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RESEARCH ARTICLE

Impact of Long-term Soil and Water Conservation Training for Effective Implementation of Watershed Programmes in India

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ABSTRACT

Responses received from field functionaries who had completed five and a half months of long-term soil and water conservation training at the Indian Institute of Soil and Water Conservation during 2003–2009 were analyzed to determine training impact as well as training needs for effective implementation of watershed management Programmes in India. The majority of trainees (81%) had total service experience ranging from 10 to 20 years. Major responsibilities of trainees mainly involved in planning and execution of watershed and soil conservation projects. The topic of structural measures for soil and water conservation in non-arable lands received the highest mean score from trainees (2.57), followed by the application of RS and GIS, map reading, delineation, characterization of watersheds (2.38),water harvesting, storage, and recycling for irrigation planning (2.33). This study further indicates that capacity-building programmes improve not only individual knowledge but also the productivity of their working areas. This findings also identified that lack of appropriate literature on SWC technologies is found as a major technological constraint in order to implement watershed project more effectively.

Key words: *Capacity building; Impact; Knowledge gain; Soil conservation; Watershed.*

Specific skill is very essential to perform a task efficiently. In this regard, human resource development has been linked to capacity building, with a focus on skill development and training at the individual level. The term "capacity" has been defined in a variety of context. In a simple way, Capacity is defined as the ability of individuals, institutions, and societies to perform functions, solve problems, set and achieve goals. *Lavergne (2004)* describes as the process whereby individuals, groups, organizations and societies enhance their capacities in terms of human, organizational, institutional and social capital. Capacity development is, thus, frequently equated with training or support for some type of organizational development process. Capacity building is a complex concept that involves individual and organizational learning that develops social capital and trust, knowledge, skills, and attitudes, and, when successful, creates an organizational culture that enables organizations to set objectives, achieve results, solve problems, and create adaptive procedures that allow them to survive in the long term (*DFID, 2008*). Again, training is the most effective way to put knowledge and skills to use (*Sajeev and Singha, 2010; Chauhan and Kokate 1986)*. Training is an essential component of any development activity (*Pandey et al., 2015*). Farmers' agricultural technology knowledge and skills are important factors to increase agricultural production. Training evaluation ensures that candidates can apply their knowledge in their respective work environments or in their daily routines (*Nagar, 2009*). The Government of India recognized the importance of capacity building for all stakeholders in the successful implementation of watershed development and invested significantly in it.

Assessment of training needs is an important step in identifying the areas of interest for implementing agency personally. It also helps in designing and developing curriculum to suit the existing real-world conditions of farmers and fields. As a result, post-training assessments must be performed in order to create relevant and need-based training programmes that can accommodate changes over time. *Sharma et al. (2014)*

indicates in their study that systematically planned training programmes and proper follow-up action not only increased the participants' knowledge and skills but also their production and proficiency. If we don't find the gap between current performance and technical skills, organisations waste a lot of time, money, and resources on training. As a result, the institution should understand that there are elements to identifying and assessing training needs in order to improve the knowledge, skills, attitude, and performance of field functionaries involved in the implementation of rural development schemes such as watershed programs. Furthermore, the retention of knowledge learned in specific training courses has long been a concern of trainers and organizations involved, as experience shows that almost all knowledge gained in training, including fieldwork, is lost over the course of a few years if it is not applied in the desired area. Since its inception, the Indian Institute of Soil and Water Conservation (formerly known as CS&WCR&TI) in Dehradun has been well known for capacity building in soil and water conservation in general and watershed management in particular. However, no efforts were made to determine the post-training impact of these training programmes in real-field conditions or to assess training needs in response to change development project requirements. Training evaluation serves as a systematic appraisal tool, to provide corrective measures to improve current or future training programmes (*Bober and Barlett, 2004*). Therefore, goal of this research paper is to provide feedback to policymakers, administrators, and trainers in order to improve training quality and ensure training impact by designing training modules based on trainee needs and constraints, as well as the impact experienced in the field during watershed development implementation after long-term training in Soil and Water conservation.

