14 Scaling-out Community Watershed Management for Multiple Benefits in Rainfed Areas

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Introduction

Low productivity in rainfed areas, aggravated by water scarcity, degraded and poorly managed land, poor infrastructure and lack of market, marginalizes agriculture and livelihoods in the rainfed areas. Demographic pressures in developing countries of Asia and Africa and increased vulnerability due to changing climate have further exacerbated the sustainability and threatened livelihoods in rainfed areas. Globally 80% of agriculture is rainfed; in South Asia it is about 60–65%; and in sub-Saharan Africa it varies between 90 and 95% (Rockström *et al.*, 2007). About 66% of total arable land (142 million ha) in India is rainfed and suffers acute moisture stress. Although the green revolution helped Asia, particularly India, to attain self-sufficiency in food production, it bypassed millions of poor living in rainfed areas. None the less, in so-called green revolution areas signs of yield fatigue and unsustainability are evident (Pingali and Raney, 2005). Water is a critical constraint to increasing agricultural productivity. It is estimated that by 2025, one-third of the population in developing countries, including 50% of the population of India and China, will be facing physical scarcity of water. The recent Comprehensive Assessment of Water for Food and Water for Life showed that challenges of poverty and food security with looming water scarcity cannot be met by irrigated agriculture alone, and major gains have to come through upgrading rainfed agriculture (Molden *et al.*, 2007). In India, even after exploitation of the full irrigation potential, about 60% of the arable area will continue to depend on rainfed farming. Both surface and groundwater resources are under considerable pressure and have depleted considerably. Falling groundwater tables, due to excessive exploitation and low recharge, have led to disastrous consequences. The Central Groundwater Board of India has identified 100 'critical' districts in the country where excessive use of groundwater has led to serious economic and sustainability problems and 85 of these districts are situated in rainfed regions. Estimates of water availability vis-á-vis requirement in 2050 indicate a yawning gap between demand and supply. Projections of water requirement show that in 2050 the country's utilizable water availability of 1122 km^3/year will hardly be able to match the estimated requirement of 1450 km^3/year (Gupta and Deshpande, 2004). The agriculture sector is the single largest user of

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water, which accounts for more than 80% of the total present demand. Estimates show that about 68% of the total water requirement (i.e. 628–807 km^3/year) would be available for the irrigation sector in 2050 (Sharma, 2002). It indicates an alarming situation in the years to come. If the present trend continues, water availability will reach the stress level of 1700 m^3/person by 2025 and the scarcity level of 1236 m^3/person in 2050 (Sharma, 2002). In most rainfed areas, water availability is not a problem but rainfall distribution and poor management creates water scarcity for crops, resulting in low rainwater use efficiency (40–45%) and low crop production (Wani *et al.*, 2003a). Rainwater stored in soil largely escapes to atmosphere through unproductive evaporation, and large water productivity gains could be achieved in rainfed areas by changing vapour flows through productive evapotranspiration (green water) (Rockström *et al.*, 2007).

This is a matter of concern and requires developing appropriate strategies that ensure augmentation of water resources through all possible measures, including rainwater conservation and harvesting as well as efficient and economical use of water in rainfed areas. Development of watersheds/catchments is one of the most trusted and eco-friendly approaches to manage rainwater and other natural resources, which has paid rich dividends in the rainfed areas and is capable of addressing many natural, social and environmental intricacies (Samra, 1998; Wani *et al*., 2002, 2003b,c; Rockström *et al*., 2007; Chapter 2, this volume). Management of natural resources at catchment/watershed scale produces multiple benefits in terms of increasing food production, improving livelihoods, protecting the environment and addressing gender and equity issues along with biodiversity concerns (Wani *et al.*, 2003b,c; Rockström *et al*., 2007). Watershed development programmes (WDPs) are therefore considered as a growth engine for development of fragile and marginal rainfed areas (Wani *et al*., 2008a).

This chapter assesses the ways and means of enhancing the benefits of watershed programmes through scaling-out strategies by identifying biophysical and socio-economic drivers of success based on critical analysis of case studies. It also identifies conditions for larger participation of the stakeholders in the watershed activities, which is a prerequisite for successful implementation and sustainability of the watershed development projects. To face the challenges of reducing poverty and thus meet the target of halving the number of poor in the world and also to build resilience to the impacts of climate change, a strategy for upgrading rainfed agriculture in developing countries is discussed.

Watershed Development Programme in India

In the tropics, rainfall is erratic and not well distributed during the season, resulting in long dry spells as well as severe run-off and soil erosion during the crop growing period. Year-to-year variation in rainfall as well as its distribution during the season is quite large. In 2007, Kurnool town in Andhra Pradesh received 420 mm rainfall in 24 h as against the long-term monthly average of 77 mm. Similarly, Adarsha watershed in Kothapally in Rangareddy district in Andhra Pradesh received 346 mm rainfall in 24 h on 24 August 2000 as against annual average of 800 mm. In 2006, Rajasthan, which normally suffers from deficient rainfall, experienced unusual floods in the districts, causing severe losses of humans and livestock, in addition to the huge financial losses. Ten rivers, overflowing and flooding Pali, Sirohi, Udaipur, Banswara, Jhalawar, Dungarpur, Kota and Chittorgarh districts in Rajasthan, caused enormous losses, including the death of 138 people and a large number of livestock. The most affected area was Barmer, in the Thar desert, where the houses remained flooded under 6 m of water. Barmer received about 577 mm of rainfall, 300 mm more than the annual average rainfall of 277 mm. To manage such extreme situations of water scarcity and excess, watershed development in rainfed areas provides a suitable solution to these problems (Chapter 1, this volume).

