RAINFED LIVELIHOODS – PROGRESSIVE PARADIGMS

SUMMARY

Sixty percent of risky, un-irrigated and under invested areas of India support 40% of population, contribute 40% of food grain and a vast array of livelihoods and environmental services. Climatic changes are compounding challenges to livelihood, increasing distresses and require managing of vulnerabilities, adaptations, coping and mitigation. Participatory integrated management of resources within watersheds consisting of transparency, contributions, equity, farming systems and all inclusiveness is a major driver of the current rural development process. The recent strategy focuses on enhanced farm productivity, diversification, income generation through non-farm activities for landless, assetless and micro-enterprising. Improvement in productivity and diversification aims at enhancing self-sufficiency and mopping of marketable surplus of small, marginal and subsistence producers. Improved technologies, credit, insurance, innovative safety-nets, collective purchase of assured quality inputs, sale of outputs and value addition have been argued.

Increased investments in rainwater management, diversification of cropping/farming systems, soil health management, mechanization by custom hiring, more energy inputs etc. are important to improve productivity especially for producing marketable surplus by subsistence producers. Small ruminants, livestock, trees, special attribute crops, upgrading skills and crafts is vital for the drylands.

Management of common property resources of rainwater, ground water, lakes, tanks, ponds, panchayat or other common lands, pastures,

grazing lands, usufruct rights in the forest, social capital of landless and assetless require innovative institutionalization. Harnessing of demonstrated potential technological gaps of 140% for cereals, 100% for pulses and 78% for oil seeds through IT enabled extension and private partnership for value addition has been advocated. Sharing of added value by aggregating production of small farmers and other primary producers by linking with retailers especially in fresh fruits, vegetables and food is very crucial.

Value of the land is appreciating at unimaginable rate especially due to non-agricultural demand for housing, economic zones, industry and other infrastructure. There is an urgent need of changing outdated laws for encouraging consolidation of fragmented holdings, enabling land tenure systems, share cropping, leasing, contracting and land use planning. Every centimetre of land and water drop is to be used on sustainable basis since supply of these resources is inelastic and per capita availability is declining due to demographic dynamics.

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1. Rationale

Harnessing economically viable, socially inclusive and environmentally sustainable livelihood security and growth with upfront management of land, water, forest and social capital is a challenging task. A comprehensive food security consists of security of dryland cultivation (seeds, inputs), production (risks), accessibility (purchasing power) and food absorption (hygiene). Almost entire area under forests, grazing/grass lands, 80% horticulture in hills, coastlands, drylands and 60% net sown area in India is un-irrigated or directly dependent on precipitation. Rest of the geographical area under buildings, roads, rocks, other infrastructure and snow generate run off with a vast range of opportunities for its utilization. About 84-87% pulses and coarse cereals, 77% oilseeds, 60% livestock, 60% cotton and 50% fine cereals are raised in the un-irrigated agro-ecologies. Average recorded productivity of 1.34 m^3/ha/yr of forests is very low and represent highly diminished livelihood basket for tribals, landless, assetless, small and marginal farmers.

Relatively low primary productivity of arid and dryland is compensated with opportunities of high value and low volume crops such as seed spices, guar/other gums, moth beans, herbs, natural dyes (*henna*) and medicinal plants. The 60% of un-irrigated agriculture is supporting 40 % population, contributing 40 % to the food grain production but is risky, vulnerable, diverse, complex and under-invested.

Precipitation is the source of water in the dams, other water bodies, river flows etc. and is also the ultimate source of irrigation based livelihood,

income and employment generation. However large scale public investments into multipurpose hydro electric projects, network of canals and rural electrification vis-a-vis investments into bore-well technology have created a sharp divide for the un-irrigated areas.

Incremental demands of demographic dynamics and exports are supposed to be realised by enhancing productivity since per capita land resources are diminishing. The first green revolution predominantly in irrigated region is fatigued with high cost of production and several second generation problems of resources' degradation.

Success stories of diversification into rainfed soybean, castor, Bt cotton, Hybrid *Bajra* (pearl millet), horticulture, livestock production, agro-forestry etc. are limited and overall growth in rainfed agriculture decelerated post 1995 due to WTO related terms of trade. The present write up is mainly focussed on un-irrigated agriculture and some of the issues related to ground water and watershed management for an inclusive and sustainable growth.

2. Development Trajectory

The initial management processes of un-irrigated region were empirical, restrictive, sectoral and lacked focus on integrated resource development and harnessing of social capital. *In-situ* conservation of rainwater and prevention of soil erosion was also taken up in arable drylands primarily by the government departments/agencies without invoking social capital, NGOs and the private sector. Subsequently the scope included enhancing productivity, production, livelihood, income and employment generation during 1980-1995 under the World Bank aided Integrated Watershed Development Projects (IWDP) and National Watershed Development Projects in Rainfed Area (NWDPRA) of

Ministry of Agriculture. Employment oriented schemes like Drought Prone Areas Programme (DPAP) and Desert Development Programme (DDP) under Food for Work programme and Integrated Wasteland Development Programme (IWDP) of Ministry of Rural Development also adopted principles of watershed management in their implementation strategies. In the initial stages the Ministry of Rural Development implemented their programme through NGOs and even considered involvement of corporate sector to produce raw material from wastelands. However, most of the NGOs did not have domain experience and implementation was shifted to Panchayati Raj Institutions (PRI) in the Haryali Guidelines and further modified in the Common Guidelines (2008).

