wetlands within arid and semi-arid regions and mangroves, swamps and coral reefs within the coast. The extent of inland wetlands within the country has been assessed to be 3.55 million hectares, though the baseline suffers from lack of consistent scale and resolution.

The rich natural resources of the country are also reflected in its biodiversity. India is one of the 12 mega biodiversity countries of the world. Of the 18 global biodiversity hotspots which contain about 20 percent of the world's flora, two, namely the north-east Himalayas and the Western Ghats are located in India.

Key sectoral challenges

India supports approximately 16 percent of the world's human and 20 percent of livestock population on a mere 2.5 percent of the world's geographic area. This sheer imbalance in terms of supporting the development needs of a huge population puts tremendous pressure on the natural resources. Even within the country, great spatial and temporal variations exist in terms of availability of resources. For example, the utilizable water resource availability varies from 18 417 cum in the Brahamputra valley to as low as 180 cum in Sabarmati basin [6]. Rajasthan with 8 percent of the country's population has only 1 percent of country's water resources, whereas Bihar with 10 percent of population has just 5 percent of its water resources [7]. Similar spatial distribution incongruity exists for most of the natural resources of the country. Such anthropogenic pressures coupled with natural processes have led to severe degradation and depletion of natural resources.

The trend of degradation of natural resource base of the country is underlined by several indicators. Of the total forest cover, 43 percent (28.99 million hectares) have canopy cover less than 40 percent [3]. The situation is highly precarious in case of non-elastic land resources. As per estimates of MoEF, 80 million hectares of 142 million hectares under cultivation is substantially degraded [8]. The assessment also indicates that 188 million hectares of the country's geographical area is affected by soil degradation of various degrees, the contributing factors being water and wind erosion (86 percent), salinity and water logging (11 percent) and the rest due to depletion of nutrients. The annual soil loss of the country has been estimated to be nearly 5 billion tonnes, of which 3.2 billion tonnes (64 percent) is contributed by highly eroded to severely eroded areas such as Shivalik Hills, the Western Ghats, black and red soil areas, the northeastern States and other ravinous tracts [9]. The annual loss of production of major crops due to soil erosion in India has been estimated to 7.2 million tonnes [10]. The loss of major nutrients due to erosion has been estimated to be 74 million tones [9]. Higher erosion rates have contributed to sedimentation of river beds, siltation of drainage channels, irrigation canals and most importantly wetlands. Degradation of catchments has contributed severely to loss on hydrological regulation capacity of the watersheds, leading to greater frequency and severity of floods and prolonged droughts.

The status of water resources is quite appalling. The surface water resources are under tremendous pressure for regulation to support human demands of urbanization, agriculture, hydropower development etc. The Himalayan Rivers particularly Ganga and Yamuna that have nurtured civilizations for centuries are currently facing drastically reduced flows and deterioration of water quality due to construction of hydraulic structures and continuous dumping of industrial and domestic discharge. The number of dark Blocks and Mandals wherein there is an over-exploitation of groundwater has been steadily increasing particularly in the States with larger rainfed areas. The number of dark Blocks (> 85 percent exploitation) increased from 253 to 428 during 1984 – 99 [11]. Several examples exist of upstream water diversions without considering requirements for downstream ecosystems and livelihoods. Water allocation policies formulated are heavily biased towards rich farmers who generally own land in the

head waters pushing the weaker sections of the society to the downstream areas prone to flooding and other environmental hazards. Often these policies lead to resource use conflicts between upstream and downstream resource users ultimately leading to consequences like migration. All these issues essentially emanate from lack of basic understanding of the contribution of natural resources in quantitative terms and their overall role in the economy of the marginalized communities.

Rapid depletion of natural resources poses a threat to sustainability of economic development. An assessment of environmentally adjusted State Domestic Product cost imposed due to depletion of forests, pasture lands and biodiversity indicates reduction in Net State Domestic Product (of 2002-03) by more than 2 percent [12].

Climate Change, which has implications for overall water resources availability in the region, has severe impacts for the NRM sector in general. Some of the key indicators of Climate Change have been increasing in surface temperatures (by ~0.4^{0}C), local variations in rainfall patterns, rising trends of extreme rainfall events, rise in sea levels and melting of Himalayan glaciers [13]. Threats to natural resources are expected both directly from climate change, and unmanaged responses, e.g. focus on water regulation, expansion of irrigated agriculture etc.

BOX 1:

Natural resources degradation and poverty: Case of Loktak Lake, Manipur and Chilika Lake, Orissa.

An example of the impacts of lack of integration of NR into developmental planning is that of Manipur River Basin. The floodplain wetlands associated with Manipur River are central to ecological and economic security of the entire region through their contribution to food security, hydrological regulation and cultural identity. However, regulation of water regimes through construction of hydraulic structures for irrigation development, flood control and hydropower without considering nature and functioning of wetlands have led to decline in fisheries, loss of biodiversity and an overall, impoverishment of communities dependent upon these natural resources for their sustenance. Economic evaluation of the ecosystem services indicated that the environmental damages created by unsustainable management of water resources were four times the user charges for hydropower. A skewed resource allocation system was therefore promoted by not internalizing environment into decision making, and shifting the cost of degradation to the livelihoods of marginal wetland dependent communities.

Chilika Lake is another example highlighting the impacts of lake degradation on marginalized communities. An analysis of the restoration of the lake through hydrological intervention in case of Chilika has benefited those more who are involved in marketing of fish rather than enhancement of resource through lake intervention which has been highly acclaimed at the global and national level. This essentially highlights that resource allocation policy including access to resource use, marketing and value additions are critical factors in natural resources management which so far have not been adequately addressed.

2. Current programmes and activities

The current section provides an overview of NRM within the on-going programmes of the government, developmental agencies, non-government and corporate sectors with a primary objective to assess the current status and identify priority areas for addressal under NMTPF.

National policies and strategies

The National Environment Policy [14] is one of the strongest policy statements on conservation and sustainable use of natural resources of the country. The policy is based on the dominant theme of conservation of natural resources being fundamental to achieving livelihood security and well being, emphasizing on the positive livelihood implications of conservation as compared to resource degrading options. The NRM principles are strongly emphasized through its objectives -

i) conservation of critical natural resources;
ii) intra generational equity and livelihood security of the poor;
iii) inter generational equity;
iv) integration of environmental concerns in economic and social development;
v) efficiency in environmental resource use; and
vi) enhancement of resources for environmental conservation.

Amongst the factors emphasized, the policy advocates adoption of a precautionary approach to management of environmental resources, economic efficiency by internalizing the values of resources into decision making, and equity to entitlement and participation in decision making over use of natural resources. The policy also outlines specific actions to achieve conservation and sustainable use of specific ecosystems and resources including land, deserts, forests and wildlife, freshwater, mountains, coasts and even manmade heritage. The areas of specific thrust are regulatory reforms, environmental standards, clean technology and innovation, awareness and education, capacity building, partnerships and stakeholder involvement, research and development, and international cooperation.

NRM is also reflected in several other sectoral policies notably water and agriculture. The National Water Policy [15] besides highlighting the productive aspects emphasizes on water being part of larger ecological system and as an essential environment for sustaining life forms. The policy promotes water resources development and management multi sectorally at basin and sub-basin levels considering both surface and ground water resources. It also advocates integration of all individual development projects and proposals within the framework of a larger basin plan, including ecological requirements as water allocation priorities within other development requirements, e.g. drinking, irrigation, hydropower, industrial use, navigation etc. Similar concerns are reflected in the national agriculture policy [16] which amongst other growth trajectories emphasizes on its sustainability - technologically, environmentally and economically. The policy seeks to promote technically sound, economically viable, environmentally non-degrading, and socially acceptable use of country's natural resources to promote sustainable development of agriculture. The National Forest Policy [17] identifies maintenance of environmental stability and restoration of ecological balance as the fundamental premise. Checking soil erosion and denudation in the catchments of rivers and lakes is included as one of the key basic objectives. Human demands from forests are considered along with their overall ecological role.

The policies also indicate the role of village level institutions in governance of natural resources. This is supported through the 73rd Amendment to the Indian Constitution in 1993 which identified village level panchayats being responsible for preparing plans for management of natural resources within their boundaries. This shift indicated changeover

from centralized management of natural resources and enabled recognition of local needs, rights and control in planning and decision making.

National Action Plan on Climate Change also indicates the government priorities in responding to the emerging challenges due to climate change. The action plan identifies eight national missions on solar energy, sustainable habitat, energy efficiency, water, Himalayas, green India, agriculture and knowledge-base development [18].

Government programmes

The approach paper to the Eleventh Five Year Plan identifies protecting the environment as one of the eight major challenges facing the economy and advocates building on synergies and complementarities between environment and development. Although no specific mention of the term NRM is made in the approach paper, weak and relational references have been made within agriculture sector strategies (emphasis on water management, management of degraded land, maintenance of soil quality, agricultural research) and environment (enhancing green cover, improving water quality and emphasis on role of PRIs).

NRM programmes within the Eleventh Plan framework are presently being implemented through the Ministries of Agriculture, Rural Development, Environment and Forests and to a limited extent through the Ministry of Water Resources. The Ministry of Agriculture is implementing programmes on rainfed farming, soil and water conservation, shifting cultivation, reclamation of salinized soils and establishment of watershed development fund. The Ministry of Rural Development implements Drought Prone Areas Programme, Desert Development Programme and Integrated Watershed Development Programme. The Ministry of Environment and Forests (MoEF) implements the integrated afforestation and development of degraded forests projects scheme and also has investment plans under the national river, lake and wetlands conservation programmes.

The National Natural Resource Management Systems Programme of the MoEF and National Natural Resources Database Management Systems of the Department of Science and Technology are some of the dedicated Government programmes for inventory and assessment of natural resources.

Within the overall ambit of NRM, specific mention may be made of NRM policy and implementation within National Bank of Agricultural and Rural Development (NABARD). The policy uses watershed management as a tool for achieving NRM. NABARD has created a Watershed Development Fund, which has a cumulative sanction of over Rs 500 crores in 14 States of the country.

Programmes of International Developmental Agencies

Within the programmes of international development agencies, the World Bank, ADB, IFAD and DFID have programmes which bear strong complementarity to NRM in different aspects. The World Bank in its country strategy for India identifies 'ensuring environmental sustainability' as one of the key development goals [19]. Focus on NRM is made through the umbrella objective on 'investing in people and empowering communities'. Emphasis is made on the importance of devolution of responsibilities and rights to the local communities to achieve conservation and development. The Bank envisages to scale up its support to improved rural livelihoods through support to better management of watersheds in the rainfed areas, and to seek opportunities for poverty reduction in and around forests areas.

The Asian Development Bank's Country Operations Business Plan for India 2008–10 overlaps with NRM and appears in its emphasis to address water management alongside the three core sectors – transport, energy and urban development [20]. The 2008–2010 programme includes the following loans to help improve water resource management: Orissa Integrated Irrigated Agriculture

and Water Management Project (US$ 200 million, 2008); the North Eastern States Integrated Flood Control and River Erosion Mitigation Project (US$ 200 million, 2009); and Sustainable Coastal Zone Protection and Management Project (US$ 200 million, 2010). As a proportion of the total funding portfolio, these constitute a relatively smaller fragment.

The Country Strategic Opportunities Paper of IFAD identifies close linkage between land degradation, natural resource access and poverty [21]. NRM bears a strong overlap with all of its three thrust areas, which are (i) grassroot institutions building and institutional strengthening of support agencies, (ii) promoting and securing access to marginalized groups to resources, and (iii) promoting diversification of livelihood activities within 'on-farm' and 'off-farm' sectors. The strategy identifies semi arid tropic areas (Maharashtra, Madhya Pradesh and Rajasthan), Gangetic floodplains of Uttar Pradesh and Bihar and tribal areas in the northeastern region as priority areas for implementation.

Within the DFID country support plan for 2008-2015, NRM has been integrated into delivery of programme of work related to livelihood support, mainly concentrated in Orissa and Madhya Pradesh. The investment of DFID has been into transformation of the regular conservation focused watershed projects emphasising physical conservation works and primarily benefiting larger landowners, to people centred programmes, inclusive of all the residents of the watersheds and paying particular attention to the landless, women and other vulnerable groups. This has become known as a 'watershed plus' approach. Specific elements of the 'plus' are components for productivity enhancement and micro-enterprise promotion with earmarked funding, as part of a broader approach that includes enhanced participation, capacity building and innovation. Some of the major on-going initiatives include Western Orissa Rural Livelihood Project – Orissa Watershed Development Mission, Orissa Tribal Empowerment Programme (£ 9.8 million, 2005-2010) and Madhya Pradesh Rural Livelihoods Programme Phase II (£ 45 million, 2007-2012).

NRM within programmes of non-government agencies

The non-government agencies have played a critical role in delivering NRM at various levels, from grassroot level conservation development models to outreach at policy levels. The genesis of community participation in NRM can be largely attributed to these efforts as reflected in Arabari pilot project, West Bengal; Ralegaon Siddhi, Maharashtra; and most recently the Aravari River revival by Tarun Bharat Sangha. They also played a critical role in establishing a new genre of exemplary environmental leadership through Anna Hazare, Rajendra Singh and others. Besides watershed management, efforts have also been made through this sector for other ecosystems as wetlands. Wetlands International – South Asia has partnered with the government of India to support wetland conservation through formulation of integrated management plans at river basin level. Organizations such as Center for Science and Environment (CSE) focused on advocacy on role of natural resources in development.

Apart from the above sectors, NRM within the corporate sector implementation strategies also form a small component of investment into the sector. NRM is also emerging strongly in corporate social responsibility portfolios of large companies from the information technology, oil and gas exploration, agriculture products, water and hydropower companies.

3. Development strategies

This section aims to map the development strategies adopted for development of the NRM sector based on the review of current programmes and activities in the sector. The following emerge as the major sectoral development strategies within the country.

Decentralization of governance

In terms of governance, the NRM sector within the country indicates a definite trend towards its decentralization. A principal conclusion of review of NRM programme implementation by the Government as well as developmental agencies has been that decentralized NR management regimes, with focus on Panchayati Raj Institutions, would enhance sustainability as well as equitable access to NR particularly by the poor [22].

Water as a common theme

NRM programmes are increasingly focusing on water being a central theme within the whole gamut of natural resources being considered. This has an implication in shifting the programmatic approaches from being totally NR commodity centric (and thereby looking at NR products such as fisheries, agriculture, hydropower etc.) to spatial approaches for integrated delivery of multiple functions and services of NR. The focus on watershed management and integrated water resources management within the development portfolio is a reflection of this emerging trend. The increasing frequency of water related disasters, e.g., Indian Ocean tsunami, 2004; Bihar floods, 2008, is expected to enhance the focus on water being the central theme in NRM.

Regional focus on NR-poverty linked areas

The regional focus of most of the major implementation programmes within this sector is based on the co-existence of natural resources degradation and poverty. Thus, major segments of NR sector funds have been invested into the poorest states of the country, or target disadvantaged sections of society aiming to have a more equitable access to resources. Only few programmes cater to the needs of representative ecosystems, which need to be conserved and managed owing to their functional importance within landscapes, e.g., high altitude wetlands, coral reefs etc.

Knowledge-base development

Design and implementation of NRM programmes have been often limited by absence of information on location and extent and functionality of NR especially in terms of safeguarding economic development. Redressal of this aspect has been attempted through creating multiscalar inventories and assessments of NR. This has seen a commendable development in terms of land resources and to a marginal extent for water resources. Similarly, attempts are also being made to inventorize representative ecosystems as wetlands at a national scale.

Technology and NRM

Technological innovation for effective NRM delivery is reflected as one of the major development strategies in the sector. Accessibility and increasing user friendliness of remote sensing and spatial mapping technologies is enabling strategic representation of NR, including identification of factors leading to their degradation. This is presently playing a critical role in upscaling patch level conservation programmes to watershed level integration. Use of environmental flows is increasingly being discussed, and pilot projects undertaken for application in rationalizing water use for human and ecological purposes. At micro scales, several watershed projects have invested into development of cost effective technologies for water and soil management.

Despite a huge and diverse intervention portfolio, the natural resources of the country continue to be degraded and livelihoods of the associated communities remain under a state of continuous deprivation and duress. The primary sector, which amongst others has strongest linkage with natural resources, has reached a state of stagnation with food output languishing and millions of poor farmers struggling for survival. A perusal of sectoral economic development agenda is being done at the huge cost of natural resources degradation, which is now acting as a limiting factor to growth. Within the last decade, there has been resurgence of natural resources related disasters claiming a huge toll of lives and productive assets. Environmental conflicts are fast emerging as issues of concern. The situation is worsening with increasing impacts of climate change on natural resources extent and availability. Some of the key factors that are attributed to the under-performance of this sector are as follows:

Sectoral approaches to NRM

Effective delivery of NRM mandates a multi-sectoral and multi-stakeholder led spatial approach with a holistic view of sustainability of all development sectors without undermining the natural resource base. However, most of the NR sector programmes adopt a sectoral approach, focused largely on the development agenda, i. e., increasing food production, enhancing irrigation water availability, more hydropower generation, without sufficient integration with ecosystem functions and processes which form the very basis of production. The lack of coordination among various State agencies dealing with NR has failed to capture the critical linkages amongst various sectors. Water being the critical factor is never considered in terms of ecological demands which essentially govern productivity of natural resources. The sectoral approaches need to be revisited and commonalities identified in the context of natural resources management.

Structural approaches to livelihood – NR linkages

Most of the strategies of NR sector present poverty–NR degradation as one of the key contributing factors to programme design. However, this linkage is ineffectively internalized in most of the development programmes, leading to their limited conservation and livelihood outcomes. The linkage is often interpreted as structural, without assessing the functional linkage of ecosystem services to sustainable livelihoods. For example, achieving sustainable livelihoods within the flood prone Gangetic basin would be an enormous challenge until conservation of high altitude wetlands of the Himalayan region is effectively integrated in the intervention strategy. A mere structural approach to livelihood-NR linkage has led to incomplete responses as enhancing local flood defences.

Polarized institutional and governance arrangements

The NR sector has definitely made a progress towards decentralization of governance in favour of the PRIs. But, this decentralization has not been fully effective in ensuring participation of the poorest in NR planning and decision making. Larger farmers have been found to have higher stakes in implementation of NR programmes. Several irrigation projects have actually led to concentration of rich and powerful farmers at the head, allowing little water to flow down to the small landholders at the end of the scheme. Despite enormous investments into decentralization of NRM, institutions remain dominated by the elite and the focus of mobilization and collective action is merely directed upwards to pull down centrally allocated resources, rather than downwards to development and management of NR base.

Absence of adequate NR baselines

A critical factor limiting development of a comprehensive approach and intervention

strategy for the NR sector has been the absence of adequate inventories of the country. Most of the baselines that are available till date are related to forests, soils and to a limited extent on surface water quality. The inventories are of static nature and do not highlight ecosystem functionality in a multiscalar hierarchical representation. Several ecosystems as wetlands do not even have appropriate baselines. Absence of baselines and the extent of change in NR status reduce the effectiveness of targeting and monitoring of sectoral programmes.

Under-assessment of contribution of NR to economic development

Conventional approach to assessment of economic growth at best recognizes only the productive component of NR use, without providing a holistic picture of use of natural resource base in economic development. Thus, the contribution of NR to economic development at local, regional and national levels remains highly under-estimated and under-assessed, leading to skewed incentive systems favouring resource depletion and under-investment into conservation. Attempts at economic valuation of natural resources have remained largely theoretical exercises without practically demonstrating the macro scale consequences of natural resource degradation and depletion.

Ineffective capacities

Much of the programme investment within the NR sector has been aimed at developing community level capacities for addressing micro level NR issues. However in practice, given the multiscalar and landscape level inter-relationships governing NR, there is a need for a systematically designed capacity building strategy involving all stakeholders including decision makers, policy planners, and local communities. The efforts made in this direction have been very limited.

Effective NRM requires management of diverse sectors adopting landscape approach with well defined policies, strategies and action plans. Conservation is critical to sustainable management of resources and needs to be integrated into developmental planning.

For complementary input to the strategic areas identified, international agencies may promote dedicated NRM programmes with a strong focus on environmental resources integrating range of ecosystem services into planning and decision making. Programmatically, the four broad thematic areas identified are:

Integrated River Basin Management

This thematic area would include support to implementation of large river basin level NRM projects. Strategically, prioritization of the basins could be made on the basis of extent of food insecurity, poverty and environmental degradation. Implementation strategies could include application of innovative financing to rationalize incentive systems in NR use and allocation policies.

Climate change

Initiatives under this thematic area would focus on mainstreaming ecosystem services into climate change adaptation policies and strategies. Strategic implementation could focus on the Himalayan region and the coastal ecosystems. Implementation of conservation plans, for example under the National Wetland Programme could be considered, reviewing their implications for climate change adaptation.

Capacity building

Initiatives under this thematic area would focus on multiscalar capacity building, inventory and assessment, and research and development related to NRM. Linkages could be made with existing capacity building and research and development initiatives of the Government, and complementary support provided to strategic areas.

Policy and governance

This thematic area could focus on inter-sectoral policy dialogues and promoting good governance practices in NRM. Specific emphasis could be made to initiatives which promote equity in access and strengthen participation of the marginalized in NRM.

The specific aspects to be addressed inter alia may include the following:

Integrated River Basin Management within priority basins

Integrated River Basin Management can be promoted in select river basins prioritized on geographical situations and specificity of issues, for example declining food productivity, accentuating poverty and environmental degradation. The emphasis should be on ecosystem restoration, promoting effective governance, development of knowledgebase, capacity building at multiple levels, policy and advocacy. A key opportunity exists in promoting integrated river basin management within transboundary basins wherein international agencies would facilitate integrated management of shared river basins based on their experiences, neutrality and international mandate.

NR inventory and assessment

The international agencies should invest into integrated inventory and assessment of NR at the National level, building on the strengths of existing National programmes. The integrated inventory and assessment system should enable mapping of diverse ecosystem services, assess impacts of developmental activities and support mainstreaming of NR into developmental planning. A key element of inventory and assessment should be integrating natural resources into the conventional national income accounting estimates, which would enable translating use of these resources into economic estimates, and provide macro economic indicators which can truly reflect changes in natural resources base of the economy.

Mainstreaming NR into climate change adaptation strategies

Interventions should be targeted at highlighting the synergies of effective NRM with climate change adaptation strategies through investment into pilot initiatives across the country. The Himalayan region and the coastal region could be taken up on a priority basis for demonstration.

Capacity building

Interventions for NRM should target multiple levels of stakeholders engaged in planning and decision making over NR. A capacity building strategy should be evolved based on national level scoping exercise and needs assessment. An integral component of the capacity building strategy should be to focus on research and development particularly in areas of (i) defining critical linkages between poverty and natural resources degradation (ii) identifying factors governing natural resources at ecosystem level, and (iii) evaluation of impacts of sectoral development on NR in social and economic terms.

Innovative financing mechanisms

Application of innovative conservation financing schemes such as payments for ecosystem services to achieve rationalized incentive systems integrating conservation and development needs be promoted. Pilot projects could be focused on areas with significant upstream – downstream conflicts.

References

1. **Consultative Group on International Agricultural Research.** 2000. Research towards Integrated Natural Resources Management - Examples of research problems, approaches and partnerships in action in the CGIAR. Food and Agricultural Organization, Rome.
2. **Lal, J. B.** 1989. *India's forests: myths and reality.* Natraj Publishers, New Delhi.
3. **FSI.** 2007. *State of Forest Report – 2005*. Forest Survey of India, Dehradun.
4. **World Bank.** 2006. *India – Unlocking opportunities for forest dependant people in India: Volume I.* Agriculture and Rural Development Sector Unit, South Asia Region.
5. **Ministry of Water Resources.** 2008. *Integrated Water Resources Development and Management. Theme Paper – Water Resources Day.* Central Water Commission, New Delhi.
6. **Chitale, M.A.** 1992. *Population and Water Resources of India. Pune:* Unmesh Communications.
7. **UNEP.** 2001. *State of the Environment-India.* United Nations Environment Programme-Regional Resource Center for the Asia and the Pacific, Pathumthani, Thailand.
8. **CSWRCTI.** 1994. Annual Report (1994 / 95). Dehradun: Central Soil and Water Conservation Research and Training Institute.
9. **Ministry of Environment and Forest.** 2001. *State of the Environment,* UNEP Regional resourse centre for Asia and the Pacific.
10. **UNEP.** 1993. *Land degradation in South Asia: its severity causes and effects upon the people.* Rome: FAO.
11. **Planning Commission.** 2001. Report of the working group on watershed development, rainfed farming and natural resources management for the Tenth Five Year Plan.
12. Green Accounting for Indian States and Union Territories Project, 2008 (accessible at www.gistindia.org).
13. **Government of India.** 2008. National Action Plan on Climate Change. Prime Minister's Council on Climate Change.
14. **Government of India.** 2006. *National Environment Policy* (available at envfor.nic.in/nep/nep2006e.pdf).
15. **Government of India.** 2002. *National Water Policy.* (available at http://www.nih.ernet.in/belgaum/NWP.html).
16. **Government of India.** 2000. *National Agricultural Policy.* (available at http://agricoop.nic.in/agpolicy02.htm).
17. **Government of India.** 2000. *National Forest Policy.* (available at http://envfor.nic.in/agpolicy02.htm).
18. **Government of India.** 2008. *National Action Plan on Climate Change.* Prime Minister's Council on Climate Change.
19. **World Bank.** 2004. *Country Strategy for India.*
20. **ADB.** 2007. *Country Operations Business Plan.* India 2008 – 2010.
21. **International Fund for Agricultural Development.** 2005. Country Strategic Opportunities Paper- Republic of India.
22. **Baumann, P. & Farrington, J.** 2003. Decentralizing natural resources management: lessons from local government reform in India. Natural Resources Perspectives. Number 86.

Food and Nutrition Security and Food Safety

Prepared by

Vijay Sardana

About the author

Mr. Vijay Sardana is a well known food and agri trade expert with specialization in food safety laws. He has about twenty years experience of working in corporates, cooperatives, MNCs, industry associations, FAO, World Bank and has been involved in policy-making in various parts of the world. Mr Vijay Sardana is a PGDM from the Indian Institute of Management, Ahmedabad. He has a post graduate degree in Food Technology from CFTRI, Mysore, and in International Trade Law from Indian Law Institute. He graduated in Dairy Technology and qualified ISO-22000, ISO-9000, ISO-14000 as Lead Auditor. He has also specialized in Food Packaging, Supply Chain Management and other professional programmes related to the agrifood sector. Mr Sardana has visited US, China, UK, Switzerland, South Korea, Canada, Poland, Germany, Italy, Thailand, Barbados, Bangladesh, Nepal, Singapore etc.

He has undertaken more than 200 projects, published more than 350 papers in various trade journals and trained more than 35 000 people in the sector on various aspects of agrifood trade in about 95 cities in India. He is also the author of *A Guide Book to HACCP Implementation in Food Industries,* and has written a series of articles on managing intellectual property in agrifood business, Good Manufacturing Practices in food business, and managing supply chain and marketing of food products.

Contents

Executive summary

India has always been dependent on agriculture for its political and social stability. Since independence, the political system has focussed on the agriculture sector with a single point agenda - to ensure prosperity in rural India where about 60-70 percent of the Indian population lives. Even after almost sixty years, the situation has not improved and in many areas things are going out of control and this is clearly reflected in the growing restlessness in the rural community and growing social and political unrest.

Recent political and price trends have raised concerns regarding food and nutrition security, farmers' income, food safety and poverty. The same is also reflected in various studies and surveys carried out by many agencies both in public as well as in the private domain.