METHODOLOGY

The Indian Institute of Soil and Water Conservation, or ICAR, provided training ranging from one day to five and a half months. As a result, a list of trainees who underwent a five-and-a-half-month long-term training in soil conservation and watershed management, consisting of graduate assistants (Agricultural development officers, junior engineers, Rangers) and officers (Agriculture officers, Soil Conservation Officers, Assistant Engineers) who were trained at the IISWC Research Centre, Kota and Dehradun headquarters between 2003 and 2009. On this basis, 84 respondents were finalized for sending mail questionnaires based on information provided by the state government. To collect data, a specially designed mail-in questionnaire was used. The responses received from 36 out of the 84 respondents were analyzed. To achieve the objectives and meaningful results, descriptive statistics such as percentages, rank order, and scoring techniques (three- to five-point continuums) were used to analyse the training need, impact of training, change in knowledge level, utilization of knowledge after training, and constraints encountered during project implementation, among other things. A list of training need items or thematic areas pertaining to soil and water conservation in general and watershed management in particular that are relevant to the field implementation of soil conservation and watershed management projects was prepared through a review of existing resources under each area.

RESULTS AND DISCUSSION

Personal and professional characteristics of the respondents: Table 1 shows the respondents' personal characteristics. It was observed that majority of the trainees (81%) were young, followed by those in their middle years (19%). It was also found that the majority of trainees (50%) are from the assistant cadre, with officers (28%), and supervisory (22%), coming in second and third place. In terms of gender, it was revealed that only 84 per cent of respondents was female and their response were very good. According to qualification data, the majority of trainees (50%) were graduates, followed by master's degrees (42%). It was also interesting to note that agriculture accounted for the majority of trainees (80%), followed by others (14%), which included forestry, horticulture, agricultural engineering (6%) and so on . According to Table 1, the majority of trainees (50%) had total service experience between 10 and 20 years, followed by those with less than 10 years (47%). In terms of the nature of duties performed by trainees in his departments, it has been reported that majority of trainees (72%) were involved in the planning and execution of watershed and soil conservation works. Some trainees (17%) reported being involved in scheme management and evaluation. This table also shows that majority of trainees (81%) had only attended one training in the field of soil and water conservation whereas only two respondents (5%) had attended more than two trainings.

Table 1. Personal and professional characteristics of trainees

Characteristics	No.	%
Age		
Young (aged 25–38 years)	29	80.55
Middle age(39-50Years)	07	19.45
Cadre		
Assistants	18	50.00
Supervisory	08	22.23
Officers	10	27.77
Gender		
Male	35	97.22
Female	01	02.78
Education		
Diploma	01	02.78
Graduate	18	50.00
Post Graduate	15	41.66
Doctorate	02	05.56
Field Specialization		
Agriculture	30	80.33
Ag. Engineering	02	05.56
Others	04	14.11
Working experience		
10 years	17	47.22
10-20 years	18	50.00
>20 years	01	02.78
Nature of duties		
Management	04	11.11
Planning and execution	26	72.22
Monitoring and evaluation	06	16.67
No. of SWC trainings attended		
01	29	80.55
02	05	13.88
03	02	5.57
>3	---	---

Assessment of training needs : A three-point rating scale containing "most needed," "needed," and "least needed," with scores of 3, 2, and 1, respectively, was used to assess the training needs of trainees in soil and water conservation against each item of the index as perceived by them. After doing the math, the total scores and mean scores for each item in the index, as well as the rank values, were given using the scale below and put into the following groups:

Most Needed	2.25-3.00
Needed	1.50-2.25
Least needed	0.75-1.49

The data in Table 2 revealed that trainees reported their training needs by having the highest mean score for the topic of structural measures for soil and water conservation in non-arable lands (2.57), followed by the application of RS and GIS and map reading, delineation, and characterization of watersheds (2.38), water harvesting, storage, and recycling for irrigation planning (2.33), knowledge about data sources (2.29), aquaculture in farm ponds (2.29), Knowledge about data source (2.29), aquaculture in farm ponds under watershed management (2.29),economic evaluation (2.27) and design, costing & execution of mechanical measures (2.26).The study also indicates that the remaining topics and areas are also needed to complete the job of project execution satisfactorily in the field of soil and water conservation and watershed management programs. It was interesting to note that none of the topics were classified as least needed, which ultimately supports the view that the content of soil and water conservation training programs should be designed with the listed areas in mind as per the study's ranking for future training programmes to be conducted by the Institute. *Kumar et.al 2022* also identified motivation technique and programme planning most important training need areas of supervisory skills by horticulture development officers in Jammu region while, *Yadii et al. 2022* findings indicated that plant protection measures, propagation and planting, and climate and soil were the top three areas perceived as priority areas in regard to training needs by the Kiwi grower respondents in Arunachal Pradesh.