The most important feature of watershed development is *in-situ* conservation and harvesting rainwater for augmenting surface and groundwater resources in rainfed areas. Watershed development aims at optimum and prudent use of soil and water resources in a sustainable and cost-effective mode.

Augmentation of water resources is at the heart of WDPs.

The catchment watershed development approach is a viable option for unlocking the potential of rainfed areas and doubling or quadrupling the productivity through augmenting water resources in the rainfed areas (Rockström *et al*., 2007; Wani *et al.*, 2007). Watershed management is of strategic importance in bringing in the 'second green revolution' and achieving the goal of 4% agricultural growth in the country. Evidence shows that the watershed approach to rainfed farming with water harvesting and supplemental irrigation technologies shows great promise for increasing groundwater recharge and crop yields since the seventh 5-year plan (Sharma, 2002; Wani *et al*., 2003b,c; Joshi *et al*., 2005). The government of India, therefore, has accorded high priority to the holistic and sustainable development of rainfed areas through the integrated watershed development programme (Wani *et al.*, 2008a).

The emphasis is on the augmentation of water resources by implementing small watershed projects. The majority of watershed development projects in the country are sponsored and implemented by the government of India with the help of various state departments, non-governmental organizations (NGOs), self-help groups (SHGs), etc. The Drought-Prone Area Programme (DPAP), the Desert Development Programme (DDP), the National Watershed Development Project for Rainfed Area (NWDPRA), the Watershed Development in Shifting Cultivation Areas (WDSCA) and the Integrated Watershed Development Project (IWDP) are a few of the important development programmes that plan, fund and implement watershed development projects. A total sum of US$7 billion has been invested in the country in various watershed development projects from the inception (early 1980s) of WDPs until 2006. Several international organizations, including the Department for International Development (DFID), the Deutsche Gesellschaft for Technische Zusammenarbeit (GTZ), the Swiss Agency for Development and Cooperation (SDC), the World Bank, and the International Fund for Agricultural Development (IFAD), also sponsor and implement watershed development projects, but a significant proportion (about 70%) of the investment in WDPs is being made by the government of India. Evidence shows that WDPs have yielded considerable benefits in terms of increasing agricultural productivity, groundwater recharge, reducing run-off and soil loss, increasing greenery, diversifying cropping systems, conserving biodiversity, equity, sustainability and efficiency (Farrington and Lobo, 1997; Hanumantha Rao, 2000; Kerr *et al.*, 2000; Joshi *et al.*, 2003, 2005; Wani *et al.*, 2003b,c).

Approach

The watershed development approach in India has evolved over time, based on the knowledge gained from various programmes. Wani *et al.* (2006a) noted that it started with soil and water conservation programmes and then laid emphasis on water harvesting and increasing crop productivity and recently focused on full livelihood improvement programmes. Although new approaches such as livelihood improvement and productivity enhancement are developed and have proven their superiority, large numbers of watershed programmes have not graduated fully into holistic/integrated programmes. Most programmes heavily emphasized water augmentation interventions but did not accord much emphasis on efficient use of conserved soil and water resources (Wani and Ramakrishna, 2005). Similarly, many watershed programmes did not address the issues of women and vulnerable groups, and in the process they paid the price of development with increased workload without any tangible social or economic benefits to women (Meinzen-Dick *et al.*, 2004; Shah, 2007; Sreedevi and Wani, 2007).

Along with the evolution of the compartmental approach to the integrated and holistic approach, the processes and institutional arrangements also evolved. The government of India responded with revision of watershed guidelines, emphasizing more collective action and participation by the primary stakeholders (Government of India, 1994; Hanumantha Rao, 2000) and involvement of community-based organizations (CBOs), NGOs and Panchayat Raj Institutions (DOLR, 2003). For ensuring tangible economic benefits to individual farmers, women and vulnerable group mem-

bers, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has developed an effective consortium approach for integrated watershed development (Wani *et al.*, 2003c), and the approach is used for upscaling in India and other Asian countries (China, Vietnam, Thailand and Philippines) (Wani *et al.*, 2006a). The public–private partnerships (PPP) in the area of integrated watershed development and management are emerging (Wani *et al.*, 2007a) and are also encouraged by the Government of India (2005).

To identify biophysical, socio-economic and institutional drivers, a number of watershed case studies have been analysed. For monitoring the impact of watershed programmes on various aspects, appropriate indicators are being evaluated (Joshi *et al.*, 2004; Pathak *et al.*, 2004; Shiferaw *et al.*, 2006; Wani *et al.*, 2006a; Shah, 2007). The various biophysical and socio-economic indicators used for assessing the macro- and micro-level impacts of watershed programmes are listed in Table 14.1. At the macro level, the aggregate impacts of watershed programmes in India were assessed by Joshi *et al.* (2003, 2005), considering different socio-economic and agroecological indicators by adopting a meta-analysis approach. At the micro level, a number of detailed case studies (Wani *et al.*, 2003a; Sreedevi *et al.*, 2004, 2006; Shiferaw *et al.*, 2006) were evaluated and analysed to observe the micro-level impacts of different watershed programmes in the country.