Some of the major highlights of various studies are: slowdown in agriculture growth, widening economic disparities between irrigated and rainfed areas, and increased vulnerability to world commodity price volatility following trade liberalization. This has had an adverse effect on agricultural economies of regions growing crops such as cotton, pulses, sugar and oilseeds. It has also led to uneven and slow development of technology to boost productivity, inefficient use of available technology and inputs due to lack of adequate extension services, incentives and appropriate institutions. Degradation of natural resource base, rapid and widespread decline in groundwater table, increased non-agricultural demand for land and water as a result of the higher overall GDP growth and urbanization are other areas of concern. Migration of rural youth towards cities, aggravation in social distress as a cumulative impact of the above has been reflected in an upsurge in farmers' suicides.

The major outcome of all the policies practiced is that agriculture has performed well below expectations during the two recent Five Year Plans. Cereal production has declined in per capita terms. From 320 million to 300 million, the number of the poor has declined barely by 20 million people over three decades, i.e., 1973–2005, and most of this decline has occurred during the most recent decade (1993/94 – 2004/05). Low and stagnating incomes among the poor have meant that low purchasing power remains a serious constraint to household food and nutritional security, even if food production picks up as a result of interventions in agriculture and creation of rural infrastructure. The outcome of these policies is that more than sixty years after Independence, nearly half of India's children under three years of age are malnourished. India also has the largest number of children in the world who are malnourished. Even more significantly, on an average, India's rate of malnutrition is worse than that in Africa.

When half of the population is not getting enough to eat, expecting that the rest should get safe food somewhere leads to a serious debate on the system. This is one of the reasons why policy planners have been more concerned about how to produce more food rather than how to produce safe food.

This paper compiles the required information with evidence highlighting the need for immediate action and how various stakeholders including the international community can play an important role on the subject so that food and nutrition security and safe food can be ensured to a billion plus population providing each one with a minimum of three meals a day on a sustainable basis.

1. Brief overview

The Mid-Term Appraisal (MTA) for the Tenth Five Year Plan had drawn attention to the loss of dynamism in agriculture and allied sectors after the mid-1990s. In fact, during the last decade or so Indian agriculture and food security situation has faced a number of severe challenges, superimposed on the long-term demographics.

At the beginning of the Eleventh Plan period the serious concerns around food and nutritional security were re-emphasized. Agriculture has performed well below expectations during the two recent Five Year Plans. Cereal production has declined in per capita terms. The number of the poor has barely declined by 20 million people over three decades, 1973-2005: from 320 million to 300 million; and most of this decline has occurred during the most recent decade (1993/94 - 2004/05). Low and stagnating incomes among the poor have meant that low purchasing power remains a serious constraint to household food and nutritional security, even if food production picks up as a result of interventions in agriculture and creation of rural infrastructure.

Recent trends that have raised concern regarding food and nutrition security, farmers' income, food safety and poverty are:

- Slowdown in agriculture growth
- Widening economic disparities between irrigated and rainfed areas
- Increased vulnerability to world commodity price volatility following trade liberalization. This had an adverse effect on agricultural economies of regions growing crops such as cotton and oilseeds.
- Uneven and slow development of technology
- Inefficient use of available technology and inputs
- Lack of adequate incentives and appropriate institutions
- Degradation of natural resource base
- Rapid and widespread decline in groundwater table, with particularly adverse impact on small and marginal farmers
- Increased non-agricultural demand for land and water as a result of the higher overall GDP growth and urbanization
- Aggravation in social distress as a cumulative impact of the above, reflected in an upsurge in farmers' suicides

The Approach Paper for the Eleventh Five Year Plan, unveiled by the Planning Commission, provided a vision for the accelerated growth of the economy including that for the agriculture and rural economy. The Paper seeks the opportunity to restructure policies for achieving accelerated, broad based and inclusive growth, aiming at faster reduction in poverty and helping to bridge the divide in the economic conditions amongst different segments of population. The essence of the strategy to actualize the stated vision is the rapid growth, aiming at 9 percent annual increase in the overall economy during the Eleventh Plan period (2007-08 to 2011-12). This growth target is considered attainable and feasible against the background of accelerated 7 percent annual growth achieved during the Tenth Plan (2002-03 to 2006-07) that itself was upscaled from 5.5 percent annual growth achieved during the Ninth Plan (1997-98 to 2001-02). Given the moderated population growth at 1.5 percent per year, the 9 percent targeted growth would eventually result in doubling of real per capita income in ten years.

The approach to the Eleventh Five Year Plan focuses on faster and more inclusive growth and its actualization is accordingly factorized into 4.1 percent annual growth from the agriculture sector, 9.9 percent annual growth from industry and 9.4 percent annual growth from the services sector. The Approach Paper for the Eleventh Five Year Plan acknowledges that the stimulation of agricultural growth would not be free from challenges particularly when the average annual sectoral growth had decelerated from 3.2 percent in the eighties to

TABLE 1: Average GDP growth rates - Overall and in Agriculture (Percent per year at 1999-2000 price)

Period	Total economy	Agriculture and allied sectors	Crops and live-stock
Pre-Green revolution (1951-52 to 1967-68)	3.69	2.54	2.65
Green revolution period (1968-69 to 1980-1981)	3.52	2.44	2.72
Wider technology dissemination period (1981-82 to 1990-91)	5.40	3.52	3.65
Early reforms period (1991-92 to 1996-97)	5.69	3.66	3.68
Ninth Plan (1997-98 to 2001-02)	5.52	2.50	2.49
Tenth Plan period (2002-03 to 2006-07)	7.77	2.47	2.51
2002-03 to 2004-05 of Tenth Plan	6.60	0.89	0.89
2005-06 to 2006-07 of Tenth Plan	9.51	4.84	4.96

Source: Planning Commission of India

only 1.5 percent subsequently. However, the ambition of the growth has been backed with the investment rate of 35.1 percent of GDP of which 10.2 percent of GDP investment is envisaged to be sourced from public channels and 24.9 percent of GDP investment from private sector. Thus, the investment rate looks forward to a substantial hike from 27.5 percent of GDP during the Tenth Plan and 23.8 percent of GDP during the Ninth Plan.

The slackness in the agricultural growth in the recent decade has co-existed with accelerated growth in the non-agricultural sector. This has widened the gap between the rural and the urban economy. The absence of percolation of relative economic gains in the rural economy to neutralize the effects of mounting demographic pressures has accentuated rural distress. The distress in agriculture is no longer confined only to the small and marginal farmers but is having an effect across other classes of farmers.

Thus, the accelerated growth of 4 percent, which appears to be a daunting task of doubling the existing rate of growth, is considered to be the need of the hour and would require canalising resources for ushering a second green revolution.

TABLE 2: Growth rates of National State Domestic Product (NSDP) from Agriculture (States ranked by percent of rainfed area)

State / India	Growth rate in NSDP agriculture		Rainfed (percent)	States	Growth rate in NSDP agriculture		Rainfed area (percent)
	1984-85 to 1995-96	1995-96 to 2004-05			1984-85 to 1995-96	1995-96 to 2004-05	
Punjab	4.00	2.16	3	Gujarat	5.09	0.48	64
Haryana	4.60	1.98	17	Rajasthan	5.52	0.30	70
Uttar Pradesh	2.82	1.87	32	Orissa	-1.18	0.11	73
Tamil Nadu	4.95	-1.36	49	Madhya Pradesh	3.63	0.23	74
West Bengal	4.63	2.67	49	Karnataka	3.92	0.03	75
Bihar	-1.71	3.51	52	Maharashtra	6.66	0.10	83
Andhra Pradesh	3.18	2.69	59	Kerala	3.60	-3.54	85
All India	3.62	1.85	60	Assam	1.65	0.95	86

Source: Planning Commission of India

The Planning Commission's assessment of agricultural growth is preliminary and is primarily based on demand assumption of increasing consumption as a result of faster reduction in poverty, 10 percent growth in the export of agricultural commodity and import remaining unchanged. However, there are critical issues both on demand as well as supply side and these require interventions.

Food and nutrition security - growing challenges

Outcomes in terms of protein-energy malnutrition (PEM) speak for themselves: in 1998–99, according to the National Family Health Survey-2 (NFHS-2), as much as 36 percent of the adult population of India had a body mass index (BMI) below 18.5 (the cut-off for adult malnutrition). Eight years later (2005–06), that share had barely fallen to 33 percent of the population, despite a decade of robust economic growth. Similarly, share of the under-weight children aged under three years (in the total under three years child population) had not fallen at all (47 percent in 1998–99 and 46 percent in 2004–05/06). There is a need to look at food security issues not in isolation as being confined to cereal production and consumption, but also to examine how nutritional outcomes can be improved for the vast majority of the poor.

Aged and children are the most vulnerable

Ensuring food and nutritional security, however, cannot be enough. There is far too much vulnerability in the lives of the poor and those just above the poverty line. Around 93 percent of our labour force works in the informal sector, without any form of social protection, especially against old age. With growing migration of younger rural residents to urban and fast-growing rural areas, elderly parents are often left behind in the village to cope on their own or are dependent upon women who also have to tend to the family farm, as agriculture gets feminized with growing male migration. Old-age pension is thus becoming a crying need for those dependent on insecure employment in the informal economy as well as for parents who may be fending for themselves.

Moreover, vulnerability in respect of health arises from under-funding of the public health system and its inability to provide comprehensive care, which is a major concern for a majority of the population.

Sixty years after Independence, nearly half the children under three are malnourished; this indicates that India has the largest number of children in the world who are malnourished. Even more significantly, on an average, the country's rate of malnutrition is worse than that in Africa. In fact, South Asian countries have the world's worst rate of malnutrition, and India's rate of malnutrition is among the worst in South Asia (together with Nepal and Bangladesh). Some of the best States in the country - from the nutritional status point of view, e.g., Kerala and few Northeastern States - have a rate of child malnutrition comparable to that of Africa's average rate. For the State-wise details please see the annexures 1, 2 and 3.

Food safety scenario with respect to agriculture practices

As a major agriculture based economy, use of agro-chemicals is a very common practice in food production. According to the Joint Parliamentary Committee (JPC) on Pesticide Residues, under section 2.184 of the report, no survey has been carried out to establish the daily intake of various food items including water, soft drinks and other beverages, which can be used for deciding the intake rate of pesticides. There is therefore an urgent need to initiate research studies on total exposure. Surveillance studies to identify high risk areas, seasons, foods, high risk population groups etc., to pesticide residues especially organochlorines need to be undertaken in different agro-climatic zones of the country. The data needs to be combined with dietary intake studies. Thus, exposure assessment from multiple exposure routes needs to be calculated so as to qualify the aggregate exposure. The JPC therefore suggests that

TABLE 3: Comparative demand-supply projections for terminal year of Eleventh Five Year Plan

Crops	Demand projections for 2011-2012	Range of production supply projections for 2011-2012
Foodgrains (in million tonnes)	244[a]	214-240
Oilseeds (in million tonnes)	53	45[c]
Sugarcane (in million tonnes)	340[b]	278-334
Cotton (in million bales of 170 kg each)	29	16 -50
Jute & Mesta (in million bales of 180 kg each)	10	11

Note:

a. Includes 2 million tonnes for augmenting buffer stock and average export of 8 million tonnes.

b. Includes 1.2 million tonnes for augmenting buffer stock and average export of 0.54 million tonnes of sugar.

c. The supply projection for oil seeds are based on realization of potential yield. This supply assessment would improve the self-sufficiency level in edible oils from existing 55 percent to 80 percent. However, if the level of edible oil imports to meet the domestic demand is assumed to be retained at the present level (4.7 million tonnes), the supply would require to be of 36 million tonnes of domestic production of oilseeds.

Source: Planning Commission Working Group data, ARPL analysis

in order to achieve this, a coordinated research project should be undertaken by the ICMR involving CSIR, Indian Agricultural Research Institute (IARI), National Institute of Occupational Health (NIOH), National Institute of Nutrition (NIN), Vector Control Research Centre (VCRC) and various other research centres. It is expected that building up of a vast data base on pesticide residues, its occurrence in food and environment, total intake by humans along with the long-term effects of pesticides on health will go a long way in taking appropriate control measures.

The health and environmental problems arising from pesticide use in developing countries have received widespread recognition. The Food and Agriculture Organization (FAO) of United Nations has adopted the International Code of Conduct on the Distribution and Use of Pesticides (the FAO Code) to address the issues. The earlier code has been amended to include a section on Prior Informed Consent (PIC) to enable governments to prohibit imports of certain hazardous pesticides. Many of the organochlorine pesticides are included in the Persistent Organic Pollutant (POP) category and are to be phased out gradually.

Pesticides sustain food production and control vector borne diseases. They are vital for crop production and instrumental in continuous increase in food production. The consumption of pesticides in India is one of the lowest in the world. India uses a low amount of 0.5 kg / hectare pesticide compared to 7.0 kg / hectare by USA, 2.5 kg / hectare by Europe, 12 kg / hectare by Japan and 6.6 kg / hectare by Korea. However, despite the low consumption of pesticides, India has several problems of pesticide residues vis-a-vis other countries and these have entered into food products and underground water because of -

- non-prescribed use of chemical pesticides
- wrong advice and supply of pesticides to farmers by vested interests
- non-observance of prescribed waiting period
- pre-marketing pesticide treatments during storage and transport
- use of sub-standard pesticides, effluents from pesticide manufacturing units
- continued use of persistent pesticides for public health programmes
- lack of awareness, and
- lack of aggressive educational programmes for farmers/consumers

Role of water in food safety

Since there is enough scientific data to prove that most of the serious diseases and deaths particularly in rural areas are caused due to unsafe drinking water, it is the primary duty of the State to make safe drinking water available to the people.

Future potential of the sector

Food security situation analysis - demand side issues

Overall, the economy during the Tenth Plan has surged ahead impressively and this high economic growth was expected to translate into enhanced demand pressure, consequent to higher disposable income with the consumers. This postulation has been extended to the Eleventh Plan too. In contrast to the accelerated economic growth, the deceleration of agricultural growth was witnessed during the Ninth as well as in the Tenth Plan. The production growth of several agricultural commodities, such as foodgrains, had been much lower than the population growth causing stress on supply.

However, this supply mismatch with demand did not reflect on the market. The majority of agricultural commodities witnessed either price depression, or their aggregate movement during the Plan was slower than aggregate inflation, except in the terminal year of the Tenth Plan. The weak supply co-existed with slack demand, despite relatively faster growth of economy during the Tenth Plan.

- The plausible reason for this mismatch was the concentration of accelerated economic growth in select urban pockets and its weak diffusion over larger segments of population. As a result, aggregate consumption propensity especially for foodgrains, did not get adequately stimulated.
- This phenomenon also affected the farm income adversely. Decline in farm profitability is often attributed to adversity of relative prices of agricultural products.

However, certain steps have already been taken to energize the demand impulses in the economy:

- The National Rural Employment Guarantee Scheme is likely to enhance the purchasing power of the population.
- The Eleventh Plan envisages substantial hike in the outlays for social sectors such as rural education and health that would spare household disposable income for other goods and services. The thrust on rural infrastructure and rural connectivity envisages strengthening commodity flow opportunities.
- The promotion of agricultural exports with several initiatives of agri-export zones is also expected to enhance the demand, encourage agricultural diversifications and value additions.
- The policies have been re-shaped for a congenial environment for private investment in marketing, post-harvest methods and other such measures for strengthening linkages of the farm sector.
- These on-going initiatives should supplement the augmentation of demand.

Food security situation analysis - supply side issues

There are serious supply side issues in agriculture as listed below:

- The slackness of production and declining productivity growth needs urgent attention. There is no dramatic technological breakthrough visible in the crop production system and even the existing technology appears to have not been exploited fully.
- The major supply side constraint is on account of depletion and degradation of production resources mainly land, water and soil. As a result, production response to inputs has seriously eroded.
- There is urgent need to identify the region and crop specific constraints and to address the impediments in policies.
- The priority area in the supply constraints relates to seeds. There is substantial gap

between the availability and performance of seeds in the domain of research and its availability, adoption and performance in field conditions. The lag in technology transfer is a critical area to be addressed. In this respect, constraints are highlighted on account of delivery system of research, though from ICAR's point of view, there are no constraints in research availability. Timely and adequate availability of quality seed is the core supply side issue.

- As already stated, the National Commission on Farmers has addressed this problem terming it wide prevalence of knowledge deficit existing in our agrarian structure.
- The institutional issues, delivery mechanism, credit and extension continue to be the core concern areas.
- The issue of crop diversification may need to be given a fresh look both from supply and demand perspective.
- The supply side issues also need to be addressed in conjunction with marketing and value addition linkages. Besides, the emerging market environment requires production system to be adjusted to meet specific requirements of consumption and quality.
- The supply issues also have to be dovetailed with on-going reform agenda in marketing, contract farming, fostering private investment and involvement of farmers' organizations and self help groups for integrating the production system with market.
- These developments, while offering newer opportunities for Indian agriculture, also bring to focus the risk in agriculture. Agricultural risk is prevalent on the front of production, price and also on adoption of newer technologies.
- The sourcing of seeds from numerous channels.
- Investments for improving quality for exports and global trade uncertainties are some of the additional risk dimensions.

In recent years, the stagnation in agriculture, particularly in the production of foodgrains has brought the issue of macro and micro food security to the forefront of policy consideration. India's food management system finds itself vulnerable on more than one count. The supply constraints have destabilized the flow of foodgrains procurement and food distribution. In the evolving economic environment, the market forces are apparently denting the established mechanism of public market intervention and procurement. The unprecedented increase in the prices of wheat in the marketing season 2006-07, though had benefited the price realization by farmers, but has significantly affected the consumers. On the other hand, the livelihood security of millions of people dependent on agriculture is becoming more vulnerable due to low levels of farm income caused by a whole range of factors such as endowments of fall in terms of trade, low price realization due to cheaper and unabated imports, declining level of delivery of supports and inputs, and increasing risk in agriculture. The consumption basket and consumer's profile is under-going changes, albeit in the pockets of higher dynamics of economic restructuring, and the Indian economy is becoming more market friendly and is termed as one of the fastest growing economies, albeit in a macro sense. However, the country has increasing number of food insecured people inside as well as outside the domain of the agrarian economy who cannot be left at the mercy of the market forces alone.

In the emerging economic environment of agricultural trade liberalization, there are schools of thought arguing for de-linking the issue of food security from food production self sufficiency. This argument is based on the premise that India's healthy foreign exchange reserves may take care of bridging the demand-supply gap through liberalized imports. The food policy postulations of self-sufficiency in production, equitable distribution, and price stability are, therefore, set in a more complex economic environment. This necessitates urgent attention of policy-makers and planners for repositioning the aspects of sustainable food security that have shown signs of vulnerability at the onset of the Eleventh Plan. Yet the consideration of

TABLE 4: Per capita intake of calorie and protein				
Survey details	Calorie (Kcal/day)		Protein (gm/day)	
	Rural	Urban	Rural	Urban
1983 (NSS 38th round)	2221	2089	62.0	57.0
1993–94 (NSS 50th round)	2153	2071	60.2	57.2
1999–2000 (NSS 55th round)	2149	2156	59.1	58.5
2004–05 (NSS 61st round)	2047	2020	57.0	57.0

Source: NSS report no. 513, Nutritional Intake in India, 2004–05.

livelihood of large population dependent on agriculture, with limited occupational choices in short to medium term, cannot be ignored.

The recent vulnerability of food security as reflected by the wheat production scenario of 2005-06 has further restricted the scope of diversion of land away from mainstream crops of food security. Thus, a substantial land diversion from crops to horticulture may not be a desirable proposition. Hence the horticulture sector also may have to rely more on increase in productivity rather than on area for achieving its growth.

Therefore, for meeting the growth targets, the supply side issues need meticulous attention with due consideration to zone specific requirements. In other words, what emerges is that first, per capita availability of cereals has declined, and second, the share of non-cereals in food consumption has not grown to compensate for the decline in cereal availability.

Even if the latter has grown there may well be a problem for significant sections of the population who may be feeling the distress caused by falling per capita cereal availability, and who also do not have the purchasing power to diversify their food consumption away from cereals.

In any case, the significant point is that overall per capita intake of calories and protein has declined consistently over a twenty-year period from 1983 to 2004–05, according to NSS data. Rural food energy consumption per day has fallen from 2221 to 2047, an 8 percent decline. Similarly, the urban food energy consumption fell by 3.3 percent, from 2080 to 2020. The rural protein consumption fell by 8 percent over the same period and urban consumption remained the same over the twenty-year period. Since this data is for households, it does not capture the impact of intra-household food distribution. It is well known that women and girls in poor households receive poorer quality food and less food in a normal, patriarchal household.

Taken together we have a set of overlapping problems in the country. First, the calorie consumption on average in rural areas has fallen way below the calorie norm for the rural poverty line (2400 calories). It was lower than that norm twenty years ago and on an average, it has actually fallen since then. Similarly, the poverty line threshold for urban areas for calorie consumption is 2100 and urban consumption too was lower on average than the norm two decades ago and has also fallen. It is obvious that the non-poor consume more calories on average than the poor. Hence, to allow for distributional inequity that prevails in any society, calorie availability on average in the country as a whole should be at least 20 percent higher than the per capita requirement (i.e., 2100 calories for urban and 2400 calories for rural areas). Even twenty years ago, Indian consumption of calories on an average was way below the requirements. So inevitably the poor, let alone the extremely poor, were and still are consuming calories that are way below the norm. And the intra-household allocation, not just among the poor but also among those who are marginally above the poverty line, is likely to be highly skewed against women and girls. When one combines this fact with the well-known fact (established in repeated NFHS since the early 1990s) that women and girls are less likely to

TABLE 5: Growth rate in output of various sub-sectors of agriculture (Gross value of output at 1992-2000 price)

Period	Cereals	Pulses and Oil-seeds	Fruit and Vegeta-bles	Other Crops	All Crops	Live-stock	Fishery
1951-52 to 1967-68	4.19	2.98	2.67	2.42	3.00	1.02	4.68
1968-69 to 1980-81	3.43	0.97	4.82	2.98	3.00	3.26	3.08
1981-82 to 1990-91	3.52	5.41	2.84	1.71	2.97	4.78	5.74
1991-92 to 1996-97	2.36	2.92	6.07	2.18	3.09	4.00	7.05
Ninth Plan 1997-98 to 2001-02	1.49	-1.43	4.11	3.82	2.25	3.53	2.63
Tenth Plan 2002-03 to 2006-07	1.28	4.29	2.97	3.58	2.46	3.69	3.23
2002-03 to 2004-05 of the Tenth Plan	-1.27	5.95	0.30	1.57	0.42	3.32	1.77
2005-06 to 2006-07 of the Tenth Plan	3.52	1.61	6.97	6.59	5.53	4.23	5.49

Source: New Series of National Accounts Statistics, Central Statistical Organization, Ministry of Statistics and Programme Implementation, New Delhi

access health services when they fall sick, it is hardly surprising that the sex ratio in the population is as low as it is, and falling.

Current challenges of micronutrient malnutrition control

The National Nutrition Monitoring Bureau (NNMB) report of December 2006 reveals that the consumption of protective foods such as pulses, Green Leafy Vegetables (GLV), milk, and fruits was grossly inadequate. Consequently, the intake of micronutrients such as iron, vitamin A, riboflavin, and folic acid were far below the recommended levels in all the age groups.

The data from nutritional survey of children under five years shows that the prevalence of signs of moderate vitamin A deficiency (VAD) (Bitot spots on conjunctiva in eyes) and that of B-complex deficiency (angular stomatitis) was about 0.6 percent and 0.8 percent respectively among the preschool children. Among the school age children, Bitot Spots were found in 1.9 percent, and the prevalence of B-complex deficiency and of mottling of teeth (dental fluorosis) was 2 percent each.

Challenges for food security

The future is bright for food producers but the rate of growth is putting serious pressure on producers as well consumers. In India, poor farmers are producing for poor consumers. It means both are highly vulnerable in case of a shortage of food production.

- Growth of agricultural GDP decelerated from over 3.5 percent per year during 1981–82 and 1996–97 to only around 2 percent during 1997–98 and 2004–05. This deceleration, although most marked in rainfed areas, occurred in almost all States and covered almost all major sub-sectors, including horticulture, livestock, and fisheries where growth was expected to be high. Consequently, growth of agricultural GDP has been well below the target of 4 percent set in both the Ninth and Tenth Plans. In fact, the Tenth Plan growth averaged even less than that during the Ninth Plan because, as was noted in the MTA, growth plummeted to below 1 percent during its first three years, i.e. from 2002–03 to 2004–05. There has been some upturn since then and growth has averaged more than 4 percent in the subsequent two years, with early indications that this is likely to be maintained in 2007–08 as well. This revival gives hope that at least some of the causes of recent poor agricultural performance are being reversed and that the Eleventh Plan target, set at 4 percent,

may actually be attainable. The question here is – Can India sustain this growth?

- From food and nutrition security point of view, a one-size-fits-all approach to food and nutrition management is misplaced. As there are large differences in the efficiency of implementation of the PDS among the States, it may be desirable to introduce State-specific designs and implementation strategies rather than continuing with a uniform design. Separate designs and implementation strategies may be thought of for areas with high concentration of the poor.
- Food and nutrition security is also linked to the awareness about food consumption habits and availability of food at an affordable price.
- From the social equity point of view, some distinction needs to remain between the 'poor' and 'non-poor', the nature of exclusion/inclusion errors suggests that it is much better to define 'poor' for PDS purposes as much larger than current Planning Commission estimates of the number of poor, and exclude altogether the residual 'non-poor'. If the current allocation of 35 kg per household per month continues, the present PDS off-take (rice and wheat) of about 40 million tonnes would meet PDS requirements of nearly 100 million households, i.e., roughly 60 percent more households than those defined to be poor by current official poverty estimates.
- The effectiveness of the system can also be improved by better management with the help of IT. Computerization of PDS operations and introduction of a unique ID-based Smart Card System would help in addressing the issues related to bogus ration cards, diversion of food grains, etc. The Eleventh Plan will therefore focus on improving the delivery mechanisms and the monitoring arrangements based on IT.
- There is also a need to make concerted efforts for minimizing the operational costs of the FCI from the present high levels through better management practices so that a major part of the food subsidy actually accrues to the beneficiaries.
- Attention should also be given to streamlining and standardizing the State-level taxes on procurement of foodgrains. Decentralized procurement will be further encouraged and extended to other States with potential for procurement. It is also necessary to strengthen both domestic and international trade in foodgrains by means of appropriate changes in trade policies.
- Quality of foodgrains given to the beneficiaries' should be checked. Unsafe food also leads to food and nutrition insecurity.

Food safety system

Observations by Joint Parliamentary Committee (JPC) on pesticide residues

No agency regularly monitors pesticide residues in market, samples or undertakes diet basket surveys to assess actual exposure of consumers to pesticide residues in food or water and project health risk, if any. Such activity comes under the purview of the Ministry of Health but no comprehensive regular monitoring programme is being conducted in the country. The Committee feels that such monitoring of food commodities requires to be done extensively and on an yearly basis.

Integrated food control systems

Producing food supply that is safe and are of good quality is a prerequisite to successful domestic and international trade in food. This is a key to sustainable development of national agricultural resources. All consumers have the right to expect and demand safe, good quality food.

Food control can be defined as the mandatory regulatory activity of the enforcement of food laws and regulations by national or local authorities to provide consumer protection and ensure that all foods during production, handling, storage, processing and distribution are safe, wholesome and fit for human consumption; conform to safety and quality

requirements; and are honestly and accurately labelled as prescribed by law.
The food control system is thus the official institutional set up, at national and sub-national levels, responsible for ensuring the safety and quality of the food supply. At its core an integrated food control system includes:

- food control management;
- food law, regulations and standards;
- inspection services;
- good practices and quality assurance;
- laboratory services;
- information, education, communication and training.

