Watershed Approach for Better Natural Resource Management, Agricultural Productivity and Livelihoods in Rainfed Areas –

Experiences of India

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Scope of the presentation

The concept of watershed is briefly discussed at the first instance. Then the impact of the watershed development programme (WDP) by different agencies is discussed. Based on the lessons learnt, the possible improvements in implementing WDP are presented.

Watershed Approach in Rainfed Areas

Several agencies are implementing the Watershed Development Programmes (WDPs). They aim at comprehensive area development on watershed basis.

A watershed is a hydrological unit wherefrom the surplus runoff drains through a common point (Fig.1). It has no geographical limits. It would have land-holders (marginal, small, medium and large) and landless persons. They may be of different economic strata with uneven ecological settings and aspirations. Any such area may have different classes of land (arable as well as non-arable). The non-arable area includes the common pool resources (CPRs) of land and water and would provide runoff and biomass for use by the habitants in the encompassed area on an equitable basis. The community effort, largely taken by NGOs and individuals, was on a habitat basis.

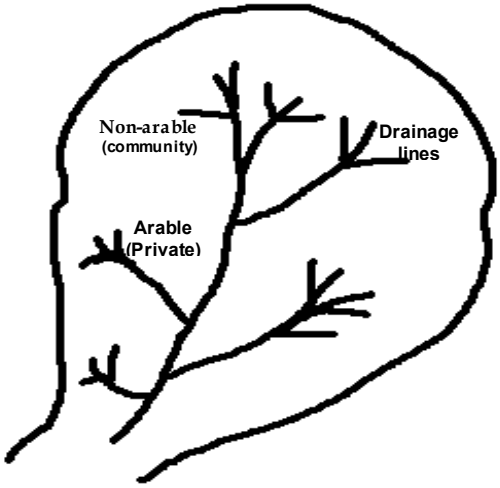


Fig 1 - Watershed: a conceptual model

Rejuvenation of the material resources (soil, water, vegetation), improving productivity (crops, livestock), providing livelihood security, enhancing wage employment, human resource development and improving skills

through training and capacity building are the main components in the programme. Equity, transparency and flexibility are the others in this venture. In order to involve the people (primary stakeholders) in the overall development and management of the habitation on a watershed basis, homogenous groups are formed by a Project Implementing Agency (PIA) over viewing and assisting in the WDPs (Self Help groups – SHGs; User Groups – UGs; Common Interest Groups – CIGs; Labour Groups – LGs; etc). These Community Based Organizations (CBOs) form the basic pillars of the Watershed Association (WA) who in turn nominate a Watershed Committee (WC). The WA and WC have President and Chairman are rotational basis. The WC members are also on rotation with a nominee from the local Panchayat Raj Institution (PRI). The WC is assisted by a technical Watershed Development Team (WDT) who assist the WC to evolve an Action Plan in developing and managing the WDP. The GoI provides Rs 6000 / ha to the State Government on a 3:1 basis for an area of about 500 ha selected as a watershed. The finances are provided to the groups by the WC/PRI after the Action Plan is approved by the WA. The individual beneficiaries as well as the community share a part of the cost (5-10%) of the 'works'. This fund is deposited as Watershed Development Fund (WDF) for use after the cessation of the project. In order to provide livelihood support systems for the poor, women and landless 10% of the total finances are utilized. Another 20 % of the finances are used for effective production systems. 50 % of the funds is placed for executing works on natural resources and the rest 20% for administration of which 5-10% are meant for training and capacity building.

Impact of WDPs

The impact of some the programmes implemented by different agencies is highlighted here through three cases studies.

NWDPRA Watersheds

The programme (National Watershed Development Programme for Rainfed Areas) is implemented by the Ministry of Agriculture, Government of India from 1990-91 was assessed in various parts of the country. Several impact parameters were taken up in the study. The overall assessment is presented in Table 1.

Table 1. Impact of NWDPRA watersheds

Impact parameter	Overall rating (%)	Remarks
Productivity	78	Poor in arid or dry semiarid
Employment	54	Poor in subhumid
Diversification	69	Poor in subhumid
Incremental net income	81	
Adoption level of new technologies	69	Poor in subhumid
Effectiveness of administration	51	Poor in subhumid and Gangetic plains
Multi-disciplinary approach	57	Poor in arid and subhumid
Sustainability	60	Poor in arid and semiarid
Moisture conservation	75	
Biomass generation	72	Inadequate in arid and semi-arid
Ground water depletion	72	
Soil degradation	78	Severe in all except wet semi-arid
People in planning	39	
People in implementing	48	Poor in dry subhumid and humid
Sustenance	63	Poor in dry subhumid and humid
Mitra Kisan and Gopal	57	
Overall	64	

The data indicate that peoples' participation in the programme was quite inadequate, being 39% in planning and 48% in implementing. There was enhancement in productivity of crops and biomass with improved soil-moisture conservation. However, groundwater depletion and soil degradation continued. The overall rating came to 64%.

It is argued that the implementation processes need a fresh look at the constraints indicated above. Substantial improvement in the processes of implementation is called for.

MoRD Watersheds

The objectives and overall achievements of the watersheds under Ministry of Rural Development (MoRD) with the revised guidelines implemented from 1994 onwards were also assessed (Table - 2).

Table – 2: Impact of MoRD watersheds

Objective		Overall achievement
Regeneration of natural resources in drought-prone and desert areas	i.	Greater emphasis on private and community lands through water harvesting and soil conservation that were mostly exogenous
	ii.	CPRs received relatively less attention
	iii.	Existing NRM systems were largely bypassed, e.g. tanks have in fact been further degenerated with the present