Benefits of watershed programmes

The watershed programmes produce multiple tangible and intangible benefits for individuals as well as for communities as a whole. The present generation watershed programmes are not only conserving but also augmenting water and land resources, increasing agricultural and livestock productivity, enhancing incomes, protecting and providing environmental services, promoting collective action and addressing issues of women and equity for vulnerable groups through development of social capital and institutions, including building resilience of natural and human resources to cope with future changes, including those due to climate change (Wani *et al.*, 2008b). Therefore, watershed management has been a key component of development planning of rainfed drought-prone areas since the early 1980s.

The results of meta-analyses using 311 case studies showed that watershed programmes, apart from raising income levels and generating employment opportunities, have been remarkably successful in conserving and augmenting water resources in the rainfed areas, by the adoption of different soil and water conservation measures and trapping of surface run-off water. A summary of multiple benefits derived from watersheds, as indicated in various studies, is shown in Table 14.2. It is obvious that watershed programmes in India have yielded multiple exemplary benefits, including augmentation of water resources. The watershed programmes are largely aimed at conserving soil and water to raise farm productivity. The available evidence revealed that both these objectives were accomplished in the watershed areas. Conserving soil means raising farm productivity and transferring good soils to the next generation. It was noted that, on average, about 38 ha-m additional water storage capacity was created as a result of the watershed programme in 500-ha watersheds. Augmenting water-storage capacity contributed to: (i) reducing rate of run-off; and (ii) increasing groundwater recharge. This has a direct impact in expanding the irrigated area and increasing cropping intensity. On average, the irrigated area increased by about 34%, while the cropping intensity increased by 64%. Such an impressive increase in the cropping intensity was not realized in many surface-irrigated areas in the country (Joshi *et al.*, 2005).

However, it is important that unless a programme is economically viable, it will never succeed. Fortunately, the mean benefit– cost ratio of the watershed programme was also quite modest at 2.14 (Table 14.2). This revealed that investment in the watershed programmes under fragile and challenging rainfed environments has yielded enormous benefits (more than double). About 15% of watersheds attained a benefit–cost ratio of more than three (Fig. 14.1). Only less than 3% of the watersheds were reported to have a benefit–cost ratio of less than one. The mean internal rate of return on watershed investment was about 22%, with a maximum of 94% (Joshi *et al.*, 2005).

Table 14.1. Agricultural sustainability criteria and indicators.

Criteria	Indicators
Agrodiversity	Index of surface percentage of crops (ISPC)
	Crop agrobiodiversity factor (CAF)
	Genetic variability
	Surface variability (monoculture)
Agrosystem efficiency	Yield and yield gap
	Cost–benefit ratio
	Parity index
Use of the land resource base	Land availability/land demand
	Land demand/land used
	Cultivated land/inhabited
	Cultivated land/deforested land
	Irrigated land/irrigable land
	Degraded land
Food security	Per capita production index
	Agricultural population/total population
	Export/import
	Food production/food demand
Soil quality	Soil physical indicators (e.g. bulk density, clay content, water infiltration rate, tilth, penetration resistance, soil pH, water-holding capacity, waterlogging, soil loss, etc.)
	Soil chemical indicators (e.g. total organic C, total and available N, P and other nutrients, nutrient-supplying capacity, cation exchange capacity (CEC), salinity, accumulation of toxic compounds, etc.)
	Soil biological indicators (e.g. soil microbial biomass, soil respiration, soil enzymes, biomass N, quotient of soil organic C to biomass C and total N to biomass N, diversity of microbial species, etc.)
Water availability and quality	Quantity of fresh surface water available
	Groundwater level fluctuations
	Quality of surface water and groundwater (chemical and biological quality)
Environmental services	Greenery cover/vegetation index
	Carbon sequestered
	Reduced emissions of greenhouse gases
	Reduced land degradation/rehabilitation of degraded lands
Biodiversity:	Animal population, species, etc.
socio-cultural functions	Changes in landscape and scenery
	Changes in recreational benefits (agro-ecotourism, outdoor sports, etc.)
	Changes in cultural and artistic use (e.g. motivation for books, films, advertising, etc.)
	Changes in use for religious and historical use (e.g. heritage, spiritual symbol)
	Recognition for scientific or educational purposes

Source: Wani *et al.* (2006a).

The mean internal rate of return on watershed investment is comparable with any successful government programme. It is interesting to note that 35% of watersheds yielded more than a 30% internal rate of return (Fig. 14.2). About 5% of watersheds performed very poorly; the internal rate of return was less that 10%. This evidence suggests that the watershed programmes performed reasonably well in the fragile and challenging environments. The investment was logically justified, which was responsible for raising the income levels and reducing poverty of the beneficiaries in the target domains.

Benefits from watershed programmes were conspicuously more in the low-income regions as compared with the high-income regions

Table 14.2. Summary of benefits from the sample watershed studies[a].

