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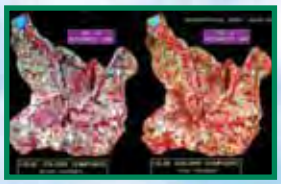

Use of High Science Tools in Integrated Watershed Management

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Application of Meta-analysis to Identify Drivers for the Success of Watershed Programs

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Introduction

Nearly two-third (60 per cent) of total arable land in the country is rain-fed, characterized by loss of fertile soil through erosion, land degradation, loss of productivity, low income, low employment with high incidence of poverty and a bulk of fragile and marginal land. These areas witness acute moisture stress during critical stages of crop production, which make agriculture production vulnerable to pre and post production risks. Dryland agriculture contributes to 36 per cent of agricultural exports and 44 per cent of food production in the country. Thus, holistic development of the rain-fed areas is one of the prime challenges of the 21st century. Development of watersheds/catchment is one of the most trusted and eco-friendly approaches to manage rainwater and other natural resources, which has paid rich dividends in the rain-fed areas and is capable of addressing many natural, social and environmental intricacies (Samra 1998, Wani et al. 2002, 2003 a, b, 2009, Rockström et al. 2007). Management of natural resources at catchment/watershed scale produce multiple benefits in terms of increasing food production, improving livelihoods, protecting environment, addressing gender and equity issues along with biodiversity concerns (Sharma, 2002; Wani et al. 2003 a, b, 2009, Ahluwalia, 2005; Rockström et al. 2007). It is also recommended as the best option to upgrade rain-fed agriculture to meet the growing food demand globally (Rockström et al. 2007).

Watershed development program is, therefore, considered as an effective tool for addressing many of these problems and recognized as a potential engine for agricultural growth and development in fragile and marginal rain-fed areas (Joshi et al. 2005, 2008; Ahluwalia 2005;

Wani et al. 2006). The Government of India has accorded high priority to the holistic and sustainable development of rain-fed areas through the watershed development program since the VIIth Five Year Plan (1985-90).

A 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. Drought-Prone Area Program (DPAP), Desert Development Program (DDP), National Watershed Development Project for Rain-fed Area (NWDPRA), Watershed Development in Shifting Cultivation Areas (WDSCA), Integrated Wasteland Development Project (IWDP) are some of the important development programs that plan, fund and implement watershed development projects under the aegis of Ministries of Rural Development; Agriculture; and Environment & Forestry, Government of India. A total sum of Rs 286 billion has been invested on various watershed development projects since inception (mid 1980s) of watershed development programs in the country until 2006. Some international organizations also sponsor and implement watershed projects but a significant proportion (about 70%) of the investment in watershed development programs is being made by the Government of India under these five major programs.

During the last three decades, watershed programs have gone through a sea change. Numerous modifications are made in the watershed programs based on experiences and learnings from the implementation of different generation watershed programs. The first generation watershed programs were mainly designed for soil conservation whereas the second generation watershed programs aimed at conserving degraded land area or more specifically soils (Joshi et al. 2005; Ahluwalia 2005). The watershed development approach was adopted during mid 1980s and in early 1990s third generation watershed programs were introduced that emphasized on participatory approach. The new approach focuses on raising crop productivity and full livelihood improvement programs (Wani et al. 2006). The newly developed approaches like livelihood improvement and productivity enhancement are fairly superior to the earlier approaches but a large number of watershed programs are yet to graduate into a holistic/integrated programs. This paper intends to

identify the drivers for the success of watershed programs using meta analysis.

Approach

The watershed development approach that evolved in India is based on the knowledge gained from various programs. Watershed development programs started with soil and water conservation programs and then laid emphasis on water harvesting and increasing crop productivity, and recently focused on livelihood improvement programs (Wani et al. 2006; Government of India, 2008). The new common guidelines emphasized on decentralization of powers to state/district level administration in order to ensure efficient implementation of the program. Although new approaches such as livelihood improvement and productivity enhancement have proven their supremacy, a large number of watershed programs have not graduated fully into holistic/ integrated programs. Wani and Ramakrishna (2005) noted that much of the watershed programs heavily emphasized on water augmentation interventions but did not accord much emphasis on efficient use of conserved soil and water resources.