Consumer protection

It is the role of national, regional or even local governments to apply appropriate health and consumer protection laws. It is their job to make sure retailers, traders, importers, manufacturers and food producers in their country observe the rules. It is the mandate of new Food Safety and Standards Act to establish and improve regulatory frameworks for food control and quality assurance compatible with international requirements, based on scientific principles, and to supply technical advice and expertise for the development of integrated food control systems.

Although the final link in the food chain, the consumers themselves are also important. Advice to consumers on the storage, handling and preparation of foods at home is an essential element of the food chain approach. Improper handling and preparation by consumers can negate food safety measures introduced by other sectors at earlier stages of the food chain. Consumers thus need to be provided with adequate and accurate information on food hygiene to use food properly and, through correct storage and preparation, be able to prevent the contamination and growth and survival of food-borne pathogens.

In addition to maintaining the safety of food through home preparation, consumers also facilitate increased emphasis on food safety throughout the food chain by exerting consumer pressure for the supply of safe, quality food.

Food chain approach

The production of safe food requires all those involved along the food chain to recognize that primary responsibility lies with those who produce, process and trade in food.

The key is to strengthen each and every link in the complex process of food reaching the consumer - from the way it is grown or raised, to how it is collected, processed, packaged, sold and consumed. One weak link can mean the whole food chain collapsing. Stakeholders include farmers, fishermen, slaughterhouse operators, food processors, transport operators, distributors (both retail and wholesale) and consumers, as well as governments obliged to protect public health.

Its implementation requires an enabling and rule-based policy and regulatory environment at both national and international levels, as well as the establishment of food control systems and programmes throughout the food chain at national and local levels. Sharing the responsibility for providing safe food among all players in the food and agriculture sector - from food producers and processors to retailers and households - is mirrored by an approach in which developed countries offer developing ones the resources and experience to build their capacity to ensure their food chains are safe.

The approach includes the adoption of good practices which establish basic principles for farming, including soil and water management, crop and animal production, storage, processing and waste disposal, e.g., Good Agricultural Practices (GAP), Good Hygiene Practices (GHP) and Hazard Analysis and Critical Control Point (HACCP) systems. The ultimate aim of the food chain approach, incorporating these improved practices, is to increase the transparency of the food chain so that national and global food crises can be prevented rather than treated.

Food trade

Exports of food and agricultural products (crops, livestock and livestock products) adds up to over US$ 300 billion each year. The food trade is both an important source of foreign exchange earnings and a crucial component of food security.

Food safety and quality have become increasingly important in international trade over the last few years. Agreements reached during the Uruguay Round of Multilateral Trade negotiations and the establishment of the World Trade Organization (WTO) brought agriculture and food products under global trading rules for the first time. The inclusion of international food standards in the WTO's agreement on Sanitary and Phyto-sanitary Measures (SPS) and the agreement on Technical Barriers to Trade (TBT) provided a level playing field for countries involved in food and agricultural trade. The SPS and TBT agreements have also created new opportunities for developing and transition countries to stimulate economic development through increased food and agricultural exports.

However, weak capacity seriously limits India from taking advantage of these emerging global opportunities. Responsibility for food safety is sometimes divided among several agencies with overlapping authority, which can lead to disjointed food safety strategies. In the most extreme cases, exports from India have been banned because they fail to meet food safety standards. However, even when exporters can meet the requirements of export markets and the SPS Agreement, compliance costs can be prohibitively high.

The new Food Safety and Standards Authority will have to focus on how to strengthen the food quality and standards services. It involves a wide range of activities and programmes to meet these challenges, and State governments and food enterprises to become more competitive to capitalize on growing international trading markets.

Weak bio-security systems can threaten food security and public health

Bio-security, as defined by FAO, offers a strategic and integrated approach to analyse and manage risks in food safety, animal and plant life and health, and bio-safety. It provides a policy and regulatory framework to improve coordination and take advantage of the synergies that exist across sectors, helping to enhance protection of human, animal and plant life and health, and facilitate trade.

Bio-security is emerging as one of the most pressing issues facing developed, developing and transition countries. Globalization, the increased movement of people, agricultural and food products across borders, changing agricultural practices, greater awareness of bio-diversity and the environment, uncertainties surrounding new technologies, as well as international legal obligations are just some of the factors driving this interest.

Need to have food safety mission in India

Safe food is a fundamental human right. It is an integral part of livelihood protection. Most of the times focus of research and policy-making bodies is limited to production aspects. Safe food production agenda is not getting enough attention so we need to have a mission for food safety in India.

2. Current programmes and activities

Major programmes by the Government

The National Development Council (NDC) in its 53rd meeting held on 29 May 2007 adopted a resolution to launch a Food Security Mission comprising rice, wheat and pulses to increase the production of rice by 10 million tonnes, wheat by 8 million tonnes and pulses by 2 million tonnes by the end of the Eleventh Plan (2011-12). Accordingly, a centrally sponsored scheme, 'National Food Security Mission', has been launched from 2007-08 to operationalize the above mentioned resolution.

The National Food Security Mission has three components:

i) National Food Security Mission - Rice (NFSM-Rice)
ii) National Food Security Mission - Wheat (NFSM-Wheat)
iii) National Food Security Mission - Pulses (NFSM-Pulses)

Schemes under implementation by the Department of Agriculture & Cooperation, GoI

The Department of Agriculture and Cooperation has been assigned the responsibility to formulate and implement national policies and programmes aimed at enhancement of agriculture production and productivity through optimum utilization of natural resources of land, water, soil, etc., in the country. In furtherance of this basic objective, a number of schemes and programmes are under implementation. These are listed below -

1) National Horticulture Mission
2) Technology Mission on Integrated Development of Horticulture in Northeastern States, Sikkim, Jammu & Kashmir, Himachal Pradesh and Uttarakhand
3) Micro Irrigation
4) National Bamboo Mission
5) Macro Management of Agriculture Scheme
6) Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM)
7) Technology Mission on Cotton (TMC - Mini Mission – II)
8) Jute Technology Mission (JTM - Mini Mission – II)
9) Technology Mission on Coconut
10) Agricultural Extension
11) Organic Farming
12) Agricultural Marketing
13) Risk Management
14) Agriculture Mechanization
15) Information Technology
16) Cooperation
17) Agriculture Statistics / Data
18) National Rainfed Area Authority
19) Rainfed Area Development Programme
20) Post Harvest Technology and Management
21) Development and strengthening of infrastructure facilities for production and distribution of quality seeds
22) Strengthening and modernization of plant quarantine facilities in India
23) National Food Security Mission
24) Rashtriya Krishi Vikas Yojana (RKVY) under State Plan

Efforts and approaches by other development partners

The projects in the area of agriculture which are funded by multilateral international funding agencies like WB, ADB, IFPRI, DFID, IFAD, WFP etc., for the growth of the sector is mentioned in Table 6.

Food safety programmes

Barring few financial assistance schemes and few seminars here and there for exporters there is no national strategy for food safety in the country.

MoFPI and APEDA are providing some financial support to the domestic industry for implementation of HACCP and few certification programmes. There is no serious attempt by the industry to ensure safe food

TABLE 6: List of projects in agriculture; funded by international agencies			
Project code with the name of agency	Project name	Committed	Actual disbursed
		(in Million US$)	
311 - Agriculture	Total amount through international agencies	2 803.74	981.74
0506 - IN (IFAD)	Jharkhand-Chhattisgarh Tribal Development Programme	22.828	10.122
2159 - IND (ADB)	Chhattisgarh Irrigation Development Project	42.419	3.633
2382239E (GoDE)	Minor Irrigation Programme Maharashtra	20.567	11.01
3152 - IN (IDA)	Uttar Pradesh Sodic Land Reclamation Project-II	192.214	197.46
320735E (GoDE)	Rural Water Supply Rajasthan	23.923	19.506
3332 - IN (IDA)	AP District Poverty Initiatives Project	103.476	118.33
3339 - IN (IDA)	Rajasthan District Poverty Initiatives Project	94.53	103.8
3431 - IN (IDA)	Kerala Rural Water Supply & Environmental Sanitation Project	52.655	57.857
3528 - IN (IDA)	Karnataka Watershed Development Project	81.986	80.017
3635 - IN (IDA)	Karnataka Community Based Tank Management	86.996	44.752
3681116E (GoDE)	Watershed Development Programme (Rehabilitation of Watersheds) Gujarat	11.177	0.307
3749 - IN (IDA)	Chhattisgarh District Poverty Reduction Project	98.918	48.023
3907 - IN (IDA)	Uttaranchal Decentralized Watershed Development Project	35.752	31.658
4013 - IN (IDA)	Assam Agricultural Competitiveness Project	158.395	40.367
4133 - IN (IDA)	H.P. Mid-Himalayan Watershed Development Project	59.543	22.6
4161 - IN (IDA)	National Agricultural Innovation Project	60.512	11.428
4162 - IN (IDA)	National Agricultural Innovation Project	147.911	15.007
4255 - IN (IDA)	Tamil Nadu Irrigated Agri-Modernization & Water Bodies Restoration & Management Project	152.181	14.356
4291010E (GoDE)	Watershed Development Programme Phase III, Maharashtra	17.496	3.753
4500766E (GoDE)	NABARD XI - Reform Of The Rural Cooperative Credit Structure	158.053	0
4749 - IN (IBRD)	Hydrology Project - Phase II	104.98	16.137
4846 - IN (IBRD)	Tamil Nadu Irrigated Agriculture Modernization and Water Bodies Restoration	335	22.695
4862 - IN (IBRD)	Strengthening Rural Credit Cooperative Project	300	25.725
624 - IN (IFAD)	Livelihood Improvement Project for the Himalayas	40.034	10.32
7726233E (GoDE)	SEWA Bank: Capitalization of Rural Financial Intermediate	4.384	0.861
8380662E (GoDE)	Watershed Development Programme - AP	7.627	1.909
967 - IN (IFAD)	Livelihood Improvement Project for the Himalayas	0.1	0
IDP -133 (GoJP)	Chhattisgarh Sericulture Project	9.351	10.497
IDP - 134 (GoJP)	Manipur Sericulture Project	30.747	36.153
IDP - 161 (GoJP)	Rajasthan Minor Irrigation Improvement Project	107.85	0.078
IDP - 181 (GoJP)	Andhra Pradesh Irrigation & Livelihood Improvement Project	204.254	1.123
NLGG009E (GONL)	Training Women in Agriculture - Gujarat Phase – II	3.509	2.368
TEST (IDA)	Test Loan for FMR testing	10	2.863
UKGG023(GoUK)	Western India Rainfed Farming Project-II, date 21-4-99	24.021	17.021

Source: Ministry of Finance, Government of India.

to consumers because there is no national strategy and action and research programme to ensure safe food in India.

The focus is only on export consignments and there is no focus to ensure safe food for citizens of India. A large number of imported products are also violating domestic food laws.

Industry associations are not aggressive in raising the issue of food safety because they are not sure how the political system and administration will react to their demand for safe food production in India. The political system is not keen to address the issue of safe production at the farm level because they too are not sure how of the farmers' reaction to their policy initiative. This is a classic public policy conflict where public health is in direct conflict with vote bank politics. No one is willing to take the lead and the country is suffering because of unsafe and adulterated food.

Bio-terrorism is now a reality in India but no policy initiative is visible and therefore no effective action plan is in place.

3. Development Strategies

The prime concern revealed by the review of agriculture in the past decade is the loss of rhythm of growth in the crop husbandry sector that had built up during the Green Revolution and had helped sustain food security in the decades of the eighties and nineties. After an impressive growth of 5.7 percent per annum during the Sixth Plan (1980-81 to 1984-85), a slackening of agricultural growth set in. During the Ninth and Tenth Plan the growth was a modest 2 percent. In contrast, the economic reforms initiated in the nineties yielded accelerated growth of the non-agriculture sector. As a result the economic gap between agriculture and non-agriculture gradually widened and in 2005-06 the share of agriculture in the total economy had fallen below 20 percent. The slow agricultural growth begun during the last decade is continuing since then. Against this background, the envisaged growth of 4 percent during the Eleventh Plan would necessitate special efforts for reversing the current trend of growth deceleration.

Core development strategies

The strategy to accelerate agricultural growth to 4 percent per annum in the Eleventh Plan requires action in the following broad areas:

- bringing technology to the farmers
- improving efficiency of investments, increasing systems support, and rationalizing subsidies
- diversifying, while also protecting food security concerns
- fostering inclusiveness through a group approach by which the poor will get better access to land, credit, and skills
- investment in irrigation and irrigation delivery systems
- information and input delivery
- product marketing
- promoting unused land access
- land pooling of owned land, or joint purchase or joint leasing and group farming
- contract farming

TABLE 7: Growth rate in area, input use, credit and capital stock in agriculture from 1980-81 to 2005-06 (Percent per year)

Parameters	1980-81 to 1990-91	1990-91 to 1996-97	1996-97 to 2005-06
Technology *	3.3	2.81	0.00
Public sector net fixed capital stock	3.86	1.92	1.42*
Gross irrigated area	2.28	2.62	0.51*
Electricity consumed in agriculture	14.07	9.44	-0.53#
Area under fruits and vegetables	5.60	5.60	2.71#
Private sector net fixed capital stock	0.56	2.17	1.17*
Terms of trade	0.190	0.95	-1.69*
Total net fixed capital	2.00	2.06	1.28*
NPK use	8.17	2.45	2.30
Credit supply	3.72	7.51	14.37*
Total cropped area	0.43	0.43	-0.10
Net sown area	-0.08	0.04	-0.22
Cropping intensity	0.51	0.39	0.12

*Note: Yield potential of new varieties released of paddy, rapeseed/ mustard, groundnut, wheat, maize and cotton; *upto 2003-04; # upto 2004-05*

Source: Planning Commission of India

Analysis of overall sector policy

The objectives of the National Food Security Mission are -

- increasing production of rice, wheat and pulses through area expansion and productivity enhancement in a sustainable manner in the identified districts;
- restoring soil fertility and productivity at the individual farm level;
- creation of employment opportunities; and
- enhancing farm level economy (i.e., farm profits) to restore confidence amongst the farmers.

The strategy suggested as per the National Food Security Mission says:

- implementation in a mission mode through active engagement of all the stakeholders at various levels;
- promotion and extension of improved technologies, i.e., seed, integrated nutrient management including micronutrients, soil amendments, IPM and resource conservation technologies along with capacity building of farmers;
- flow of funds would be closely monitored to ensure that interventions reach the target beneficiaries on time;
- various proposed interventions would be integrated with the district plan and targets for each identified district would be fixed;
- constant monitoring and concurrent evaluation for assessing the impact of the interventions for a result oriented approach by the implementing agencies.

Review of NGOs and private stakeholders' perspective

To ensure inclusive growth, encourage value addition in agriculture and allied activities and to promote globally competitive exports of quality agricultural products new institutional arrangements are the need of the day. While this is important, the persistent asymmetry in bargaining capabilities between sections of our rural communities and the corporate sector, both public and private sector players need to be taken note of. The solution lies in:

- Providing an enabling legal environment for multiple institutions to emerge: the Producer Company Act is one example.
- Ensuring that private sector companies interact in relation to marketing and technology with the federations of farmers; producer companies and cooperatives provide an avenue for small producers to come together.
- Encouraging structures which bring together profit orientation into marketing and production with latest technology.
- Ensuring that the Panchayati Raj Institutions (PRIs) have financial power to back the functional delegation thrusted on them. This will enable them to perform critical governance roles with respect to rural volunteers for extension, health and education schemes.
- Continuing to encourage the emergence of NGOs which have multiple roles as parts of information dissemination entities, watchdogs and parts of producer companies as well.
- Providing an even playing field to civil society organizations vis-a-vis Government departments.
- Promote joint management institutions of stakeholder for all activities. New legal provisions, in particular for forest management which do not give government departments the final authority to dissolve or create joint management institutions.
- Making NGOs accountable within the structure in which technical and third tier government institutions such as PRIs and gram sabhas or tribal organizations play a monitoring role.

4. Specific needs and potential areas of international cooperation

Ensuring safe food to all citizens all the time is going to be an extremely challenging task. Therefore it is important for policy planners to focus on this area more carefully to ensure good health for citizens or else all other development plans will suffer due to poor health of citizens.

Development strategy should include the following:

- quality of agriculture inputs must be ensured;
- quality of water needs monitoring;
- need to promote and support Good Agriculture Practices, Good Animal Husbandry, Good Feeding Practices;
- need to promote Good Post-harvest and Post-production Practices;
- food processing industry should be encouraged to adopt Good Manufacturing Practices, Good Hygienic Practices and Good Handling Practices; and
- consumers should be made aware of food safety and hygiene through various campaigns through schools and social group interactions.

Growing population, shrinking resources and changing technological dimensions, regulatory requirements and climate change will force India to look at the agriculture sector in more professional and proactive manner or India will face serious shortage of food supplies and the price of food for average citizen will be very high. The Government will be forced to increase food subsidy to minimize the political implication of rising food costs. In fact this may impact the overall growth story of India.

The following are the sector specific interventions which can help India in retaining food security. Indian policy planners should attract new investment in knowledge and skills to either develop, intervene or monitor the following areas -

Seeds

- Development of newer and improved seed varieties
- To ensure effective use of diversity of genetic pool
- To encourage judicious use of bio-technology to ensure bio-security without side effects on the eco-system
- To strengthen infrastructure, scientific strength and expertise
- To monitor cost of the seeds, its quality and production assurance
- Investment in seed multiplication, seed farms, certification
- Extension services to defuse inappropriate and inefficient farming practices
- To encourage seed production by farmers

Nutritional management

- To curb soil degradation
- For restoration of soil health (carbon)
- Initiate a mission for soil testing
- Policy support for balanced use of fertilizer
- Rejuvenate fertilizer use efficiency
- Dovetailing with all extension activities

Water

- To encourage efficient use of water and water harvesting
- Encourage water budgeting
- Promote appropriate cultivation practices
- Reorient incentives and disincentives related to excessive use of water
- Irrigation management – four-fold focus:
  - Replenishment of existing irrigation infrastructure that has been depreciating over the years on account of a variety of reasons
  - Unfinished irrigation projects to be completed on priority
  - Creation of new irrigation projects, and
  - Ensure substantive increase in the cropping intensity in irrigated areas

Chemicals

- Check indiscriminate and injudicious use
- Control of un-prescribed pesticides
- Qualitative and quantitative issues in pesticide application
- Strengthening coordination and adoption of integrated pest management
- National plan for bio-control measures
- Propagation of bio-fertilizers

Management of energy

- Enhance energy use efficiency in agriculture (human, bullock, mechanical and electrical etc.)
- Transform composition and consumption pattern
- Energy saving and energy transformation
- Rationalized farm mechanization
- Dovetailing research with propagation and adaptation

Pricing of the produce

- Encourage systems for better price discovery at market yard level
- Farmer should be given option to decide where to sell - either in market yard or outside
- Lack of understanding about farm management and how to calculate cost of production also leads to sale of product below the cost of production
- Mode of communication about the near by market yards must be improved to provide real time information

Analysis of the sector

The major areas of relative weakness, gaps and implementation hurdles faced by the sector, are identified and documented in consultation with stakeholders. The key factors continuing to contribute to the decelerated agricultural growth can be identified as follows:

- Stressed natural endowments
- Capital stock depletion and inadequate investment supplementation
- Fatigue in production response to application of various inputs
- Declining resource use efficiency
- Persisting technology gap and knowledge deficit in agriculture
- Weakness of the supporting institutions of research, extension, credit and marketing
- Inadequate risk mitigation measures

In the area of nutrition security, the following interventions should be evaluated. If required, NGOs and civil society should be encouraged to play an active role.

- Most of the vulnerable sections are below poverty line, children, aged and women;
- Rainfed agriculture and low productivity areas are also major areas of nutritional deficiency;
- Over-nutrition in many urban centres is also emerging as new form of malnutrition in nutrition insecurity zones;
- Implementation of food fortification programmes needs a re-look because most of them have not delivered desired result;
- Role of mid-day meal must be reviewed to deliver micro-nutrients in deficit areas;
- Need to ensure the type of quality and nutrition offered by fast food chains and restaurants to ensure proper delivery of sensible foods to vulnerable groups like children and girls;
- Traditional foods must be promoted to ensure balanced diet culture in society;
- Special focus should be given to region producing only one crop a year, due to lack of money supply nutrition intake also suffers;
- Nutritional labelling must be more consumer friendly and easy to recognize;
- There must be code of conduct for advertisement and promotion of foods to avoid inducement of consumers towards unhealthy foods.

In the area of food safety, it is important to address the following issues to ensure sustainable food and nutrition security.

- Producers and support services are not sensitive towards food safety and hygiene issues in food production.
- Food safety issues are ignored because

public services departments are not in position to deliver the basic infrastructure like clean water and handling facilities.
- The misconception that food safety and hygiene will make food expensive is also influencing public policy and decision making process.
- Lack of food testing facilities within the reach of consumer groups and consumers.
- Credibility and accountability of food safety enforcement system is very low. This is encouraging people to ignore the issue of food safety and quality because there is no system to address the grievances.
- Water quality is questionable in many production facility and production areas.
- Modern technologies like irradiation processing should be promoted as common processing facilities.
- Need to have promotion campaign to promote good practices in all aspects of food production and supply chain.
- Food safety surveillance mechanism and contaminated food recall systems must be introduced.

Areas of international cooperation

- Capacity building to address wrong notions about technology and good operating Practices and systems.
- Encouraging policy makers to have zero tolerance towards adulterated and unsafe food supplies.
- Corporate houses must direct their CSR programmes to ensure safe food to people.
- Document the success stories from around the country and from other countries and widely circulate among stakeholders with clear message on do's and don'ts.

Requirements of the Government

The common agenda for all the Governments should be to develop a strategy to accelerate agricultural growth to 4 percent per annum in the Eleventh Plan. This requires action in the following broad areas -

- Bringing technology to the farmers
- Improving efficiency of investments
- Increasing systems support
- Rationalizing subsidies towards efficient use of inputs
- Diversifying, while also protecting food security concerns
- Fostering inclusiveness through a group approach by which the poor will get better access to land, credit, and skills
- Priority in agriculture research should be given to strategic research with accountability to deliver in time bound manner
- Water management and accountability of irrigation system at all levels

Agenda for food safety

- Capacity building of concerned departments down to the grassroot level
- Food safety status surveillance system
- Cost effective recall / traceability system
- Food safety risk detection infrastructure
- Food safety risk communication strategy to inform consumers about risky foods and advice to stop buying it

Developing an action plan for food safety

All the concerned agencies are keen to have safe food production system from farm to fork, but very often the agencies involved have differences on the following issues -

- Lack of coordination and in many cases lack of communication between departments is a major concern. This is mainly due to fund constraints and overlapping jurisdiction.
- Lack of political leadership about food nutrition and food safety is also a major hurdle in motivating the field staff and concerned departments.
- Lack of budgetary support to ensure food safety for masses is not coming forward at State level.
- Lack of institutional framework to run the systems in India.

While developing an implementation plan, it is advisable to address the above mentioned points. This will help in smooth implementation at all levels.

Key development strategies

Considering the diminishing return from the earlier policies, there was an urgent need for restructuring the agriculture planning process to ensure food security and food safety.

An important innovation during the Eleventh Plan is the new RKVY with an outlay of Rs 25 000 crore, which is designed to give more flexibility to the States, as well as incentives to spend more on agriculture on the basis of properly designed district and State plans.

The RKVY provides a framework to achieve this objective since it requires that every district should draw up a district plan that fully utilizes an initial resource envelope available from all existing schemes, State or Central, including resources at district level from Central schemes such as those of Rural Development, Ministry of Panchayati Raj, Ministry of Water Resources (MoWR), and other Ministries. The District Agricultural Plan should include livestock and fishing and be integrated with minor irrigation (MI) projects, rural development works, and with other schemes for water harvesting and conservation. The State agricultural plan should be based on these initial district plans, subject to reasonable resources from its own plan and adding those available from the Centre. These should be aimed at achieving the State's agricultural growth objective, keeping in view the sustainable management of natural resources and technological possibilities in each agro-climatic region. This plan should then determine each district's final resource envelope, their production plan, and the associated input plan.

Annual targets at the start of the fiscal year should be fixed and funds for relevant schemes ensured, with implementation reviewed every quarter both at district and State level.

Most agricultural activities figure in Schedule XI of the Constitution and form part of the domain of PRIs. The 74th Constitutional Amendment Act stipulates District Planning Committees at the district level to integrate sectoral plans of a district which then get further integrated into the State plans.

The Planning Commission has already issued detailed guidelines of the Plan process which needs to be followed by the States while preparing the District Agriculture Plan as well. Unfortunately, State agricultural plans today are far from this ideal. In many cases these are only little more than an aggregation of the States' shares of CSS whose guidelines are centrally determined and whose release is often a problem. Moreover, since Central funds flow through different channels and to different levels, district plans are no more than a collection of proposals to different Central departments and since each Central department clears proposals on its own priorities, the resulting State and district plans fail to come up with better region-specific solutions. Things are, of course, somewhat better where the State plan component of the total Plan expenditure on agriculture is high, but this is becoming rare.

There is a need to ensure that adequate resources are available for agriculture from both the Centre and the State and that this be known adequately in advance for meaningful planning at district and State levels. The RKVY is an attempt to address these issues.

This is conditional on States adopting appropriate district planning and also on States maintaining a baseline share for agriculture in total Plan expenditure. The guidelines already issued give strong incentives to higher State expenditure on the sector and also stress on almost all the priorities outlined earlier in the chapter.

In this format, not only RKVY but also the work plans of existing schemes of macro-management and extension (including district-level SREPs) will be integrated into the district plans. On the basis of these, the State plan can be the basis for early discussion

between the State, the Ministry of Agriculture, and the Planning Commission so that resource envelopes can accordingly be communicated to the districts. It would allow much more integration especially with NRM, on which the NRAA could advise and also provide incentives for States to maintain the share of agriculture in their own plans. The Planning Commission, along with the Ministry of Agriculture and Panchayati Raj, has already started intensive consultation with the States to put into effect adequate and comprehensive district agricultural planning. If this works, the Centre could consider, in consultation with the States, decentralizing the administration of its CSS through empowered Regional Production Commissioners acting alongside ICAR regional coordinators so that the Central role in both research and development becomes more consistent, with the agro-economic requirements. However, the workability of this needs to be further discussed in detail with the State Government.

Potential contributions from international community

Government of India must take the advantage of global experiences. Learning from the mistakes as well as best practices of other countries can be a useful guidance while developing a new food safety system for India.

The areas where experience of global community can assist are as follows:

- There is a need to develop a compendium to list the reasons for failure of various schemes and programmes so that we do not repeat the same mistakes and a useful guide can be developed to facilitate future interventions by new officers and functionaries.
- Food security intervention can be in the form of sharing success stories with Indian policy planners of how other countries have improved their agriculture performance, what were the challenges and how these were addressed.
- On nutrition security, food fortification and consumer education is the key. Challenge is how to make them effective at the least cost, so that it can be shared with school administration.
- How to ensure food and nutrition security in areas where one crop a year is harvested. What should be the integrated model for those areas which can be linked to the market keeping women as focus of development.
- There is a need for truthful labelling of seeds and agro-chemicals to ensure the stated quality is delivered.
- Need to develop an extension system, developed and run by local panchayats and village workers to minimize their dependence on university managed and operated systems.
- An accountability system for the private sector must be developed to ensure good quality inputs for farmers / producers.
- Need to evaluate existing schemes and develop a system to converge them into a few schemes which can be manageable and deliverable with auditable tangible results.
- Success stories of food fortification and how to execute these in India will be of great help.
- Scientific support about the role of traditional foods in nutrition security and how to integrate in the mainstream food trade through food laws.
- There is a need to have a national plan for nutrition security infrastructure and delivery system.