Objective		Overall achievement
		interventions.
Integrated development with special reference to the poor, SC/ST communities	i.	Provisions were made in the guidelines and their representation was notional. Their involvement in the overall development was poor, barring a few instances (some NGOs and a few GOs).
	ii.	There had been no specific budget focusing their needs.
	iii.	There was no technology exclusively for them.
	iv.	Even in the share of usufructs, there was no pro-poor bias.
	v.	Largely these communities were benefited as labour.
Mitigate the effect of drought and desertification on crops, human beings and livestock	i.	There had been no specific programme on mitigating the effects of drought or desertification.
	ii.	The concepts of seed bank, fodder bank and grain bank had not been considered.
	iii.	A premise was made that through Soil Conservation (SC) works and Water Harvesting Structures (WHSs) and the consequent employment generated, drought or desertification was mitigated.
Integrated or overall development	i.	There was considerable skewness in the approaches. The NGOs were strong in Human Resource Development (HRD). The GOs were strong in production technologies. There had been no integration of the efforts of NGOs and GOs; instead each tried to hire or acquire the missing links, leading to partial success and unnecessary duplication.
	ii.	Further, the development had been on the soil and water and to some extent on trees. But production systems and livelihood support systems had not received due attention.
Conservation of natural resources leading to protection of bio-diversity	i.	Bio-diversity had not been on the agenda in almost all the programmes
	ii.	However, mixed cropping was a step towards maintaining bio-diversity in crops and cropping systems
	iii.	Similarly, the social fencing of the silvi-pasture systems is meant to revive the bio-diversity in the tree, shrub and grass combinations
	iv.	But in the demand-driven approaches, overenthusiasm is created on less proper initiatives (e.g. teak in dry semi-arid region, cotton in shallow red soils)
	v.	Unless overexploitation of the NRs is stopped, bio-diversity is impossible.
Involve community to protect and maintain the developed natural resources	i.	The community-owned NRs (developed, regenerated) were used by the beneficiaries. Presently there is not tacit understanding on their sustainability, except that they should be handed over to the village or gram panchayat.
	ii.	The WDF is to be spent on its future maintenance.
	iii.	These two issues are now being seriously considered regarding manner to implement them.
Involve community to improve the productivity of the NRs	i.	The technological input on improving the productivity was less adequately brought in.
	ii.	Presently retrieval of the NRs or prevention of further degradation is the aim.

Objective		Overall achievement
	iii.	Improvement in productivity in arable lands may enthuse the community to evince more interest in maintaining the NRs without degradation.
	iv.	The fallow land cultivation by groups of people (women in particular) was seen occasionally.
Use ITK and local resources through cost-effective technological options for development	i.	Such an approach is more frequently seen in NGO-operated watersheds.
	ii.	However, taking these steps at the start and evolving internalized external technologies would be (a) cost-effective and (b) lead to higher productivity (e.g. improved genetic material; INM, NPM, PHM)
	iii.	For such a purpose, investment on capacity building needs to be adequately provided.
Generate employment	i.	As works (soil conservation, water-harvesting structures) received more attention during the implementation phase, adequate labour employment was generated.
	ii.	However, some of the works were done through outside contractors or heavy machines.
	iii.	With improved irrigation, there was additional cropping. Similarly, with diversification (e.g. dairy) more employment was generated.
Reduce poverty	i.	While assessing poverty reduction, no direct estimates could be made.
	ii.	But poverty alleviation could be assessed through employment generation, access to food and nutrition, and continuous occupation through diversification (e.g. dairy, vermicompost, flower or vegetable farming, green-fodder production)
	iii.	Only indicator available is the number of days of employment and formation of labour groups
Peoples participation	i.	Formation of WA and WC had been through nominations in all the GO-managed watersheds.
	ii.	SHGs and UGs are formed. SHGs limited their activities mostly to thrift and credit.
	iii.	The UGs and sometimes SHGs were involved in development of WHSs, SC works and even in CPR management.
	iv.	The rotation of chairman, WC and president, WA was not seen. Only in defunct cases the new persons took over.
	v.	The linkages between PRIs and WA and between WA and WC were not cordial in many places.
	vi.	The linkages between PIAs and Project Director needed further improvement.
Overall development of the habitat	i.	In a few instances the construction of new houses were seen, particularly by the poor.
	ii.	There was diversification in the rural activities. These included dairying, vegetable farming, fruit orchards and flower cultivation.
	iii.	More loans were available from the banks to the SHGs.
	iv.	New farming systems such as NPM, INM, PHM and emphasis on low-duty crops were seen in a few of the

Objective	Overall achievement
	watersheds, particularly those run by NGOs.

Watersheds Funded by Different Agencies

In the recent study (2003) of National Agricultural Technology Project (NATP) some of the watersheds (31) were financed through different funding / management agencies. They include NWDPRA, MoRD, ICAR, International Agency (IA) and NGOs.

The operational details studied included organization of communities, training and capacity building, participation of people in project preparation and implementation, productivity of crops and livestock and finance management. The details on the impact of the watersheds funded by different agencies are listed in Table – 3.

Table - 3: Impact of watersheds funded by different agencies

Indicator	Achievement (%) by different agencies				
	NWDPRA	MoRD	ICAR	IA	NGO
Community-based organization	50.5	53.5	41.5	41.0	63.0
Training and capacity building	47.0	56.0	50.0	58.0	65.0
Participation in project participation	51.0	60.0	42.0	57.3	64.7
Participation in project implementation	60.0	57.5	47.0	65.0	60.0
Productivity	61.3	72.0	84.0	65.3	73.3
Finance	41.0	44.0	44.0	59.0	48.5

There are subtle differences in the implementation through different agencies. With due weightages, the data indicate these overall ratings.

Agency	Overall performance (as %)
NWDPRA	54
MoRD	54
ICAR	48
NGO	62
IA	63

The data indicate that

i. The community organization is superior with NGOs;

ii. Training is good with NGOs and less adequate with NWDPRA and the ICAR;

iii. Peoples' participation in planning is superior with NGOs;

iv. Peoples' participation in implementation is low with the ICAR;

v. Production systems are superior with the ICAR; and

vi. Finance management is satisfactory only with the IA.

An overview of the various components indicates the following grading:

Production > Participatory implementation > CBOs = Training and capacity building > Participatory planning = Finance management

In fact several workers emphasized the need for participatory approaches in not only implementation but also in planning, involving women. Finance management shall be transparent and flexible, because they are the two cardinal principles in devolution of the programmes on watersheds.

The overall impact of 31 WDPs reviewed in the NATP programmes are as follows.

1. With watershed the percentage of irrigated area increased from 38.2 in non-watershed areas to 52.4 in watershed areas.
2. All the socio-economic and other indicators showed marked improvement in watersheds over non-watershed areas. But the large and medium farmers (LMF) were more benefited in the programme, because the programme was land-based (at Rs 4,000/ha).
3. Further, LMF derived greater benefit even from livestock. Stall feeding was adopted more by the LMF.
4. In participatory approaches, the government-funded programmes (NWDPRA and MoRD) were poorly placed. NGOs and international agencies were well above the governmental agencies (ICAR, NWDPRA and MoRD).
5. In crop production, cereal production was more with small and marginal farmers (SMF). In other commodities the difference between SMF and LMF was not significant.
6. The differences in yield of selected crops between watershed and non-watershed areas was generally more.
7. The milk production was generally more in the watersheds.
8. The rise in ground water was more in watersheds and LMF were more benefited.