Knowledge gain, retention, and application: Table 3 reflects knowledge gaining by respondents due to training programmes . The mean difference between post- and pre-training scores indicates significant gains in all the topics covered in the training except the topic on withdrawal strategy, which was actually not covered in the conducted training programmes. The impact varies by topic, ranging from 40 per cent to 275 per cent shows the increase in benchmark knowledge. It was also observed that the maximum change in knowledge was recorded in those topics or areas that were not taught to the trainees at the time of their educational degrees or diplomas. The main reason for significant improvements in knowledge may be attributed to methods of imparting training in an understandable way through theory, fully supported by practical or field exercises. The study also attempted to measure the level of knowledge they retained after returning to their service places. Such topics were included in the training module by the training institute, apart from the utilization of knowledge in

Table 2. Training needs of graduate assistants and officers in soil and water conservation (N=36)

Areas of training need	ATRS
Most Needed	
Structural measures for soil and water conservation in non-arable lands	2.57
Application of RS and GIS	2.38
Map reading, delineation, and characterization of watersheds	2.38
Water harvesting, storage, and recycling for irrigation planning	2.33
Knowledge about the data source	2.29
Aquaculture in farm ponds under watershed management	2.29
Economic evaluation of the watershed management programme	2.27
Design, costing, and execution of mechanical measures	2.26
Needed	
Installation of a silt monitoring station and other meteorological equipment	2.19
PRA (Participatory Rural Appraisal)	2.14
Monitoring and evaluation of soil and water conservation work	2.14
Withdrawal strategy	2.14
Techniques for identification and prioritization of interventions	2.1
Participatory programme execution and conflict management	2.1
Agronomical practices for erosion control	2.1
Structural measures for soil and water conservation in arable lands	2.09
Biological measures for soil and water conservation	2.09
Data Collection Tools and Techniques	2.05
Entrepreneurship development	2.05
Perennial vegetation planning in watersheds	2.0
Computation of soil loss from watersheds	2.0
Institutional arrangements (group formation and capacity building)	1.95
Surveying instruments are required in watershed planning	1.95
Land capability classification	1.95
Design, costing, and execution of soil fertility measures.	1.95
Monitoring of groundwater recharge	1.86
Crop water requirements are calculated.	1.81
Biological measures for landslide, mine spoil, and torrent control	1.76
Design, costing, and execution of agroforestry measures.	1.76
The design, costing, and execution of agronomical measures	1.76
Livestock management in the watershed	1.67
Design, costing, and execution of horticultural measures.	1.62
Least needed	----
Mean=1.94 SD=0.21	

ATRS=Average training requirement score

SWC work. Table 3 further revealed that all the topics covered in the programme were retained to varying degrees. However, the utilization of knowledge in SWC was very limited due to a lack of opportunities in the department to utilize knowledge in the execution of watershed projects, which is refuted by the negative trend. It means that improvements in knowledge among the trainees were not properly being utilized. *Meena et al. (2010)* also found a significant impact among extension personnel in terms of acquiring new knowledge, developing participatory skills, changing their attitude, and realizing their aspirations for increasing water productivity.

Constraints perceived by the trainees in implementation of SWC technologies: Administrative, technological, social, and financial constraints were identified and prioritized by trainees as a part of their job in the implementation of SWC technologies in real-world conditions are shown in Table 4. The most serious administrative constraint, according to the analysis, is the lack of trained manpower, followed by "a lack of requisite facilities." The lack of suitable literature on SWC technologies, as well as the "low applicability of technical knowledge gained in field conditions, combined with the complex and more expensive nature of soil and water conservation technologies," were the main technological constraints. In terms of social constraints, "legal issues related to group action benefit sharing and maintenance mechanisms after project withdrawal" as well as a "negative mindset of people toward programme implementing agencies" were also noticed from this table. This could be due to a lack of knowledge about the program's benefits. Financial constraints were also identified by the trainees as "late release of funds and a lack of credit facilities for the adoption of soil and water conservation technologies." The findings are in line with the *Vyas et al. 2022* study in ICAR, which observed constraints among the trainees as inadequate infrastructure at institutes, sometimes lesser relevancy of a few topics, and a lack of practical exposure.