Programmes of the Ministry of Agriculture continued to be implemented by the line departments because of their technically institutionalised system at the national, state, district and sub-district level. However, Ministry of Agriculture lacked experience of mobilizing communities and ultimately accepted participation of the NGOs for organizing communities, capacity building, monitoring and evaluation. Upgradation in the various editions of *Jansahbhagita* guidelines also converged on the principles of participation, empowerment of the communities, PRIs, equity, transparency, production systems, off-farm activities and enterprising by the landless and asset-less.

Similar kind of developments were also witnessed in the programmes of Ministry of Environment and Forests with the institutionalisation of Forest Development Agencies (FDA) and Joint Forest Management Committees (JFMC). Development programmes of the Ministry of Water Resources like Renovation, Repair and Reconstruction of Water Bodies, minor and micro irrigation schemes also progressed in the direction of participatory processes.

3. National Rainfed Area Authority (NRAA)

NRAA, established in October, 2006 discovered similarities in the latest development processes of various Ministries and other service providers in terms of fundamental concepts and principles, of course, with different nomenclature of their institutions. Similarities in their enabling institutionalization on various counts were major drivers for evolving new common guidelines through several rounds of consultations with Central Ministries, other stakeholders and actors.

Several innovations were incorporated into new guidelines keeping in view the emerging policies, programmes, schemes, demands, supplies, aspirations of the society and accelerated growth in the economy. For example highly innovative and transparent scheme of NREGA was the main reason of shifting focus of watershed development process from employment or wages generation to enhance livelihood, income, micro enterprising, production systems, market linkages, value addition, safety nets and all inclusive development. Convergence, coordination, harmonization and rationalisation of complementarities of financial resources of NREGA, RKVY, BRGF and other untied resources with the tied funds was enshrined in the planning process which became mandatory during the 11^{th} Plan. Rainfed agriculture is relatively more vulnerable to climatic changes requiring intensive safety nets, adaptations, coping mechanism and mitigations. Accordingly rain fed agriculture is expected to be an altogether unique business and some of the elements of the paradigm shift are described below.

4. Strategy

4.1 *In-situ* conservation of rainfall, water harvesting, recharging of aquifers, rejuvenation of water bodies and most efficient irrigation to produce maximum crop per drop of water is the bedrock of the strategy. Integrated development of all natural resources including social capital and participatory processes is proposed to be intensified. Sequenced conservation treatments from ridge to valley including forest and wastelands, if any, is uppermost process of implementation.

4.2 Climatic change due to global warming is manifesting into spatial and temporal redistribution of rainfall, increased intensity and frequency of extreme weather events like droughts, floods, temperature, cyclones and outbreak of pests and diseases. High vulnerability, risks and distress would demand befitting responses and safety nets. This calls upon restructuring the approach for realising robustness, resilience, adaptations and mitigation of vulnerabilities. The converged approach underpins regionally differentiated processes for the whole range of low to high rainfall agro-ecologies in unified and systematic manner.

4.3 In the initial phases of resource management, water and bio-diversity conservation and flood moderation was the aim of investments in the high rainfall areas. Calamity management of droughts, relief and food for work programme was generally emphasised without measures of permanent solutions, prevention, adaptation and mitigation. The new generation programmes give greater emphasis on long term mitigative strategies, multilevel convergence, integrated and holistic growth.

4.4 Greater linkages with demand, creating marketable surplus of subsistence farmers or primary producers with enhanced productivity, safety nets, value addition and credit have been explored. Harnessing of social capital, PRIs and emerging technologies is unwavering commitment of paradigm shift.

5. Integration of on-farm and non-farm activities

5.1 An integrated and holistic view of all natural resources including social capital of landless and asset-less, labour, gender, socially and economically disadvantaged sections is called upon for realising the all inclusive progress, prosperity, peace and social harmony.

5.2 Creation of non-farm jobs involving micro-enterprising due to low primary productivity and seasonal nature of the agricultural activities in the drylands are the major drivers of the paradigm shift.

5.3 Diversification into value added chain of aqua-culture, horticulture, agro-forestry and regionally differentiated various permutations and combinations of the production systems are the vast opportunities for harnessing all round development in high rainfall rainfed regions. Primary productivity of high rainfall rainfed areas is relatively high compared to dryland and intensified livelihood generation is possible.

5.4 Promotion of livestock especially ruminants which convert non-human feed and roughages into human consumable products have a high potential in the rainfed areas. Rearing of animals, value addition collectively through dairying and marketing have tremendous potential of generating employment and providing regular flow of cash and income for households. Livestock

rearing and dairying has 4-5 times more employment generating potential compared to crop cultivation and is advocated especially for small holders.

5.5 Micro financing through self-help groups, scaling up of extension, inputs, services and marketing by producers' companies, cooperatives and their federations have tremendous potential. Imparting training in emerging skills and crafts as per diversified demands in the market will go a long way for realising all inclusiveness of landless, asset-less, small and marginal farmers. Group action can procure assured quality inputs and sell products with minimum transaction costs.