Possible areas of cooperation

Food Safety Authority of India and professionals should consider the following options to work on the development of food safety systems:

- Assisting in emergency or crisis situations through the provision of food safety guidance like Bird Flu or major outbreaks like milk contamination etc.
- Capacity building programmes to raise awareness and knowledge among officials in government agencies at all levels and the private sector about the

importance of food quality and safety for food trade and economic development. This is vital to implement the policies in the right spirit and with the right frame of mind.

- Develop scientific justifications to facilitate food safety laws and also harmonization of food regulations and standards with Codex and other international and regional regulatory instruments.
- Discussion papers and justifications on controversial issues can be shared from the Codex Alimentarius to develop correct opinion on the subjects.
- Extend assistance to food enterprises and exporters to obtain accreditation of their quality assurance and HACCP systems.
- Professionals can also develop a formal arrangement to share inputs on emerging technologies and issues like nano-technology and global warming and their implication on food safety in India.
- Professionals can assist Food Safety Authority of India (FSSAI) in establishing and improving national regulatory frameworks for food control and quality assurance compatible with international requirements, keeping ground reality in mind.
- Professionals can assist in developing guidelines and tools on food safety risk assessment and its use in food safety risk management, and on capacity building in various aspects of food safety and quality.
- Professionals can help FSSAI in developing systems to ensure credible system to seek independent scientific advice, risk assessments and related guidance concerning food safety, including the assessment of food additives, chemical and microbiological contaminants, naturally occurring toxicants, and foods derived from modern bio-technology.
- Professionals can help in improving the understanding on various aspects of food laws by compiling global experiences on the particular subject or topic.
- Professionals can play a major role in capacity building for Central as well as State government employees. Supplying technical advice and expertise for the development of integrated food control systems, thus building capacity in food safety and quality throughout the food chain.
- Various international agencies can share global experience of ensuring safe water for consumers at least cost.
- Food security intervention can be in the form of sharing success stories with Indian policy planners on how other countries have improved their agriculture performance and what were the challenges and how these were addressed.
- How to ensure transparency in food safety enforcement department and accountability of field staff so that consumers can trust the system and its credibility.
- On nutrition security, food fortification and consumer education is the key and ways of making them effective at the least cost can be shared by the international agencies.
- Policy advice on specific issues related to food safety and trade to develop regulations under new FSSA.
- Specific studies and applied research on specific subjects related to food safety and trade.
- Support to upgrade the capacity of food analysis laboratories and inspection services so that they meet international standards, conform to accreditation requirements, and/or comply with other relevant international and regional trade agreements.
- Surveillance of foods sold in the market and their recall procedure in case of contaminated food is an urgent need.

International agencies and communities can pick up their areas of interest and either singly or as a consortium to help India in ensuring food and nutritional security and food safety on a sustainable basis. It is in the interest of everyone that a country like India with huge population and growing economy remain food secured and provide safe food to

consumers. Today, it is not possible to ignore the impact of commodity prices in India on global markets especially when India is increasingly dependent on imports to meet her growing domestic demand, e.g., edible oils, pulses, sugar, wheat, spices, etc. Any disturbance in the Indian food supplies can impact world markets and supplies which can hurt many food importing countries. This situation can become more complicated with the impact of changing climate.

Acknowledgements

- Mr P Suvrathan, Chairman, Food Safety and Standard Authority of India
- Mr Shailender Singh, Europe Desk, Department of Economic Affairs, GoI
- Mr Arvind Kaushal, Joint Secretary, Department of Animal Husbandry, GoI
- Mr S Dave, Director, APEDA
- Dr Gavin Wall, FAO Representative - India and Bhutan
- Dr Gopi Ghosh, Assistant FAO Representative - India and Bhutan
- Mr Raj Ganguly, Consultant, FAO
- Mrs Renuka Taimni, Programme Officer, FAO
- Mr Anand Krishnan, Netherlands Embassy
- The ARPL Team

References

Website of Ministry of Agriculture and Cooperation (www.agricoop.nic.in)

Website of Ministry of Finance (www.finmin.nic.in)

Website of Planning Commission (www.planningcommission.gov.in)

Website of Ministry of Food Processing Industries (www.mofpi.nic.in)

Website of Codex Alimentarius Commission (www.codexalimentarius.net)

ANNEXURE

ANNEXURE 1: Nutrition security status - Malnutrition of Children (0 - 3 years)		
Country / State	**Current level of weight for age below 2 SD**	**Eleventh Plan Goal - reduce by 50 percent**
India	45.9	23.0
Andhra Pradesh	36.5	18.3
Arunachal Pradesh	36.9	18.5
Assam	40.1	20.2
Bihar	58.4	29.2
Jharkhand	59.2	29.6
Goa	29.3	14.7
Gujarat	47.4	23.7
Haryana	41.9	21.0
Himachal Pradesh	36.2	18.1
Jammu & Kashmir	29.4	14.7
Karnataka	41.1	20.6
Kerala	28.9	14.4
Madhya Pradesh	60.0	30.2
Chattisgarh	52.1	26.1
Maharashtra	39.7	19.9
Manipur	23.8	11.9
Meghalaya	46.3	23.2
Mizoram	21.0	10.8
Nagaland	29.0	14.9
Orissa	44.0	22.0
Punjab	27.0	13.5
Rajasthan	44.0	22.0
Sikkim	22.6	11.3
Tamil Nadu	33.2	16.6
Tripura	39.0	19.5
Uttar Pradesh	47.3	23.7
Uttarakhand	38.0	19.0
West Bengal	43.5	21.8
Delhi	33.1	16.6

Note: 1. Figures for current level are that of NFHS 2005-06,

2. For State level figures, pro-rata reduction has been applied on the basis of targeted reduction at all-India level. Figures for other States are not available.

Source: NFHS 2005-06, Ministry of Health and Family Welfare, Government of India.

ANNEXURE 2: Nutrition security among children of various age groups – Malnutrition Rate of Children			
Country / State	**Children age 0-5 months exclusively breast-fed (percent)**	**Children age 6-9 months receiving solid or semi-solid food and breast milk (percent)**	**Children under 3 years, who are under-weight**
India	46.3	55.8	45.9
Andhra Pradesh	62.7	63.7	36.5
Arunachal Pradesh	60.0	77.6	36.9
Assam	63.1	59.6	40.4
Bihar	27.9	57.3	58.4
Chattisgarh	82.0	54.5	52.1
Delhi	34.5	59.8	33.1
Goa	17.7	69.8	29.3
Gujarat	47.8	57.1	47.4
Haryana	16.9	44.8	41.9
Himachal Pradesh	27.1	66.0	36.2
Jammu & Kashmir	42.3	58.3	29.4
Jharkhand	57.8	65.3	59.2
Karnataka	58.0	72.5	41.1
Kerala	56.2	93.6	28.8
Maharashtra	53.0	47.8	39.7
Madhya Pradesh	21.6	51.9	60.3
Manipur	61.7	78.1	23.8
Meghalaya	26.3	76.3	46.3
Mizoram	46.1	84.6	21.6
Nagaland	29.2	71.0	29.7
Orissa	50.2	67.5	44.0
Punjab	36.0	50.0	27.0
Rajasthan	33.3	38.7	44.0
Sikkim	37.2	89.6	22.6
Tamil Nadu	33.3	77.9	33.2
Tripura	36.1	59.8	39.0
Uttar Pradesh	51.3	45.5	47.3
Uttarakhand	31.2	51.6	38.0
West Bengal	58.6	55.9	43.5

Source: NFHS-3 (2005-06), Ministry of Health and Family Welfare, Government of India.

ANNEXURE 3: Nutritional status of women in India		
Country / State	**Current level (in 2005-06)**	**Eleventh Plan goal: reduction by 50 percent**
India	56.1	28.1
Delhi	43.4	21.7
Haryana	56.5	28.3
Himachal Pradesh	40.9	20.5
Jammu & Kashmir	53.1	26.6
Punjab	38.4	19.2
Rajasthan	53.1	26.6
Madhya Pradesh	57.6	28.8
Chattisgarh	57.6	28.8
Uttar Pradesh	50.8	25.4
Uttarkhand	47.6	23.8
Bihar	68.3	34.2
Jharkhand	70.4	35.2
Orissa	62.8	31.4
West Bengal	63.8	31.9
Arunachal Pradesh	48.9	24.5
Assam	69.0	34.5
Manipur	39.3	19.7
Meghalaya	45.4	22.7
Mizoram	38.2	19.1
Nagaland	30.8	15.4
Sikkim	46.8	23.4
Goa	38.9	19.5
Gujarat	55.5	27.8
Maharashtra	49.0	24.5
Andhra Pradesh	62.0	31.0
Karnataka	50.3	25.2
Kerala	32.3	16.2
Tamil Nadu	53.3	26.7
Tripura	67.4	33.7

Note:
1. Figures for current level are that of NFHS 2005-06.
2. For State level figures, pro-rata reduction has been applied on the basis of targeted reduction at All India level.
3. Figures for other States are not available.

Source: NFHS 2005-06, Ministry of Health and Family Welfare, Government of India.

Agribusiness

Prepared by

V P S Arora

About the author

Dr V P S Arora is Professor, Agricultural Economics, and former (Founder) Dean, College of Agribusiness Management, G B Pant University of Agriculture and Technology, Pantnagar. He conceived, planned, executed, and successfully ran the first College of Agribusiness Management in the country. He is an academician, researcher and consultant. He has successfully completed a dozen research projects, written two books, edited two publications (including an international one), contributed chapters in various books and published over eighty papers in journals of repute. He has been consultant / national expert to APO, Japan; FAO, Rome; IRRI, Philippines; OECD, France; Ministry of Agriculture, Government of India; and other organizations. He has visited a number of countries for academic pursuits. He successfully organized three national conferences, three summer schools, five national seminars, and over twenty management development programmes as organizing secretary / director. He has been bestowed with a number of awards and honours for his academic activities and leadership qualities including Dr Rajendra Prasad Award for his book titled *Agricultural Marketing* and *Price Analysis* which has been rated as the best book published in the subject during the period 1994-96 by the ICAR, New Delhi.

Contents

Closer integration of the Indian economy in the global market place, advances in information and biotechnology, enhanced emphasis on privatization and public-private partnerships, and domestic reforms have all contributed to considerable change in production, processing and marketing environment for Indian agriculture in the recent past. This has increased market orientation of the sector and created a plethora of opportunities and challenges. There have been increased agribusiness activities in the areas of organized retailing, contract farming, future trading, etc. This, however, necessitated a more efficient and strengthened supply chain as well as technology and institutions to integrate small farmers into these supply chains.

Several initiatives have been taken for promoting agribusiness in the country. The amendments in Agricultural Produce Market Regulation Act to facilitate setting up of private markets, promote direct purchases of farmers' produce, and contract farming arrangements is one such initiative. Other major initiatives / programmes include Bharat Nirman Yojana; National Horticulture Mission; amendment in Essential Commodities Act; the Warehousing (Development and Regulation) Bill, 2007; enactment of Integrated Food Law etc. To improve access to credit, innovative schemes launched include Mobile Banks, the Kisan Credit Cards, Micro Finance Programme, Crop Insurance, and Comprehensive Personal Accident and Health Insurance cover for farmers.

To give a boost to agricultural production precision farming, cluster approach to production of commercial crops, rejuvenated extension system for farmers and other stakeholders on integrated package of production, value addition and marketing activities are called for. Farmers are to be effectively linked with the market through contract farming like arrangements. Improved technologies for organic farming, dryland agriculture, and high value enterprises are to be put in place.

Establishment of efficient and effective cool / cold chains for perishable produce with active private sector participation is pre-requisite to promote food processing. The processing industry needs strong backup of institutional credit, latest technologies, and required infrastructural facilities. Marketing system reforms should promote direct marketing and infrastructure development through private sector participation and harmonization of national grade standards with international grade standards. Developing rural primary markets; modernizing principal market yards; creating terminal and specialized commodity markets; promoting modern abattoirs and modern meat retail markets in PPP mode are priorities.

Credit flow in rural areas can be increased by promoting groups of homogeneous borrowers; tying up with input supply agencies, output marketing firms or processors; organizing and linking farmers with contractors under contract farming arrangements; involving NGOs and rural educated youths in outreach and financial activities; and subsidizing insurance premium and creating mass awareness programmes for popularizing insurance schemes. A system of monitoring and capacity building of NGOs, SHGs, and other institutions should be put in place.

Greater autonomy should be given to RRBs and cooperatives in planning and lending policies. The cooperative credit system needs rejuvenation by recapitalization and by infusing professionalism. Overall strategy for building an inclusive financial sector should be through improvements in credit delivery mechanism; improvement in credit absorption; capacity building of farmers; and by leveraging on technology based solutions.

The slow process of agrarian reforms including existing laws on land ceiling, land

market, tenancy provisions and conversion of agricultural land for non-agricultural uses are issues of concern. Weak system of disease surveillance and generation of technologies on feeding and management of livestock result in low productivity. Skill gap amongst stakeholders exists on cutting edge farm technologies. Ineffective public extension system and limited participation of private sector in transfer of technology programme also exist.

Value addition particularly at the farm gate is very low on account of poor connectivity, non-scientific post harvest handling and unorganized marketing. There are high pre and post harvest losses, particularly in perishable products. Capacity building of stakeholders in terms of good post harvest, marketing, processing, and trade practices does not exist. Research and development efforts on quality control, labelling, and packaging are weak. Inadequacy of specialized markets for high value products; inter-State variations in market fee / charges / taxes and regulations are other weaknesses.

Existing access to credit and risk mitigating measures are weak in terms of awareness of farmers about various financial schemes and institutions and limited coverage thereof and poor credit discipline. The system for coordination, monitoring, and capacity building of institutions engaged in agribusiness; and national system / policy on farmer's organizations/ farmer's groups to deal with corporates do not exist.

International agencies can assist the Government in formulation and implementation of projects related to rainwater harvesting, watershed development, drip and sprinkler irrigation, weather forecasting; and establishment of supply chains, terminal markets, and specialized commodity markets. The research and training activities of international agencies may be in the area of precision farming and eco-friendly technologies for unreached agro-climatic regions; capacity building of stakeholders; and impact analysis of initiatives taken by the Central and State Governments. Their advocacy role should aim to fasten the speed of land reforms, empowerment of farm women, promote education, research, and outreach activities in agribusiness, evolve system of monitoring activities of NGOs and SHGs etc. Generation and dissemination of technology for accelerating production and productivity are the key areas of complementary inputs from global institutions.

1. Brief overview

Agriculture in any country goes through a cycle of development process which can be termed as commoditization to commercialization. The commodity oriented agriculture is supply driven wherein the emphasis is on production of bulk commodities which are sold in spot markets. At this stage, consumers demand un-differentiated commodities at lower cost and production-market interfacing is dictated by the consumer response to market prices. These price signals are interpreted by the intermediaries, modified according to grades and standards and sent back to the farmers. In such markets the trade engages itself in manipulating these price signals resulting in market imperfections. These market imperfections affect the process of agriculture development by influencing the pace of commoditization to commercialization cycle.

Indian agriculture is also under-going such transition which is described as 'Agriculture to Agribusiness'. This move is, in a sense, industrialization or commercialization of agriculture. Conceptually the agribusiness sector includes four distinct sub-sectors viz. inputs; production; agro-processing; and marketing and trade. All these add value or utility to the goods. Whether it is increasing the incomes of farmers, saving the national loss of farm products along the traditional supply chain or creating more employment opportunities, sound development of agribusiness provides a new frontier by creating an environment of much needed investment in agriculture marketing and trade.

While the share of agriculture in the GDP is declining over time, the share of agribusiness is consistently rising over the last couple of decades. It is reported that in the year 2007 total Indian agribusiness was worth at least Rs 11.43 trillion [29]. This includes the value of agricultural products marketed at the first point of sale, the value of farm inputs marketed, the value of agro-processed products, the value addition that takes place during the marketing system, value addition from trade and hotels / restaurant activities, the value of trade and sales of imported agricultural products, and the value of imported agricultural or processed products.

Input sector

Following technological revolutions in Indian agriculture (green, white, blue, yellow, and golden), the input sector has been growing fast to meet the surging demand for purchased inputs (seed and planting materials, fertilizers, agrochemicals, machines, feed, concentrate, energy (diesel, electricity), veterinary pharmaceuticals etc). Value of farm inputs marketed in 2004-05 was Rs 727 billion including seeds, fertilizers, pesticides, repair and maintenance services, livestock feed / fodder, organic manure, and electricity / diesel [29].The share of the private sector in the input market is growing with the entry of multinational companies therein. Almost all major global players of the sector now exist in India. Today the Indian seed market is one of the biggest in the world. Similarly, the Indian pesticide industry is ranked second in Asia and twelfth in the world in value terms. Per hectare consumption of fertilizer has also risen to 115 kg (2006-07) against 0.49 kg in 1960s.

Production sector

Although the production sector of Indian agribusiness contributes only about 18.5 percent of the national GDP and 10.92 percent to total exports (2006-07), its importance in the Nation's economic, social, and political fabric goes well beyond these parameters. It provides employment to 52 percent of Indian population, large number of them being poor [31]. Further most of the rural poor depend on rainfed agriculture and fragile forests for their livelihoods. A buoyant agriculture production sector is necessary to ensure food security, growth of the economy by producing wage goods, raw material for industry; goods for exports, generate

surpluses, and provide market for non-agricultural goods. Diversity in agro-climatic conditions and biodiversity in plants, animals, insects, and micro-organisms offers advantage to India for growing high value farm produce including fruits, vegetables, flowers, and livestock and aqua products.

In India, majority of farmers belong to the category of small and marginal holders. While the number and proportion of and area cultivated by such holders have been growing, the average size of operational holding has been declining over time. Over 60 percent of farm households own less than one hectare of land. However, a redeeming feature is that small farmers, including the landless, have higher livestock ownership (60 to 80 percent of all livestock population) including crossbred cattle. Small farms produce 41 percent of the country's total grains and over half of total fruits and vegetables despite being resource constrained [1]. Women play a pivotal role in agriculture as labour, farmer, co-farmer, family labour, and manager / entrepreneur of farms. They constitute 40 percent of the agricultural work force and 20 percent of rural households as de-facto head due to widowhood, desertion, or male out-migration [3].

Initially agricultural activity in India was confined to the production of foodgrains and a few cash crops such as cotton, sugarcane and jute. The agriculture scene is now under-going change in terms of diversity in the range of products and greater sophistication in pre and post production activities with the creation of critical infrastructural facilities like cold storage, refrigerated transportation, packaging, quality control etc. The sector is now poised for a leap with the introduction of new technologies like information technology (IT) and biotechnology.

The horticulture boom

Horticultural crops including fruits, vegetables, flowers, plantation crops, spices, coconut, medicinal and aromatic plants, mushrooms, cashew, cocoa, having large commercial potential, have gained a significant share in the crop portfolio. The boom in this sector in the recent past is evident from the rise in its share in the total agricultural output, employing about 24.5 percent of the total cultivated area. Besides providing nutritional and livelihood security and helping alleviate poverty and generating employment, the sub-sector sustains a large number of agro-industries, which generate huge additional non-farming employment opportunities. Horticulture contributes nearly 28 percent of the agricultural GDP and 54 percent of agricultural export (2005-06) [31].

Almost all types of horticultural crops are grown in India. Temperate fruits are grown in the north Himalayan region while sub-tropical and tropical fruits, vegetables, ornaments, mushroom, spices are cultivated in the rest of India. Spices and plantation crops are found in the peninsular region. Arid zone crops are grown in western India. The production of vegetables has substantially increased from 58.5 million tonnes during 1991-92 to 111.77 million tonnes during 2006-07 [31]. Yield has increased substantially with adoption of hybrid seeds and also with increased cultivation of disease and pest resistant varieties. The domestic floriculture industry has also witnessed an unprecedented growth in the recent past and has also been getting increased acceptability in world markets. The floriculture industry has been growing at an annual rate of 17 percent, which has also seen a number of corporate houses entering the fray. Higher standards of living and the growing desire to live in an environment-friendly atmosphere have led to a boom in the domestic market as well. The export of cut flowers has been identified as one of the thrust areas at the national level.

Livestock and fisheries

Livestock production in most cases is the second most important economic activity in farm households apart from crop production and provides supplementary income, food, farm power, and farm yard manure. The sector gained significance in the process of farm diversification. The country produces more than 101 million tonnes of milk, 51 billion eggs, 45 million kg of wool, 2.3 million

tonnes of meat, and 6.9 million tonnes of fish during 2006-07 [31]. The livestock and fisheries sector together contributed 6.5 percent to the national GDP and about a quarter to the agricultural GDP. Nearly 70 million farmers enabled India top the chart of milk producers in the world.

The dairy sub-sector is growing impressively at about 5.6 percent per annum, largely due to the Operation Flood programme of the National Dairy Development Board (NDDB) for augmenting dairy production, processing and marketing of milk and milk products by the cooperative dairy sector following the famous "Amul" model. India is the world's sixth largest producer of fish and the second largest producer of inland fish. The fisheries sector is recognized as a powerful generator of income and employment. It is also a source of nutritious food, besides being a major foreign exchange earner.

Processing sector

Currently the value addition in Indian agriculture is estimated to be just 7 percent which is very low by global standards, but the trends indicate that the value addition process is gradually gaining momentum. The segments showing consistency in growth include edible oil, biscuits, alcoholic beverages, and to some extent processed foods. At the same time, consumer expectations from marketplace with regard to variety and quality in food have multiplied in recent years. The process is gaining further momentum with the opening of Indian markets to imported value added food products resulting in diversification of food consumption at the household level. The exposure of consumers to these products is raising their expectations from the marketplace.

The food processing sector is poised for fast growth and is getting organized. This sector is being termed as a sunrise industry in India in view of potential. The industry ranks fifth in size (6 percent of GDP) and has high potential for growth (existing growth rate being 8.6 percent) [31]. The export of processed food was US$ 20.51 billion in 2006-07, recording a whopping growth rate over 2002-03 level. The processed food market accounts for 32 percent (US$ 70 billion) of the total food market in India (US$ 218.75 billion). The level of processing is estimated at 35, 21, 6, and 2.2 percent in dairy, meat, poultry, and fruits and vegetables respectively, the key segments of the industry.

The growing vertical coordination in the food and agribusiness sector is expected to shift part of the marketing effort toward discovery of consumer preferences rather than manipulation of the same by the retailers. Information technology is shown as a means of coordinating activities across levels in order to assure certain product attributes. The emerging consumer evaluates additional characteristics (product quality, nutrition, food safety and environmental aspects) which were previously experienced only indirectly in addition to traditional aspects like variety, convenience, price stability, and value. Some of the product attributes will have to be ensured from the beginning of production-marketing chain in tune with the expectations of present and potential consumer. This in turn will transfer the major responsibility of product differentiation to the production sub-sector (producer and input supplier) [15]. This calls for greater integration in activities aimed at expansion of demand and production rather than simply balancing the demand and supply sides.

Marketing and trade

The current agricultural marketing system in the country is the outcome of several years of government interventions. The system has undergone several changes during the last 50 years owing to increase in marketed surplus; increase in urbanization and income levels and consequent changes in the pattern of demand for marketing services; increase in linkages with distant and overseas markets; and changes in the form and degree of government intervention. Present policy thrusts are encouraging farmers for collective and direct marketing; promoting organized

trade; creating enabling environment for greater participation by the private sector in marketing system including infrastructure development.

Some basic features of the system and associated problems are:

- The market size and farmers' market linkages are continuously expanding.
- Private trade, which handles 80 percent of the marketed surplus, has not invested in marketing infrastructure due to excessive regulatory framework.
- Direct marketing by farmers to consumers remains negligible.
- Of 27 294 rural periodic markets, where small and marginal farmers sell their produce, 85 percent lack facilities for efficient trade.
- Due to poor handling at the farm gate about 7 percent of grains, 30 percent of fruits and vegetables and 10 percent of seed species are lost.
- The existing Agricultural Produce Markets Committee (APMC) legislation in most of the States hampers contract farming initiatives and private sector investment.

The experience of agricultural development in India has shown that the existing systems of delivery of agricultural inputs and marketing of agricultural output have not been efficient in reaping the benefits of technology. The qualitatively superior, cost effective and timely delivery of adequate inputs still remains a dream. There are plenty of distress sales among farmers as also temporal and spatial variations in the markets. Producers' share in consumers' rupee has not been satisfactory. The market performance parameters like absolute share of the producer in terms of remunerability, fluctuations in prices across seasons, large spatial price differences and lack of proper market outlets itself, are issues which have become increasingly crucial in the present context.

There are structural weaknesses in agricultural markets like unorganized suppliers as against organized buyers, weak holding capacity of farmers, and the perishable nature of the produce. In the environment of liberalization and globalization, the role of the States in agricultural marketing and input supply is being reduced, and an increasing space is being provided to the private sector to bring about better marketing efficiency in input and output markets. On the other hand, processors as well as marketers face problems in obtaining timely, cost effective, and adequate supply of quality raw materials.

There are around 3.7 million food retail outlets in India with an estimated turnover of Rs 7 400 billion. Food retailing is, by and large, unorganized, highly fragmented and predominantly small, family owned business. The food retail sector employs about 21 million people. Increasing attempts are being made for organizing the retail sector in the country by a number of corporate houses but still organized retailing constitutes only 2 percent of total retail sales which is expected to go up to 10 percent in coming years. Food is the largest segment of the retail industry.

External trade

Compared to its magnitude, India's share in world exports of agricultural produce is very small, i.e. slightly higher than one percent. It is, however, poised to rise given the comprehensive policy measures being put in place. India's exports of agricultural and allied products including plantations are of Rs 777 billion (2007-08). Export of these products has grown at a CAGR of 12.22 percent in the first four years of the Tenth Five Year Plan. During 2007-08, the export of these products grew at CAGR of 23.5 percent raising it to 12.15 percent of the total exports. Import of agricultural commodities rose to Rs 297 billion during 2007-08. The share of farm imports in total merchandise imports is around 3.9 percent. Edible oils accounts for almost two-thirds of total farm imports. Import of pulses is also significant and accounts for around 20 percent of total agricultural imports [31].

Institutions

The benefits of growing commercial agriculture are expected to accrue to the small farmers only if they are integrated into the markets as recognizable players through innovative institutional arrangements. Institutions, especially farmers' groups, cooperatives and corporates have attempted to integrate small farmers into the market by removing bottlenecks in marketing of agricultural produce and regulating the market in favour of small farmers. Institutional arrangements like Maha Grapes, Suguna, Amul model of cooperatives, and e-choupal of ITC Ltd.claimed to have reduced the transaction costs by steadily transforming from manpower driven to technology driven, from disintegrated supply chains to integrated supply chains, and from finance as a source of control to information as a source of control [13]. NGOs and SHGs are also becoming active institutions in the agribusiness sector [5].

Constraints

Growth in Indian agriculture decelerated during 1990s (2.29 percent) but improved during last six to seven years (3.17 percent), mainly on account of impressive growth in high value crops [30]. The area of concern, however, is the deceleration in the growth rate of foodgrains production during 1990-2007 to 1.2 percent, below the annual growth rate of population, averaging 1.9 percent. Diversion of productive agricultural land to non-agricultural purposes is another serious constraint. Potential to increase production through increase in area under cultivation appears limited. Under such a scenario, acceleration in agricultural growth is the real challenge. The consumption pattern is diversifying towards high value agricultural commodities. The constraints in transition to high value agriculture include lack of necessary information on production methods, marketing opportunities, and the probable distribution of net returns on crops not grown by farmers earlier. This problem is particularly acute when the target consumers have very specific quality requirements and / or strict food safety requirements.