9. By and large employment generation was more, being 7% more with male and 14% more with female-workers. In the watersheds, more work was found in the agricultural sector.
10. The women in the watersheds as well as non-watersheds worked for 12-13 hrs a day. However, there was a saving of 18% time in fetching water and fuel for household purposes in the watershed areas.
11. The family-budget analysis indicated that on an average Rs 250 more were spent/head/year in watershed areas. Savings were more with watershed areas, average being Rs 34,491 and Rs 14,224 per household / annum respectively in watershed and non-watershed areas.

Important Lessons learnt

Some of the important lessons learnt, while reviewing the completed and on-going watersheds are mentioned below.

1. The two important paradigm shifts in the WDP are "participatory development" and "bottom-up approach". While the GO programmes are woefully inadequate, even some of the NGO-programme (larger sized) also are not adequate in practising such shifts. The IA programmes only indicated superior adoption of participatory management (67.2%), followed by NGOs (59.0%). The government supported programmes had been less than 50.0%.
2. In resource conservation, the farmers tend to take up strengthening of field bunding (68.8%), followed by levelling (57.1%). They opted even for soil concentration in the natural drainage lines (44.6%). Thus there is a need to accept the farmers' innovations as practical and easily adoptable, and should be financed in the WDP.
3. In the WDP the farmers appear to be more comfortable with water that can be tapped individually (farm ponds and wells) than through community (tanks). In the process the LMF are more benefited in accessing the harvested rain-water.
4. In the WDP equity is not achieved and the LMF are more benefited followed by SMF. Least benefits accrued to the landless. It is because the WDP was largely land-based and the rich obtained more funds for improving their holdings. They are also able to reap better from out of CPRs. It was the case even with the access to fuel and fodder. Hence

there is a need for a pro-poor bias on the share of the usufructs from CPRs. The RF should properly be organized to benefit the landless.

5. The WHSs have been mostly the job of the contractors except with NGOs and selected IAs where the stakes of the beneficiaries had been more with their increased contribution and involvement in putting the WHSs in place. Hence post-project maintenance was also less of a problem, besides the quality of the works. The indigenous WHSs also received approval when the stakeholders had a say in their construction.
6. In Land Based Activities (LBAs), there has been 75% increase in the yield of cereals, 50% of oilseeds and 30% of pulses. Similarly there are increases in yield of milk. However, these increases cannot be sustained unless the needed infrastructure facilities are provided. They include not only in-village seed production, INM, NPM and PHM but also a resource centre for continued support in training and capacity building, besides collective marketing through warehouse, product processing, credit, insurance cover and other marketing facilities. This is in addition to A.I. centres, co-operatives for sale of milk and milk products, and increased green-fodder availability to ensure sustained and enhanced milk production. Similarly, improvement of silvi-pasture systems in CPRs for enhancing grazing or carrying capacity for the livestock, particularly small ruminants would be necessary.
7. That Non-land Based Activities (NLBAs) also need support has come into focus to ensure equity and sustainable livelihood-support systems for one and all, particularly for the women and landless, living in these hinterlands.
8. "Open access" to the CPRs had been the bane and must be stopped. While giving due attention to the existing rights on CPRs (graziers, NTFP – livelihood, fishing rights to the locals) care should be taken to develop the silvi-pasture systems through social fencing. The new WHSs should not put the traditional WHSs in jeopardy. The additional water harvested at least must be treated as a common pool with access to all the habitants. Such an approach leads to a win-win situation, benefiting the landless from the silvi-pastures and the landholders from the WHSs.
9. It is necessary to treat WHSs (e.g. tanks or *johads*) on a cascade basis. Similarly, the vegetating of the CPRs should be beyond one watershed. So

would be the federating of the SHGs on *mandal* or block basis. All these structures need to be viewed beyond one watershed. Hence the community should be geared up to meet such a challenge cutting across habitations.

10. Finally, the success of a watershed can be measured with four parameters, e.g. (i) rain-water harvesting without jeopardy to the traditional WHSs and riparian rights; (ii) proper vegetating of CPRs with social fencing and with a pro-poor bias in the share of usufructs; (iii) a good training and capacity building of the CBOs to ensure sustainable LBAs and NLBAs; and (iv) participatory development in action planning and execution by groups and not by WC or PRI, with adequate flexibility and transparency in management of finances that are routed through PRIs to federation or village organizations to reach the groups. There is a need for participatory M&E for fine-tuning through mid-course correction while implementing the WDP

With the above lessons learnt, the MoRD has gone ahead with further revising the guidelines (*Hariyali*) so as to fully involve the PRIs in the WDP. Funds will now be placed at the disposal of the PRI who in turn provide the same to the Groups for implementing the approved Action Plan. In all cases the assets created in the WDP are handed over to the PRI for their post-project maintenance.

With the various lessons learnt thus far, proposals are made for improving the implementation of WDP in the following pages.

SOCIAL STRUCTURES

The proposed structure in mobilizing the primary stakeholders is as follows (Fig - 2).

The primarily stakeholders are to be organized into homogeneous groups. The Project Implementing Agency (PIA) is to mobilize them into SHGs for thrift and credit and UGs for undertaking the

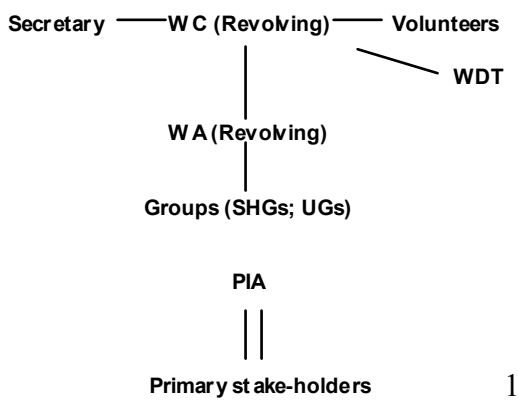


Fig 2: Proposed social mobilization

'works'. These groups are to form WA. The WA, in turn, is to elect a WC. They have to elect a president and a chairman respectively on the rotational basis. The WC would employ a secretary to assist both WA and WC in their transactions. Also WC shall appoint two volunteers (1 male and 1 female) along with four members as a Watershed Development Team (WDT). The WDT members are paratechnical and help in social mobilization, soil conservation, water harvesting and production systems. In all these structures the women, SC/ST and nominees of SHGs and UGs are to be represented.

However, the existing structure (Fig.3) had quite a few distortions. There were no elections. Mostly WA President, WC Chairman and members were nominated. There was no rotation of these persons. The WA was not formed out of SHGs and UGs.