In the beginning, watershed program went through the structure-driven approach for soil conservation and rainwater harvesting, aiming at only some productivity enhancements. Soil conservation program became synonymous with contour bunding and water conservation with check-dams. This was a compartmental and top-down approach. Along with the evolution of compartmental approach to the integrated and holistic approach, the process 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 (PRIs) (DoLR, 2003). The Government encouraged 'Public Private Partnership (PPP)' in the area of integrated watershed development and evidence indicates that PPP is emerging in this area (Wani et al. 2007). Evidences show that watershed development programs have yielded considerable benefits in terms of equity, sustainability and efficiency (Kerr et al. 2000; Hanumantha Rao,

2000; Farrington and Lobo, 1997; Joshi et al. 2004, 2005; Sreedevi et al. 2006).

Even after almost over four decades of implementation of watershed programs in the country, there was still no strong evidence to show the actual performance of the programs. The results were scattered across different agro-ecoregions and few watersheds have proven their efficiency in terms of B:C ratio, internal rate of return (IRR) and net product value (NPV). In this context, Joshi et al (2005, 2008) assessed the aggregate impacts of watershed programs in India at the macro level, considering different socio-economic and agroecological indicators by adopting a meta-analysis approach. It was meticulously applied to evaluate the impact of watershed programs by Joshi et al., in 2005, with the help of 311 micro-level studies. In 2008, Joshi et al., re-emphasized and evaluated the impact of watershed programs with the help of 636 micro-level studies including the 311 studies included in the previous study to get more authentic and realistic results. These micro-level studies have been critically reviewed and analyzed for upscaling the conclusions to stipulate the macro-level picture of the watershed programs as well as impact of people's participation on the performance of watersheds[1]. This paper identifies drivers for the success of watershed programs in India using these results.

Benefits of Watershed Programs

The watershed programs produce multiple tangible and intangible benefits for individuals as well as for communities as a whole. It emanates that watershed programs have been successful in raising income levels, generating employment opportunities and augmenting natural resources, specifically soil and water in the rain-fed areas (Joshi et al. 2003; 2005; Wani et al. 2005). With the adoption of different soil and water conservation measures and trapping of surface run-off water, watersheds have emerged as the growth engines in the fragile rain-fed areas (Wani et al. 2008).

Summary of multiple benefits derived from watersheds, as indicated in numerous studies, is shown in Table 1. It is obvious that watershed

1 For detailed methodology, see Joshi et al. 2005 and 2008.

Table 1. Summary of benefits from the sample watersheds.

	Particulars	Unit	No. of studies	Mean	Mode	Median	Mini-mum	Maxi-mum	t-value
Efficiency	B:C ratio	Ratio	311	2.0	1.7	1.7	0.8	7.3	35.09
	IRR	Percent	162	27.40	25.9	25.0	2.0	102.7	21.75
Equity	Employment	Person days ha^{-1} yr^{-1}	99	154.50	286.7	56.5	5.00	900.0	8.13
Sustain-ability	Increase in irrigated area	Percent	93	51.5	34.0	32.4	1.23	204	10.94
	Increase in Cropping intensity	Percent	339	35.5	5.0	21.0	3.0	283.0	14.96
	Runoff reduced	Percent	83	45.7	43.3	42.5	0.34	96.0	9.36
	Soil loss saved	Tons ha^{-1} yr^{-1}	72	1.1	0.9	1.0	0.1	2.0	47.21

Source: Joshi et al., 2008

programs in India have yielded multiple exemplary benefits. On the part of efficiency, watershed programs performed well with a mean benefit-cost ratio of 2 that indicates that investment on watershed programs is economically viable and substantially beneficial. However, the performance of watershed in accordance with their BCR was quite varied. About 32 per cent watersheds generated a mean BCR above 2, which is quite modest (Fig. 1). Merely 0.6 per cent watersheds failed to commensurate with cost of the project. The mean internal rate