Other major constraints at the national level include -

- outdated and multiplicity of laws, regulations, and taxes
- inadequate backward and forward linkages
- poor infrastructure for marketing and high transaction costs
- inadequate outreach of services and credit to farmers
- lack of modernization in storage techniques and transportation methods
- inadequacy of information on standards and requirements for exports
- low value addition at farm gate; and low capital formation in agriculture

There is a need for radical policy reforms and removal of physical constraints. Active participation by civil society organizations and private sector is also called for.

Prospects and potential

India has potential to be a global agricultural power. Agricultural products have potential to earn US$ 14 billion from exports. Potential areas include [28] –

- Food crops, plantation crops, poultry, dairy, sugar, cotton and oilseeds in which India has already made its mark.
- Areas like sericulture, marine and inland fisheries in which emerging strength is already evident.
- Areas in which India has competitive advantages such as wide range of fruits, vegetables and flowers which are and can be grown in abundance.
- The rich variety of medicinal plants and herbs, if efficiently processed and marketed, offer other untapped agribusiness option.
- Tens of millions hectare of wastelands can be a nearly inexhaustible source of industrial hardwoods and raw materials.

India can easily wrest a commanding position in developing and extending the benefits of biological software comprising highly promising, worldwide and at the same

time relatively in-expensive vermiculture, bio-fertilizers, bio-pesticides, tissue culture propagated material, nitrogen fixing shrubs and trees and sero-diagnostics and vaccine [28].

The stipulation of India's agriculture policy to push agricultural exports to Rs 1 00 000 million for slightly over US$ 3 billion is certainly modest, being only 15 percent of the country's overall exports. However, there are a few preconditions before Indian agribusiness can be said to have come of age and be ready to make its presence felt within and outside the country. In terms of basics, they pertain to three different and equally important factors – yields, guaranteed grade, and well established modes of value addition. Observance of standards of grading and quality and creation of adequate facilities for credit, processing and marketing are called for.

For promoting agribusiness in the country, several initiatives have been taken by the Central and State governments which have created favourable environment for its growth. Some marketing related restrictions have been withdrawn or replaced. The amendments in State Agricultural Produce Markets Regulation Acts based on Model Act 2004 are being made to facilitate setting up of private markets, direct purchases of farmers' produce and contract farming arrangements. Several monetary concessions have been announced by the Central and State governments. These include 100 percent excise exemption for 10 years, 100 percent income tax exemption for 5 years (later withdrawal in phases) and capital investment subsidy of 15 percent (upto Rs 3.0 million). The Small Farmers Agribusiness Consortium (SFAC) was set up in 1994 to promote agribusiness and provide venture capital to agribusiness projects. Research, development, and education in the total agri food system are being undertaken at reputed institutions with the support of international organizations including World Bank, FAO, ADB, IFPRI, and ICRIER.

Boosting production

Land reforms

Immediately after Independence, comprehensive agrarian reforms in most of the States were initiated to accomplish the desired objectives. Four types of legislative measures were undertaken: legislation for the abolition of intermediaries, tenancy legislation, and legislations for land ceiling and consolidation of holdings. The task of abolition of intermediaries was accomplished decades ago and the consolidation of holdings was completed in regions where topography and institutions permitted. The ceiling laws being more radical, both in form and content are yet to be faithfully implemented. Most of the tenancy laws in the present situation appear to be illogical. There is widespread prevalence of concealed tenancy despite enactment and implementation of radical tenancy legislations in different States. Nevertheless agrarian reforms carried out after Independence has given a boost to investment in land development and commercialization of farms.

Contract farming

Contract farming involves industry partners as stakeholders in agriculture production and is emerging as a remedy against the scale infirmities of small farms in India. It helps small and marginal farmers diversify to high value cash crops, gaining access to latest agricultural technology, adequate capital and assured market at an agreed price. The organized sector is using contract farming model for meeting its requirements of farm produce for retailing, processing or export purposes. The area covered under contract farming is so far limited and mainly confined to the States of Tamil Nadu, Punjab, and Orissa. This institutional arrangement however is picking up across the nation. The main companies involved in contract farming are Hindustan Unilever, WIMCO, Pepsi, Food Pro, NDDB, Maxworth Orchards, Cadbury India, BILT, ITC, JK Paper, AV Thomas, Reliance, Agrotech, Godrej Agro, United Breweries, DCM Shriram, MARKFED, L&T, and Escorts [1]. The contract farming is likely to get a boost in States which amend their APMC acts on the pattern of model APMC Act 2003. The arrangement will benefit farmers as well contracting parties if implemented as per the provisions made in model APMC Act.

Crop diversification

The Government is encouraging farmers to diversify to high value options such as horticulture, floriculture and oilseeds. Oilseed is another critical area that is receiving policy attention. During 2007-08, India produced 28.83 million tonnes of oilseeds but also imported Rs 114.9 million worth of edible oil. The Government intends to help farmers diversify into oilseeds by promoting superior seed technology and an appropriate price support. The National Horticulture Mission

was initiated in 2005-06 with an allocation of US$ 145 million, with a goal to double production from the present level of 150 million tonnes to 300 million tonnes by 2011-12. The mission intends to ensure an end-to-end approach with backward and forward linkages covering research, production, post harvest management, processing and marketing, under one umbrella, in an integrated manner [27, 30]. Creation of huge irrigation potential has helped the process of diversification.

Research and development

The Indian Council of Agricultural Research (ICAR) is a beneficiary of the scheme under which every commercial rupee earned by the institution is incrementally matched by another rupee from the budget. Besides this, ICAR receives funds from the Technology Development Board for all commercially viable projects. Recent budgets aimed at expanding farm related R&D to new frontiers like biotechnology, vaccines and diagnostics. There is special focus on farming in drylands and non-irrigated areas. Research has a vital role in reviving and encouraging diversification. A task force headed by Dr. M S Swaminathan has recommended the creation of a National Fund for Strategic Agricultural Research. An initial provision of US$ 11.5 million to operationalize this fund was announced in the budget for fiscal year 2005-06 [27]. The World Bank funded National Agricultural Technology Project and National Agricultural Innovation Project also aimed at upscaling Indian agriculture through needed research input.

The corporate sector in seed, fertilizer, agrochemicals, and veterinary pharmaceuticals is coming up in a big way with high yield potential seeds, agro chemicals, innovative veterinary drugs, and technologies based on their own R&D activities to boost and commercialize the farm sector. Sprinkler and drip irrigation, efficient farm machines, zero till seed drill, laser land leveller etc. are being introduced to make farmers go in for precision farming.

Marketing and pricing

The Ministries of Agriculture, Food Processing Industries, Consumer Affairs, Food and Public Distribution, Health and Family Welfare, Commerce, Rural Development, Fertilizers and Chemicals and Finance are mainly responsible for formulation of policy related to the agribusiness sector, regulations in their respective areas, and the implementation of programmes related to agricultural marketing. They have launched about 40 schemes in agricultural marketing. These schemes promote private investment in domestic trading, post harvest management, exports, quality management, and support initiatives for capacity building, food safety and improving market information.

Regulatory measures

To improve the marketing system of farm products, wholesale agricultural produce markets began to be regulated in the 1950s and 1960s under legislations (APMC Acts) enacted by State governments. This legislation has already covered 7 566 markets (2008), i.e. almost 99 percent of the identified wholesale markets in the country. The Model APMC Act 2004 after comprehensive scrutiny has been reformulated in consultation with State governments, trade and industry, and circulated to the States for adoption. When adopted, it will help improve the efficiency of the marketing system and encourage private sector investment in agricultural marketing. However, State governments and traders / commission agents are resisting its adoption. So far 17 States have amended their APMC Act; however in most cases the amendments are only cosmetic in nature. The legislation provides for direct marketing and procurement from farmers; private sector participation in infrastructure provision; creation of Special Commodity Markets; single point levy of market fee and contract farming.

Marketing infrastructure

Till late eighties, the marketing infrastructure in the country was largely created in the public sector. Electricity, railways, roads, tele-

communication, postal services and ports were among the sectors that remained in the domain of the public sector. However, after 1991, virtually all sectors of infrastructure have been opened for private investment. The public sector continues to play an important role in creation of infrastructure in backward, remote and difficult desert and hilly areas because of their low utilization and poor returns to investment. World Bank/ IMF, ADB and other international organizations have proactively contributed in formulating infrastructure related projects and funding the same. In the year 2005-06 the Government introduced a scheme called Development / Strengthening of Agricultural Marketing Infrastructure, Grading and Standardization to induce large scale investment from the private and cooperative sectors for setting up agricultural markets, marketing infrastructure and support services such as grading, standardization and quality certification. NABARD and the NCDC are implementing the scheme.

Storage

Central and State Warehousing Corporations have constructed a number of warehouses in different States. The FCI and State governments have also created warehousing facilities and godowns. The scientific storage capacity available in the country with CWC, SWC, and FCI including hired capacity was estimated at 80.7 million tonnes at the end of 2006. The cooperative sector has also built storage capacity of 13.55 million tonnes [31]. The overall shortage of storage capacity is of 35 million tonnes [1]. Presently, with 5 316 cold stores a capacity of 23.33 million tonnes exists in the country in different sectors. Of the available cold stores, 90.7 percent units (95.33 percent storage capacity) are in the private sector. The Cold Storage Order, 1980 has been rescinded in 1997 to encourage further entry of private entrepreneurs in this sector [1].

Cooperative marketing

Cooperatives are considered to be one of the best institutions in marketing and processing of agricultural produce especially in situations of market failure which occur quite often in agrarian economies like ours. The cooperatives have been successful in processing of sugar, paddy, milk and cotton. There are 203 sugar cooperatives, producing nearly 55 percent of the total sugar production in India. Similarly, more than 87 000 dairy cooperatives federated into 187 district level cooperatives and 27 State level federations working with 8.7 million milk producers have been important players in the milk marketing business. There are 173 cooperative spinning mills accounting for 22 percent of yarn and fabric production, and 431 ginning and pressing cooperatives accounting for 12 percent of all units and 21 percent and 18 percent of all gins and presses. Besides, there are 13 000 fisheries cooperatives in India. The main reasons for the success of this segment in cases like milk and sugar have been the focus on value addition and, therefore, high returns to producing members, functional vertical integration, high participation of members, and professional management and leadership [1, 2, 30, 31].

The network of farmers' cooperative organizations includes (i) Primary, Central and State Level marketing societies/ unions/ federations, (ii) Special Commodities Marketing Societies for sugarcane, cotton, milk etc. (iii) Processing Societies e.g. cotton processing and ginning societies, oil processing societies, fruit and vegetables preservation societies, sugarcane crushing societies, milk processing and chilling societies, etc. (iv) NAFED and (v) TRIFED.

Agricultural price policy and food management

Agricultural price policy, after the creation of Agricultural Price Commission and Food Corporation of India in 1965, has considerably influenced the marketing system of agricultural commodities. The policy was primarily intended to stabilize agricultural prices and influence the price spread from farm gate to the retail level. Its objectives, thrust, and instruments have conspicuously shifted during the last fifty years. Government intervention in purchase of agricultural commodities under Minimum Price Support programme, procurement of

foodgrains, Market Intervention Scheme (MIS), monopoly purchase, open market purchases of commodities by NAFED, CCI, JCI and other State agencies, etc., have attained importance in recent years. The entry of these Public and Cooperative Agencies has altered the existing channels and also their importance in terms of quantity marketed through them.

The pubic distribution system created in India is one of the largest in the world. Supply of subsidized inputs to farmers and subsidized distribution of foodgrains pushed down the real prices of staple cereals *vis-à-vis* per capita incomes, which improved economic access to food. These policy measures also enabled the organized sector and industry to keep their wage bills low, as cereals have a considerable weightage in the consumer price index. The benefits of price policy and input / food subsidies have, thus, been shared by all sections of society.

Other reforms initiated

- **Farmers' Market** formats like Apni Mandi, Hadaspar Mandi, Rythu Bazars and Uzhavar Sandies offer direct marketing channel.
- **Essential Commodities Act** has been amended and the list of commodities pruned from its preview.
- **The Warehousing (Development and Regulation) Bill 2007** has been approved by the Parliament. The new legislation provides for warehouse receipt being treated as negotiable instruments so that they can be traded.
- The Bill for amendment in **Forward Contracts (Regulation)** Act has been placed before the Parliament for approval.
- **The Integrated Food Law** has been passed by the Parliament and the Food Safety and Standards Authority of India, set up for its implementation.
- Scheme for setting up **modern terminal markets** under National Horticulture Mission (NHM) for perishable agricultural produce with sustainable backward and forward linkages has been launched by the Ministry of Agriculture.
- Development of post harvest / cold chain infrastructure, CA storage facilities, refrigerated transportation by road / rail, and perishable cargo centres at air and sea ports under NHM initiated.
- Action Plan for development of Food Processing Industries including setting up of **Mega Food Parks** taken up.
- **World Bank** assisted **MACP** (5-6 States) and **ADB** Study for **Agribusiness Development** project (2 States) have been launched.
- This Central Sector Scheme **Marketing Research and Information Network (AGMARKNET)** sanctioned by the Ministry of Agriculture in year 2000 to establish a nationwide information network for speedy collection and dissemination of market data for its efficient and timely utilization; to ensure flow of regular and reliable data to the producers, traders and consumers to derive maximum advantage out of their sales and purchases, and to increase efficiency in marketing by effective improvement in the existing market information system. Close to 3 000 markets have already been covered under the network and market information on arrivals and prices from more than 1 700 markets are received regularly in respect of 300 commodities and 2 000 varieties daily.
- **Organized Retailing:** Foreign Direct Investment (FDI) in retail business is restricted to the party either offering services as commission agent or participating in wholesale business. However, foreign retailers are allowed to operate in India through joint ventures and 'cash and carry' operations.

Credit support

India presently has an extensive banking infrastructure comprising over 30 000 rural and semi-urban branches of commercial banks, over 14 000 branches of Regional Rural Banks (RRBs), around 12 000 branches of District Cooperative Credit Banks (DCCBs) and 1 12 000 Primary Agricultural Credit Societies

(PACs) at the village level (around 66 000 PACS are stated to be functional; the remaining are dormant). Banks have initiated schemes to inculcate a savings habit and to provide financial assistance including Pigmy deposit scheme, Mobile banks in rural areas, Regional Rural Banks (RRBs), and Local Area Banks (LABs).

Banking initiatives started with restructuring of cooperatives; initiating 'social banking' in the form of nationalization of commercial banks in 1969, adoption of direct lending programmes to rural areas; and development of credit institutions such as Regional Rural Banks (RRBs). A brief review of initiatives is given as under.

- **Shivaraman Committee (1978):** The Committee recommended for allowing a line of consumption credit to poor households by the formal banking sector; and legislative reforms in all States for universal membership in all the Primary Agricultural Cooperative Credit Societies (PACs) across the country. The introduction of bank-SHG linkage programme in the 1990s has in some ways addressed the need of consumption credit of the poor. Under this system, the banks lend to the SHGs who, in turn, are free to disburse loan to their members in their best judgment, whether for production or for consumption purposes.
- **Formal / banking sector initiatives:** Banks have initiated schemes to inculcate a savings habit and to provide financial assistance including Pigmy deposit scheme, Mobile banks in rural areas.
- **Self Help Groups (SHGs):** In 19991-92, NABARD launched the SHG-Bank Linkage Programme on a pilot basis to finance SHGs across the country through the formal banking system. High repayment rates by the SHGs encouraged the banks to finance SHGs. In 1996, the Reserve Bank of India included financing of SHGs as a mainstream activity of banks under the priority sector lending programmes.
- The Government of India, in 2001 re-designated the existing Micro Finance Development Fund as Micro Finance Development and Equity Fund with the objective of facilitating and supporting the orderly growth of the microfinance sector, by especially assisting women and vulnerable sections of the society and also by supporting their capacity building. The size of the fund was also enhanced. The additional amount was to be contributed by the Reserve Bank of India, NABARD and the commercial banks in the proportion 40:20:20.
- In March 2004, the Ministry of Small Scale Industry introduced the Micro Finance Programme along with SIDBI. The Government provides funds for Micro Finance Programme to SIDBI, called "Portfolio Risk Fund (PRF)". This fund is used for security deposit required of the MFIs/ NGOs to get loan. Up to December 2006, 39 MFIs have disbursed loan to the tune of Rs 1 020 million, thereby utilizing an amount of Rs 76.4 million from the PRF. This has helped approximately 0.320 million beneficiaries, mainly women. The Micro Financial Sector (Development & Regulation) Bill (2006) was recently introduced in the Parliament. The salient features of the draft Bill include ensuring greater transparency, effective management and better governance; cover small and tiny enterprise, agriculture and allied activities including consumption; provision for the creation of a Micro Finance Development Council; and provision of redressal mechanism through a Scheme of Micro Finance Ombudsman etc.
- Credit package announced in June 2004 stipulated, among other things, doubling the flow of institutional credit for agriculture in the ensuing three years. The credit flow got almost doubled in two years itself (to Rs 20 32 970 million in 2006-07).
- The **Kisan Credit Card** scheme launched in 1988 to provide adequate and timely support from banking system to the farmers for purchasing inputs in a flexible and cost effective manner has been recently extended to more farmers including non-wilful defaulters, oral

leases, tenant farmers, share-croppers etc. About 70.55 million KCCs have been issued up to November 2007 [31].

- From Kharif 2006-07 the interest rate on crop loans has been lowered to 7 percent.
- In 2006 the Government announced a package for revival of Rural Cooperative Credit Structure involving a financial assistance of Rs 1 35 960 million. A task force has also submitted its report for revival of Long-term Cooperative Credit Structure.

Other initiatives

The other Government sponsored programmes aimed at alleviating poverty, Swarnajayanti Gram Swarozgar Yojana (Golden Jubilee Village Self-employment Scheme), envisages the formation of SHGs by the beneficiaries of Swarozgar (self-employment) scheme and financing them by banks in different stages. It is a holistic scheme covering all aspects of self employment such as organization of the poor into self help groups, training, credit, technology, infrastructure and marketing. The Government also facilitated formation of Joint Liability Groups (JLGs) of farmers who are share-croppers/ tenant farmers; and Micro Finance Institutions (MFIs) promoted by banks, NGOs and individuals.

Increased domestic and foreign investment

Direct foreign investment in agriculture is so far not permitted in India. However, foreign investment is encouraged in related sectors like food processing. The process of investing in these sectors has been considerably simplified.

Trade and taxes

During the recent past excise and import duty rates have been lowered substantially on a number of inputs for food processing and processed food items. In fact, many processed food items are now totally exempt from excise duty. Custom duties have also been substantially reduced on plant and equipment as well as on raw materials and intermediates, especially for exports.

Export promotion

Keeping in view the growing importance of agri-exports in improving farmers' income, the Government has set up several Agri Export Zones (AEZs). APEDA is the nodal agency to promote exports of agricultural and processed produce. Besides setting up AEZs in different parts of the country, it creates awareness about sanitary and phytosanitary requirements of destined nations for various commodities; assists in getting certification for exports, promoting GAP for exportable farm products; funds research and development activities in the area etc.

The current Exim Policy provides many sops for export of agricultural products namely - assistance for reducing marketing costs such as transportation, handling and processing for exports of selected farm commodities; financial assistance for improved packaging, strengthening of quality control mechanisms and modernization; setting up of processing units, as well as arranging promotional campaigns such as buyer-seller meets and participation at important international fairs and exhibitions; introduction of the Vishesh Krishi Upaj Yojana (Special Agricultural Produce Scheme) for promoting the export of fruits, vegetables, flowers, minor forest produce and their value added products by increasing incentives for exporters of such products; earmarking funds under ASIDE (Assistance to States for Infrastructure Development of Export) for development of Agri Export Zones (AEZs); and permitting installation of capital goods imported under the Export Promotion Capital Goods (EPCG) scheme anywhere in the AEZs.

Infrastructure

Well funded schemes to create or maintain rural infrastructure including the Rural Infrastructure Development Fund (RIDF) and the Accelerated Irrigation Benefit Programme (AIBP) have been launched / re-launched. An interesting innovation is the launch of a new scheme to repair, renovate and restore all the water bodies (lakes, tanks, ponds etc.) that are critical for irrigation. A very ambitious

infrastructure development programme in the rural area giving a boost to agriculture sector too has been launched in the form of Bharat Nirman.

Risk mitigation

The Agriculture Insurance Company (AIC) was incorporated in December 2002. The AIC is re-designing the earlier scheme for insurance of farm income rather than crop yields. It is also introducing a weather insurance scheme and is extending insurance coverage to livestock. The initiatives taken for mitigating risks in agribusiness include Crop Insurance; Weather Insurance; and Comprehensive Personal Accident and Health Insurance cover for farmers, wherein the corporate sector is actively participating.

Institutional arrangement

The corporate sector has started investing in R&D to bring new varieties of crops, change cropping patterns, generate employment and income opportunities, and facilitate marketing of produce by farmers. Through backward linkages and aggregation, the corporate organizations have been able to reduce transactions costs. Leveraging the information technology (IT), they have brought about innovative business models to integrate farmers into the markets. One such widely recognized corporate initiative is ITC's *e-Choupal*. It is an agribusiness initiative providing complete end-to-end solution. Cooperatives - through the Amul model - provided a good institutional structure for assisting small farmers taking advantage of agribusiness activities. Panchayati Raj Institutions (PRIs) are also crucial for implementing various agribusiness initiatives and making the same sustain in the rural area by ensuring participation of rural community.

3. Development strategies

Agribusiness promotion strategy in the country should aim at providing conducive marketing and financial infrastructure, growth promoting policy and regulatory environment, good technology back up, and friendly institutional arrangement that enhances farm production and income, value addition, orderly marketing with minimum post harvest losses, and place quality product through consumer friendly retailing or export. Various components of proposed development strategies are briefly outlined in the following pages.

Production system

Second green revolution

The second green revolution also known as knowledge agriculture should use labour intensive high technology for high value crops, having competitive advantage in global market too. The production process should be accomplished under precision farming mode where no production input is wasted be it land, water, fertilizer, or manpower. The selection of products mix should be based not only on resource base but also on market demand. To make the knowledge agriculture work the following enabling conditions are to be met:

- Timely availability of farm inputs through efficient and effective outlets. Strict monitoring of quality parameters, packaging, and pricing of farm inputs is also called for.
- Production of adequate amount of quality seed and planting material and making the same available at reasonable price at required time to improve seed replacement rate.
- Balanced use of nutrients by farmers including micro nutrients so as to improve the total factor productivity and resources use efficiency.
- Adoption of cluster approach of production of commercial crops to ensure scale economies to growers, processors, marketers, and traders.
- The extension system will have to build competency in farmers and other stakeholders on complete package of production and marketing activities including value addition at farm level.
- Backward and forward linkages of farmers with suppliers and potential buyers (processors, organized retailers, exporters etc.) will have to be explored in terms of contract farming or some such arrangements.
- Provision of Futures Market, Crop Insurance and Rural Credit Cards for farmers including women farmers.
- Popularization of organic farming under dryland conditions is also to be attempted.
- Development of location specific technologies particularly for dryland farming conditions.

Expansion of food production

Increase in grain (rice, wheat, maize, barley, soybean etc.) supply should continue to be the part of the strategy for three reasons. One, demand for grains is growing. It is also true that for "new" grains (maize, soya and barley) the demand is growing faster as better-off Indians eat more non-carbohydrate foods such as poultry and spend on newer food items such as beer. Two, India needs food security as there is not enough global surplus to meet the foodgrains needs of India's surging population. Finally, recent years have seen little increase in food output due to the failure of the public extension network as well as the lack of innovation in inputs such as seeds.

Punjab and Haryana lands need to be rested from the view point of foodgrains production. While output there could potentially be doubled, several other States could do their share in creating grain surplus for India. These include Bihar, Uttar Pradesh, West Bengal, Madhya Pradesh and Jharkhand. It is a win-win approach: firstly, the newly contributing states will see farmers there prosper as their output grows three to five times, and the long term

value of fertile land in Punjab and Haryana is protected by easing the "pressure" to produce for India. Secondly, farmers in these States will also prosper as land can be "switched" over time to horticulture and other high value crops / enterprises.

Success will require a National Grain Mission; an effective (public-private) extension service, converting agricultural knowledge into insights and ensuring selective investment in grain yield related research; a national grain market with uniform taxes and regulations that will encourage the entry of large grain players into the sector, and reducing risk for farmers by introducing transparent pricing and risk mitigation measures. Further the measures will have to be taken to tap existing irrigation potential.

Horticultural crops and livestock

In the proposed agribusiness strategy farmers in addition to grains will supply other farm produce that consumers are now demanding, i.e. fruits and vegetables and proteins such as poultry and dairy. In line with global trends, as incomes rise in India, food habits are changing, with a shift from basic grains (i.e., carbohydrates) to first proteins and then value added foods such as fruits and vegetables. There is an additional opportunity to cultivate globally priced crops such as wine grapes, orchids and medicinal herbs. This could increase farmer income two to five times. There is growing recognition worldwide that India has large tracts of fertile land, low cost farm labour and multiple seasons, and can be the future supply (and demand) centre for several agricultural sectors.

Cultivating wastelands

India has over 30 million hectares of wasteland that can be used to grow "dollar" priced crops including jatropha and eucalyptus trees that are economical to raise on relatively degraded land and can generate reasonably high income and direct employment for millions and are in demand globally. In fact, at current global prices for crude and pulpwood, no subsidies are needed for cultivating either of these crops. States such as Madhya Pradesh, Gujarat, and Andhra Pradesh have taken steps to demarcate land for the cultivation of bio-fuel crops. Private entrepreneurs such as Nandan Biomatrix and D1 Oils are actively pursuing pilot projects in bio fuel crops while companies such as ITC and Britannia India Ltd. (BIL) have succeeded with new high growth, disease resistant varieties of pulpwood trees that can be cultivated on degraded forest land. Thus the basic technologies, the economics, the entrepreneurs, and the land required are present.

The biotech opportunity

Biotechnology is proving to be of tremendous help to the farm sector in India. India is the second largest food producer after China and thus offers a huge market for biotech products. Transgenics of rice, brassica, mungbean, pigeonpea, cotton, tomato and some vegetables like cabbage and cauliflower are already into field trials. The share of the GM seed is growing rapidly. Monsanto is carrying out field tests of its GM crops in 40 locations across the country. Promotion of biotech research and use of biotech products will be an important component of the strategy. Regulatory safeguards and effective delivery system should accompany this opportunity.

Processing and value addition

The value addition in food products is envisioned to increase to 35 percent by the end of 2025, especially in fruits and vegetables. Commercial processing is expected to increase to 10 percent by 2010 and to 25 percent by 2025. The food industry which employs 1.6 million workers directly at present is expected to provide jobs to 37 million workers by 2025. This 'potential' can be realized only if conducive policy climate is created which encourages the growth of this capital intensive sector. The measures include exemption of processing activities from the provisions of industrial licensing except for beer and alcoholic drinks; automatic approval for raising 100 percent foreign equity; and exemption of fruit and vegetable products from excise duty.

Without a strong and dependable cool / cold chain system, the food processing industry cannot survive. The Government has to put emphasis on establishing cold storage chains throughout the country with private sector participation. The scheme should aim at reducing the post harvest losses too. Connectivity of production centres / clusters through motorable roads is also needed. The sector should also be given increased access to credit from formal financial institutions for investing in fixed capital and new technologies and thus expand viably; providing required infrastructural facilities including electricity connection, reliable power supply, availability of raw materials, transportation etc.

Intended strategy also aims at bringing uniformity in the State level tax structure in agricultural commodities including VAT in agriculture to boost the growth of the agro-processing industry; removal of *de facto* restrictions on movement of farm goods across State borders; formulation of rules and regulations under the Food Safety and Standards Act 2006; and encouraging FDI in food retailing with due safeguards of protecting the existing retail corner stores / employees of these stores.