6. Farming System

6.1 The alternative strategy moves away from the crop or commodity centric approaches to diversified farming systems of harnessing complementarities, reducing vulnerability and cycling and recycling of residues. Integration of crop, livestock, horticulture, agro-forestry, fishery, biomass and income generating activities will be focussed. In addition to synergies, enhanced employment and income, risks get spread over seasons and years leading to reduced distress. This is also necessary due to shrinking per capita availability of natural resources, capital intensive production and preserving integrity of the environmental services by recycling of residues.

6.2 About 67% of crop residue in the country is consumed for rearing livestock and recycling of animal dung as manure. Inclusion of milch, meat, dual purpose and draft animals into the production chain can diversify livelihood of landless and small land holders. Optimisation of the entire production and livelihood assembly will be the best bet for creating resilience to risks.

6.3 Excavation of ponds in 65% area for aquaculture and raising embankments on the remaining 35% land for horticulture can replace traditional low productive rice-fish culture with 3-5 times enhanced production, income and employment generation from a unit of land.

6.4 There is a vast range of possibilities of permutation and combinations of farming systems keeping in view the regionally differentiated socio-economic conditions, demands, market linkages and availability of natural resources.

7. Integration of Tree Crops

7.1 Raising fodder trees like Khejri (*Prosopis cineraria*) in Rajasthan, *Bahunia* sps. in the Himalaya and many other species elsewhere is a traditional practice to support fodder and feed for livestock, fibre and fuel wood requirements. Making Charcoal from the *Prosopis juliflora* (Vilayati Babul) in Gujarat, Tamil Nadu, Rajasthan and waterlogged saline coastal Andhra Pradesh have created utility of this otherwise unwanted species which has invaded the vast grazing lands in the country. Such systems need to be evaluated and revamped in terms of emerging economic realities, environmental needs and climatic changes.

Rubber trees have potential of earning Rs.75,000 to 1,20,000 per ha per year in the high rainfall areas and its market has revived. Industrial wood based value chain by raising commercial plantations with fast growing cloned saplings under rainfed conditions has tremendous potential. Pulpwood based plantation on one hectare can generate employment of approximately 450 man days. Trees are ideally suited for managing wasted and degraded lands. Plantation of fruit trees like *Amla,* Walnut, *Jamun, Kathal* etc. under Joint Forest Management (JFM) has tremendous potential. In addition, agro-forestry

plantation are carbon, water and environmentally positive with tradable credits. Agro-forestry can meet food, fuel, fodder, feed and fibre demands in economically viable, socially inclusive and environmentally sustainable manners.

7.2 Restrictions on the transportation of wood and relocation of wood based industry out of the forest area have created market for trees raised on the private, common and waste lands for various industrial and commercial enterprises. Agro based income of some of the corporates like ITC, other paper, paper board, packaging and plywood industries has become a major source of profit and employment generation for the communities. Value added benefits may be shared with primary producers through well designed agreements and contracts.

7.3 Planting of Aldar trees, fruits like cashew-nut, oranges and pineapple during the second year of shifting cultivation are leading to permanent settlement of tribals. This is the best way to resolve the problem of resource degradation due to repeated slashing, burning and shifting or zoom cultivation. Trees can withstand large variations in the rainfall and other environmental factors and can be liquidated under extreme drought situations as a safety net. Unlike seasonal or annual crops, growing cycle of trees extend beyond 5 to 10 years and these opportunities should be encouraged and supported by assured marketing contracts and appropriate credit services.

7.4 Fast growing tree species planted on the private land may be treated as agriculture produce/activity for marketing so as to avail various concessions, tax benefits, minimum support prices, etc.

7.5 Raw material for the wood based industry from the private producers may be promoted by discouraging supply from the traditional forest areas.

7.6 Scale of production for supporting a viable industry could be realised through formation of producer companies, cooperative or user groups for growing trees. Benefits of aggregation and value addition can enhance share of primary producers of the retail prices by 20-25 percent.

7.7 A minimum support price with multi-partite and legally enforceable contracts can also be signed by the industry, service providers, government and farmers. Policies for such a long gestation period of growing trees may not be changed frequently.

7.8 Research and development efforts by the private companies was a major driver in promoting plantation of eucalyptus, poplar, *Acacia mangium*, and other soft woods. This should be extended to other species of trees and products.

7.9 Custom duty on wood import is only 5% despite a bound rate of 40% committed under WTO. Import of wood was liberalised to save timber forest in the country. However specific tariff/non-tariff import barriers on the planted species being grown by the domestic farmers can also be thought of to promote production and income in rainfed regions. The country is losing employment and carbon credits on this account.

7.10 Multi-tiered or staggered plantation system should be devised for regular and sustained income of farmers. Primary producers can also be registered as shareholders in the tree based companies so as to share additional benefits of value addition and permanent multiple partnerships. This will be a win-win situation both for the industry and primary producers.

7.11 Large corporate involvement for harnessing commercial linkages is possible for offering long term leases or contracts of wastelands since trees have a long gestation period. However land use changes for other commercial purposes may be prohibited.