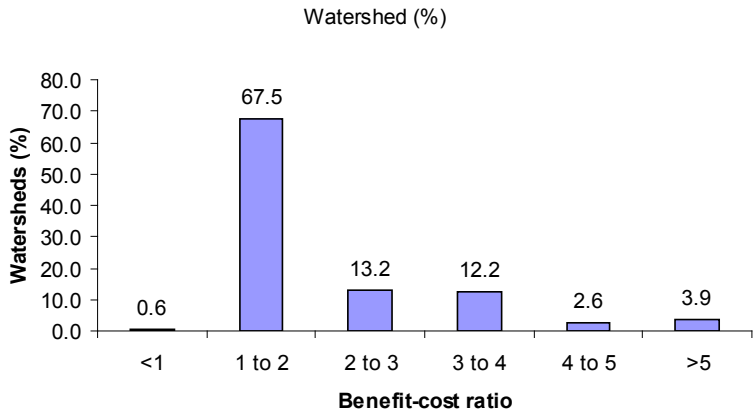

Figure 1. Distribution (%) of watersheds according to benefit-cost ratio (BCR).

of return of 27.4 per cent on watershed investment shows marginal efficiency of the projects. However, that seems to be significantly high and proves that investment in watershed programs is comparable with other successful government programs. It is interesting to note that about 27 per cent watersheds yielded an IRR above 30 per cent. The watersheds with IRR <10 per cent were only 1.9 per cent (Figure 2). These results reconfirm that watershed programs were able to meet their initial costs, generate substantial economic benefits and justify the investment in watershed programs as income levels were raised within the target domains.

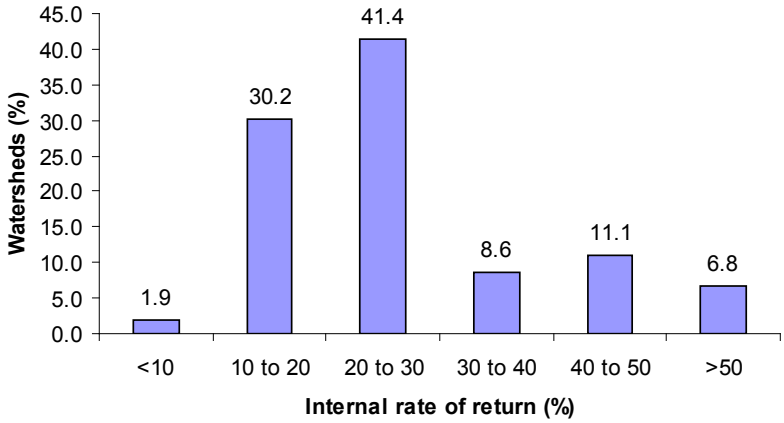

Figure 2. Distribution (%) of watersheds according to internal rate of return.

Another important purpose of the watershed programs was to generate employment opportunities and through that alleviate rural poverty and reduce disparities among rural households. The mean additional annual employment generation in the watershed area on various activities and operations was about 154 person days. It was as high as 900 person days per ha in those watersheds that included multiple activities. Based on these observations, the watershed investment may be characterized as a poverty alleviation program in the fragile areas.

Watershed programs have been specifically launched in the rain-fed areas with the sole objective to improve the livelihood of poor rural households that encounter disproportionate uncertainties in agriculture (Joshi et al. 2005). Their income levels are meager and uncertain. Their

plight is further compounded by acute degradation of soil and water resources. The Government of India aggressively intensified watershed program in fragile and high-risk ecosystems, where the farm incomes had markedly descended due to excessive soil erosion and moisture stress. It was viewed that the watershed programs would augment farm incomes, raise agricultural production and conserve soil and water resources in rain-fed areas by providing appropriate technical and financial support.

The watershed programs are largely aimed at conserving soil and water to raise farm productivity. The available evidences revealed that both these objectives were accomplished in the watershed areas. Soil loss of about 1.1 ton ha^{-1} yr^{-1} was saved due to interventions in the watershed framework. Conserving soil means raising farm productivity and transferring good soils to the next generation. With regard to water conservation, it was noted that on an average about 38 ha m additional water storage capacity was created in a 500 ha watershed as a result of watershed program. Augmenting water storage capacity contributed in (i) reducing rate of runoff, and (ii) increasing groundwater recharge. These have direct impact in expanding the irrigated area and increasing cropping intensity. On an average, the irrigated area increased by about 52 per cent, while the cropping intensity increased by 35.5 per cent. Such an impressive increase in the cropping intensity was not realized in many surface irrigated areas in the country. These benefits confirm that the watershed programs performed as a viable strategy to overcome several externalities arising due to soil and water degradation. Therefore, it can be reiterated that watershed could be a safe and effective strategy for augmentation of water resources in the rain-fed areas.