Indicator	Particulars[b]	Unit	No. of studies	Mean	Mode	Median	Minimum	Maximum	t-value
Efficiency	B/C ratio	Ratio	128	2.14	1.70	1.81	0.82	7.06	21.25
	IRR	Per cent	40	22.04	19.00	16.90	1.68	94.00	6.54
Equity	Employment	Person-days/ ha/year	39	181.50	75.00	127.00	11.00	900.00	6.74
Sustainability	Irrigated area	Per cent	97	33.56	52.00	26.00	1.37	156.03	11.77
	Rate of run-off	Per cent	36	−13.00	−33.00	−11.00	−1.30	−50.00	6.78
	Soil loss	t/ha/year	51	−0.82	−0.91	−0.88	−0.11	−0.99	39.29
	Cropping intensity	Per cent	115	63.51	80.00	41.00	10.00	200.00	12.65

[a]Source: Joshi *et al.* (2005); [b]B/C = benefit–cost, IRR = internal rate of return.

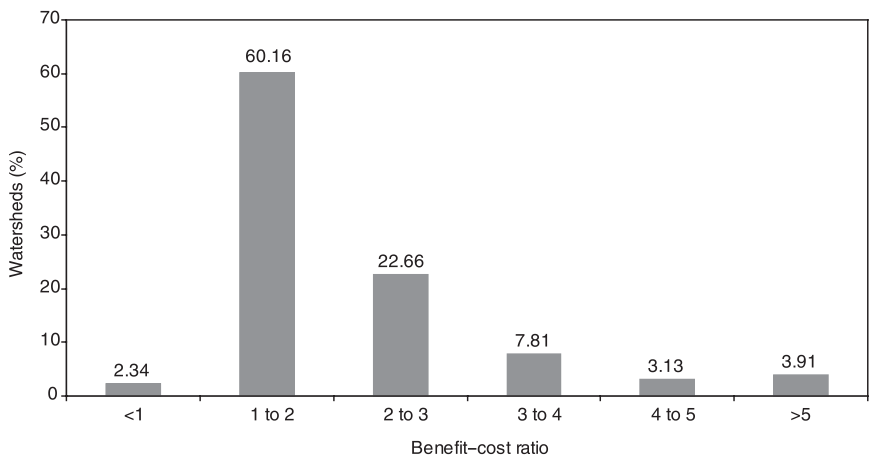

Fig. 14.1. Distribution (%) of watersheds according to benefit–cost ratio.

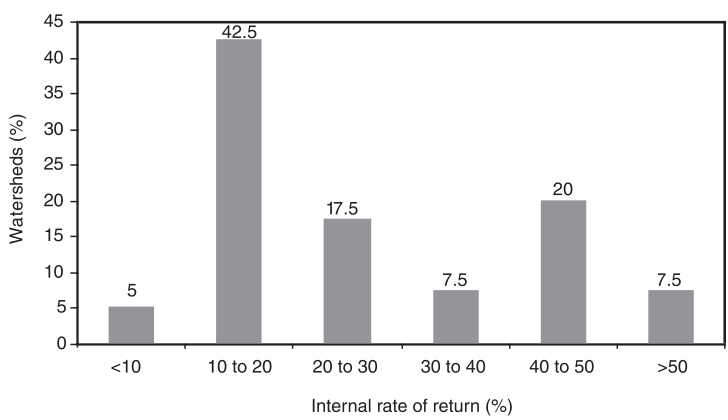

Fig. 14.2. Distribution (%) of watersheds according to internal rate of return (Source: Joshi *et al.*, 2005).

(Table 14.3). The benefit–cost ratio was 2.46 in low-income regions as compared with 1.98 in high-income regions. The corresponding figures for annual employment generation were 175 and 132 person-days/ha. The low-income regions call for such investments to enhance income levels of the rural poor. This suggests that watershed programmes should receive higher priority by the government in medium- and low-income regions. Such investments will not only raise income and employment opportunities in the backward regions but also contribute in conserving soil and water resources.

The study by Fan and Hazell (1997) demonstrates that the returns to investment in inputs as well as research were higher for dryland areas than for irrigated areas. Farmers in these regions could not invest due to low income and limited opportunities. Government intervention through watershed programmes would benefit the rural poor in the low-income regions. Ironically, the participation of beneficiaries in planning and execution of the watershed in the low-income regions was observed to be less than that in the higher-income regions.

This implies that poor rural households were less involved in planning and decision-making processes in the watersheds. However, the rural poor in the low-income regions were offering their labour in various activities launched in the watershed. In fact, for the smaller farmers and the landless labourers in the watershed, there is often little prospect for development beyond the employment generated from the watershed works over the project period (Farrington *et al*., 1999). Perhaps greater involvement of the beneficiaries would yield higher dividends from the investment in watershed-related activities as active people's participation is a critical factor for success and sustainability of watershed programmes. The available evidence also confirms that the watershed programmes with high people's participation were able to harness more benefits. Joshi *et al.* (2005) estimated that the benefit–cost ratio was much more (2.4) in watersheds where people's participation was high in comparison with the watersheds with low participation (1.24). The other impact indicators were also far ahead in watersheds having greater people's participation.

The above evidence reveals that people's participation was the key determinant in the success of the WDPs. It implies that people's participation is not only critical during the implementation phase of watersheds but beyond the actual investment phase. In the absence of active involvement of the stakeholders, the watershed programmes would not be sustained. However, there are other enabling factors too that determine the performance of watershed programmes. A strong linkage of the

Table 14.3. Summary of benefits from the watershed studies according to economic status of the region[a].