7.12 Collection of minor forest products and medicinal usufruct right is the major source of livelihood for millions of rural dwellers. However, intermediary agents or aggregator garner lions share. More than one lakh Joint Forest Management Committees can be considered to replace intermediary by well designed institutionalization and empowerment.

8. Value Addition

8.1 Benefits of promoting and servicing milk production, collection, processing and organised marketing by NDDB have been shared by the small herders in the predominantly rainfed region of Gujarat and few other states. However this model is being considered for further revamping for better insulation from unwanted interferences. There are ample unexplored opportunities of procurement, collection, aggregation, processing and commercial linkages in several other farm commodities.

8.2 Trade in the meat of goat, sheep, broiler and others is still in the form of un-perishable live animals and primary producer is not harnessing benefits of processing, reducing wastages, packaging and marketing of preserved products. There is tremendous potential of exporting processed lean meat of male buffalo calves and its feasibility may be explored in various regions.

8.3 Contract farming and collection of vegetables and fruits by fresh food corporates and retailers have enhanced share of farmers by about 20% of the retail prices. ITC, Nestle, Reliance Fresh, Subhiksha, Heritage and traders in castor oil are also incentivising benefits to primary producers in the form of extension services, input supplies etc. through e-chaupal and other methods as per their commercial interests. ITC invested about Rs.50 crores into rainwater harvesting under their obligation of social responsibilities. The productivity of

the farmers and herders was almost doubled and they mopped up additional production to add value through processing and organized marketing. There are several possibilities of similar win-win situations. Such partnerships may be scaled up and multiplied.

8.4 Minor forest products such as tree oil seed, tamarind, *palas* (flowers), *mahua,* medicinal plants etc. can also be considered for processing, value addition and marketing by organizing pickers or collectors into groups to retain benefits normally cornered by the intermediary agents. The natural medicinal plants, herbs and dyes are witnessing impressive growth with the help of Medicinal Plant Board of the Govt. of India. Joint Forest Management Committees (JFMCs) can be converted into Producer Companies to reap benefits of collectiveness and corporate provisions.

8.5 Agro-chemical input in the arid region is very low and livestock population for supplying organic manures is relatively high to support organic farming of low volume and high value crops of seed spices, moth beans, guar gums, natural dyes, herbs, ginger, curcumin etc. with assured market and export. Animal and milk products can also be marketed as organic produce to fetch premium prices. It is a simple matter of creating area or cluster based certification process and organisation.

9. Inputs, Marketing and Private-Public Partnership (PPP)

9.1 These three items have deliberately been clubbed under one heading because of their strong cross linkages traditionally as well as in the current context. Production, distribution and sale of inputs are generally with the private sector except subsidy linked distribution of fertilizers, seeds of important crops and farm machinery. Corporate sector and private players

with business interest in soybean, wheat, poultry, milk, Basmati rice, vegetables and fresh fruit are providing extension services, free health check-ups of farmers, credit, procurement, buy back, processing, value addition and marketing through Information and Communication. These partnerships have enhanced share of farmers (primary producers) of 20-25% by eliminating the intermediaries. Enhancing productivity of small, marginal and subsistence production to generate marketable surplus should be the major agenda of such partnerships.

9.2 Some Private Limited Companies dealing with weather risks and hedging are also interfacing between importers, exporters, manufacturers, suppliers and farmers or other primary producers. They also procure for bulk consumers and organize credit at reasonable rate of interest.

9.3 Realization of Green Revolution in the rainfed region will be driven by enhanced investment into creation of water infrastructures/systems for enhanced water availability and accessibility, inputs, credit, new technologies, marketing and risks management. However these kinds of multi partnerships are limited. These are mostly at the experimental stage in majority of cases and may require re-structuring and up-scaling as we go along.

9.4 Rainfed agriculture is also known for the cultivation of diverse and regionally differentiated minor crops and private companies may not be interested in their promotion due to the small scale of business. Public sector is expected to undertake production of improved seeds, implements and other specific inputs in such cases.

9.5 Primary Producers Ltd. Companies

In order to rectify deficiencies in the services of cooperative institutions and to rationalise loose formation of watershed committees, self-help groups, users groups and their variants, Article 9(a) of the Companies Act 1956 was amended in 2002 to set up Primary Producers' Limited Companies. This institution takes care of politicization and veto powers of the Registrar of Cooperatives to enable the primary producers to take advantage of efficiencies of the companies. Conceptually Primary Producers Companies replace emphasis of social welfare of the cooperatives by a competitive process from production to marketing, value addition, consumption and recycling of the residues/wastes. The office bearers essentially have to be primary producers. There is only one vote per member irrespective of his number of shares to avoid take over by powerful members. The shares are transferable but not tradable. There are several innovative mechanisms of insurance, governance, management, sharing of inputs, marketing and value addition transparently by the primary producers only. About 200 primary producers companies are being experimented since 2004 and their effectiveness and efficiency is being watched with the keen interest of restructuring institutions to harness emerging opportunities and managing challenges.