*Impact of training on the implementation of soil and water conservation technologies***:** In assessing the impact of training on various aspects, the respondents assigned values from 1 (least impact) to 5 (excellent impact) depending on their perception and experience. The impact level on various aspects related to their work in general and SWC work in particular was determined based on the total

Table 3. Gain, retention and application of knowledge after training

Topics covered under training	Knowledge level					Knowledge retained				
	Before training		After training		MD	At present		being utilized		MD
	TS	MS	TS	MS		TS	MS	TS	MS	
Engineering aspect	46	1.76	124.5	3.45	1.68	123	3.41	77.5	2.15	-1.26
Soil aspect	79	2.19	131	3.63	1.44	130	3.61	80	2.22	-1.38
Field crops	102	2.83	141	3.91	1.08	137	3.8	94	2.61	-1.19
Perennial vegetation	79	2.19	134	3.72	1.52	133	3.69	84	2.33	-1.36
Social aspect	76	2.11	126	3.50	1.38	125	3.47	86	2.38	-1.08
Financial aspect	53	1.47	119	3.30	1.83	116	3.22	77	2.13	-1.08
Tools &techniques for data collection	54	1.5	121	3.36	1.86	115	3.19	63	1.75	-1.44
Institutional arrangements (group formation capacity building)	59	1.63	106	2.94	1.30	102	2.83	60	1.66	-1.16
PRA	70.5	1.95	135	3.75	1.79	131	3.63	76	2.11	-1.52
techniques for identification & prioritization of interventions	51	1.41	116	3.22	1.80	107	2.97	66	1.83	-1.13
Participatory programme execution &conflict management	57	1.58	109	3.02	1.44	106	2.94	71	1.97	-0.97
Surveying instruments required in watershed planning	49	1.36	122	3.38	2.02	115	3.19	74	2.05	-1.13
Application of RS&GIS	10	0.27	27	0.75	0.47	26	0.72	16	0.44	-0.27
Map reading, delineation characterization of watershed	32	0.88	109	3.02	2.13	109	3.02	64	1.77	-1.27
Land capability classification	38	1.05	125	3.47	2.41	122	3.38	69	1.91	-1.47
Structural measures for soil and water conservation in arable lands	48	1.33	123	3.41	2.08	123	3.41	68	1.88	-1.53
Structural measures for soil and water conservation in non-arable lands	47	1.30	118	3.27	1.97	118	3.27	66	1.83	-1.44
Perennial vegetation planning in watersheds	42	1.16	119	3.30	2.13	119	3.30	74	2.05	-2.25
Computation of crop water requirement	43	1.19	99	2.75	1.55	99	2.75	70	1.94	-0.81
water harvesting, storage & recycling for irrigation planning	53	1.47	113	3.13	1.66	113	3.13	76	2.11	-1.02
Biological measures for land slide, mine spoil & torrent control	48	1.33	129	3.58	2.25	126	3.15	76	2.11	-1.04
Agronomical practices for erosion control	64	1.77	132	3.66	1.88	130	3.61	82	2.27	-1.33
Monitoring of groundwater recharge	33	0.91	91	2.62	1.61	84	2.33	62	1.72	-0.61
Computation of soil loss from watersheds	30	0.83	99	2.75	1.91	93	2.58	61	1.69	-0.88
Installation of silt monitoring station &other meteorological equipment's	34	0.94	92	2.55	1.61	91	2.52	58	1.61	-0.91
Livestock management in watershed	52	1.44	98	2.72	1.27	103	2.86	64	1.77	-1.08
Aquaculture in farm ponds under WS	41	1.13	82	2.27	1.13	79	2.19	53	1.47	-0.72
Design, costing & execution of mechanical measures	30	0.83	107	2.97	2.13	105	2.91	61	1.69	-1.22
Design, costing & execution of Horticultural measures	51	1.41	110	3.05	1.63	105	2.91	67	1.86	-1.05
Design, costing &execution of agroforestry measures	48	1.33	130	3.61	2.27	157	4.36	80	2.22	-2.13
Design, costing & execution of soil fertility l measures	58	1.61	118	3.27	1.66	112	3.11	77	2.13	-0.97
Design, costing &execution of agronomical measures	56	1.55	115	3.19	1.63	112	3.11	77	2.13	-0.97
Entrepreneurship development	49	1.36	106	2.94	1.58	128	3.55	67	1.86	-1.69
Monitoring &evaluation of soil& water conservation works	44	1.22	113	3.13	1.91	107	2.97	75	2.08	-0.88
Economic evaluation of watershed management programme	30	0.83	119	3.30	2.47	113	3.13	80	2.22	-0.91
Withdrawal strategy	21	0.58	74	2.05	1.47	70	1.94	44	1.22	-0.72