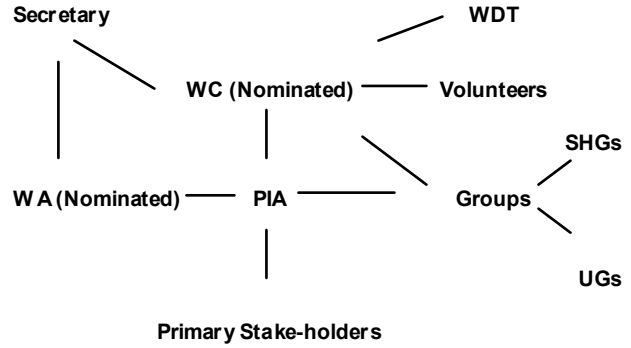


Fig 3 Existing social mobilization

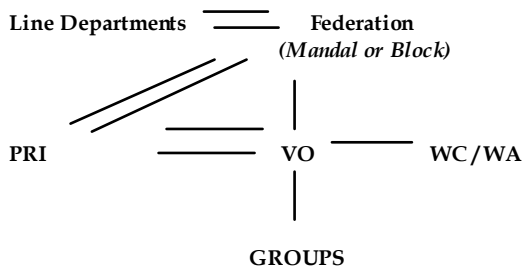


Fig 4 New social mobilization

With these distortions, new proposals (Fig.4) are put forth. All groups must be successful in credit and thrift activities. They can be men, women or mixed in nature. Now the PIA is to form the groups not only of SHGs, UGs but also of others. They include Common Interest Groups (CIGs), Cattle Breeders Association (CBAs), Graziers, Vana Samrakshan Samithis (VSSs), Chit groups and others making a living on the Non-Timber Forest Products (NTFPs). These groups shall network as a Village Organization (VO), who would liaise with WC or WA on one side and the PRI on the other. Such VOs at village or habitat level shall federate at block or *mandal* level. These federations shall liaise with the line departments of the government for converging the existing rural development programmes with the WDP.

ACTION PLAN

The action plan is to be developed by the stakeholders on a demand-driven participatory approach. Emphasis should be on moving away from the ad-

hoc pre-determined programmes to need-based programmes. That is why Prof. Hanumantha Rao committee suggested action plan based on the status of the NRs, their present use, aspirations of those that make a living in the area and the feasible or doable technologies that are eco-friendly, leading to sustainable development with equity being uppermost in the agenda.

Then the first step is a resource inventory, not necessarily through PRA (participatory rural appraisal). Several new approaches are now available. Appreciative enquiries to know the successful ventures of the primary stake-holders in the management of NRs and production systems are one such example. They are easy to replicate and enable to move faster. Similarly, situation analysis by the primary stake-holders (APRLP-DFID funded AP programme) provides an understanding of the state-of-the-art in NRs, production systems, social and other institutional capitals. This approach helps in identifying the needed capacity building, particularly for reaching the unreached. However, the components should include: (i) Natural Resource Management (NRM); (ii) Land-Based Activities (LBAs); (iii) Non-land Based Activities (LBAs) and (iv) Marketing.

Natural Resource Management

The natural resources (NRs) include land and water of the CPRs and private (individual) stakeholders (Fig.5). In the CPRs land includes community lands, wastelands and fallow lands, which need protection, development, and food production respectively.

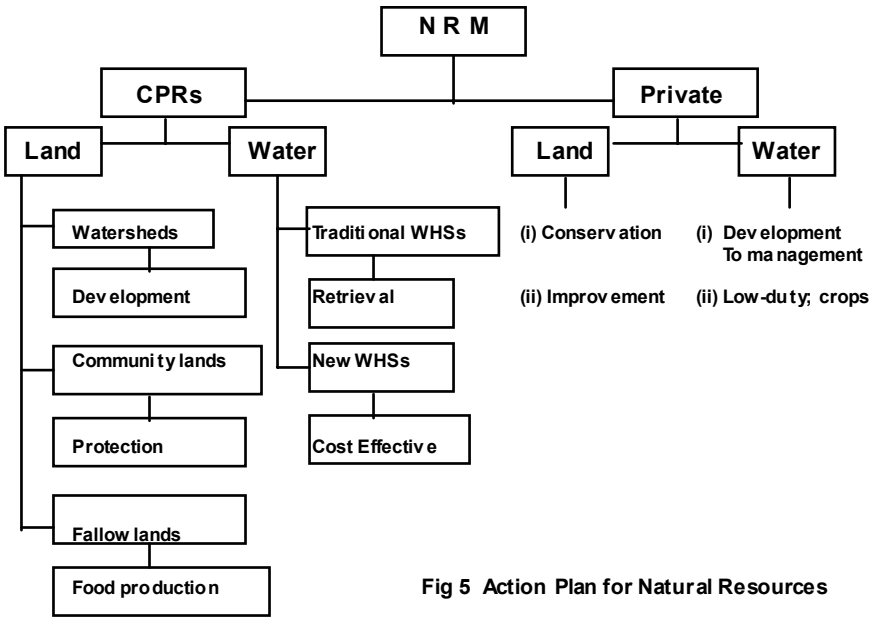


Fig 5 Action Plan for Natural Resources

The water from CPRs has two dimensions. First are the traditional WHSs that need retrieval and the new WHSs that have to be cost effective. The private lands need conservation and improvement to enhance their productivity. The

waters of the private owners are developed considerably and now need proper management. In the watersheds low-duty crops need to be encouraged with the necessary infrastructural support.