10. Credit

Crop failures, indebtedness due to risky investments for developing uncertain ground water resources, capital intensive inputs of improved technologies, diverting crop loans for social functions and household consumption led to farmers' distress in the rainfed region. A one-time loan waiver of Rs.71,000 crore was sanctioned in 2008-09 to enable farmers to raise

fresh loans to invigorate primary production. A restructured credit policy with following elements is called upon.

10.1 A cyclic composite credit for cropping or farming rather than a few months of a crop season will be ideal for rainfed areas.

10.2 Dryland farmers receive major portion of income during one season and require consumption credit for the remaining lean season.

10.3 Dryland livelihoods are highly diversified and credit for the total income portfolio will be more appropriate rather than a crop.

10.4 Waiving of a part or whole of the interest or principal or both depending upon severity and duration of livelihood failures should be inbuilt within the schemes.

10.5 Kissan credit card limits for the non-defaulting loanees may be enhanced from time to time. Credit limits for landless and assetless may also be introduced with some innovative securitization.

10.6 Micro-credit by local self help groups has lower transaction cost and easy to obtain with high human values. Credit limits of Self-help Groups with the banks may be revisited periodically to reward the performers with enhancement.

11. Vulnerability and Safety Nets

Vulnerability of rainfed livelihood to the climatic variations is relatively higher compared to irrigated agriculture. Risks in some of the high rainfall coastal hilly regions of Maharashtra, Goa, Karnataka, Kerala, Tamil Nadu, Andhra Pradesh, Orissa, Assam, NEH cultivating/plan ting rubber, tea, coffee, nuts, beverages, spices, etc. are quite unique. Most of them are high value and low volume annuals or perennials with tremendous risk of diseases and pests. They have to face international competition of high productivity elsewhere and

extreme volatility in the prices. Epidemic of foot root disease in pepper around 2006, its high productivity in Vietnam and flooding of Indian market via Sri Lanka distressed farmers of Wayanad in Kerala. Similar tragedy happened with cocoa beans and vanilla. Coconut wilt and mites have forced relocation of its plantation to escape build-up of pests and diseases over years of mono-culturing. Rubber price fluctuates with highly volatile prices of oils and petroleum. Most of the re-plantations are having long gestation period which adds to the severity of risks. Bird flu in poultry wiped out micro-enterprising livelihood of many during 2004-2008.

11.1 Traditional robustness, resilience, adaptation, moderation and mitigation of vulnerability are getting compounded due to climate changes and emerging demands. Vulnerability of rainfed production to climate variations is relatively high compared to the irrigated production systems. Supplementing part of family income from other sources, livestock rearing and raising trees for their liquidation during crop failures and calamities may be re-designed in terms of new skills, crafts and market preferences.

11.2 Marketing of drought hardy sunrise commodities of fruits like *Amla, Ber* and coarse cereals is not assured, prices crash during the main season and value addition by processing is non-existent. Investments for assured income and profit stabilization are essential in such cases.

11.3 Income or loss of a farmer is a product of yield and prices. Minimum Support Price (MSP) takes care of volatility of prices and is very well established for the predominantly irrigated crops such as wheat, rice, sugarcane, etc. However, there is a large diversity of crops and commodities in the rainfed region and only a few of them are covered under MSP and that

too without commitment of operationalization, procurement and prompt payment.

11.4 Setting up of food, feed, seed, fodder and water-banks is not properly institutionalised to deliver adequate and right kind of relief at the time of distress. These banks have to be created in the surplus regions with a provision of fast movement and supply to the calamity afflicted regions. Periodical updating in case of their non-use and expiry may be planned properly.

11.5 Wind-breaks around the orchards, shelter belts in the arid and coastal regions and tree plantation along the field or farm bunds, roads, canals and railway lines also provide protection against inclement weather conditions. There is hardly any appreciation of this safety-net in the planning and development process.

12. Insurance

12.1 Crop insurance, initiated in 1972 for the first time is an important safety net in a predominantly rainfed crop of cotton (Hybrid 4) in the un-irrigated areas of Gujarat. During 1985-2003, rainfall deviations accounted for 95% of the insurance claims and 85% being rain deficit cases and 10% of excess rainfall. Initially, insurance was an administered rate regime and was not carried out with financial prudence. Services of the traditional system, based on the estimation of yield losses, were inadequate due to excessive delay in claim settlements, high transaction cost and remained restricted to loanee farmers. Rapid estimation of losses by remote sensing (RS) and Geographical Positioning Systems (GPS), modelling and ICT may help to shorten the claim settlement time with objectivity.

12.2 Several weather based insurance derivatives have been attempted since 2003 with pilots in the Mehbubnagar and Anantpur districts of Andhra Pradesh. The claims were settled within 15 days of the completion of the policy period compared to 12-18 months in the conventional crop insurance. However, coverage and spread of new insurance derivatives was confined to cash crops like seed-spices, vegetables, soya-bean, live-stock, etc. Ready reckoners elaborating relationships of productivity losses with variation in climate parameters at different stages of crop growth are not well established. This is a significant technical handicap in scaling up of weather based insurance. Availability of high-resolution satellite data, Geographical Positioning System (GPS), modelling techniques and rapidly emerging ICT should be able to fill up various gaps.