Rain-fed areas are confronted with intrinsic problem of degradation of land and water. Soil erosion, which is often induced by high wind velocity and intense precipitation, not only degrades the land masses but also leads to the problem of sedimentation and siltation of water-bodies/ reservoirs and reduces their storage capacity and causes increased release of CO_2 from degraded silt carbon anaerobically. Consequently, a sizable volume of water that could be stored in these water-bodies/ reservoirs gets lost and leads to floods in low-lying rain-fed areas. Another water related problem that adds to the agony of

rain-fed areas is loss of water due to heavy run-off of surface water. In general, rain-fed areas experience many contrasting agro-climatic conditions. A vast portion of rain-fed areas face arid and semi-arid type of situations and receive scanty rains for nearly 50-55 days during monsoons, which is grossly insufficient to meet the year-round water requirement. In contrary, there are regions (entire eastern region) that experience humid and perhumid climate with a long spell of intense and profuse rains. Technological interventions through soil and water conservation can greatly overcome these eventualities.

The above evidences suggest that the watershed programs successfully met initial three principal objectives of raising income, generating employment and conserving soil and water resources. These benefits have far reaching implications for rural masses in the rain-fed environment. The results of meta-analysis further showed that the benefits vary depending upon the location, size, type, rainfall, implementing agency, and people's participation, among others.

People's Participation and Benefits from Watersheds

People's participation in planning, developing and executing the watershed activities is indispensable (Wani et al. 2003a, b, Joshi et al. 2005). Active and voluntary participation of all stakeholders guarantees the successful implementation of watershed programs. Therefore, watershed programs always call for community participation and collective action. It is necessary because individual choices have collective consequences in the watershed framework as several externalities are involved. Action of one group of farmers in one location affects adversely (or favorably) to other group of farmers in different location (off-site impacts). 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 action 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 and observed that better organized and effective people's participation would yield higher benefits. Summary of results of people's

Table 2. Summary of benefits from the sample watersheds according to people's participation

Indicator	Particulars	Unit	People's participation		
			High	Medium	Low
Efficiency	B: C ratio	Ratio	2.63 (16.01)	1.60 (29.72)	1.42 (16.36)
	IRR	Per cent	38.28 (10.21)	22.26 (4.74)	17.30 (8.21)
Equity	Employment	Person days/ $ha^{-1}yr^{-1}$	165.17 (5.29)	118.73 (4.31)	105.42 (9.97)
Sustainability	Increase in irrigated area	Per cent	77.43 (8.23)	56.17 (8.07)	29.43 (10.32)
	Increase in cropping intensity	Per cent	44.60 (9.37)	24.96 (10.21)	32.03 (14.21)
	Runoff reduced	Per cent	43.24 (6.03)	40.41 (4.22)	69.00 (7.19)
	Soil loss reduced	T ha^{-1} y^{-1}	1.18 (43.21)	1.1 (18.21)	0.87 (22.33)

Notes: Figures in parentheses indicate t-values

Source: Joshi et al. 2008

participation and benefits from watersheds are given in Table 2. The available evidences confirm that there existed a positive relationship between people's participation and benefits from watershed program. The benefit-cost ratio was much more (2.63) in watersheds where people's participation was high in comparison to the watersheds with low participation (1.42). The other impact indicators were also far ahead in watersheds having greater people's participation.

It is interesting to note that benefits from watershed programs were conspicuously more in the low-income regions as compared to the high-income regions (Table 3). The benefit-cost ratio was 2.25 in low-income regions as compared to 1.75 in high-income regions. The corresponding figures for annual employment generation were 164 and 91 person-days ha^{-1}. The low-income regions call for such investments to enhance income levels of rural poor. This suggests that watershed program should receive higher priority by the government in medium and low-income

Table 3. Summary of benefits from the sample watersheds according to income status of the region.