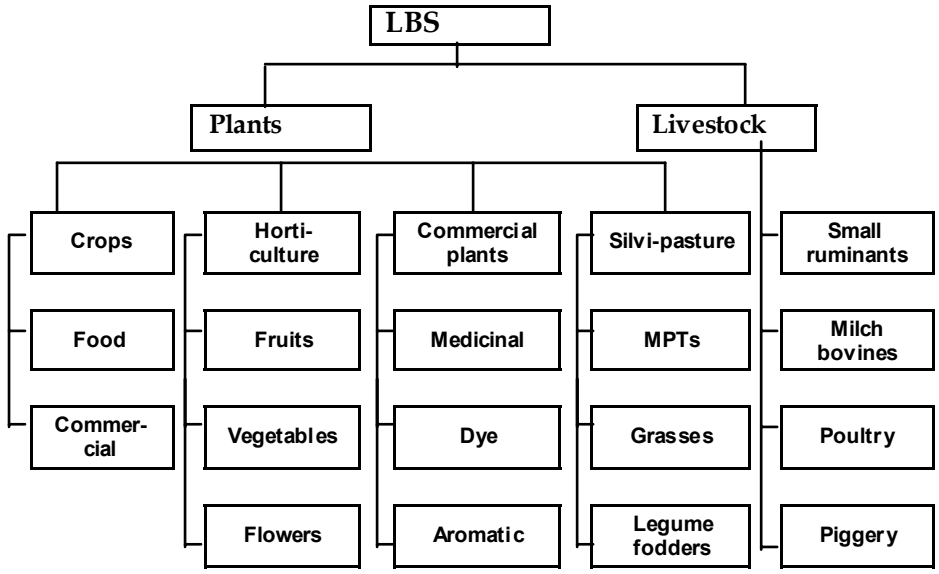


Fig 6 Acton Plan for LBSs

Land-Based Activities

The land-based activities include plants as well as livestock (Fig.6). In the action plan when the NRs are properly developed, the productivity of both plants and livestock need to be improved. Among the crops, food crops must receive the priority attention to minimize food insecurity and ensure ecological access to food and nutrition. Commercial crops can then be considered. Based on the land-use capability, Classes I to III, lands may be brought under crop, vegetable and flower production. Even cultivated fodder may be taken up to meet the increased demands for milch bovines. Class IV lands may be considered for fruit trees. The higher classes of land may be put to silvi-pasture systems to ensure increased availability of biomass. On the community-basis, commercial plants like bio-fuel, medicinal, dye and aromatic plants can be taken up. This alone can ensure easy marketability of the produce. In the community lands, silvi-pasture system with MPTs, grasses and legume fodders must be taken up. Social fencing for regenerating the biomass and introduction of new plant species of multipurpose nature are the two focal themes in such systems.

Among livestock, small ruminants for the shepherds and the milch cows and buffaloes depending on the rainfall (water availability), poultry and piggery for the poor may be taken up. The viable units at the household level on the livestock are as follows.

Type of livestock	Viable units
Cows (crossbred)	3
Buffaloes (Murrah)	2-3
Sheep (local improved)	50 ewes + 1 or 2 rams
Goat (local improved)	30 does + 1 buck
Poultry	10-20 Giri Raja or Vana Raja

At least two more livestock-based enterprises may also be considered. First is to rear aged crossbred cows or buffaloes of 3 months for 2 ½ and 3 ½ years respectively and sell. Second, dry animals could be reared for 6 months, during which, they may conceive and, when 3-4 months old pregnant, may be sold. Both the enterprises have high economic returns.

The livestock have an important role in nutrient recycling. A unit of 3 cows and 2 calves can add 113 kg N + 67 kg P_2O_5 + 80 kg K_2O per annum, where litter, dung and urine are converted into FYM. Thus the 'manure' component in the livestock is important but is often less emphasized or even ignored.

Non Land-Based Activities

The non-land based activities are important as livelihood support systems for the landless or have-nots in the habitation (Fig.7). These include services and other activities. Among services are the communications which are the most critical in creating awareness, answering problems in technology spread and even in marketing. They include STD, cable network, audio-visuals, courier and internet. There are several essential services. In fact in the earlier days as many as 14 such services have been existing at the rural level. Among others they include blacksmith, barber,

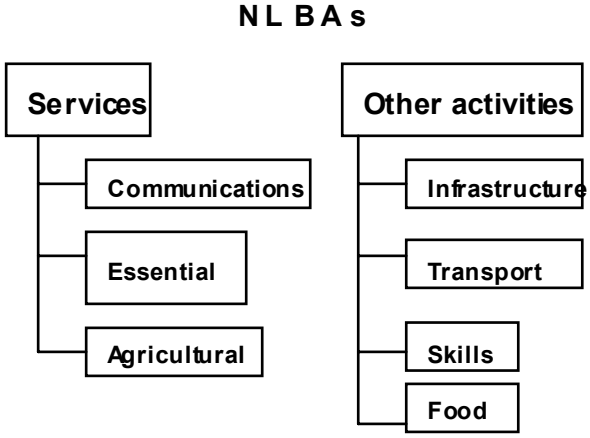


Fig 7 Action Plan for NLBAs

laundry, tailoring, carpentery, *Neergatti* (tank-water manager), hotel etc. The others relate to agriculture services like preparation of vermicompost, nursery, and service providers through decorticators, threshers, sprayers and tractors. And others include infrastructure, transport, skills and food processing. Trading, manufacturing, maintenance and repair represent the infrastructural activities. Transport includes automobiles, bullock cart and POL. Skills encompass embroidery, goldsmiths, wood carving etc., whereas food processing includes making pickles, eatables, fruit juices, jams, jellys, tomato *purrie,* etc.

Marketing

Marketing and market intelligence is acquiring greater importance in the present-day context (Fig.8). Price stability through warehousing, value addition through product processing, barter marketing in *shandys* and recently organized urban marketing (super *bazaar* or *Rythu bazaar*) besides inward marketing at the rural level are the components under marketing. Present efforts are for collective marketing, which leads to reduced costs in transport, processing and storing. The producers shall have a definite say and can even specialize in the products that have a greater demand. As CIGs, they can also take loans and seek insurance cover.

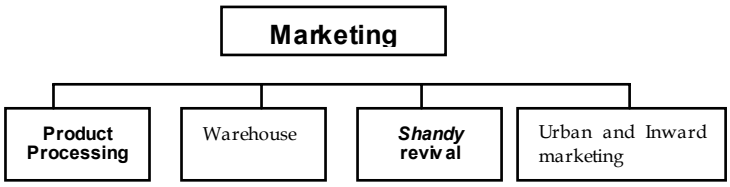


Fig 8 Action Plan for Marketing

PRODUCTION SYSTEMS

For enhancing the productivity of crops and livestock, training and capacity building are important. This is a two-way process and needs to be continuous. In fact with time it should be a self-financing institution.

As per FAO, 87 % agricultural extension services are in public sector. In India with 116 million farm families, there are 117,000 extension staff employed by the government agencies. This works out 1:1000 of extension workers to farm families. In one estimate, MANAGE found that the effective extension contact period per year per farmer would be less than 30 minutes (½ hr). What is of greater worry is the virtual stoppage of recruitment of staff in public

extension. On the contrary, annually about 3.0% of staff would be superannuating from service. Thus the public-extension system is shrinking.

Private-extension has excellent potential, but is not well organized. In fact, public extension could shoulder this very concept. It is only in the present National Agricultural Policy that Government of India recognized the need for Private Extension Service Providers (PESPs) in improving the extension services.