Marketing system

- **Wholesale markets:** Ensuring effective implementation of Model Agricultural Produce Market Regulation Act and rules made under the same throughout the country should be the priority. It is being argued that if not agriculture as such atleast agricultural marketing may be taken on the concurrent list to ensure market reforms speedily and uniformly throughout the nation.
- **Promotion of contract farming** to ensure private sector participation in farming, input supply and technology transfer; capital flow; marketing; risk mitigation etc. However for promoting contract / corporate / collective farming, land reforms are also to be pursued expeditiously including freeing land market and allowing land leasing arrangements. For making such institutional arrangements the networking or clustering of farmers; bringing fairness and transparency in the negotiation process; innovation in pricing mechanism; involving NGOs in alliance are also to be attempted.
- Harmonizing national grade standards with international grade standards; and upgrading grading facilities at all the stages of the marketing chain is also needed.
- **Strengthening marketing infrastructure:** It includes developing rural primary markets; modernizing principal market yards; setting up of new wholesale markets by the private sector; setting up of Terminal Markets in PPP mode; setting up of farmers' markets; creating commodity specific markets for livestock, fruits, flowers, medicinal and aromatic plants, and vegetables; promoting modern abattoirs and modern meat retail markets in PPP mode; creating cool chain infrastructure facility and automated weather stations under PPP format; promoting GAP (Good Agricultural Practices), National Electronic Spot Markets, and farmers' organizations .
- Strengthening **Agricultural Marketing Information System** using **ICT** including integrated website for all stakeholders in agricultural marketing services; AGMARKNET with SWAN and NICNET; computerization of all mandies; and development of agricultural commodity specific portals is vital.
- **Human Resource Development:** The strategy comprises of launching agribusiness programmes (on the pattern of GB Pant University of Agriculture and Technology, Pantnagar) at all State Agricultural Universities; and imparting training to all stakeholders by SAUs, ICAR institutes, State marketing departments and Boards, APMCs, KVKs, Marketing Cooperatives, NGOs and PRIs in various agribusiness activities including value addition; constituting farmers' groups for collective marketing and value addition.
- **Reforming agricultural price policy** by giving the CACP statutory status; phasing out outlived instruments of

price policy like levy on rice millers, levy on sugar factories, state advised prices of sugarcane, control on release of free-sale quota of sugar, and monopoly procurement of raw cotton in Maharashtra.

- **Promotion of exports / external trade:** Strategy includes creating awareness about sanitary and phytosanitary standards; making national standards harmonize with international standards; strengthening quarantine system; promoting agricultural commodities in destined markets aggressively etc. Threefold path for making sustained and determined drives for finding global markets for agricultural exports is 'once in, stay in'; capturing world markets for value added horticultural products; and holistic pursuit of global goals.
- **Promoting organized retailing** by modernizing wet markets under public-private partnership mode is an important strategy for agribusiness development. It includes facilitating cash-and-carry outlets; encouraging cooperatives and associations of unorganized retailers for direct procurement from suppliers and farmers; ensuring better credit availability to unorganized retailers through innovative banking solutions; facilitating the formation of farmers' co-operatives to directly sell to organized retailers; and encourage formulation of "private codes of conduct" by organized retail dealing with small suppliers.

Credit system

- Increasing credit flow and reducing risk: Experiences show that group approach to lending is cost effective, the rate of recovery is high, and the lender's risk is reduced. Keeping this in view, credit flow in rural areas can be increased by adopting one or a combination of the alternatives like promotion of groups of homogeneous borrowers; tying with input supply agencies, output marketing firms or processors; organizing and linking farmers with contractors under contract farming arrangements; linking production credit with credit for post harvest operations; involving NGOs or rural educated youths in organizing farmers or rural families in groups, scrutinizing applications, disbursement of loan, and effecting recoveries; subsidizing insurance premium and creating mass awareness program for popularizing insurance schemes; and launching Rural Credit Card Scheme (RCCS) on the lines of Kisan Credit Card (KCC) Scheme. A system of monitoring and capacity building of NGOs, SHGs, and other groups should be put in place. RRBs are to be given greater autonomy and flexibility in planning and lending policies.
- Cooperatives: The cooperative credit system needs rejuvenation by recapitalization and giving the cooperatives greater autonomy and infusing greater professionalism. The cooperative credit system is de-layered, i.e. where District Central Cooperative Banks (DCCBs) are weak, State Cooperative Banks (SCBs) should finance directly to Primary Agriculture Credit Societies (PACSs), and where PACSs are weak, DCCBs should finance directly to the farmers. Non-viable cooperative institutions and rural development banks should be liquidated. Also, weak DCCBs should be taken over by SCBs.
- The strategy for building an inclusive financial sector should be based on effecting improvements within the existing formal credit delivery mechanism; suggesting measures for improving credit absorption capacity especially amongst marginal and sub-marginal farmers and poor non-cultivator households; evolving new models for effective outreach; and leveraging on technology based solutions.
- The post offices are to be encouraged to work as "business facilitator" and as "banking correspondent" in accordance with RBI guidelines.
- Both public and private sector banks should come together and formulate a strategy at the national level to cover all

regions of the country and to address the needs of the MFIs.

- To facilitate the expansion of micro credit, the Centre should prepare a model Bill on money lending; formulating national policy on microfinance; mobilization of savings by MFIs; charging cost-recovering interest rates by MFIs; establishing network of internet enabled Information and Communication Technology (ICT) access points termed as Common Service Centre; and promoting micro insurance.

The Indian agribusiness sector comprises of four major sub-sectors viz., input supply, farming (production), processing and manufacturing, and marketing and distribution system (retailing and exporting included). The sector has potential to bring prosperity to farms as well as to other stakeholders, and convert the nation as a major food supplier to the world. Growth in the sector in the recent past has become visible but the pace is less than the potential. To suggest exploitation of the potential a critical analysis of weaknesses, gaps, and implementation hurdles faced by the sector is done.

Production system

Land relations

The process of agrarian reforms in the country that was religiously started in 1950s and 1960s has slowed down during last couple of decades. This is emerging as an important obstacle to agribusiness development. Land related weaknesses and gaps are -

- Small size of holding, resulting in low commercial surplus per farm.
- Outdated and non-scientific ceiling limits on land holdings, impacting scale economies adversely.
- Lack of land market and outdated tenancy provisions, creating problems for popularizing corporate / contract farming. There is a need to free land market and provision for lease in and lease out of agricultural land.
- Eroding water table and soil health puts question mark on sustainability of farm productivity and calls for change in farming practices.
- Diversion of agricultural land to non-agricultural purposes due to outdated Land Acquisition Act.
- Weakness in law, policy and programmes for recognizing women as owners / joint owners / farmers / cultivators / tenants and thus denying them access to credit and risk mitigation instruments.
- About 60 percent of cultivated area is still under rainfed / non-irrigated condition.
- Only 68 percent of irrigation potential created is being used.
- Watershed management and rainwater harvesting efforts are very limited particularly in dryland agriculture.
- A usable waste land of over 30 million hectares is unutilized / un-allocated.

Technology

Promotion of agribusiness needs massive diffusion of technology in the farm sector. The following weaknesses and gaps in this context need immediate attention -

- Lack of location specific technologies particularly for dryland areas resulting in low productivity of crops.
- Weak system of disease surveillance, feeding and management technologies for livestock resulting in low productivity.
- Skill gap amongst stakeholders on cutting edge technologies like precision farming, protective cultivation, organic farming, biotechnology, intellectual property rights, Seed Act, Good Legal Practices, international laws, weather forecasting, etc. which is pre-requisite to efficient and effective agribusiness system.
- Weak public extension system and limited participation of private sector in transfer of technology programme. Further, the public sector extension is largely confined to production and protection aspects and virtually ignores value addition and marketing activities.
- Inadequate private investment in agricultural research and skill upgradation due to various regulatory restrictions.

Input supply

- Weak system for quality control in farm inputs delivered to farmers alongwith low awareness results in supply and use of sub-standard / spurious inputs.

- Inadequate availability of vital farm inputs at right time and at reasonable price. For instance, inadequacy of quality seeds and planting material is mainly responsible for low seed replacement rate.
- Lack of adequate emphasis on development, supply and promotion of micro nutrients.
- Lack of coordination in public and private sectors for research on evolving efficient input mix.
- Low R & D investment in evolving new molecules.
- Information gap at farm level about right type or quality of input to be used and the sources thereof.
- Shortage of well qualified/equipped and motivated agribusiness managers.

Processing and value addition

Value addition in farm produce particularly at the farm level is very low on account of poor connectivity, non-scientific post harvest handling, unorganized marketing, and knowledge deficit on grading, packaging, sorting, pre-cooling methods etc. among stakeholders. Lack of mobile and common infrastructure for post harvest management is another gap. Lack of credit, insurance and cool / cold chain infrastructure prevails. Capacity building of people engaged in village and agro-processing is needed in terms of market intelligence, good processing, marketing, and trade practices. Research and development efforts particularly on quality control, labelling, and packaging are weak. Food regulations are archaic.

Marketing system

- High pre and post harvest losses, particularly in perishable products, on account of poor road conditions, non-availability of cool / cold chain, and poor knowledge on scientific pre and post harvest management practices.
- Rural periodic markets where majority of small and marginal farmers transact their produce are virtually neglected in terms of infrastructure development.
- Inadequate number of specialized markets particularly for high value products - fruits, vegetables, flowers, fish etc.
- Reluctance of most of the State governments to effectively implement the model APMC Act for direct marketing (including contract farming) and private investment in market infrastructures.
- Inter-State variations in market fee / charges / taxes and regulations, makes it difficult for the private sector to enter in agribusiness.
- Almost all markets for livestock and livestock products, fisheries and aqua products are unorganized.
- Marketing intelligence system is outdated and hence there is a need for IT-led market extension by efficiently enriching and implementing AGMARKNET and other similar portals/ websites.
- Virtual non-existence of capacity building activities for farmers and other stakeholders on post harvest techniques, marketing, quality control, and value addition.
- Outlived price instruments like levy on rice millers and sugar factories, State administered sugar prices, and monopoly purchase of cotton.

Credit and insurance

Access to credit empowers farmers (particularly poor and women), small processors, and small market functionaries to upgrade and upscale their activities. Existing access to credit and risk mitigating measures are weak. Specifically efforts are called for to improve following areas:

- Lack of knowledge of farmers about various financial schemes, microfinancial institutions (MFIs) and insurance products.
- Limited coverage of pledge finance, marketing credit, crop insurance, and weather insurance in the farm sector.
- Participation in futures market is confined to retailers while farmers and big corporates are not found participating therein.

- Non-existence of national policy and legal framework on microfinancial institutions.
- Limited application of Information and Communication Technology in MFIs.
- Lack of effective farmer friendly risk mitigation measures.
- Poor credit discipline and repeated loan waivers.

Institutional issues

In India regulatory system on agribusiness sector (processing included) is very complex. Existence of multiple stakeholders, Ministries and Government departments in the system adds to this complexity. Following are the few other issues related to institutional arrangement that need attention of concerned authorities -

- Lack of a system for coordination and capacity building of institutions engaged in agribusiness, particularly cooperatives, NGOs, SHGs, and PRIs.
- Lack of uniformity of rules, regulations, norms and policies for small agribusiness institutions.
- Lack of monitoring the activities of NGOs and SHGs and coordination amongst them.
- Non-existence of a system of contract farming registration with local panchayats and redressal mechanism at village / block / district level in most of the States.
- There exists no system / policy on farmer's organizations / farmer's groups to deal with corporates collectively.

Potential areas of international cooperation

Development of prototype model projects on:

- Rainwater harvesting and watershed development particularly in rain-fed / dryland areas as also on efficient irrigation methods including drip and sprinkler irrigation.
- Evolving efficient weather forecasting system including setting up of Automatic Weather Stations (AWSs) at Block levels to facilitate risk mitigating measures.
- Wasteland development particularly for bio-fuel / pulpwood production.
- Standardization and establishment of supply chains including pack-houses, cold storages, refrigerated vans to cater to livestock products/fruit/vegetables/flower belts and aquaculture centres
- Terminal and specialized commodity markets as also assisting State governments in setting such markets.
- Model of cost effective rural periodic markets as well as in collection/ assembling/ procurement centres particularly in hill/ remote areas having potential to produce high value perishable products. International organizations may also financially assist Governments in creating infrastructure in rural periodic markets as well as in collection / assembling / procurement centres particularly in hill / remote areas.

Information generation and dissemination in the area of -

- Precision farming and eco friendly technologies for different agro-climatic regions including product-mix and input-mix.
- Capacity building of all stakeholders viz. farmers, farmer's groups, cooperatives, PRIs, NGOs, SHGs, processors, extension officials etc. in various agribusiness activities including on IPR issues, international law, and good production, processing, marketing, and trade practices including grades and standards.
- Impact analysis of AGMARKNET portal and such other initiatives taken by the Central and State Governments (e.g. Bharat Nirman, Krishi Mahotsava in Gujarat and Uttarakhand, Horticulture Mission, Kerala Horticulture Development Programme), and ways to make these more focused and useful to stakeholders.

Advocacy on regulatory reforms in the area of -

- Land reforms in terms of freeing land market, relaxing existing land ceilings, provision for lease, and land consolidation.

- Amendment in Land Acquisition Act to prevent diversion of agricultural land for non-agricultural purposes.
- Empowering women farmers by recognizing them as owner / joint owner/ tenant.
- Strengthening Agribusiness and Agriclinic Centres Scheme for not only ensuring professional delivery of farm inputs and knowledge to farmers but also to create a cadre of agripreneurs).
- Evolving a workable system of disease surveillance in livestock sector.
- Promoting education, research, and outreach activities in agribusiness (value addition and institutional arrangement included) at all State Agricultural Universities (SAUs) in PPP mode.
- Revamping public extension system through capacity building and by making it holistic (with fair mix of production, protection, post harvest, value addition and marketing activities).
- Amending APMC Acts in other States as well, on the pattern of Model Act for attracting private investment in marketing and value addition and linking small farmers to markets through contract farming.
- Evolving system of monitoring activities of NGOs and SHGs and bring uniformity in their working rules and procedures.
- Evolving national credit policy and uniform legal framework on microfinancial institutions including micro insurance.

5. Complementary inputs from international agencies

The Eleventh Five Year Plan aims to promote agribusiness activities through a number of initiatives related to acceleration in productivity; promoting value addition; providing and enabling marketing facilities, credit and insurance environment and revamping regulatory system and institutional arrangements. Active participation by civil society and private institutions has also been envisaged. However, the task is so gigantic that there is enough space for international organizations like World Bank / IMF, Asian Development Bank, DFID, IFAD, FAO etc. Some of the programmes where complementary input from international organizations is expected to make these initiatives effective are indicated here:

Technology generation and dissemination

- Promoting research and development activities in cutting edge technologies including organic farming, biotechnology, integrated plant protection, and information and communication technologies.
- Development and dissemination of appropriate models of soil conservation, wasteland development, rainwater harvesting, watershed management, and precision farming for different agro-climatic conditions.
- Identification and generation of technologies in mission mode for high value crops and livestock management for different agro-climatic situations. Emphasis is to be laid on farming system approach rather than commodity approach. Cluster approach of production for providing scale economies will be beneficial.
- Evolving cost effective methods of vermiculture, bio-fertilizers, bio-pesticides, tissue culture propagated material, nitrogen fixing shrubs and trees and sero-diagnostics and vaccine and promoting their use by farmers.
- Putting in place disease surveillance and weather forecasting systems.

Infrastructure development

- Creation of infrastructure including quality control, road and power connectivity and reliable logistics for packaging, storage and transport to promote agro-processing.
- Participation in infrastructure development particularly in rural periodic markets, terminal markets, and specialized commodity markets for high value products.
- Development of appropriate supply chains including cold storages, pack-houses, refrigerated vans etc. for perishable commodities.
- Developing and implementing models for specialized market/terminal market/ sub-market yards (rural market) and market mapping in terms of location, infrastructure, training centres, cold/ cool chains including common sharable infrastructure facilities.
- Assisting APEDA and other Government agencies in strengthening AEZs, organic certification agencies (like one in Uttarakhand), identifying exportable commodities and put in place a system of creating awareness about sanitary and phytosanitary requirements among stakeholders.

Areas for capacity building

- Farmers in good agronomic practices, good pre and post harvest activities, on farm value adding techniques (packaging, grading etc.), good marketing practices (including marketing information and contract farming) and in utilizing available credit and insurance options.
- Small processors in quality assessment of raw materials (while procuring and handling), good processing practices, and good marketing practices.

- Exporters in good legal practices, documentation, negotiation, and SPS requirement of importing countries etc.
- Strengthening public extension system though capacity building of extension officials in value addition, post harvest, marketing activities in addition to production and protection as also by ensuring effective participation by private sector and non-government organizations therein.
- Setting up training centres in focused areas for capacity building of farmers and other stakeholders in good agronomic and protection practices, quality control of inputs and output, value addition at farm gate, and post harvest management.

Advocacy for policy reforms

- Land reform measures (i.e. amendments in Land Ceiling Act, Tenancy Act, Land Consolidation, Land Acquisition Act etc.).
- Improving input services, equipments, risk mitigating instruments (credit and insurance) and output services including buyback arrangement, contract farming and warehousing facilities.
- Promoting the adoption of Model APMC Act, uniform tax / fee / VAT structure in respective States to promote contract farming, direct marketing, private investment, and organized marketing and retailing.
- On coordination, monitoring and networking of institutions associated with agribusiness particularly cooperatives, NGOs, SHGs, and MFIs.
- Evolving appropriate credit and insurance products for farmers and small processors and transferring the same to participating institutions.
- Promotion / replication of institutional arrangements like Maha Grapes, AMUL and e-choupal, to empower farmers and for giving a boost to agribusiness.
- APMC Act, tax/ levy structure (bringing uniformity in VAT, market cess /fee), and coordination and monitoring of activities of MFIs, NGOs and SHGs.
- Promoting cultivation of export oriented commodities like wine grapes, orchids, and medicinal herbs in suitable areas to earn foreign exchange.

References

1. **Planning Commission, Government of India.** 2006. *Report of the Working Group on Agriculture Marketing Infrastructure and Policy Required for Internal and External Trade for the Eleventh Five Year Plan (2007-2012).*
2. **Planning Commission, Government of India.** 2006. *Report of the Working Group on Outreach of Institutional Finance & Cooperative Reforms for the Eleventh Five Year Plan (2007-2012).*
3. **Planning Commission, Government of India.** 2006. *Report of Sub-group on Gender and Agriculture for the Eleventh Five Year Plan for the Eleventh Five Year Plan (2007-201).*
4. **Planning Commission, Government of India.** 2006. *Report of Sub-group on Land Related Issues and Agriculture for the Eleventh Five Year Plan (2007-2012).*
5. **Planning Commission, Government of India.** 2006. *Report of Sub-group on PPP, PR Institutions and NGOs in Agriculture for the Eleventh Five Year Plan (2007-2012).*
6. **Planning Commission, Government of India.** 2006. *Report of Sub-group on Innovative Finance and Microfinance for the Eleventh Five Year Plan (2007-2012).*
7. **Planning Commission, Government of India.** 2006. *Report of the Steering Committee on Microfinance and Poverty Alleviation for the Eleventh Five Year Plan (2007- 2011).*
8. **Planning Commission, Government of India.** 2006. *Report of the Sub-group on flow of private investment of SME and Agriculture Sector for Eleventh Five Year Plan (2007-2012).*
9. **Planning Commission, Government of India.** 2006. *Report of the Working Group on Land Relations for Formulation of the Eleventh Five Year Plan.*
10. **Planning Commission, Government of India.** 2006. *Report of the Steering Committee on Rapid Poverty Reduction and Local Area Development for the Eleventh Five Year Plan (2007-2012).* Accessed at - http://planningcommission.nic.in/aboutus/committee/strgrp11/str11_rpr.pdf.
11. **Sarkar Sandip & Anup K. Saran.** 2005. *Status and Potentials of Village Agro Processing Units/ Industries.* National Bank for Agriculture and Rural Development (NABARD) Occasional Paper 37.
12. **Acharya S. S.** 2006. *Agricultural Market Credit for Strengthening Indian Agriculture.* ADB Economic and Sector Studies, INRM Policy Brief No. 3.
13. **Sridhar G. & Vishwa Ballabh.** 2007. *Indian Agribusiness Institutions for Small Farmers Role, Issues and Challenges.*
14. **ADB Economic and Sector Studies.** 2006. Decentralization and Local Finance by G. Narendra Kumar and the Working of State Finance Commissions by Ravikant Joshi.
15. **Vasvani L.K., V. Vaenkatakrishnan, Ravindra Upadhyay & Jayesh Talati.** 2003. *Agriculture Market Linkages: Evaluating and Evolving a Conceptual Framework in Indian Context.* NABARD Occasional paper 28.
16. **NABARD. 2007.** Report of the committee on financial inclusion.
17. **IFAD.** 2003. *Transforming Rural Institutions in Order to Reach the Millennium Development Goals.* Roundtable Discussion Paper for the Twenty-Fifth Anniversary Session of IFAD's Governing Council.
18. **Keya Choudhury & Andreas Springer-Heinze.** 2003. *Building Alliances to Empower the Rural Poor.* Report on a GTZ-IFAD Forum in Berlin.

19. **Forhad Shilpi, Dina Umali-Deininger.** *Where to Sell? Market Facilities and Agricultural Marketing.* The World Bank Policy Research Working Paper No. 4455.

20. **Mathew Joseph, Nirupama Soundarajan, Manisha Gupta,& Sangramitra Sahu.** 2008. *Impact of Organized Retailing on the Unorganized Sector.* Indian Council for Research on International Economic Relations (ICRIER) Working Paper No. 222.

21. **Hoda Anwarul.** 2004. *Special and Differential Treatment in Agricultural Negotiations.* ICRIER WTO Research Series No. 1.

22. **Government of India.** 2003. Ministry of Agriculture, Department of Agriculture & Cooperation, Directorate of Economics and Statistics, New Delhi. 2003. *Report of the Committee on Capital Formation in Agriculture.*

23. **Kathleen Mullen, David Orden & Ashok Gulati.** 2005. *Agricultural Policies in India: Producer Support Estimates 1985-2002.* MITD Discussion Paper No. 82, IFPRI.

24. **FICCI.** 2007. *Industry- Academic Convergence "Bridging the Skill Gap",* Mumbai.

25. **Surbhi Mittal.** 2007. *OECD Agricultural Trade Reforms: Impact on India's Prices and Producers Welfare.* Working Paper No. 195, ICRIER.

26. **CII.** 2007. *Bharat Nirman Plus: Unlocking Rural India's Growth Potential.*

27. **Crisil.** *A Report for IBEF on Agriculture,* India. (www.ibef.org).

28. **Viswanadham N.** *Can India be the Food Basket for the World?* Working Paper Series. Indian School of Business, Hyderabad.

29. **Acharya S. S.** 2007. *Agribusiness in India: Some Facts and Emerging Issues.* Agricultural Economics Research Review, Vol. 20 vi + 409-630.

30. **Government of India.** 2008. Ministry of Agriculture and Cooperation, Directorate of Economics and Statistics, New Delhi. *Agricultural Statistics at a Glance.*

31. **Government of India.** 2008. Ministry of Agriculture, Department of Agriculture and Cooperation, Directorate of Economics and Statistics, New Delhi. *Economic Survey 2007-08.*

Knowledge Generation and Management

Prepared by

Rasheed Sulaiman V

About the author

Dr Rasheed Sulaiman V is an extension policy researcher and has worked as Extension scientist (1993-2006) at the National Centre for Agricultural Economics and Policy Research (NCAP), New Delhi for thirteen years. His main areas of work include: institutional innovations in extension; developing new approaches to strengthen women in agriculture programmes; and exploring extension as part of broad-based development interventions in the agricultural sector. In recent years, he has worked on the development and application of the innovation system framework as a way of exploring partnerships and institutional arrangements in agricultural research and development. Since April 2006, he is working as Director of the Centre for Research on Innovation and Science Policy (CRISP) at Hyderabad and also as Regional Director of the South Asia Rural Innovation Policy Studies Hub of UNU-MERIT (United Nations University-Maastricht Economic and Social Research and Training Centre on Innovation and Technology, Maastricht, The Netherlands). He is associated with several committees at the national and international level looking at research and extension and his recent studies have focused on understanding innovation capacity in various rural sectors and the role of civil society organizations in promoting pro-poor rural innovation.

Contents

Executive summary

FAO India is working with the Government of India to prepare a National Medium Term Priority Framework (NMTPF). This paper on Knowledge Generation and Management is an input to the preparation of NMTPF. The paper identifies opportunities for meaningful intervention by international developmental agencies based on identification of weaknesses, gaps and hurdles faced by the sector as reported in several recent studies and reports.

The need for strengthening the generation, management and application of new knowledge has been very well articulated in the Indian context. India has several programmes on knowledge generation and management. While many of them are public sector led, private and civil society initiatives are expanding rapidly. Though a number of public, private and civil society actors capable of providing different types of knowledge support and services exist in India, many of the programmes implemented by these actors have failed to quickly respond to the rapidly evolving and increasingly complex challenges faced by farmers.

The paper argues that this sector is affected by two major weaknesses. Firstly, those related to institutional issues or its ways of working and secondly, those related to lack of expertise, manpower and finances. The paper identifies capacity development for knowledge generation and management as the most appropriate role international development agencies could play in the Indian context. These include enhancing capacity to deal with new science and technologies, promoting new ways of working, and supporting institutional and policy changes.

1. Brief overview of the sector

Public sector research and extension agencies continue to dominate the knowledge generation and management provision for agriculture in India. Private sector, especially input companies and agro-processors, have become important producers and promoters of new knowledge in the last two decades. The NGOs have also expanded their involvement in agriculture, from promoters of technical knowledge initially to generation of a range of new knowledge covering technology, institutions and policies relevant for agriculture. In addition to these, different forms of media also play an important role in disseminating new knowledge on agriculture. Though there is an increasingly diverse mix of actors currently engaged in knowledge generation and management, this has not resulted in better knowledge use or application at the ground level. This is not a new finding on its own, as several recent reports / studies have pointed to the need for improved generation, management including diffusion, adaptation and integration, and application/use of new knowledge. This is more important than ever before, considering the rapidly evolving nature of Indian agriculture and the new set of challenges it has to currently deal with.

The challenges of development

India's economic security is heavily dependent on agriculture and more than half of its rural population is still dependent on agriculture for most of its income. Though the Green Revolution increased production and productivity of food crops, improved food security and raised rural incomes, India still has a large poor and malnourished population. Raising productivity as well as farm income through a second green revolution is much talked about. Indian agriculture is currently facing greater challenges from unsustainable use of natural resources and significant threats - as well as opportunities - from opening of agricultural markets. Addressing many of these complex issues requires solutions which are beyond the decision making capacities of individual farmers. Recent years have also witnessed a deceleration in the growth of agriculture.

There is a growing gap between scientific know-how and field-level do-how. This knowledge deficit would have to be overcome speedily to enhance farm productivity and profitability [1]. There are wide gaps in yield potential and national average yields of most commodities are low. As the sector is dominated by small farms - often with weak bargaining power and limited political voice, new forms of collaboration to ensure collective decisions on resource use and marketing would also become important. A second green revolution is possible only through an integrated use of new knowledge and the real challenge is going to be in finding ways of generating and managing new knowledge and supporting farmers to apply new knowledge in his / her farm.

Future potential

A sustainable and efficient agriculture is important for India for both alleviating poverty and achieving food and nutrition security at the national level. Agricultural research and extension also needs to tackle the new challenges emerging from climate change, increasing integration with global economy and soaring food prices.