			Per capita income of the region[b]		
Indicator	Particular	Unit	High	Medium	Low
Efficiency	B/C ratio	Ratio	1.98	(16.86)	2.21
			(12.28)	2.46	(7.73)
Equity	Employment	Person-days/ha/year	132.01	(4.14)	161.44
			(5.29)	175.00	(4.66)
Sustainability	Irrigated area	Per cent	40.34	(9.73)	23.01
			(6.24)	36.88	(4.19)
	Cropping intensity	Per cent	77.91	(8.67)	36.92
			(11.99)	86.11	(7.64)
	Rate of run-off reduced	Per cent	12.38	(5.31)	15.82
			(3.39)	15.43	(6.01)
	Soil loss reduced	t/ha/year	0.82	(40.32)	0.88
			(37.55)	0.69	(4.60)
Extent of people's participation			High	High	Low

[a]Source: Joshi *et al.* (2005); [b]Figures in parentheses are t-values. Includes the states having per capita AgGDP (1996–1997) greater than Rs 4000 for high-, between Rs 2000 and Rs 4000 for medium-, and below Rs 2000 per annum for low-income regions.

watershed programme with various institutions is critical for yielding desired outputs. Effective linkages between SHGs or users' associations and various institutions would sustain the watershed programme.

Drivers of Collective Action and Success

People's participation

Active people's participation is a prerequisite for the success of WDPs. Involvement of local stakeholders in planning, development and execution of the watershed activities is crucial. The watershed is a community development approach and hence it calls for community participation and collective action. It is necessary because individual choices have collective consequences in the watershed framework. Action of one group of farmers in one location affects (adversely or favourably) another group of farmers in a different location (off-site impact). Such externalities influence the performance of the watershed at large. Often the different groups and locations have conflicting objectives with respect to their investment priorities and enterprise choices. These need to be converted into opportunities. The actions of all the farmers in the watershed should converge in such a way that the positive externalities are maximized and negative ones are minimized. To achieve this, the community or stakeholders have to develop their own rules, which resolve their conflicting objectives. It is believed that better organized and effective people's participation would yield higher benefits.

The first-generation watershed programmes in the country were supply driven. The government officials used to identify locations and decide various activities for implementation of watershed programmes, which were funded by central and state governments. This top-down approach did not match the needs of stakeholders in the watershed. In the absence of people's participation, the potential benefits of the watershed programmes could not be realized. To overcome this problem, the concept of Participatory Integrated Development of Watershed (PIDOW) was initiated in the 1980s. However, only a partial success could be achieved, and some radical steps were taken to involve the local stakeholders/people in planning, formulation and implementation of watershed programmes in the country. In due course, the people's institutions, such as *Zila Parishad*, SHGs and watershed-implementing committees, were gradually involved in the project management system. With more funds allocated for watershed development, several NGOs aggressively participated in implementing this programme and demonstrated the importance of people's involvement in the success of the watersheds. Most of the arrangements were informal and varied across watersheds and implementing agencies. To make it formal, the 1994 watershed guidelines specifically included people's involvement as one of the conditions in the watershed development. It is important that people come forward and participate voluntarily. Only voluntary participation (not forced) would sustain the watershed programme. It is therefore important to identify conditions under which the watershed beneficiaries would involve themselves in implementation, during the project tenure and maintenance of structures after the project is formally over.

Bottom-up approach

The watershed that involves activities which are able to cater to the specific needs of local people certainly attracts higher people's participation. It is therefore essential to ensure that once the watershed is identified, the needs of the stakeholders must be assessed together by the implementing agency and the stakeholders. Since a watershed has diverse groups of beneficiaries, all genuine and valid needs of each and every group should be appropriately addressed in the watershed. There are reports which state that in many watersheds only influential and large farmers were involved and the small and marginal farmers were not involved. Besides, there was evidence that most of the watershed programmes were not sensitive to the needs of women and landless labourers. Often the women and landless labourers were silently left out of watershed-related decision-making processes (Meinzen-Dick *et al.*, 2004; Sreedevi and Wani, 2007). The integration of small and marginal farmers, women and landless labourers into the process requires conscious efforts right from the beginning.

Tangible economic benefits to individuals

In spite of a bottom-up participatory approach for planning and implementation of watershed development, community participation was not forthcoming in most of the watershed programmes. The main reason for the low or contractual mode of participation was that large numbers of small and marginal farmers were not getting tangible economic benefits as productivity-enhancement initiatives were missing to large extent. Improved groundwater availability benefited a few well-to-do farmers who could invest and extract the groundwater. Such well-to-do farmers, who were beneficiaries of the improved groundwater availability, had no time to participate. On the other hand, large numbers of small and marginal farmers who had time to participate were not getting any tangible benefits. One of the important drivers of success in a consortium approach was tangible economic benefits to large numbers of farmers through increased crop productivity on individual farms through *in-situ* rainwater conservation and its efficient use, with improved crops/cultivars, nutrient, water and pest management options (Wani *et al.*, 2002). Through this approach, a greater number of farmers started participating in WDPs as they derived tangible economic benefits from the productivity-enhancement activities from the first season itself.