Indicator	Particulars	Unit	Per capita income of the region*		
			High*	Medium**	Low**
Efficiency	B:C ratio	Ratio	1.75 (15.34)	1.96 (28.21)	2.25 (9.36)
	IRR	Per cent	24.55 (7.23)	27.9 (6.89)	30.64 (6.02)
Equity	Employment	Person days ha^{-1} yr^{-1}	91.05 (7.27)	159.7 (9.16)	164.3 (6.76)
Sustain-ability	Increase in irrigated area	Per cent	48.48 (12.50)	45.83 (8.09)	76.02 (6.71)
	Increase in cropping intensity	Per cent	31.4 (10.82)	34.09 (14.41)	43.75 (10.27)
	Runoff reduced	Per cent	43.21 (9.32)	43.27 (6.81)	49.32 (5.28)
	Soil loss reduced	T ha^{-1} yr^{-1}	1.18 (36.23)	1.1 (41.11)	0.87 (12.26)

Notes: Figures in parentheses indicate t-values. *, **, and *** include the states having per capita AgGDP greater than Rs. 4000, between Rs. 2000 and Rs. 4000, and below Rs. 2000 per annum, as in Joshi et al. 2005. (Source: Joshi et al. 2008)

regions. Such investments will not only raise income and employment opportunities in the backward regions but also contribute in conserving soil and water resources. Fan and Hazell (1997) demonstrated that the returns to investment in inputs as well as research at the margin 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 programs 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 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.

Above evidences reveal that people's participation was the key determinant in the success of the watershed development programs. 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 programs would not be sustained.

Drivers for the Success of Watershed Programs

The meta analysis identifies drivers for the success of watershed programs. The efficiency of watershed programs is determined by a number of factors. Joshi et al (2005) in their first meta analysis using 311 micro-level case studies found that geographical location, rainfall pattern, focus of watershed program, implementing agency, status of target population and people's participation are some of the critical factors that play a deterministic role in the performance and efficiency of watersheds. The study confirmed that performance of watersheds (Joshi et al. 2005, 2008) is largely influenced by the rainfall. Further, it concludes that the current approach 'one size fits all' does not benefit lower (<700 mm) and higher (>1000 mm) rainfall regions due to scanty and excessive water availability. Therefore, these regions need different soil and water management interventions.

Watershed development is a community approach. Active people's participation is, therefore, highly critical in the success of the watershed programs (Kerr et al. 2000; Sreedevi et al. 2004; Joshi et al. 2005). The results of Meta-analysis showed that the benefits were the highest from the watersheds where people's participation was high (Joshi et al. 2005, 2008). Therefore, the success of watershed programs is people centered and suitable technologies for different agroecoregions.

From Meta-analysis, the following issues have emerged as important drivers of success of watershed development programs in India.

People's Participation

As highlighted above active people's participation is a pre-requisite for the success of watershed development programs. Involvement of local stake-holders in planning, development and execution of the watershed activities is crucial. Watershed is a community development approach and hence, it calls for community participation and collective action (Sreedevi et al. 2007). It is believed that better organized and effective people's participation would yield higher benefits. Community participation does not happen simply; it needs to be nurtured through a process of trust building, by harnessing synergies between the project objectives and needs of communities and most importantly ensuring tangible economic benefits equitably for the community (Wani et al. 2003a, 2007).

The first generation watershed programs in the country were supply-driven. The government officials used to identify locations and decide various activities for implementation of watershed programs, 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 programs could not be realized. To overcome this problem, the concept of Participatory Integrated Development of Watershed was initiated in 1980s. However, only a partial success could be achieved and some radical steps were taken to involve the local stake-holders/people in planning, formulation and implementation of watershed programs in the country. Overtime, people's institutions, like *zilla parishad*, SHGs, and watershed implementing committees were gradually involved into the project management systems. With more funds allocated for watershed development, several non-government organizations (NGOs) aggressively participated in implementing this program, and demonstrated the importance of people's involvement in the success of the watersheds. Most of the arrangements were informal and vary 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 more important to see how people's participation comes forward voluntarily. Only voluntary participation (not forced one) would sustain

the watershed program. 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, leaving out the involvement of small and marginal farmers. Besides, there were evidences that most of the watershed programs were not sensitive to the needs of women and landless laborers. Most often, the women and landless laborers were silently left out of watershed related decision-making processes (Meinzen-Dick et al. 2004, Sreedevi and Wani 2007). Efforts to integrate small and marginal farmers, women and landless laborers into the process require conscious efforts right from the beginning.