12.3 Some of the companies retailing in milk, dairy products, vegetables, fruits and export commodities are also entering into complex contracts. They provide credit, insurance, free health check-ups, extension and buy-back for processing, packaging, value-addition and marketing. There are several special attribute high value and low volume crops of seed spices, guar gum etc. in the rainfed region where this concept could be extended. Export commodities in the rainfed regions like seed-spices, soybean, castor, guar gum, moth-bean, organic dyes (henna etc.) and medicinal herbs are several products where safety-nets could be evolved and income of the farmers enhanced and insulated by multiple private and *panchayat* partnerships.

13. Terms of Trade

13.1 Relaxations in the import of edible oil after1995 caused serious set-back to the domestic production and decelerated agricultural growth rate of the rainfed region faster compared to the irrigated agriculture.

13.2 Volatility of the prices, tariff and non-tariff barriers, minimum support and export prices, procurement, movement regulations and subsidies are important to ensure income and profitability of the farmers.

13.3 International export prices of rice doubled from US $ 300-500 per tonne in November 2007 to US $ 700-1000 per tonne in 2008. The international crisis unleashed various restrictions by the exporting countries so as to preserve stocks to keep domestic supplies intact and avoid hardships to the local consumers even at the cost of farmers' profit.

13.4 Over-production of pearl millet (*bajra*) and potato frequently and of cotton in 2008-09 led to representations and protests by the farmers for assured marketing of their produce.

13.5 Volatility in the prices of the special attribute crops of the dry region is very high due to limited trade and demand. Uncertainties, income fluctuations and profit especially of the un-irrigated commodities are extreme whereas insurance for income has not been found feasible or profitable. Minimum support price for cotton, coarse cereals and apple may not be actualised due to the lack of commitment for operationalization, procurement and payment to the farmers.

13.6 Froward trading of the traditional *satta* commodity of guar gum was formalised for other agricultural commodities by NCDEX. However speculative prices and procurement did not work well especially for rice and wheat being staple diet of our food security system. Some derivatives and innovative regulation and rules may be devised in due course of time to balance interest of the consumers, producers, marketers and the governance.

14. Convergence

14.1 Economic restructuring, inclusive development, progressive planning, policies, programmes and revamped governance have evolved innovative schemes and investment portfolios such as National Rural Employment Guarantee Scheme (NREGS), Rashtriya Krishi Vikas Yojana (RKVY), National Food Security Mission (NFSM), Backward Region Grant Fund (BRGF), Compensatory Afforestation Fund (CAMPA), National Horticulture Mission (NHM), Bamboo Mission (BM) etc. Vast resources of such schemes could be networked for improving productivity, efficiency, income and employment of the rainfed agriculture. During 2006-08 about 64-68% of NREGS expenditure was incurred for rainwater conservation and management.

14.2 In 2007-08 out of the total expenditure of Rs. 15,856.89 crores under NREGS, 49% was utilised for water conservation, 16% for land development and 15% for providing irrigation facilities to the land owned by the SC/ST/BPL and IAY beneficiaries. Proper designing and execution of structures is pre-requisite to realise full benefits. While providing employment, the created durable assets also strengthened food and nutritional security by supporting better agricultural productivity and marketable surplus. NRGES has great potential and vast opportunity for convergence with watershed development programmes, water resource development and afforestation programmes in rainfed areas. This can be diversified according to local skills, situation and resource status.

14.3 About 32 million ha forest land is situated around 1.7 lakh villages with about 300 million population. In addition to minor forest products, conservation of rainwater, vegetation and re-charging of aquifers in the forest area can provide immense benefit for enhancing productivity and reduce

vulnerability for the nearby arable lands. The highly rated successful watersheds in India are generally those where forest land in upper part and arable land downstream was treated jointly and simultaneously.

Ministry of Environment and Forests (MoEF) has also opened up to step up their activities outside the designated and reserved forest land through schemes like Greening of India, *Gramin Van Karan* (Rs.1,000 crores) and Compensatory Afforestation Fund (CAMPA Act, 2008). NREGS also provide unlimited opportunities for planting trees which require lot of labour input. The implementation of Forest Rights Act, 2006 has opened up avenues for convergence in livelihood opportunities for the tribal and forest dwellers. It is a simple task of extended convergence already realized with Forest Department in RVP to the micro scale of watershed. Animal husbandry becomes important pathway of improved livelihoods in the forest fringe areas.

14.4 Similarly untied funds of BRGF, IWMP, RKVY, NHM, MPLAD and others can also be utilised to fill up critical gaps by preparing comprehensive plans to take up the development process to its logical conclusion.

14.5 Rainfed agricultural management can also benefit immensely by dovetailing with the Artificial Ground Water Re-charging Scheme (Rs.1800 crores), Renovation, Repair and Reconstruction of Water Bodies Scheme (Rs.6000 crores) and other minor irrigation schemes of the Ministry of Water Resources.

15. Diversification

15.1 Diversification of low value high volume traditional crops like pearl millet, sorghum etc. with high value vegetables, fruits, better yielding hybrids,

improved farming systems, reduced tillage and alternative agronomic practices have tremendous potential to enhance productivity and reduce vulnerability.