TS=Total Score; MS=Mean score; M D= Mean difference

score received by each aspect. The results show that respondents with the highest ranking produced higher-quality work, indicating that training assisted them in improving the quality of their work as well as their services. Enhanced production (rank III) in the working area also indicates the impact of training (Table 7). According to *Sahu et al. (2010),* after KVK training, farmers' income, knowledge, and skill levels increased, resulting in a rise in socioeconomic status. *Anithakumari et al. 2021* also reported the positive impact of training programs on improvement in income, savings and knowledge on agricultural topics among the participants in Kerala.

Table 4. Constraints perceived by the trainees in the implementation of watershed technologies (N=36)

Constraint	TS	MS	Rank
Administrative			
Do not get the opportunity to use the knowledge.	114	3.257143	I
Do not get the requisite facilities.	107	3.057143	II
No support from subordinates	90	2.571429	III
Lack of good leadership	88	2.514286	IV
Frequent transfer	90	2.571429	III
Lack of SMS in the project team	78	2.228571	VI
No award, reward, or appreciation for creativity or sincerity	77	2.2	VII
No sufficient time exists for programme planning and implementation	82	2.342857	V
Technological			
Suitable literature about SWC technologies is not available.	93	2.657143	I
Technological knowledge gained is not applicable in real life.	79	2.257143	II
SWC technologies are costly and complex in nature.	85	2.428571	III
Required inputs (implements, seeds, etc.) are not easily available.	76	2.171429	IV
Social			
Legal issues related to group actions, benefit sharing, and maintenance mechanisms after the withdrawal of the project	101	2.885714	I
Negative mindset of the people about programme implementing agencies	96	2.742857	II
lack of interest among farmers due to illiteracy and the small size of their holdings	94	2.685714	III
Factionalism and conflict among people	91	2.6	V
Political interference	92	2.628571	I V
Financial			
late release of funds	105	3	I
Lack of credit facilities for the farmers	96	2.742857	III
Lack of market support for the farmers	102	2.914286	II
Lack of transparency in fund utilization	91	2.6	V
Insufficient budget	95	2.714286	IV

CONCLUSION

The study concludes that long-term training is critical for making watershed implementation more efficient and viable. However, respondents to the study stressed the importance of receiving training on watershed withdrawal strategies in order to create sustainable watershed development with success stories. Based on these findings, the ICAR-IISWC and other institutions involved in soil and water conservation training programmes can reorient their training modules and subject matter to enrich field functionaries' knowledge on planning, execution, monitoring, and evaluation of ongoing watershed or soil and water conservation works across the country. The study also suggested that a framework or methodology be developed for assessing the direct benefit of training by maintaining the baseline of individual functionaries for follow-up in the field after some lapse of time.

Table 5. Impact of training on various aspects of the implementation of watersheds (N=36)

Names of aspects	TS	MS	Rank
Increased efficiency	118	3.28	V
Use of the latest know-how and technologies	113	3.14	VI
Saving time	108	3	X
less expenditure	111	3.08	IX
Better quality of service	134	3.72	II
Better quality of work	135	3.75	I
Runoff reduction in the project area	122	3.39	IV
Soil loss reduction in the project area	114	3.17	VIII
Enhanced production	128	3.56	III
Satisfaction of beneficiaries	116	3.21	VI

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