The PESPs, among others, include progressive farmers, farmers' organizations, external input dealers, private extension workers, agricultural cooperative banks, non-governmental organizations, mass media (radio, TV, print and more recently internet), private banks and different funding agencies. Among these, the most unorganizsed but most effective entity would be the progressive farmers. Even if one such farmer per village is considered, there would be a good number (about 625,000) of progressive farmers who could be the PESPs.

These PESPs presently are not tapped. They constitute the time-tested agricultural technologists at the habitat level. They think locally and can also act locally. What is now needed is the dissemination of their fund of knowledge through the PESP system. And for this the first attempt need to be proper documentation of their knowledge in various production systems as success stories. Such an approach would enable us to identify master farmers and self-employed youth to work as service providers in the crop and livestock production systems.

CROP PRODUCTION

The emphasis on production systems is less emphasized presently in the WDP. With NGOs, however, some efforts are seen for integrating the crop-livestock production systems. The GO or NGOs, with their promoting role, and the master farmers, with their success stories, should work through the SHGs on systems requiring less external input-sustainable agriculture (Fig.9). The LEISA involves participatory technology development (PTD), farmers' field schools (FFSs) and integrated crop management (ICM). The ICM encompasses in-village seed production, particularly of crops with heavy seed rate (rice, groundnut and soybean) besides integrated nutrient management (INM), non-pesticidal pest

management (NPM) of insects and pests, and participatory hydrological monitoring (PHM) in efficient use of the scarce water in the rainfed areas. All these steps help in bringing out eco-friendly sustainable production. Though comprehensive approach encompassing all these components is ideal, one can also proceed on a tier basis depending on the critical nature of each of the components and their availability besides the skills of the producers.

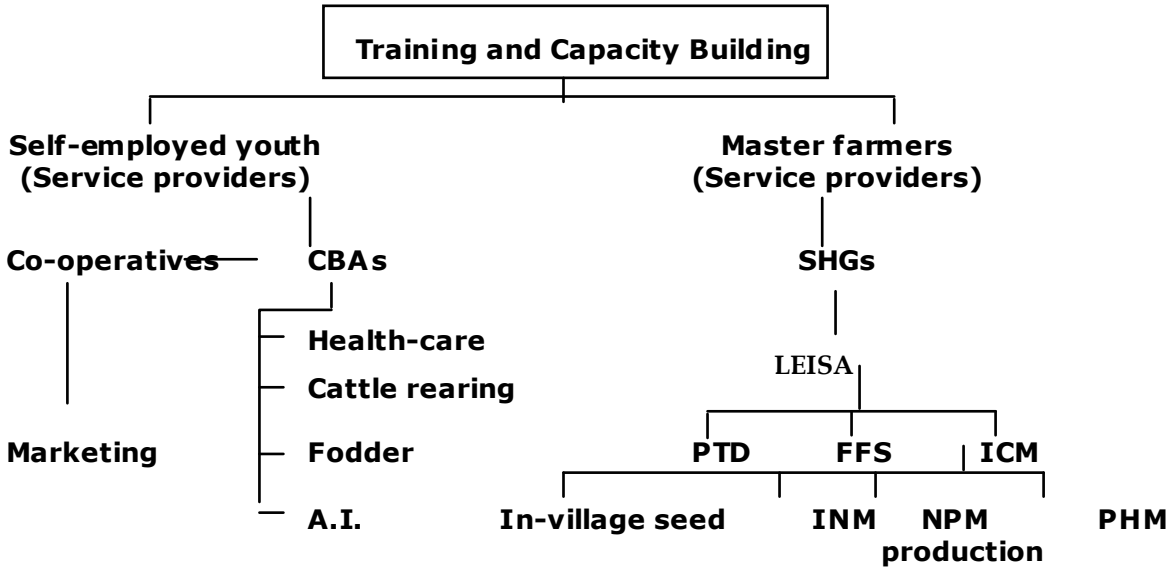


Fig 9 Production systems involving LBAs

The INM involves less use of external inputs like chemical fertilizers and improved organic recycling through integrated crop-livestock management, legume in rotation, sequence or intercropping and green-manuring or green-leaf manuring, besides proper preparation of compost (e.g. vermicompost). Many of these components are indigenous in nature. Legume is a part of mixed cropping that is mostly practised by the small-holders. In Vertisols of medium to high rainfall, sequence cropping is common. *Phoseolus* pulses (greengram, blackgram) are taken as the first crop followed by the staple crop like sorghum in parts of Telangana, Vidarbha, north interior Karnataka and Central Maharashtra. Similarly, horsegram is common after rice in Orissa and field bean is grown prior to taking up *ragi* in south Karnataka. Use of *Pongamia* from early days and rekindled interest in the use of *Gliricidia* in many parts as green-leaf manure are common. Growing of a short-duration legume (e.g. sunnhemp) in Deccan as a green-manure prior to taking *rabi* crop (e.g. sorghum) is also common. Composting was badly organized by the governmental agencies right from the early Independence days. It is only after the spread of

vermicomposting concept, renewed emphasis is laid on it. It should be our endeavour to supply the nitrogen requirements of crops through organics as cited. The phosphorus and potassium needs would be partly met from the same sources. However, additional requirements could be met from minerals like phosphate rock (Mussoorie) and gluaconite. The calcium and magnesium needs can be met through gypsum and dolomite. There will be little need for external application of other nutrients (e.g. S and Zn) if recycling processes are practised. Such organic recycling is also supported by government agencies from the recent past.

The NPM calls for revitalizing the earlier systems of pest control. Timely sowing, use of decoy crops in inter or mixed cropping, spray of leaf decoctions (neem, *Pongamia*, *Vitex*, *tulasi*) are some examples. Recently bonfire or use of light traps for attracting insect pests and killing in kerosonated water has also gained ground. Similarly use of Nuclear Polyhedrosis Virus (NPV), *Trichogramma* and *Trichoderma* is picking up. Producing of such bio-agents by the stake-holders themselves on a network basis is now a reality. The government provides funds for creating such facilities. If the need arises, only relatively environment-friendly pesticides may be put to use. Whenever herbicides are used for weed control, it is mandatory to combine it with mechanical measures as to reduce the use of active ingredient, and thus leading to effective control of weeds.