15.2 Diversification of soybean in the Kharif season fallow in black soil of Central India, hybrid castor in Gujarat and surrounding States, Bt cotton in Maharashtra, industrial trees in Karnataka, etc. can be scaled up. Diversification of cultivation practices like zero tillage and rainwater conservation by land levelling, ridge-furrow systems mulching etc. are the recent examples of the demonstrated results with vast scope of their expansion.

15.3 More than 11 million ha of the cultivated land remain fallow in rabi season after kharif rice in the high rainfall regions of Orissa, Bihar, MP and several other pockets. *In-situ* conservation and re-charging of rain water in upper catchment, water harvesting and re-cycling for limited irrigation has tremendous potential for enhancing productivity of rice and introducing a second crop of oil seeds, pulses, vegetables and fodder to expand basket of livelihood.

15.4 Planting of fruit trees in the rainfed region and cultivation of vegetable in the peri-urban areas has the highest elasticity of income and growth. Mango is very drought tolerant crop after its initial establishment and can be planted in semi-arid to humid region in clusters to link up with processing and better marketing. Cashew-nut has the ability to grow in excessively leached and degraded lands in the high rainfall coastal areas and lower ranges in the NEH region. Improved grafted variety of tamarind is another crop for enhancing productivity and income in drylands of Southern India.

15.5 Managing rainwater for cultivation of tomato in Himachal Pradesh, enhancing productivity of apple in Himalayas and Mandarins in Khasi Hills has potential for a wider range of options to diversify income, etc. In the high rainfall coastal areas of Orissa, cultivation of rice alone returned Rs.42,000/ha, banana alone Rs.64,000/ha and a system of aquaculture in dug out ponds (65% area) plus banana/coconut on the raised embankments (35% area) returned Rs.1,98,000/ ha. Replacement of upland rainfed rice with hardy fruit trees like cashew nuts, mango etc. in the Eastern India also provides ample opportunities, to diversify income and livelihoods.

16. Soil Fertility Management

In the context of risky and subsistence farming, dryland areas were generally considered thirsty but they are hungry also. While preparing soil health cards deficiency of major (N,P,K) and micro-nutrients (Sulphur, Boron, etc.) and significant responses to fertilizer application have been reported. Reduced risks with better conservation and management of rainwater and safety nets, capital intensive fertilizers and other inputs will go in a long way to enhance overall productivity. Bio-fertilizers and organic manure should be the important components of integrated fertilizers management.

17. Energy and Mechanization

Direct and indirect (agro-chemicals) per hectare energy consumption in rainfed agriculture is three times less compared to the irrigated regions. However per unit energy productivity of rainfed agriculture is double that of the irrigated farming. Unlike irrigated conditions the staggering of cultivation operation under rainfed situation is highly restricted. Making beds and furrows or ridges and furrows for proper management of rainwater especially in black

soil is a difficult task and requires mechanisation. Keeping in view the socio-economic conditions of land tillers, custom hiring services can be promoted by public investments and linkage with RKVY funding would be one of the options. Rural electrification with 33/11 KVA supply under RGGVY should be able to provide cheaper energy for the stationary operations.

18. Ground Water Management

18.1 Unlike surface water resources, ground water has been developed by private investment throughout the country both in the canal irrigated and rainfed areas. The highest irrigation expansion both in the alluvial zones of Northern India and hard rock region with limited aquifers in Central, Western and Southern regions has been witnessed. Its over-exploitation, decline in water table and failure of the bore wells has negated the private investment of the farmers and made food security volatile. Recharging by watershed developments and managing risks is the upper most priority.

18.2 Drilling/boring beyond 300 meter with a failure rate of 60% leading to distress has been reported in many parts of Central and Southern regions of the country.

18.3 Tripling of the capital investment and doubling of energy consumption for redeveloping declined ground water is envisaged during the next 10-15 years if the current trend of utilisation continues.

18.4 Watershed development projects are the best options to re-charge aquifers. Re-charging of the limited aquifer in the hard rock area is a slow process and requires special structure (injecting wells), treatment and investments. It is a relatively easier job in the alluvial parts of Punjab, Haryana, Western UP and Rajasthan but water for re-charging is not available due to low

rainfall. Therefore scientific land use planning for the optimum use of ground water and improving efficiency with micro-irrigation, mulching and re-configuration of the field surfaces is essential. There is need for water as well as energy efficient farming practices and devices.

18.5 The optimization exercises should aim at realizing the highest productivity of water and other in-puts rather than traditional concept of per unit area basis. Diversification into most water efficient cropping and farming systems keeping in view the emerging demands and marketing scenarios, are called upon. Cultivation of rice and sugarcane in Punjab, Haryana and Western UP requires diversification with equal or better economic options.

18.6 Under utilization of ground water in high potential, low productivity Eastern India is untapped opportunity to consolidate livelihood security. Cultivation of water guzzling crops like paddy, banana, *makhana* and sugarcane etc. will be sustainable due to 2-3 times more rainfall in Eastern areas compared to Punjab, Haryana, UP etc. However bold policy initiative of consolidating land holding and linkages with rural electrification under RGGVY could be the fundamental step.