Knowledge-based entry point activity

In most watershed programmes, entry point activity (EPA), as identified by the community, is undertaken under the project to build rapport with the community through activities such as construction of a meeting room, school, classroom, borewell pump, drinking water tank, etc., using project financial resources allocated for EPA. However, it was observed that such cash-based EPA passed on a wrong signal to the community that all activities can be undertaken through project funds, which the community capitalized on without contributing their share. Such a subsidy-dependency approach never got community ownership, resulting in the neglect of the resources invested. The ICRISAT-led consortium has developed knowledge-based EPA to build rapport with the community using soil analysis or introduction of disease-tolerant cultivars, etc., which provided free knowledge but farmers had to pay for the material (Wani *et al.*, 2006a).

The knowledge-based EPA ensured that demand-driven technologies were evaluated by the farmers rather than supply-driven ones provided by the project staff, which resulted in a cooperative and consultative mode of community participation, as against the contractual mode in the case of direct cash-based EPA. Knowledge-based EPA was one of the important drivers of collective action in the community watersheds developed through the consortium approach for technical backstopping (Sreedevi *et al*., 2004; Shiferaw *et al.*, 2006).

Watershed institutions/self-help groups

The next stage of people's participation is even more critical. It denotes the phase of implementation where various interventions are being made. This stage requires regular monitoring because success of the watershed depends upon how effectively the stakeholders are monitoring the progress. Evidence shows that some successful watersheds constituted informal groups for regular monitoring of watershed activities. However, there was considerable difference between these groups. For instance, some watersheds constituted formal users' associations. The users' groups were found to be active during the implementation phase only and had no mechanisms in place to meet regularly once the construction activity was completed, unlike the SHGs, which met regularly for financial transactions. In a recent study of institutional arrangements in different watershed programmes, Sreedevi *et al.* (2007) observed that the area groups approach adopted in the Sujala watershed programme in Karnataka was far superior to the users' groups approach in terms of functional efficiency, sustainability and regularity, as the membership was voluntary for undertaking project activities in their area. In the same study, membership criteria and actor linkages in the APRLP–DFID programme, the Sujala watershed, the Indo-German Watershed Development Programme and the Hariyali guidelines-based watershed

programme were studied. It was concluded that representation in the watershed committee for women SHGs in the Sujala and APRLP programmes was effective for women's participation and decision making, whereas the community was not effective/functional in the Hariyali programme watersheds. The *Gram Panchayat* had a major role in Hariyali watersheds but it was not the same in other programmes. Similarly, the apparent convergence of line departments in Hariyali watersheds was evident on paper only, and the effective and close working relationship between watershed development teams, the watershed committee and area groups was found in the Sujala programme (Sreedevi *et al.*, 2007). Concepts such as *Mitra Kisan* or *Gopal Mitra* have shown mixed results across different watersheds in different states (Deshpande and Thimmaiah, 1999).

The success of watershed programmes not only relies on the watershed institutions but also depends more on how effective the credit delivery system, the input delivery system, the output markets and the technology transfer mechanisms are. It is therefore imperative to ensure that watershed programmes/institutions should also have a strong linkage with various institutions such as markets, banks, etc.

Decentralize decision-making process

Decision making is the key component of watershed programmes. The success or failure of watershed programmes very much depends on who makes decisions and how they are made. Hence, decentralization of the decision-making process is of utmost importance. Several watershed evaluation reports show that watersheds performed reasonably well where the decision-making process was decentralized. Decentralization of the decision-making processes, however, requires flexibility. Often it is noted that the rigid norms did not allow decentralization of decision making. To some extent, involvement of elected representatives of the people (Members of Legislative Assembly and Parliament) in the development process may ease the process (Joshi *et al.*, 2004). There are reports that in Madhya Pradesh a conscious effort was made since 1995 to involve elected representatives of the people. Greater involvement of local Members of Legislative Assembly and Parliament and Panchayat Raj Institutions may assume a significant role in project planning and execution, since they are the elected representatives who would like to make political mileage as a result of developmental programmes such as watersheds. In this process, they become accountable to the watershed and can be voted out in the event of tardy progress.

Commensurate benefits and costs

The watershed is a community-based approach but individual actions are also important. As stated earlier, the individual actions have collective consequences. There are many conflicting objectives among the stakeholders. Benefit-sharing is perhaps the most complex challenge in management of the watershed. In a watershed framework, often benefits are not commensurate with the cost incurred and the labour involved in the watershed activities. Sharing of benefits in accordance with the cost and contributions of the participants will go a long way in sustaining the watershed programme. For example, in the watershed framework, the farmers located at the upper reaches have to invest more but the gains of their actions are more to farmers at the middle or lower reaches (Joshi *et al.*, 1996).