Tangible Economic Benefits to Individuals

In spite of bottom-up participatory approach for planning and implementation of watershed development, community participation was not forthcoming in most of the watershed programs. Main reason for low or contractual mode of participation was that a large number of small and marginal farmers were not getting tangible economic benefits as productivity enhancement initiatives were missing to a large extent (Wani et al. 2002). Improved groundwater availability benefited few well-to-do farmers who could invest and extract the groundwater. Such well-to-do farmers had no time to participate. On the other hand, a large number of small and marginal farmers who had time to participate were not getting any tangible benefit. One of the important drivers of success in a consortium approach was tangible economic benefits to a large

number 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, Sreedevi et al. 2004). Through this approach more number of farmers started participating in watershed development programs as they derived tangible economic benefits from the productivity enhancement activities from the first season itself.

Knowledge-Based Entry Point Activity

In most watershed programs, entry point activity (EPA) as identified by the community is undertaken under the project to build rapport with the community activities such as construction of meeting room, school, class room, bore well pump, drinking water tank, etc. 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 and they need not contribute their share. Such a subsidy dependency approach never got community ownership, resulting in neglect of the resources invested. 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 for materials farmers had to pay (Wani et al. 2006; Dixit et al. 2007).

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

Agroecoregion Specific Technologies

Meta analysis of watershed case studies revealed that the current technologies and interventions showed better impact in terms of B:C ratio and IRR in the 700-1100 mm rainfall agroecoregion and not in

<700 mm and >1100 mm rainfall zones (Joshi et al. 2005). This study highlights the need to identify and adopt specific watershed development technologies for <700 and >1100 mm rainfall zones (Wani et al. 2007). Current practice of allocating greater proportion of resources for RWH structures that too of big size needs close scrutiny. Wani et al. (2003a) have demonstrated the benefits of low-cost water harvesting structures throughout the toposequence that benefited more number of farmers than construction of only masonary check dams at lower reaches in a watershed.

Targeted Activities for Women and Vulnerable Groups

In order to enlist active participation of women and vulnerable groups targeted activities benefiting these groups economically are suggested by Sreedevi and Wani (2007). Based on specific case studies these authors reported that 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. Mere presence of women members on the watershed committee had no real impact on women as they were not effective in 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 effective to enhance the impact of community watershed programs (Sreedevi and Wani 2007, Sreedevi et al. 2007).

Watershed Institutions/Self-Help Groups

The next stage of people's participation is even more critical. It connotes the phase of implementation while 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. Evidences show 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 (UGs) were found active during the implementation phase only. They did not 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 programs Sreedevi et al. (2007) observed that area groups (AGs) approach adopted in Sujala Watershed program in Karnataka was found far superior over UGs approach in terms of functional efficiency, sustainability and regularity as the membership was voluntary for undertaking project activities in their area and had a role in decision-making process in the watershed.

In the same study, membership criteria and actor linkages in the APRLP, Sujala, Indo-German Watershed development program (IGWDP) and Hariyali guidelines-based watershed program were studied. It was concluded that representation in watershed committee for women SHGs in Suajala and APRLP programs were effective for women's participation and decision-making where as community was not effective/functional in Hariyali program watersheds. The *gram panchayat* had a major role in Hariyali watersheds but it was not the same in other programs. Similarly, the apparent convergence of line department in Hariyali watersheds was evident only on paper. Effective and close working relationship between WDTs, WC and AGs were found in Sujala program (Sreedevi et al. 2007). The concepts like '*Mitra Kisan*' or '*Gopal Mitra*' have shown mixed results across different watersheds in different states (Deshpande and Thimmaiah 1999).

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

Decentralize Decision-Making Process

Decision-making is the key component of watershed programs. The success or failure of watershed programs very much depends on who and how decisions are made. Hence, decentralization of decision-making process is of great importance. A number of watershed evaluation reports show that watersheds performed reasonably well where decision-making process was decentralized. Decentralization

of 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 (MLAs and MPs) in the development process may ease the process (Joshi et al. 2004). There are reports that in Madhya Pradesh a conscious effort have been made since 1995 to involve elected representatives of people. Greater involvement of local MLA, MP and PRIs may assume significant role in project planning and execution. Since MLAs and MPs are the elected representatives, who like to take political mileage as a result of developmental programs like watershed, they become accountable to the watershed.

Commensurate Benefits and Costs

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 watershed. In a watershed framework often benefits do not commensurate the cost incurred and the labour put on 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 program. For example, in the watershed framework, the farmers located at the upper reaches have to invest more but gains of their actions are enjoyed by farmers at middle or lower reaches (Joshi et al. 1996).