19. Common Property Resources (CPRs) Management

19.1 The CPRs play a significant role for the gathering of livelihood and income by the landless and asset-less, socially, economically and gender disadvantaged inhabitants, and small and marginal farmers. There are more than one lakh of Joint Forest Management Committees for participatory management and utilisation of the minor forest produce. CPRs are generally afflicted with the “tragedy of commons” and enabling participatory management of these resources is called upon to enhance their productivity and efficiency.

19.2 Collective management and sharing of goods, services, responsibility and accountability by the self help groups, user groups, cooperatives and other institutions of managing common/Panchayat land, wasteland, village ponds, lakes, water bodies and harvested rainwater are very important. Creation of alternative institutions based on transparency, equity, contributions, sharing of collective marketing, procurement of inputs and decentralised governance with low transaction cost is advisable in rural areas.

19.3 Community mobilisation, resolution of conflicts, creating corpus through contributions (*Shramdan*) and organising into Producers' Company Ltd. and other institutions is crucial for sustaining the development process. This calls upon a different mindset and efforts by the service provider of GOs, NGOs and others.

19.4 Harnessing of social capital for micro-enterprising has a lot of scope of enhancing livelihood. Micro thrift credit groups mostly organised by the women and *Grameen* Banks have shown encouraging results. Launching of the "Producers Companies" to utilise freedom and flexibility of the limited companies and aggregation through collectiveness of small producers has revealed mixed results. There is a basic issue of seed money for meeting the initial cost of purchasing the shares by the members. In some of the States like Madhya Pradesh the grant provided for seed money and diverting infrastructure of a World Bank Project (DPIP) could promote these alternative institutions of low monetary cost of transaction. However most of the states are hesitant to provide one time grant or seed money for such innovative ideas of aggregating, purchasing of inputs and marketing of outputs for realizing benefits of scale.

20. Information and Communication Technology

Rainfed versus irrigated or rural versus urban divide can be levelled off with unlimited potential of the digital and multimedia information technology. Mobiles, handheld computing gadgets, E-Mail, E-Chaupal, forecasting of weather, prices and disease have been able to improve information among the farmers, other primary producers, extension workers, input suppliers, market agents, etc. There is an unimaginable reversal in transacting of business by marketing commission agents especially in the perishable commodities like vegetables, fruits, milk, egg, etc. Now the commission agents go round the rural areas and negotiate rates on the farms before harvesting or picking up of the produce. In this way very weak bargaining power of the farmers in taking the perishable produce to the market has been converted into strengths. This system also has reduced wastage because harvesting or picking is matched to the demand management. Mind boggling technologies of unlimited bandwidth, data transfer and communication is going to consolidate and accelerate the development process even in the remote and distant agro-ecologies. Purchase of inputs and access to services for improving productivity is important even if someone is not going to produce marketable surplus.

21. Internalizing Technological Potential

The technological potential in terms of new varieties, cropping or farming systems, cultivation practices, irrigation, diseases, pests and nutrient management, etc. are being upgraded by R&D. The gap analysis between demonstrated technological potential and actual realization by the farmers reveals a great scope for improvement.

21.1 The gap between demonstrated technological potential and present actual average yield realised by the farmers under rainfed conditions is 140% for cereals, 100% for pulses and 78% for oil seeds.

21.2 There is a 40% technological gap in bio-mass productivity of agro-forestry for paper, pulp, plywood, fuel wood etc.

21.3 Optimization of the combination of crop cultivation and dairying enhances net return by 20-25% and is the best way of recycling bio-mass (crop residues), generating manure and ensuring sustainability.

21.4 Combination of crops with piggery, duckary and goatry improve net return by 6-15%.

21.5 Inter-cropping of green gram within cotton rows improves productivity by 36-40% in the Vidharbha Region.

21.6 Paired row planting of cotton on ridge and furrow improves productivity by 20% due to better rainwater management.

21.7 Drip irrigation with enhanced or extended water supplies of dug wells and farm ponds by watershed management increased cotton productivity by 59%.

21.8 Benefit : cost analysis of 2.14 and 22% Internal Rate of Return in the properly implemented watersheds justifies further investments. However 35% of cases were above average and 65% below average indicate a significant scope for improvement.

21.9 Use of Bt. Cotton seed improved productivity by about 35% in Gujarat and Maharashtra but managing of risks and farmers' distress is important due to higher inputs.

21.10 Alternative cropping pattern of soybean and gram (chick pea) is a better strategy than long duration cotton in shallow and medium soils of Vidharbha Region.

21.11 Improved rice-fish-horticulture systems increased net return by 3-4 fold as compared to the traditional system and are ideally suited for the high rainfall regions.

21.12 Capacity building is important to minimise technological gaps.

22. Land Reforms/ Tenure/ Consolidation/ Acquisition

Fragmentation of land due to inheritance laws, absentee land owners, and lack of documented share cropping or leasing is becoming counter-productive. Retaining ownership while leasing and contracting, difficulties in getting credit, claiming subsidy, calamity relief and insurance claims by unrecorded share croppers are major handicaps for investing in land and irrigation resources for enhancing productivity and producing marketable surplus. Land acquisition and compensation payment problems erupted while setting up Special Economic Zones. A comprehensive overall review for replacing outdated land tenure related acts with enabling provisions is a great urgency to catch up with fast emerging scenarios.