The PHM is slowly gaining grounds, especially with the fast depletion of ground-water. In this endeavour, groups of farmers decide on crops and cropping pattern, based on the net available water, which include soil water, rainfall, 65% of rechargeable ground-water and surface water, if any. Low-duty crops are taken up in lieu of rice, sugarcane and wheat. Priority is for foodgrains (e.g. nutritious cereals) followed by commercial crops like vegetables, fruits, flowers and medicinal, aromatic or dye plants, besides bio-fuel plants. High-value crops can be taken up by using expensive gadgets like the micro-sprinkler or drip systems of irrigation. Such endeavours are successful only when proper market support is provided or developed.

To practice such innovations, large-scale training and capacity building are needed. It is best done through the master farmers, promoted by GO or NGO

agencies. The PTD involves evolution of appropriate technologies through participatory research on the farmers' fields. For this purpose FFS would be a convenient tool, which aims at understanding the ICM from seed to seed of the important crops grown or feasible in a given region. Provision of infrastructural facilities like resource centre, warehouse, product processing for value addition and marketing also form a part of the capacity building.

The LEISA approaches are eco-friendly and they reduce cost of production and meet the growing demands of the green-consumers. Then the health of the soil, livestock and crops can be ensured, and in turn the health of the people in the habitation.

LIVESTOCK PRODUCTION

The self-employed youth can become service providers in this endeavour. They can encourage cattle breeders' associations (CBAs) who can have a two-fold activity. First, these can outsource para-extension persons for health-care and artificial insemination (A.I). Improved cattle rearing with concurrent fodder development must also be taken up. The second activity should be marketing through co-operatives.

The government has several inputs in achieving better production of crops and livestock. These include in-village seed production by farmer through supply of breeder or foundation seed in small quantities. The government also supports programme on organic farming or recycling and IPM by supporting small-scale production of bio-pesticides (NPV, *Trichogramma*) and even supply of mother cultures for the purpose besides marketing *Trichoderma*.

The government also subsidizes the supply of vegetable seed and the cuttings; saplings or grafts of fruit trees. It also has several supporting programme on rainfed crops. The Technology Missions on Oilseeds and Pulses, Cotton and Maize are such examples.

The government also supports programmes on livestock development. These include A.I. and green-fodder development (both meant for enhancing milk production). They also supply on subsidy improved seed or slips of grasses and legume fodders.

What is needed is an attempt on convergence of such programmes in the WDP.

MANAGEMENT OF FINANCES

Presently the funds are provided as grants at Rs 6,000/ha for all the activities in the WDP. These grants are routed through the government to the WC, who in turn execute the works through groups (UGs). There is a provision of Revolving Fund (RF) of Rs 100,000 per watershed for livelihood support systems to be given to the women, poor and landless as soft loans. The beneficiaries of the 'works' are to share a part of the costs (5% for the SC/ST and 10% for others). Works on community lands are to provide 10% of the costs from the beneficiaries. This money is deposited as WDF meant for post-project maintenance of the WHSs that are to be handed over to the PRIs. There had been several distortions in fund management. The WDF is collected from the labour wages, and the RF is not recovered. Much of the money was spent on WHSs and that too on private lands owned by medium and large holders.

There had been several examples where contribution to WDF is enhanced. NABARD, in the WDP through WOTR in Maharashtra, provided for 18% contribution to WDF. It also provides an incentive grant up to Rs 200,000 per watershed that performs well. Several NGO sponsored programmes encourage even up to 50% contribution from the beneficiaries, especially for the WHSs. Even the Working Committee on WDP, NRM and Rainfed Farming of the Planning Commission suggested that the contribution from the primary stake-holders must be raised to 50% by 2020 AD.

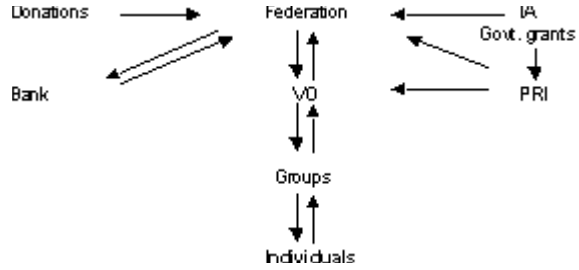


Fig 10 Financial flow

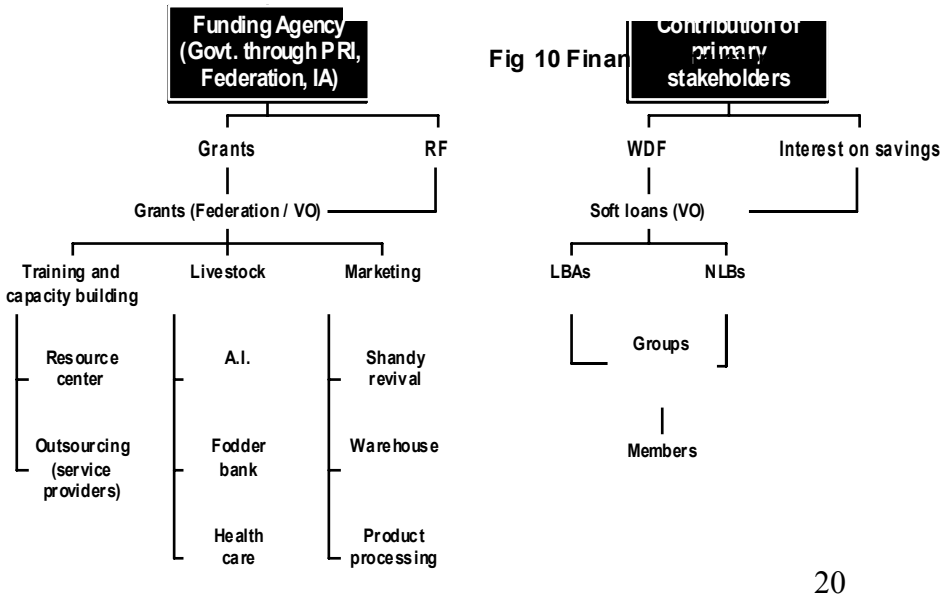


Fig 11 Fund Flow

To correct the earlier maladies, a new financial structure is proposed (Fig.10), where the government grants are routed through PRI to the federation or VO. These two groups also obtain donations as well as bank loans, and such total money shall be provided not to WC but to groups (SHGs, UGs, CIGs, CBAs etc.) based on approved action plan (which would include LBAs as well as NLBAs) submitted by individuals through groups.

Such a fund flow can also include interest on savings. These funds can not only be for the groups for livelihood and production systems as soft loans, but also as grants through Federation or VO for infrastructural development on training and capacity building, livestock and marketing (Fig.11). The trainin Interest capacity-building should include a resource centre and outsourcing (service providers). Livestock must cover A.I., fodder bank and health-care. Finally, marketing may cover *shandy* revival, warehouse facility and product-processing units.