Capacity building

Management of the watershed is a complex process. Many of the watershed-related activities that aim to conserve, restore and augment soil and water resources require specialized skills. The most important and also the weak link in watershed programmes is training and capacity building of all the stakeholders from farmers to policy makers (Wani *et al.*, 2008b). Most stakeholders conceive WDPs as construction of rainwater-harvesting structures and never go beyond to include productivity enhancement, income-generating activities, livestock-based activities, institutions, monitoring and evaluation mechanisms, wasteland development, market linkages, etc. Most stake-

holders emphasize the area of their expertise; for example, NGOs emphasize social mobilization and rainwater harvesting, and watershed development teams and technocrats emphasize technologies and overlook holistic integration. Technical backstopping through the consortium approach provides opportunities for training and capacity development of all the actors involved. Thus, training of beneficiaries is another key element for the success of the watershed activities. Unawareness and ignorance of the stakeholders about the objectives, approach and activities is one of the reasons that affects the performance of watersheds. For example, in most watersheds not only the farmers but also most stakeholders are not aware of the major constraints for increasing productivity or actual potential of the watershed (Wani *et al.*, 2003b,c). The stakeholders must be aware about the importance of various activities in the watersheds, and their benefits in terms of economic, social and environmental aspects. Many actions by the stakeholders in the watershed are being taken in ignorance, which adversely affects the income and environment of other stakeholders and locations. Educating all the stakeholders would minimize such actions and conflicts and maximize benefits from the watershed. The Professor Hanumantha Rao Committee and Sri Eshwaran Committee have strongly recommended the need for training of all stakeholders in the watershed. These recommendations must be adhered to make the programme more participatory and successful.

Targeted activities for women and vulnerable groups

In order to enlist active participation of women and vulnerable groups, Sreedevi and Wani (2007) suggested targeted activities that benefit these groups economically. More income-generating, commercial-scale activities for women resulted in better participation as well as improved decision-making power and social status for women in the family and society. The mere presence of women members on the watershed committee had no real impact on women as they were not effective in the decision-making process in the committee (Seeley *et al.*, 2000). Harnessing gender power by balancing activities for men and women, farmers and landless people was found to be effective in enhancing the impact of community watershed programmes (Sreedevi and Wani, 2007).

Agroecoregion-specific technologies

Agroecological differences play a deterministic role in the success of watershed programmes. For example, meta-analysis of watershed case studies revealed that the current technologies and interventions showed better impact in terms of benefit–cost ratio and internal rate of return in the regions receiving average annual rainfall between 700 and 1100 mm rainfall, whereas the regions with rainfall less than 700 mm and higher than 1100 mm failed to generate equal benefits because of scarcity of water on one hand and excessive water availability on the other (Joshi *et al.*, 2005). This calls for an endeavour to identify and adopt specific watershed development technologies for <700 and >1100 mm rainfall zones (Wani *et al.*, 2007). The current practice of allocating a greater proportion of resources for rainwater-harvesting structures, too large a proportion, needs close scrutiny. Wani *et al.* (2003a) have demonstrated the benefits of low-cost water-harvesting structures throughout the toposequence, which benefited a greater number of farmers than construction of masonry check-dams.

Size of the watershed

The size of the watershed has a high significance in the success of watershed programmes. Based on the economic efficiency parameters, Joshi *et al.* (2005) estimated that the performance of microwatersheds with an area up to 1250 ha was 42% less than that of large size (>1250 ha) watersheds. Thus, there is a need to reconsider the standard 500-ha watersheds and address the issues of suitable watershed size and social problems associated with administrative institutions (villages). A cluster of watersheds needs to be developed simultaneously instead of developing microwatersheds in a scattered manner (Wani *et al.*, 2006a).

Upscaling the benefits of watershed development programmes

For upscaling the benefits of integrated watershed management, there is a need to have an articulated strategy based on the main pillar of capacity building of all the stakeholders from farmers–researchers–development workers, policy makers and development investors.

New scientific tools, such as remote sensing (RS), geographical information systems (GIS), digital terrain modelling for estimating run-off and soil loss, and crop simulation modelling for the analysis of long-term potential productivity, need to be used as the planning tools. These tools provide the capabilities for extrapolating and implementing the technologies to other larger watersheds. To scale up the benefits from the innovative farmer participatory consortium model for managing watersheds in Kothapally, Rangareddy district, the following process was adopted (Wani *et al.*, 2003c) (Fig. 14.3).

In the process of scaling-up, it is envisaged that three to four nucleus watersheds are selected in each district, by adopting the principles of 'seeing is believing' participatory research and development (PR&D). In the first year, nucleus watersheds are established and the implementing NGO and farmers undertake the PR&D approach to select suitable interventions. The process of selecting nucleus watersheds is a guided process. An additional requirement is that the project-implementing NGOs should have the capacity and a good track record of implementing watershed projects in the district. The nucleus watershed-implementing NGO becomes the pilot trainer for other NGOs in the district. In addition, the pilot NGO transfers the knowledge gained from the nucleus watershed to other watershed projects implemented by their staff in the area, and so knowledge dissemination takes place. Each nucleus watershed has four satellite watersheds, and the farmers and SHG members from the nucleus watershed become the master trainers in the district for the satellite watersheds.

Emphasis in this strategy is on capacity building and empowerment of the NGOs, extension workers, farmers and SHG members. In order to further extend knowledge on the management of natural resources through integrated genetic and natural resources management (IGNRM), information and communication technology is used.