There is considerable scope to increase rural income through a second green revolution that would focus on increased productivity, sustainable use of resources, enhanced competitiveness, value addition and creation of an efficient marketing system. This would require generation, management and application of all forms of knowledge - traditional as well as modern (technological, organizational, and marketing) through an interactive network of organizations involved in research, extension and other support services. Strengthening research, extension and other support arrangements therefore would continue to remain important for transforming Indian agriculture.

2. Current programmes and activities

Major programmes undertaken by the Governments

Currently the public research system consists of about 100 research centres at the national level, 99 coordinated and network projects and 41 State Agricultural Universities (SAUs) and their several regional and commodity focused research stations. More than 22 000 agricultural scientists spread over a vast network of organizations in the public (Central and State) and private sectors were employed in the National Agricultural Research System (NARS) in the year 2001 [2]. Indian Council of Agricultural Research (ICAR) and SAU programmes focus on most of the important crops and livestock and fishery species. ICAR also oversees and regulates agricultural education in India. ICAR and SAUs have been collaborating extensively with several CGIAR centres, especially ICRISAT, IRRI, CIMMYT, IFPRI, ILRI etc. Each SAU is organized into several colleges (imparting agricultural education) and research centres dealing with specific crops and agro-ecological zones. Commodity Boards under the Ministry of Commerce, handles R&D and extension in select commodities like tea, coffee, rubber and spices. Some organizations under the Council for Scientific and Industrial Research (CSIR) are also involved with agricultural research e.g. post-harvest value addition, medicinal plants.

In the public sector, the extension machinery of the State Department of Agriculture (SDoA) reaches down to block and village levels. The village extension workers of the SDoA continue to be an important source of information for farmers in India, even though the visits are irregular, and the service is pre-occupied with the implementation of Government schemes, often linked to distribution of subsidies and inputs [3]. Compared with the SDoA, the animal husbandry and the fisheries departments do not have adequate field level presence. Advisory services in the area of animal husbandry and fisheries therefore do not reach many farmers. About 22 percent of the posts across agriculture and allied departments remained vacant in 2005-06 [4]. Since 2004, a call centre based extension service has been set up wherein farmers can call on a toll free number for farm advice.

In the case of extension, the major reform in recent years has been the establishment of a district level coordinating agency, the ATMA (Agricultural Technology Management Agency), initially in 28 pilot districts in seven states with the support of the World Bank. The ATMA model was upscaled in May 2005 across the country as a Centrally sponsored scheme. So far 567 districts have been covered by ATMA (Box 1).

To incentivize the States to increase public investments in agriculture, the Central Government in 2007 introduced a new scheme, the Rashtriya Krishi Vikas Yojana (RKVY). It provides flexibility and autonomy to the States in planning and executing programmes for agriculture to achieve the goal of reducing the yield gap and maximize returns to farmers. The State Department of Agriculture is the nodal department and the total allocation under the Eleventh Plan is Rs 25 000 crores. RKVY makes it mandatory for States to prepare district and State level agricultural plans. Resources under RKVY can be potentially used for supporting extension activities and it encourages convergence with other programmes such as NREGS, SGSY and BRGF. States have initiated attempts to bring about convergence, but the progress is less than satisfactory mainly due to the apparent reluctance of different departments to share resources, lack of adequate consultations and lack of empowered authority to coordinate and facilitate convergence at the district level [7]. These initial hiccups are expected to be resolved in the coming years.

Two other programmes, namely the Backward Regions Grant Fund (BRGF) implemented by the Ministry of Panchayati Raj in 250 backward districts, have provision for capacity building

BOX 1:

Agricultural Technology Management Agency (ATMA)

Agricultural Technology Management Agency (ATMA) is a decentralized participatory and market driven extension approach pilot tested in India in 28 districts during 1998-2005. It is a district level autonomous agency constituted for (i) integrating the extension programme across all key line departments and other extension agencies; (ii) link research and extension activities in a district; and (iii) decentralize extension decision making through a participatory programme planning process involving all categories of farmers.

All the research and extension units within the district such as KVKs, Zonal Research Stations, Department of Agriculture, Horticulture, Animal Husbandry, Fisheries, Sericulture, Marketing, etc. are constituent members of ATMA. These bodies have been created mainly to facilitate farming systems approach by working closely with different developmental departments at the district and block levels. Under ATMA, grassroot level extension is mainly provided through the involvement of Block Level Technology Teams, Farmer Advisory Committees, farmer groups/ farmer interest groups and Self Help Groups. To provide HRD support, State Agricultural Management and Extension Training Institutes (SAMETI) have also been established in each State. The district collector/deputy commissioner heads ATMA Governing Body, with members drawn from the line departments, farmers and NGOs. This model was subsequently replicated in all the districts of India with central government funds.

The performance of ATMA model during the pilot phase has been considered a success . However, ATMA is currently facing several operational difficulties at the district level such as lack of dedicated staff, handholding support and staff training, and limited success at convergence during this expansion phase . ATMA has a few positive outcomes and these include:

- development of mechanisms for participation of farmers in deciding priorities (strategic research and extension plans);
- identifying and implementing programmes (farmer advisory committees); and
- bringing additional funding for extension activities (exposure visits, demonstrations, farm schools, farmer awards, exhibitions etc). Moreover, it also provided a space for nurturing some new ideas such as public-private partnerships and user contribution for extension.

of staff of panchayats/ municipalities in planning, implementation and monitoring. These programmes also have a provision for recruiting a trained community level person for agricultural extension activities. Similarly, the Swarnajayanti Gram Swarozgar Yojana (SGSY) programme implemented by the Ministry of Rural Development through the District Rural Development Agencies (DRDAs) has provision for skill development, marketing and technology support.

The National Horticultural Mission (NHM) has provision for funding technology generation activities appropriate to each region / State keeping in view the specific agro-climatic and socio-economic conditions. These funds could be accessed by public and private organizations having capability for implementing research programmes. The NHM also supports establishment of Precision Farming Development Centres (PFDCs) to promote development of regionally differentiated technology validation and dissemination activities. Human Resource Development through trainings and demonstrations is an integral part of the Mission. Under this, programmes for training of farmers, field level workers and officers are taken up.

During the last two decades, the number of Krishi Vigyan Kendras (KVKs) established and funded by the ICAR has increased. KVKs mainly

focus on technology testing, assessment and application under farmers' condition through conducting on-farm trials, demonstrations and training. But due to its weak links with other agencies, its effective reach is limited [8]. ICAR has also established Agricultural Technology and Information Centres (ATICs) in some of the SAUs and ICAR institutes mainly to serve as a single window offering the institute's technology, advice and products.

The Department of Information Technology (DIT), Government of India has proposed to roll out over 10 000 Common Service Centres (CSCs) across the country, primarily in rural areas, that would cover at least 40 percent of the Gram Panchayat locations in every district of a State. The objective is to develop a platform that can enable Government, private and social sector organizations to align their social and commercial goals for the benefit of the rural population in the remotest corners of the country through a combination of IT based as well as non-IT based services [9]. The Government intends to use these CSCs as Gyan Choupals, providing quality information and advice to the farmers. This would however necessitate developing a framework for linking extension machinery and development of appropriate software resources. Initiatives such as e-Choupal from ITC and experiments such as e-Sagu in Andhra Pradesh provide several lessons on application of ICTs for agricultural development.

The quality and strength of the knowledge generation and management sector depends strongly on the quality of the agricultural education system. At present, there are 41 SAUs, 4 deemed Universities, and 1 Central University directly involved in agricultural education. In addition there are a few Central universities having a strong agricultural faculty. At any point, there are over 75 000 students studying in SAUs. In addition to these there are large numbers of private colleges both affiliated and non-affiliated to SAUs which also annually admit large number of students [10]. ICAR has the mandate of regulating agricultural education in the country. This responsibility is discharged through partnership with SAUs. To ensure quality assurance in higher education, ICAR has put in position a number of initiatives and reforms which include -

- establishment of an "Accreditation Board" for quality assurance;
- faculty competence improvement through training;
- library strengthening, institution of scholarship and fellowships; and
- measures for reducing in-breeding and infrastructure support for library, hostels and laboratories.

To tap the expertise of a large pool of agricultural graduates in the country, the Ministry of Agriculture in association with NABARD and MANAGE is implementing the Agri-Clinics and Agri-Business Centres (ACs & ABCs) Scheme. The objectives of this scheme are as follows:

a) supplement the efforts of Government extension system;
b) make available supplementary sources of input supply and services to needy farmers; and
c) to provide gainful employment to agricultural graduates in new emerging areas in the agricultural sector.

Agricultural graduates are provided a two-month training in agri-business development through institutions in the public/private sector. The entire cost of training and handholding is being borne by the Government of India. The trained graduates are expected to set up ACs & ABCs with the help of bank finance. Till December 2006, more than 11 500 graduates were trained resulting in establishment of 3 750 centres in various parts of the country spread across 36 categories of agri-ventures [11].

NABARD has a farmer's club programme. Farmer's clubs are organized by rural branches of banks in their operational area with the support and financial assistance of NABARD. NABARD provides financial support to these clubs for formation, maintenance

and for organizing meetings with experts. By March 2006, 28 226 farmer clubs were organized.

More than 110 million women are engaged as workers in rural India, where agricultural based opportunities form their major livelihoods. While 36.5 percent of them are cultivators, 43 percent work as agricultural labourers [12]. Women's role in agriculture got attention in Indian policy circles in the Seventh Five Year Plan (1985-89). After that several programmes for women in agriculture were implemented in India. These include -

- special donor assisted programmes on women in agriculture in select states;
- the central sector women in agriculture programmes; and
- Women Component Plan adds to the on-going initiatives for gender mainstreaming.

Rural livelihood programmes of the Central and State rural development departments and the microfinance initiatives through women Self Help Groups (SHGs) implemented by Government and NGOs also supported rural women in organizing themselves and accessing capital and other resources. A National Gender Resource Centre in agriculture has been set up by the Ministry of Agriculture within its Directorate of Extension to work as a focal point for convergence and coordination of gender related issues.

Donor initiatives

The World Bank is currently supporting the National Agricultural Innovation Project (NAIP) of ICAR and it focuses on promoting collaboration among public research organizations, NGOs, the private sector and other stakeholders. IFAD co-finances NAIP. Another important initiative is the US-India "Knowledge Initiative on Agricultural Education, Research, Service and Commercial Linkages". Biotechnology and food processing are two important areas of knowledge-sharing under this initiative. ICAR and ACIAR are collaborating on a joint five-year programme (2008-2103) on the application of marker-assisted selection as a tool to achieve greater efficiency in wheat breeding.

DFID, IFAD and WFP programmes have a broader livelihood focus. Improving agriculture is a priority in these programmes only in cases where it can potentially improve livelihoods and nutrition. For DFID, supporting rural livelihoods is currently a priority in Madhya Pradesh, Orissa and West Bengal. It also funds research on climate change, agriculture, water resources, forestry and adaptation. IFAD funds projects on rural

BOX 2:

Private and civil society programmes in India - an overview

Private industries, NGOs and research foundations are also engaged in technology development and promotion - the former comprising the input sector (seed, fertilizer, pesticides and machinery) that is involved with basic, applied and adaptive research and the latter dealing mainly with adaptive research. Recent estimates reveal that the private sector bears 15 percent of agricultural R&D expenditure costs in India [13]. Many of the private agri-business firms procuring raw materials from farmers are also providing inputs, advice and marketing support to the farmers.

The last two decades have witnessed the increasing involvement of civil society - including research foundations, NGOs and producer associations - in agricultural research and extension. Many have been working with the poor and have a broader approach to generation, adaptation, diffusion and application of new knowledge (collectively known as innovation) thereby helping the poor access, adapt and apply new information, knowledge and technology [14]. India also has strong and articulate industry associations (e.g. FICCI, CII, ICC) and they play a very important role in influencing agricultural policy.

development, tribal development, NRM, women's empowerment and rural finance and the main purpose is to strengthen people's capacities to establish and manage their own institutions. WFP focuses on addressing malnutrition and improving food security of poor women, at-risk children and poor forest-dependent population. The activities focus on capacity development of India's own schemes to reach its nutritional objective. FAO's programmes in India focus on plant protection, pro-poor livestock policy, forestry, fisheries, nutrition, food quality and safety, and it supports the States by way of providing specific technical assistance. One of its recent initiatives "Solution Exchange" has created a platform for exchanging knowledge and experiences on a number of issues related to food and agriculture. USAID implements programmes related to promoting bio-safety regulations, use of biotechnology and reforming agricultural markets in India.

3. Development Strategies

Core development strategies

Development strategies of different actors involved in knowledge generation and management are indicated in Table 1. Most of these organizations focus on development of new technologies, distribution of inputs/ subsidies, and technology dissemination activities, leaving other important functions needed for knowledge application unattended. Many of these organizations work in isolation and have weak links with other intermediaries and knowledge users dealing with other kinds of knowledge and services related to credit, inputs, markets, value addition, entrepreneurship development and policy.

TABLE 1: Development strategies of key organizations in knowledge generation & management

Organizations	Development strategies
ICAR Research	Main focus is on technology development. Themes include, germplasm conservation, varietal /breed improvement, soil and water; power and machinery, feeding practices; processing/value addition; and socio-economics.
KVKs	Main focus is on on-farm trials, front-line demonstration and training.
SAUs	Main focus is on teaching and research. Undertakes extension activities on a limited scale. Technology development activities are similar to those undertaken by ICAR (as discussed under ICAR research).
Private R&D	Agro-chemicals (including fertilizers), seed and machinery and food processing; more recently growth in plant breeding, biotechnology, animal health and poultry. Input companies focus on product demonstrations.
Commodity Boards	Rubber, tea, coffee, spices; conduct research and implement extension programmes.
MoA (DAC and DoAH & F)	Formulation and implementation of national policies and programmes and central sector extension and development programmes; support national and regional extension institutions such as MANAGE, NIAM and EEIs that conduct training and handholding support to States.
NABARD	Support establishment of farmer clubs by banks in rural areas.
State line departments	These include departments related to agriculture, horticulture, animal husbandry, fisheries, sericulture etc. These organizations focus on implementation of development and extension programmes and manage State, regional and district level training centres. DoH manages horticultural farms, DoAH runs veterinary hospitals, polyclinics and AI services; DoF runs fish seed farms; Sericulture department organizes supply of cocoons and planting materials. Rural development departments and PRIs implement several employment and development programmes, some of these include agriculture.
DRDAs	Implement SGSY programme. Organize SHGs and provide technical training and market development support.
PRIs	Panchayat Raj Iinstitutions (PRIs) implements several programmes including National Rural Employment Guarantee Scheme (NREGS). Closely involved with development of village, block and district plans.

Contd.

Contd. from page 227

TABLE 1: Development strategies of key organizations in knowledge generation & management

Organizations	Development strategies
Agri-business	Provide integrated support - inputs, technology and markets - to contract growers.
CSO/NGOs	Have good networks with communities/villages they operate in and have evolved innovative approaches to provide integrated support and services to the poor.
Media	Newspapers, farm magazines, radio and TV channels. Specialist monthlies, one page every week on agriculture in most of the vernacular dailies; daily programmes on agriculture in radio and TV channels.
Producer cooperatives	Producer cooperatives, e.g. dairy, sugar, grapes, provide a number of services - inputs, advice and marketing - to farmers.
Donors	- direct support to agricultural research through ICAR and SAUs (World Bank); - ACIAR and CGIAR institutions partner with NARS; - specific technical assistance to technology development and promotion (FAO); - indirect support to technology promotion through broad based livelihood support (IFAD, DFID, WFP); - research on climate change impact and adaptation (DFID), support for agri-market development; marketing extension; - improving bio-safety regulation and development and promotion of bio-engineered products (USAID).

Overall sector policy and the Centre - State dichotomy

According to the Indian Constitution, agriculture is a State subject though Ministry of Agriculture at the Centre lays down the major policy guidelines. For administration of agriculture, every State has a separate Department of Agriculture (SDoA), and for research and teaching, there are one or more state agricultural universities. However, the Central government substantially influences research, education and extension activities at the State level, through funding research activities (ICAR and some Ministries), overseeing agricultural education (ICAR), and designing, financing and monitoring several Central sector extension and development programmes and laying down all major policy guidelines.

Views of different stakeholders

The need for strengthening the knowledge generation, management and application has been very well articulated in the Indian context. Sustained long run growth depends critically on technological progress and steps are therefore needed to strengthen research and extension support in agriculture [15]. To overcome the prevailing technological fatigue, new productivity enhancing technologies are required and this would need increasing application of biotechnology, ICTs, renewable energy technologies and nano-technology [16]. The need for strengthening public sector research capacity in employing new generation science and technologies e.g. biotechnology, bioinformatics and nano-technology is more relevant than ever before due to changing ownership rules on new technologies. 'Incase, the public sector in India doesn't generate and put its claim on technologies that can be generated using modern tools of science, the country would become heavily dependent on developed countries and the private sector which may involve very serious implication and heavy price in future' [17].

The need for greater resources to strengthen infrastructure, HRD for research, extension and teaching faculty and greater partnership with the private sector are also emphasized[18]. We

need to reorient the training of our agricultural graduates to give them more professional touch in molecular breeding, genomics, bioinformatics, integrated natural resource management, technology transfer and IPR management [19]. There is a need to strengthen the extension machinery through re-training and retooling of existing extension personnel and for promoting farmer to farmer learning by setting up Farm Schools in the fields of outstanding farmers [20].

While the need for integrating different kinds of knowledge in the process of technology generation and promotion are clearly evident, there is an overall reluctance among the public research and extension organizations to work with CSOs and the private sector [21]. Many of the successful experiences emerging from informal R&D facilitated / carried out by civil society organizations remain unnoticed for want of support systems and incentives required for its upscaling [22]. This would necessitate bringing about institutional changes in research and extension organizations [23]. A key lesson from implementation of NATP is that deliberate investments in partnership building and shared governance are required to speed up technology adaptation and dissemination [24].

Weaknesses, gaps and implementation hurdles

Though a number of public, private and CSO actors capable of providing different types of support exist, it is quite astonishing to note that the rural producers do not get adequate support in addressing their expanding and complex challenges. Though several new schemes are introduced and more funds are committed for overall agricultural and rural development, the overall performance of these schemes has suffered due to lack of complementary linkages among different agencies and lack of convergence of schemes. Though efforts are currently being made to support development of locally relevant schemes through district and State level plans, staff shortages, fear of loss of power and control on resources, and lack of capacity in designing locally relevant programmes, are constraining real convergence. The Government of India is keen to achieve convergence among these different programmes and a number of initiatives are currently attempted to achieve this [25].

BOX 3:

Gender and agricultural extension: current status and limitations

- Despite considerable focus on women in agriculture from Seventh to Tenth Five Year Plans, the approach mainly remained as that of considering farm-women as an uniform category.
- Though SHGs have created space for women to come together and network and access small informal loans, a great majority of the micro-enterprises initiated by the SHGs lack sustainability. Most of the SHGs are severely affected by marketing problems and lack of technical and managerial skills. SHGs continue to engage in traditional stereotyped, low return activities and the fundamental livelihood concerns of the rural poor woman remain largely un-addressed.
- Though the Women Component Plan (WCP) implemented from Eighth to Tenth Five Year Plan, quantified and earmarked funds for programmes for women, most of the ministries and departments designated as women related have not achieved their obligations fully and not provided separately a women component in their programmes.
- The Mid-Term appraisal 2005 of the Planning Commission has indicated that women still remain largely untouched by gender-just and gender-sensitive budgets as well as by the mechanisms of the WCP.
- The compartmentalization of schemes and activities for women implemented by different Ministries and Departments address various facets of women's empowerment in a fragmented manner. In the absence of convergence among various schemes (even within the Ministry of Agriculture), the impact on women's economic empowerment in agriculture, at best, may remain scattered and isolated, hence not very substantial.

The status of implementation of existing government programmes reveals three major concerns -

- lower than the stipulated allocation and gap between targets and achievements;
- limited coverage especially, in terms of direct beneficiaries despite large coverage of States and districts; and
- seemingly low impact in terms of economic and overall empowerment.

Sources: 1. Planning Commission (2006) - Approach paper of sub-group on gender concerns in agricultural extension; 2. Planning Commission (2006) - Report of sub-group on gender and agriculture.

Though several programmes for women in agriculture have been implemented, it is becoming increasingly clear that, many of these programmes and projects are not formulated based on the diversity of women groups or women's interest or based on consultations with other agencies that are also interested or are working for rural women (Box 3). Research also indicates that there is a clear lack of vision about the institutional support required to turn activities into real livelihood opportunities. Even if the opportunity exists, there is lack of innovation within organizations to realize the potentials. Thus opportunities remain unchallenged and unexplored. All of these would involve fresh thinking, and an overhauling of the design, resource mobilization and implementation machinery [26].

The faculty, infrastructure, curricula and teaching methods in agricultural education institutions directly impact the quality of professionals coming out of these institutions. Though ICAR is responsible for regulation of agricultural education, it has not been able to effectively play this role because of lack of statutory powers. As a result there has been a vertical and horizontal expansion of universities and colleges in total disregard of adequate financial resources leading to poor quality education in agricultural and allied areas[27]. The Fourth Deans Committee on Agricultural Education in India constituted by the ICAR in its report acknowledged that the current UG and PG curriculum neither offers experiential learning and required skills nor the entrepreneurial mindset to prepare scholars for taking up self-employment. There is also no link of curriculum to employment in private agri-business and processing industries and meeting the demands of extension. The Fourth Deans Committee has made several important recommendations for improving agricultural education and it remains to be seen how far these recommendations would be implemented in letter and spirit.

Though the country has made a beginning in the adoption and generation of biotechnologies, it is far behind the world leaders in biotechnology. Biotechnological interventions, including (i) *transgenics* which can integrate foreign or synthetic genes of interest into target organisms across species barriers; (ii) *molecular* breeding for targeted improvement of specific traits in crops, livestock or fish; (iii) *molecular diagnosis and vaccines* for effective control of diseases; and (iv) nano-technology for biosensor development and precision farming, have tremendous scope for revolutionizing agricultural production and farmer income.

With the increasing role of the private sector in commercialization of biotech products, the public system needs to redefine its niche in the spectrum of activities starting from identification of problems, basic research and discovery, technology incubation and dissemination in biotechnology [28]. Immediate emphasis has to be laid on strengthening R&D and developing human capital in frontier scientific areas.

Despite repeated emphasis on collaborative extension efforts involving public and private agencies, this approach is yet to get adequate attention. There are very few successful partnerships in the country. Some of the critical constraints related to establishment of successful public-private partnerships (PPPs) include –

- bureaucratic hurdles;
- delays in decision making;
- hoarding of information/technologies;
- fear of operational compatibility;
- lack of a common platform to get into an operational MoU among partners;
- lack of initiatives and mission mode approach;
- unwillingness to share credit among partners; and
- reluctance for investments by private players.

Suitable partnership among national and regional players involving commodity boards, research institutes, farmer organizations and business houses will certainly prove to be successful, provided such partnership

arrangements are made on professional terms and conditions, centred on teams, free from conventional bureaucratic control with incorporation of in-built project planning, implementation and monitoring arrangements [29].

The major weaknesses associated with this sector could be broadly classified into two. Firstly, those related to institutional or ways of working and secondly, those related to resources and these include resources related to expertise, manpower and finances (Table 2).

TABLE 2: Implementation hurdles in knowledge generation and management

Type of weaknesses / gaps and implementation hurdles	Current initiatives trying to address these	Limitations
A. Institutional		
Isolated functioning of research and extension agencies and the difficulties in nurturing and promoting public-private partnerships. Mistrust of other actors, narrow evaluation norms and weak accountability with State level actors further strengthen isolated functioning. Complementary knowledge and expertise therefore remain locked in different organizations (e.g., production and value addition, extension and marketing etc.) Other crucial set of activities like intermediation/brokering, technology adaptation needed for knowledge application remain unattended. Lack of convergence leading to sub-optimal utilization of funds and expertise.	NAIP is promoting a wider consortia led approach to solve technical problems through competitive research grants. ATMA is trying to promote public-private partnerships in extension. Convergence being tried as part of several Central sector programmes.	Other than some of these Central initiatives (NAIP, ATMA), there is little progress on the ground as institutional reforms are not attempted at the State level. Lessons from implementation of new institutional innovations are yet to be used effectively to stimulate institutional and policy changes.
B. Resources (expertise, manpower and finances)		
Expertise		
New science/technologies/themes: Nano-technology, precision agriculture, horticulture, biotechnology and bio-safety testing, high-tech horticulture, agri-business, climate change impact and adaptation. *New approaches:* Facilitating public-private partnerships. Community mobilization, enterprise development, market development.	Training under Indo-US Knowledge Initiative: refresher courses, summer and winter schools sponsored by ICAR/ NAARM. Only NAIP and ATMA focus on public-private partnerships.	HRD efforts on new science/ technologies/ themes yet to get adequate attention. Importance of promoting new approaches hasn't received adequate attention.

Contd.

Contd. from page 232

TABLE 2: Implementation hurdles in knowledge generation and management		
Type of weaknesses / gaps and implementation hurdles	**Current initiatives trying to address these**	**Limitations**
Innovation systems perspectives, Linking poor farmers to high value markets technological forecasting, incubation and commercialization. Producer companies, new generation cooperatives - sector coordination.	Training on mobilization, enterprise and market development handled by different agencies. Other new approaches listed are not addressed by any programmes.	Promoting new ways of working needs an action research approach with facilitation, hand-holding and lesson learning. Need training for policy makers on new approaches and client-oriented programme development. Staff shortages at the field level and ban on recruitments leading to sub-optimal utilization of trained manpower. Faculty shortages in training organizations and lack of expertise in emerging areas affect quality of trainings.
Manpower		
Less researchers working on livestock (15.8 percent) and fisheries (2.5 percent)[30]; livestock and fisheries extension virtually non-existent. Lack of qualified extension personnel to deal with new technologies and pilot new approaches (need this expertise at block/ district levels). Vacancies in field level extension staff (average 22-25 percent). Vacancies in staff positions in SAUs.	No special programmes to address these issues available currently.	Lacks clear cut strategy on manpower development. Poor financial health of States constraining recruitments.
Finances		
Limited funding. Agricultural research and education expenditure as percent of Ag GDP now at 0.53percent[31] (The demand for increasing it to atleast 1percent hasn't got attention so far). Less research resources allocated to livestock (15 percent) and fisheries (5 percent)[32]. SAU finances in poor health[33], limited operational funds for extension (line department and KVKs).	NAIP and National Fund for Basic and Strategic Research brought some additional funding for research. NHM support for horticultural research. More funds for extension and capacity building through ATMA, RKVY, FSM, BRGF, NHM.	These are inadequate considering the current state of affairs in State level research and extension organizations.

Requirements of the Governments

The need for new technologies, new frameworks, e.g. innovation systems [34] and new ways of working, e.g. public-private partnerships and linking the poor to markets are clearly articulated in several policy documents. Though agriculture is a state subject, as indicated earlier, the Centre has considerable influence on supporting and reforming research and extension and the Centre and the States will be able to appreciate the importance of this activity. However, it is important to engage with the states and select organizations from the design stage itself. This is important to obtain the much needed state level ownership.

5. Complementary inputs from international agencies

India has a relatively robust architecture for knowledge generation and management, though its effectiveness and efficiency have weakened over the years due to lack of resources and lack of institutional changes. Programmes explicitly addressing some of these weaknesses are already under implementation. International cooperation for knowledge generation and management should focus on capacity development of the system with a network of different organizations involved and complement some of these existing approaches. The capacity development agenda should focus on the following three aspects:

a) Upgrading skills and expertise to deal with new science and / technologies through training.
b) Promoting new ways of working like consortia, partnering with private sector and CSOs, ways of integrating technologies, integrated extension delivery etc. through trainings and facilitated institutional learning experiments.
c) Supporting institutional and policy changes through training senior staff at the policy and managerial level and building their capacities to appreciate alternative approaches experiment and learn from pilot change initiatives.