MARKETING

At present the producers sell their produce cheap and later purchase the same at higher costs. Often times they go to marketing centres spending about Rs 100/q of produce on transport and sale processes. It is realized, based on several private interventions, which the producers can resort to collective marketing (Fig.12).

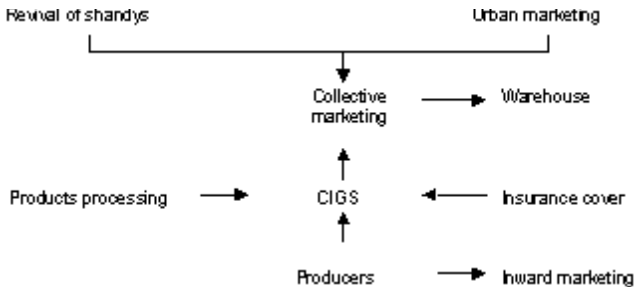


Fig. 12 Proposed structure of Marketing

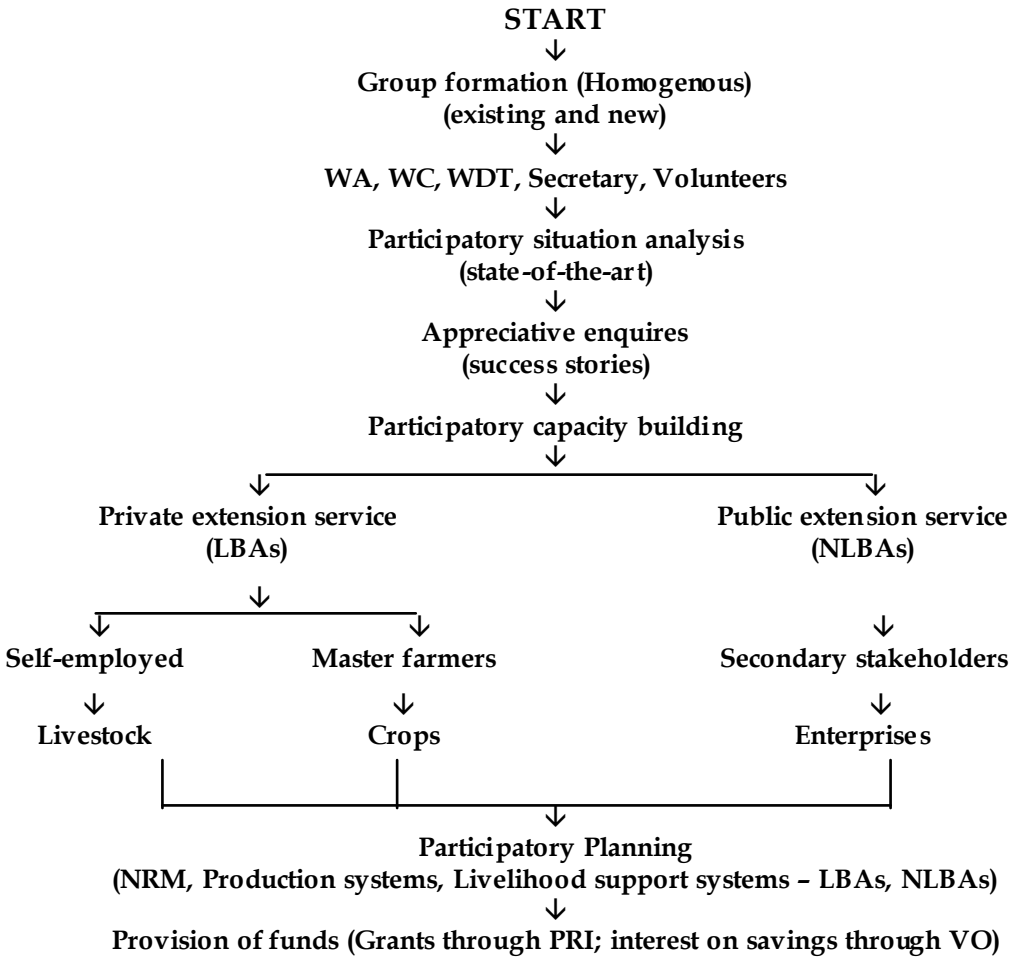
First they can meet the requirements at the habitation level (i.e. inward marketing). Then as groups under insurance cover, they can process the produce (e.g. *dal*-making) and store in warehouse for collective marketing in *shandys* as well as in urban markets.

As groups they can also acquire the needed additional funds from banks. Then can even acquire new knowledge through outsourcing. Federations can

assist in outsourcing for business plans, net working and linkages, convergence and marketing.

For a successful implementation of the WDP, the planning processes must then follow a flowchart as suggested below.

Part – A



Part – B

Implementation of plan by groups
↓
Monitor (WC)
↓
Modify plan (WA)
↓
Implementation of plan by groups
↓
Monitor plan (WC)
↓
Modify plan (WA)
↓
Implementation of plan by groups

↓

Evaluate (WA)

↓

Exit after transfer of assets to the stakeholders

EPILOGUE

India has a human population of 1073 million (2003-04), livestock of over 516 million (2000) and poultry of over 350 million (1998). The land, however, is finite, being 306 Mha of reporting area. About 142 Mha are under cultivation, cropping intensity being 133.

About 1/3rd population is expected to be the urban population by 2020. With increasing GDP, the food habits are fast changing. By 2002 the cereal consumption has come down while the consumption of livestock based and non-food products is significantly increasing. But about 1/3rd of the population go hungry, the proportion increasing with a drought. This is largely because of inadequate ecological access to foodgrains and lack of purchasing power. So more and more local employment has to be generated. And improved soil, crop and livestock husbandry provides this opportunity.

There is a need for diversification. Then it is feasible to tap synergies through crop-livestock, agrosilvipasture and legume-based cropping systems. Consequently there would be less dependency on external / purchased inputs, more of organic recycling and improved soil health. Such an approach also provides the platform for (a) the much needed carbon sequestering and (b) the scope for reducing the costs in production of crops and livestock.

Many of the natural resource degradation problems are human induced. They can be retrieved through participatory approaches. And WDP is a right step in this direction. The GoI has taken up Rainfed farming and WDP in a big way. Thus there is no need for despair. It is here that the concept of Low External Input Sustainable Agriculture (LEISA) needs consideration. We like to end this presentation with what Mahatma Gandhi said "Nature has enough for everybody's need but not enough for everybody's greed".

Acknowledgement

The document is an abstracted presentation from several, books, chapters and papers written by the author.