Capacity Building

Management of watershed is a complex process. Many of the watershed related activities that aim to conserve, restore and augment soil and water resources call for specialized skills. Most important and weak links in watershed programs are training and capacity building of all the stakeholders – from farmers to policy makers (Wani et al. 2008). Most stakeholders conceive watershed development programs as construction of rainwater harvesting (RWH) 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 stakeholders emphasize the area of their expertise. For example NGOs emphasize social mobilization, and RWH and WDTs and technocrats emphasize technologies and overlook holistic integration. Technical backstopping through consortium approach provides on-ground 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 affect the performance of watersheds. For example, in most watersheds not only the farmers but most stakeholders are not aware of the major constraints for increasing productivity or actual potential of the watershed (Wani et al. 2003 a,b). The stakeholders must be aware about the importance of various activities in the watersheds, and economic, social and environmental benefits. Many actions by the stakeholders in the watershed are being taken in ignorance, which adversely affect the income and environment of other stakeholders and locations. Educating all the stakeholders would minimize such actions, conflicts and maximize benefits from the watershed. Prof. 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 program more participatory and successful.

Demand Driven Watershed Approach

Demand-driven watershed activities will attract higher people's participation. Once the watershed is identified, the needs of the stakeholders must be assessed together by the implementing agency and the stakeholders. Since there are diverse groups of beneficiaries in the watershed, their needs should not be overlooked. There are often reports that only the influencial and large farmers were involved, while invariably, the small and marginal farmers were left out. Besides, there were evidences that most of the watershed programs were not sensitive to the needs of women and landless labourers (Meinzen-Dick et al. 2004; Sreedevi and Wani, 2007). Most often, the women and landless labourers were silently left out of watershed related decision-making

processes. Efforts to integrate small and marginal farmers, women and landless labourers into the process require conscious efforts right from the beginning. It is therefore necessary that need assessment of the stakeholders should be the precondition in designing and developing the watershed activities.

Target Poor Regions

Poorer regions should receive higher priority to get watershed programs. In poor regions the relatively backward villages should be given higher attention for the watershed program. Overall, the prioritization of stakeholders in poor regions was not sought effectively. It should be ensured that the stakeholders must be involved during planning and execution of the watershed. The observation from few watersheds in low-income regions was that the households generously participated in making the program successful to raise the farm productivity and augment income levels. The landless labourers would have incentives to get more jobs in the rural areas, and women folk for fetching water and fuel wood from the watershed area. There are reports that a well-knitted participatory approach checked migration of rural youth.

Conclusion

The paper has identified the drivers of success of watershed programs by collating information from micro-level studies to give a macro dimension. It was noted that the watershed programs were contributing in raising income, generating employment and conserving soil and water resources. The results of Meta analysis highlighted to undertake research to develop and identify suitable technological interventions for low (<700 mm) and high (> 1000 mm) rainfall regions. It suggested that the watershed program would be a vehicle of development to reduce poverty by raising farm productivity and generating employment opportunities in marginal and fragile environments.

The benefits of watershed programs were more where people's participation was higher. It was noted that people's participation is not only important during the phase of implementation of watershed development activities but beyond the actual investment phase. In the

absence of users' involvement, the watershed programs would fail to sustain. The important drivers of success of watershed development programs are related to (i) people's participation, (ii) demand-driven watershed programs rather than supply-driven, (iii) involvement of all stakeholders (including women and landless labourers) in program implementation and monitoring, (iv) decentralization of decision-making process, (v) involvement of elected representatives and PRIs, (vi) tangible economic benefit to a large number of community members (vii) knowledge based entry point activity (viii) establishing effective linkages of watershed institutions with other institutions, like credit sector, input delivery system, and technology transfer mechanism, (ix) predisposition of the community for collective action, and (x) agroecoregion specific technologies.

Watershed program is one of the most important strategies to bring socio-economic change in the rain-fed system. In dryland regions, it has silently revolutionized the agriculture and allied sector through various technological interventions, particularly soil and water conservation, and land use diversification. There is an overwhelming policy and political support. Only problem is lack of appropriate institutional arrangement. This is a major obstacle in attaining the potential benefits of watershed program. Earnest efforts to enthuse stakeholders for their voluntary participation would sustain watershed development and bring prosperity in the rain-fed areas.

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