Capacity development support

This would ideally follow a two-pronged approach. It should add value to existing initiatives and should also support development of new initiatives (Table 3).

Prioritized list for potential support

1. Synthesis of best practices and preparation of lesson learning documents on:

   a) Ministry of Agriculture initiatives to bring about convergence of various development and extension programmes at district and State levels.
   b) Institutional innovations - producer companies, linking the poor to high value markets, integrated extension support, application of ICTs, research consortia, public-private partnerships.

TABLE 3: Types of support which international agencies should provide

Major themes	Adding value to existing initiatives	Support development of new initiatives
Application of new science and technologies	ICAR on-going network projects on transgenic, gene pyramiding, marker assisted breeding, application of micro-organisms. Donors to partner with the above initiative by bringing international expertise, funding and linkages. Climate change impact, modeling and adaptation studies (ICAR, DFID, MSSRF and other NGOs). Donors to find specific niches not attended under this broader theme and partner with these initiatives to support these niches.	Conduct a scoping study to understand gaps and better ways of designing and supporting application of new science and technologies. CGIAR organizations have a comparative advantage over other donors in supporting these initiatives. Donors to partner with CGIAR centres and their national partners (mainly ICAR/SAUs) in developing expertise and negotiate property rights among different knowledge sources in these areas.

Contd.

Contd. from page 235

TABLE 3: Types of support which international agencies should provide

Major themes	Adding value to existing initiatives	Support development of new initiatives
Promote new ways of working	NAIP consortia projects (public, private and CSOs); ATMA public private partnerships in extension; district level convergence through RKVY; District Poverty Initiative Project (DPIP), Madhya Pradesh - experiments on community empowerment, local self-government and decentralization of decision making especially at the grassroots level; pro-poor rural innovations from CSO sector; new generation cooperatives and producer companies linking poor to markets; agribusiness extension initiatives of private sector. Donors to support lesson learning and influence policy through: -Evaluation studies -Policy dialogues -Lead / participate in organizational and management reviews of research and extension agencies.	Support establishment of consortia as experiments to address specific technical and institutional issues. Some of the themes are as follows: linking the poor to markets; new models of integrated extension delivery; climate change adaptation in vulnerable ecosystems; linking extension to common services centres established by the Department of Information Technology. Implement challenge programmes on select themes. Target organizations capable of piloting these interventions and support them to play a major role in building this capacity. Reform and upgrade the ability of extension management. Development banks (World Bank, ADB) to design new programmes to promote new ways of working.
Support institutional and policy changes	Support lesson learning and evaluation of institutional innovations currently in place (list given below) and link this to policy through organizing policy dialogues and consultations. New ways of funding and delivering research and extension (research consortia, contracting); recent reforms in organization of cooperatives and markets (farmer markets, changes to market acts, producer companies); decentralization-district level planning, convergence (ATMA, RKVY); development of new forms of organizations (e.g. KHDP/VFPCK); pro-poor livestock policy development (FAO-PPLPI); contract farming, leasing policies, sustainable resource management.	Facilitate change management process in Central and State agricultural development and extension agencies; support organizational and management (O & M) reviews and policy reviews of research and extension organizations; experiment with new sector coordination experiments; support organizations with business planning and development; training on new ways of organizing research and extension targeted at policy makers/ senior management (e.g. FAO extension reform course); introduce learning based monitoring mechanisms; training on client oriented programme development, and new approaches for funding and delivery of services.

2. Organize training programmes for policy-makers and senior management staff in extension organizations on new ways of organizing extension services, drawing experiences from across the world.
3. Support State level review of extension organizations and facilitate institutional reforms and capacity development.
4. Training on client oriented programme design and learning based monitoring.
5. Facilitate experimenting with new sector coordination mechanisms linking farmers, research, extension, input agencies and output markets.
6. Organize policy dialogues and consultations to support cross learning among major stakeholders.
7. Support the efforts of NARS in enhancing access to new technologies by way of international expertise and linkages to different sources of new generation science and technologies.
8. Assistance for preparation of proposals for sectoral reform by working with other donors / development banks.
9. Support curricula development and faculty improvement in emerging areas in agricultural education drawing from experiences available globally.
10. Initiate new programmes on specific themes to primarily bring about institutional changes.

Acknowledgements

The author acknowledges the support provided by Dr Gopi Ghosh and Mr Raj Ganguly from FAO, India and Mr Vijay Sardana, Consultant for the NMTPF for their valuable inputs, guidance and supporting documents in preparation of this paper. Comments and suggestions on the initial draft from the participants of the FAO-Government of India workshop on NMTPF workshop are also gratefully acknowledged.

References

1. **Government of India.** 2007 National Policy for Farmers (www.agricoop.nic.in/NPF/npff2007.pdf).
2. **Jha Dayanatha & Pandey, S.K.** 2006. *Research Resource Allocation in Indian Agriculture, NCAP Policy Paper 23,* National Centre for Agricultural Economics and Policy Research (NCAP), New Delhi.
3. a. **Sulaiman, V. R.** 2003. *Innovations in Agricultural Extension in India,* SD Dimensions-Knowledge, June 2003, FAO.

   b. **Desai, G. R. & Manohari, P. L.** 2008. *Report on Revitalising Public Extension Systems (Part-1),* National Institute of Agricultural Extension Management (MANAGE), Hyderabad.
4. **Tiwari, R. K.** 2008. *National Agricultural Extension System - Strategy for Revitalization*, Paper presented at the National Conference on Agriculture, Kharif Campaign, 29 February 2008, New Delhi.
5. **Singh, J. P., Burton E. Swanson & Singh K. M.** 2006. *Developing a decentralized, market driven extension system in India: The ATMA model,* In A.W. Van den Ban and R.K Samanta (Eds) Changing Roles of Agricultural Extension in Asian Nations, B.R Publications, New Delhi.
6. **Sulaiman, R. V. & Andy Hall.** 2008. *The fallacy of universal solutions in extension: Is ATMA the new T&V LINK News Bulletin,* September 2008, Learning Innovation Knowledge (LINK) (www.innovationstudies.org).
7. **NIRD.** 2008. *RKVY Monitoring, Presentation at the Conference on Convergence in Agricultural Development - Special Focus on Rashtriya Krishi Vikas Yojana(RKVY),* 6 December 2008, New Delhi.
8. **ICC.** 2008. *Technical Paper on Technology Transfer and Extension; Issues and Recommendations, Vision Document for Second Green Revolution,* Indian Chamber of Commerce, Kolkata and Indian Council of Agricultural Research, New Delhi.
9. **Ministry of Information Technology.** Government of India (www.mit.gov.in)
10. **ICAR.** 2006 *Report of the IVth Deans Committee,* Indian Council of Agricultural Research, New Delhi.
11. **Planning Commission.** 2007. *Recommendations of Working Group on Agricultural Extension for Formulation of Eleventh Five Year Plan.*
12. **Government of India,** Census 2001.
13. **Pal, Suresh & Dayanatha Jha.** 2007. *Public-Private Partnerships in Agricultural R & D; Challenges and Prospects,* In Viswa Ballabh (ed.) Institutional alternatives and Governance of Agriculture, Academic Foundation, New Delhi.
14. a. **Sulaiman, R. V.** 2006. *New insights into promoting pro-poor rural innovation: lessons from civil society,* Paper presented at the GLOBELICS Conference 2006 (4-7 October, 2006), Centre for Development Studies, Trivandrum.

    b. **Development Alternatives.** 2006. *Civil Society in Poorest India, Stories of Innovation and Change,* PACS Programme, Development Alternatives, New Delhi.
15. **Planning Commission.** 2006. *Towards faster and more inclusive growth: An approach to the 11th Five Year Plan,* Draft approach paper to the XI Plan, Government of India, New Delhi.
16. **Planning Commission.** 2007. *Report of the Working Group on Agricultural Research and Education for the XIth Five Year Plan (2007-2012),* Planning Commission, Government of India.

17. **Planning Commission.** 2007. *Report of the sub-group on Adoption and Generation of Relevant Technologies and their Dissemination to the Farmers.*

18. **Planning Commission.** 2007. *Recommendation of Working Group on Agricultural Extension for formulation of XIth Five Year Plan (2007-2012),* Planning Commission, Government of India.

19. **Planning Commission.** 2007. *Report of the sub-group on Adoption and Generation of Relevant Technologies and their Dissemination to the Farmers.*

20. **Government of India.** 2007. *National Policy of Farmers,* (www.agricoop.nic.in/NPF/npff2007.pdf)

21. a. **National Knowledge Commission.** 2008. *Report of the Working Group on Knowledge Applications in Agriculture,* National Knowledge Commission, October 2008, New Delhi.

    b. **Hall, A. J., Yoganand B., Rasheed Sulaiman V., Raina, R. Prasad, S., Naik, G. & N. G. Clark,** (eds). 2004. *Innovations in Innovation: Reflections on Partnership and Learning,* ICRISAT, Patancheru, India and NCAP, New Delhi, India, 238 pp.

22. **WASSAN.** 2007. *Support Systems for up-scaling successful experiences - a case study of NPM programme in Andhra Pradesh*, Presentation by N.K Sanghi to the National Knowledge Commission, Sub-Committee on Knowledge Applications in Agriculture, Watershed Support Services and Activities Network, Hyderabad.

23. a. **Pal, Suresh, Mruthyunjaya, Joshi, P. K. & Raka Saxena** (eds). 2004. *Institutional Change in Indian Agriculture,* National Centre for Agricultural Economics and Policy Research, New Delhi. Government of India (2002) National Agricultural Policy.

    b. **Rajeswari S. Raina & Rasheed Sulaiman V.** 2007. *From Technology Development and Dissemination to Learning Approaches: Institutional Change for Rural Development,* In Vishwa Ballabh (ed) Institutional Alternative and Governance of Agriculture, Academic Foundation, New Delhi and Institute of Rural Management , Anand, Gujarat.

    c. **ICAR.** 1998. *National Agricultural Technology Project: Main Document.* Indian Council of Agricultural Research, New Delhi.

    d. **Paroda R. S. & Mruthyunjaya.** 1999. *NARS in the Asia Pacific Region; A perspective,* APAARI, FAOP, RAPA, Bangkok.

    e. **Sulaiman & Hall.** 2004. *Towards Extension-Plus, Opportunities and Challenges,* Policy Brief, 17, National Centre for Agricultural Economics and Policy Research, New Delhi.

    f. **Hall, A. J., Rasheed Sulaiman V., Clark N. G. & Yoganand B.** 2003. *From measuring impact to learning institutional lessons: an innovation systems perspective on improving the management of international agricultural research. Agricultural Systems* 78 (2003) 213-241.

    g. **Several papers presented at the Workshop on Agricultural Policy.** *Redesigning R & D to Achieve the Objectives,* sponsored by the National Academy of Agricultural Sciences, New Delhi, on 10-11 April, 2002, and Papers at the session on *Institutional reform in agriculture, at the Annual Conference of the Indian Society of Agricultural Economics,* New Delhi on 19-21 December 2002, discussed issues related to institutional change in Research and Extension.

24. **ICAR.** 2006. *NAIP Main document,* NAIP Project Implementation Plan, Indian Council of Agricultural Research, New Delhi.

25. **Nandakumar, T.** 2008. *Convergence in Agricultural Development,* Presentation at the Conference on Convergence in Agricultural Development - Special Focus on Rashtriya Krishi Vikas Yojana (RKVY), 6 December 2008, New Delhi.

26. **Planning Commission.** 2006. *Report of sub-group on Gender and Agriculture.*

27. **ICAR.** 2006. IVth Deans Committee Report, Indian Council of Agricultural Research, New Delhi.

28. **Planning Commission.** 2007. *Report of the sub-group on Adoption and Generation of Relevant Technologies and their Dissemination to the Farmers.*

29. **ICC.** 2008. *Technical Paper on Technology Transfer and Extension; Issues and Recommendations,* Vision Document for Second Green Revolution, Indian Chamber of Commerce, Kolkata and Indian Council of Agricultural Research, New Delhi.

30. **Jha Dayanatha & Pandey, S. K.** 2006. *Research Resource Allocation in Indian Agriculture,* NCAP Policy Paper 23, national Centre for Agricultural Economics and Policy Research (NCAP), New Delhi.

31. **Suresh Pal.** 2008. *Agricultural R&D Policy and Institutional Reforms: Learning from the experiences of India and China,* Economic and Political Weekly, June 28, 2008.

32. **Planning Commission.** 2007. *Report of the Working Group on Agricultural Research and Education for the XIth Five Year Plan (2007-2012),* Planning Commission, Government of India.

33. **Planning Commission.** 2007. *Report of the Working Group on Agricultural Research and Education for the XIth Five Year Plan* (2007-2012), Planning Commission, Government of India.

34. a. **National Knowledge Commission.** 2008. *Report of the Working Group on Knowledge Applications in Agriculture,* National Knowledge Commission, October 2008, New Delhi.

    b. **World Bank.** 2006. *Enhancing Agricultural Innovation: How to go beyond the Strengthening of Research Systems,* World Bank, Washington, D.C.

Glossary

Agripreneur: An entrepreneur who is an agriculture graduate, trained under Agribusiness and Agriclinic Centres Scheme of the Government of India, and has started his / her own business enterprise to support farmers and farming in terms of providing scientific knowledge of production, value addition and marketing, and / or farm inputs.

"Amul" model: An integrated model of milk procurement though village dairy cooperatives wherein dairy farmers are provided required inputs and information to improve milk productivity and milk is procured from there at a price fixed on scientific basis. The milk procured is also processed and marketed through a cooperative network. The profit earned is shared with members of village dairy cooperatives.

Artificial groundwater recharge structures: Structures constructed for enhancing surface water flow downwards to join the groundwater table so as to increase groundwater storage of an aquifer. Availability of the source water in desired quantity and quality are essential prerequisites for artificial groundwater recharge.

Beels: Water bodies created due to change of river water course.

Bharat Nirman: A special initiative launched by the Prime Minister in 2005 aimed at strengthening the country's rural infrastructure through a specific funding window of Rs 1 74 000 crores to be mobilized from the Government's development outlay.

Bharat Nirman Yojana: An ambitious scheme launched by the Government of India during the Tenth Five Year Plan to provide necessary infrastructure development in the rural sector of the country. It covers almost all dimensions of rural needs including irrigation, drinking water, health and sanitation, roads, storage, and education.

Backward Regions Grant Fund: BRGF is designed to redress regional imbalances in development and this fund provides financial resources for supplementing and converging existing developmental inflows to 250 identified backward districts of the country. The programme aims at (i) bridging critical gaps in local infrastructure and other development requirements that are not being adequately met through existing inflows; (ii) strengthen, to this end, panchayat and municipality level governance with more appropriate capacity building, to facilitate participatory planning, decision making, implementation and monitoring and to reflect the needs felt locally; and (iii) providing professional support to local bodies for planning, implementation and monitoring their plans.

District Poverty Initiative Project: DPIP is a World Bank funded initiative implemented at Madhya Pradesh, India. The project activities are implemented by community and village organizations in 2 100 villages spread over 14 districts. It aims to empower disadvantaged groups by putting funds under their direct control in community bank accounts.

District Rural Development Agency: DRDA is the principal agency at the district level to oversee the implementation of different poverty alleviation programmes of Ministry of Rural Development.

Ecosystem Services: The benefits people derive from ecosystems. These include provisioning services as food and water; regulating services as regulation of floods, drought, land degradation and disease; supporting services such as soil formation and nutrient cycling; and cultural services as recreational, spiritual, religious and other non-material benefits.

Ecotones: Transition area between two ecosystems.

Environmentally adjusted State Domestic Product: The net total value of goods and services produced during any financial year within the boundaries of a State adjusted for the economic value of environmental damage or accrual due to conservation.

e-Choupal: It is an initiative of Indian Tobacco Company (ITC) Limited to link directly with rural farmers for procurement of agricultural products. With e-Choupal, the farmers have a choice and the exploitative power of the middlemen is neutralized. ITC has designed and set up Internet kiosks called e-Choupals in rural areas across several agricultural regions to support its agricultural product supply chain. The computer and internet access at these centres enable farmers to obtain information on mandi prices, weather information, crop insurance, good farming practices and place orders for agricultural inputs like seeds and fertilizers. This helps farmers in improving the quality of produce, and also helps in realizing a better price. So far, ITC Limited has established 6 500 e-Choupals so far spread over 10 States and serving about 4 million farmers.

e-Sagu: It is a tool for an IT-based personalized agro-advisory system ('sagu' means cultivation in Telugu language). It aims to improve farm productivity by delivering high-quality personalized (farm-specific) agro-expert advice in a timely manner to each farm at the farmer's doorsteps without the farmer asking a question. In e-Sagu, rather than examining the crop in person, the agricultural scientist delivers expert advice by getting the crop status in the form of digital photographs and other information. Advice is provided on a regular basis (typically once a week) on everything from sowing to harvesting, which reduces the cost of cultivation and increases farm productivity as well as quality of agri-commodities. Developments in IT such as data base, the internet, and digital photography are extended to improve the performance of agricultural extension services in this model. The e- Sagu system has been developed by International Institute of Information Technology (IIIT), Hyderabad and Media Lab Asia under the aegis of Media Lab Asia, in 2004.

Gram Sabha: The Gram Sabha constituted by all members of a village over the age of 18 years, elects the Gram Panchayat, a council of elected members taking decisions on issues key to a village's social, cultural and economic life, under Panchayati Raj Instituions. The annual budget and the development schemes for the village are placed before the Gram Sabha for consideration and approval. The Sarpanch and his assistants answer questions put by the people. Different problems and difficulties of the people are also discussed in the Gram Sabha. All decisions of community development are taken in a Special Gramsabha. (See Panchayati Raj also)

Gyan choupal: Gyan choupals are Village Knowledge Centres (VKCs) aimed at disseminating information to farmers through the use of ICTs. This model of VKCs which aim to empower the poorest of rural villages by giving them access to knowledge via networked ICTs, was piloted by M S Swaminathan Research Foundation (MSSRF), an Indian NGO in the State of Pondicherry since 1998. Two core components of the VKC model are locally relevant content and appropriate network connectivity. A VKC has access to the whole of the internet, but the information relevant for the villagers is presented in their own language. The centre works on a hub and spoke model. The information to be supplied at the spokes would be collated and digitized by the hub centre and then made accessible to the VKCs on the spokes. The information can be further shared with other hub centres. Each VKC has one or more computers with CD-ROM drives, printers and scanners. Each VKC is manned by trained local village volunteers, the Knowledge Workers. Government of India is keen to replicate this experience across the whole country and is planning to use the common service centres it is planning to set up in rural areas to play the role of village knowledge centres.

Indian Council of Agricultural Research (ICAR): ICAR is the apex National institution invested with responsibility for agricultural research, university education and extension education. It currently has 95 research institutes, including National institutes for research and post-graduate education, Central institutes, Project Directorates, National Bureaus, and National Research Centres, and 99 Coordinated and network projects. This vast network of ICAR has a manpower of about 30 000 personnel out of which nearly 7 000 are engaged in active research and its management.

Indo-US knowledge initiative: This is a joint initiative of the Ministry of Agriculture, Government of India and the United States Department of Agriculture (USDA) aimed at promoting teaching, research, service and commercial linkages to address contemporary challenges. A key feature of this Initiative will be a public-private partnership where the private sector can help identify research areas that have the potential for rapid commercialization, with a view to develop new and commercially viable technologies for agricultural advancement in both countries.

Kisan Credit Cards: As a pioneering credit delivery innovation, the Kisan (farmer) Credit Card scheme was introduced to provide adequate and timely financial support to farmers for meeting their cultivation needs including purchase of inputs. This flexible and cost effective credit delivery system was introduced in 1998-99 and became very popular among farmers.

Krishi Mahotsava (Agricultural Festival): A unique model of transfer of technology evolved in the state of Gujarat and replicated in other states like Uttarakhand. Under this model farm scientists, extension workers, and government officers go to the doors of farmers and stay there for some time to mitigate their problems of knowledge deficit on farm production and marketing.

Krishi Vigyan Kendras: KVKs are district level organizations set up by the ICAR to provide grassroot level training on agro-technologies to farmers, village level workers and NGOs engaged in agriculture. Presently 562 KVKs have been established in the country. The motto is to cover each district with one KVK, with a mandate of technology application through farm trials, demonstrations and training.

Maha Grapes: An organization of grape producers in Maharashtra for collective marketing.

National Institute of Agricultural Extension Management (MANAGE): MANAGE is an apex national institute set up in 1987 as an autonomous society under the Ministry of Agriculture, GoI. It has a mandate to assist the State Governments, the Government of India and other public sector organizations in effective management of their agricultural extension and other agricultural management systems. As an apex institution, MANAGE functions as a pace-setter, developing system designs and models of professional activities for other State level institutions to adopt.

Multiscalar: Various ecosystem scales – for example wetland site, catchment and river basins represent multiple scales that can be associated with wetland ecosystem.

National Bank for Agriculture and Rural Development (NABARD): NABARD is the apex institution accredited with all matters concerning policy, planning and operations in the field of credit for agriculture and other economic activities in rural areas. It has a mandate for facilitating credit flow for promotion and development of agriculture, small-scale industries, cottage and village industries, handicrafts and other rural crafts. It coordinates the rural financing activities of all the institutions engaged in developmental work at the field level and maintains liaison with Government of India, State Governments, Reserve Bank of India and other national level institutions concerned with policy formulation.

National Food Security Mission (NFSM): This scheme with an investment of Rs 5 000 crores aims at increasing the production of rice, wheat and pulses. It aims to achieve additional production of 10 million tonnes of rice, 8 million tonnes of wheat and 2 million tonnes of pulses over the base year 2006-07.

National Horticulture Mission (NHM): NHM is a centrally sponsored scheme initiated by the Government of India during the year 2005-06 (Tenth Plan). The objective of this scheme is to provide holistic growth of the horticulture sector in India and to enhance horticulture production. NHM activities were extended to 78 more districts during 2007-08 and presently work is under progress in 340 districts in eighteen States and two Union

Territories. NHM activities have brought an area of 7.6 lakh hectares under horticultural crops during the last three years.

National Agricultural Innovation Project (NAIP): NAIP is a world-bank funded programme implemented through the Indian Council of Agricultural Research. Its overall objective is to facilitate accelerated and sustainable transformation of Indian agriculture by promoting collaboration among public research organizations, NGOs, the private sector and other stakeholders. The project costs US$ 250 million and will run till June 2012. It comprises four components: (i) ICAR as the catalyzing agent for the management of change of the Indian National Agricultural Research System; (ii) research on production to consumption systems (value chains); (iii) research on sustainable rural livelihood security; (iv) Basic and strategic research in the frontier areas of agricultural sciences.

One Lakh: One hundred thousand

One Crore: Ten million

Over-exploited category: Categorization of areas under groundwater development are made on the basis of "stage of groundwater use" defined as the percentage of annual groundwater draft to the net annual groundwater availability. Consequently, areas with stage of groundwater use less than 70, between 70-90, between 90-100 and over 100 percent are categorized as Safe, Semi-critical, Critical and Over-exploited respectively.

Panchayat: A village level administrative body in India.

Pani Panchayat: Pani Panchayat is a voluntary activity of a group of farmers engaged in the collective management of water for both harvesting and equitable distribution among themselves in order to improve their economic condition.

Panchayati Raj: It is a system of governance in which gram panchayats are the basic units of administration. It has three levels: village, block and district. At the village level, it is called a Panchayat. It is a local body working for the good of the village. The block-level institution is called the Panchayat Samiti and the district-level institution is called the Zilla Parishad. The Gram Sabha constituted by all members of a village over the age of 18 years, elects the Gram Panchayat, a council of elected members taking decisions on issues key to a village's social, cultural and economic life. The council leader is called 'Sarpanch' in Hindi, and each member is a Gram Panchayat Sadasya or Panch. The panchayat acts as a conduit between the local government and the people.

Panchayati Raj Institutions (PRI): A third tier decentralized administrative authority created under the Indian Constitution.

Piedmont deposits: These are typical geological formations formed in the foothill areas due to deposition of an admixture of loose materials of varying size such as soil, sand, gravel, pebble, cobble, boulder etc. carried down the hill slopes. Sufficient quantity of groundwater occurs in Indian Piedmont deposits usually at a greater depth (>300 ft) under water table condition.

Rashtriya Krishi Vikas Yojana (RKVY): RKVY or the National Agriculture Development Programme is a new programme initiated by the Central Government during 2007-08. It has a total allocation of Rs 25 000 crores for the Eleventh Five Year Plan (2007-12) period. It is a 100 percent Central government grant to the States and its main objective is to incentivize the States to increase their investments in agriculture and allied sectors. It provides adequate flexibility and autonomy to the states in planning and executing programmes for agriculture. The States have to prepare agriculture plans for the districts and states and the aim is to integrate agriculture and allied sectors into the planning process.

Salinity level: Salinity level of water is determined by the amount of total dissolved solids (TDS)

as cations and anions present in the water, measured commonly in parts per million (ppm). Water with TDS more than 1 000 ppm is not suitable for human consumption.

Salinity ingress: The interface between the fresh groundwater from the land side and the saline groundwater from the sea side occurs under a dynamic hydrostatic balance within coastal aquifers. Creation of lower hydrostatic pressure in the land side due to excess pumping of fresh water tends to shift the interface landwards causing saline water ingress.

Self Help Group (SHG): SHG is a registered or unregistered group of individuals having homogenous social and economic background who voluntarily come together to save small amounts regularly, to mutually agree to contribute to a common fund and to meet their emergency needs on basis of mutual help. The group members use collective wisdom and peer pressure to ensure proper end-use of credit and timely repayment thereof. An economically poor individual gains strength as part of a group. Besides, financing through SHGs reduces transaction costs for both lenders and borrowers. While lenders have to handle only a single SHG account instead of a large number of small-sized individual accounts, borrowers as part of a SHG cut down expenses on travel - to and from the branch and other places - for completing paper work and on the loss of workdays in canvassing for loans.

Soil sodicity: Increased concentration of sodium salts in soil usually gathered through upward capillary movement of soil water renders the soil unfit for agriculture. Formation of sodic soil is common in areas underlain by impervious hard formation restricting downward leaching of excess salts from the soil.

Swarnajayanti Gram Swarozgar Yojana (SGSY): SGSY is a self employment programme financed by the Central government and under this scheme assistance is given to poor families living below the poverty line in rural areas for taking up self employment. The persons taking up self employment are called swarozgaris. They may take up the activity either individually or in groups, called Self Help Groups. For successful self employment, it is necessary to take up the right activity. For this purpose, 4 to 5 activities are selected in each block with the help of officials, non-officials and bankers. These are called 'key activities', and should be such that they give the swarozgaris an income of Rs 2 000 per month, net of bank loan repayment.

Trading in virtual water: The concept of trading in virtual water is still in its infancy wherein the price of a traded commodity may be factored by the water it consumed for its production. The concept is somewhat similar to that of carbon trading.

Vegetable and Fruit Promotion Council, Keralam (VFPCK): VFPCK is a company registered under Section 25 of Indian Companies Act 1956 and has been established with the aim of bringing about overall development of the fruit and vegetable sector in Kerala. Established in 2001 as the successor organization of Kerala Horticulture Development Programme (KHDP), VFPCK is a company with majority stake of farmers and has the Government and financial institutions as the other major shareholders.

Water stressed condition: A river basin in which per capita water availability is less than 1 700 cubic metres is considered to be under water stressed condition.

Water scarcity condition: A river basin in which per capita water availability is less than 1 000 cubic metres is considered to be under water scarcity condition.

Food and Agriculture Organisation of the United Nations

55, Lodi Estate, New Delhi – 110003, India.

Fax: +91 11 2462 0115

Email: fao-in@fao.org

Internet: www.fao.org