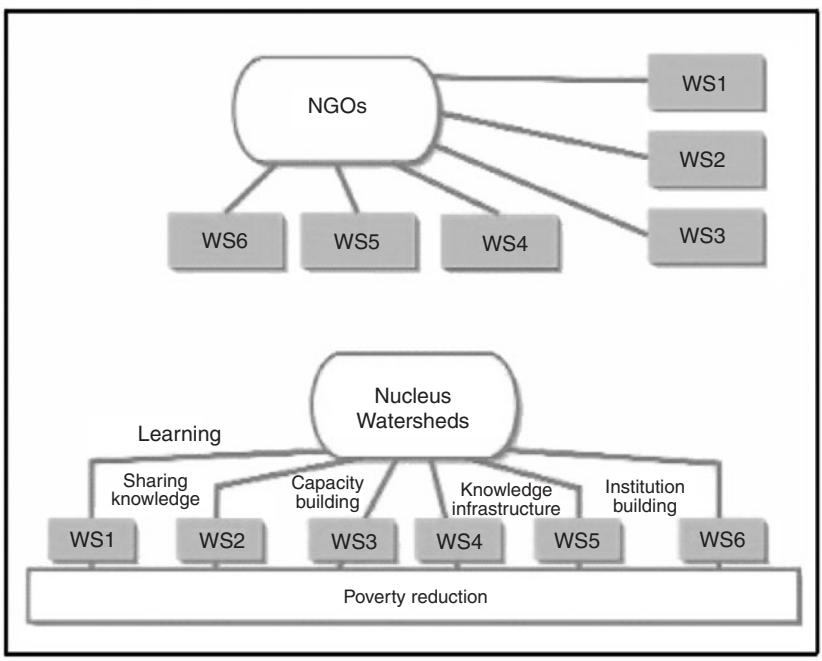

Fig. 14.3. Scaling-out the benefits of watershed (WS) development.

Adarsha watershed, Kothapally, has served as a benchmark or nucleus watershed and has demonstrated the benefits of integrated watershed management. The technology has been adopted in watersheds of neighbouring villages and other areas by farmers with little technical support from the consortium. The satellite watersheds, which are similar in terms of soils, climate and socio-economic patterns, can achieve broad impacts by adopting these technologies. The ICRISAT consortium focused on training farmers, personnel from development agencies and NGOs through demonstrations of different technologies on benchmark watersheds, and also acts as a mentor for technology backstopping. The farmers' community, through village institutions, took responsibility for all activities of implementation and monitoring. Government and non-governmental agencies catalysed the process. The important aspect while evaluating and scaling-out this approach is that the concerned line departments of the government need to be included in the consortium from the beginning, along with other partners. The role of policy makers and development investors is very critical, and sensitization of these stakeholders played a major role in scaling-out the benefits in Asia.

In the DFID-supported project of Andhra Pradesh Rural Livelihoods Programme (APRLP), the scaling-up approach has been extended to 50 watersheds (10 nucleus and 40 satellite) in three districts of Andhra Pradesh, and with support from the Sir Dorabji Tata Trust it has been extended to two districts of Madhya Pradesh and one district in Rajasthan. This approach was evaluated with support from the Asian Development Bank in China, Thailand and Vietnam. Further, the World Bank-assisted Sujala Watershed Programme in Karnataka and also the Bureau of Agricultural Research, the Philippines are adopting a similar approach for scaling-out the benefits of productivity enhancement in watersheds (Wani *et al.*, 2006b). The drivers for better collective action and success of the watershed programmes are summarized in Box 14.1.

Summary and Conclusions

This chapter has documented and analysed the benefits from various watershed programmes by eliciting information from micro-level studies to give a macro dimension. It attempts to analyse the role of watersheds in augmentation of water resources in the rainfed areas of the country. However, it is clear that a programme will never succeed unless it is economically viable, and therefore economic efficiencies of the watershed programmes were also documented and analysed. It is observed that the watershed programmes have been very much effective in augmenting water resources along with conservation of soil and water in the rainfed areas. In addition, watershed programmes have also generated considerable income and employment in the fragile rainfed areas. The analysis clearly reveals that watershed development provides a sustainable option for augmentation and conservation of water resources in rainfed regions.

However, the performance of a watershed depends on certain specific prerequisites, e.g. high people's participation in watershed activities. The benefits of watershed programmes were greater where people's participation was higher. It was noted that people's participation is not only important during the phase of implementa-

Box 14.1. Drivers of better collective action and success of watershed programmes:

- Good local leadership.
- Predisposition to collective work.
- The Novel Approach to watershed management with technical backstopping and convergence.
- Equal partnership, trust and shared vision among the consortium partners.
- Transparency and social vigilance in the financial dealings.
- High confidence of the farmers.
- Low-cost structures and equitable sharing of benefits.
- Knowledge-based entry point activities.
- Capacity building and skill development.

tion of watershed development activities but beyond the actual investment phase. A few conditions are critical to ensure people's participation. Involvement of all stakeholders (including women and landless labourers) in programme implementation and monitoring is imperative for the success of the watershed programmes. Decentralization of the decision-making process and involvement of elected representatives and Panchayat Raj Institutions in decision making enhance the chance of success. Sharing of benefits from the watershed programme is extremely critical. It is essential that benefits of all stakeholders should match their contributions and costs. Besides all these, functional and effective linkages among watershed institutions and other institutions, such as markets, banks, etc., are imperative for success. Watersheds, with sagacious institutional arrangements and voluntary participation of all stakeholders, would definitely be a boon for augmentation of water resources in the fragile and rainfed areas and set the path of a second green revolution in the country.

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