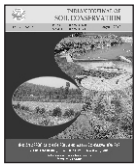
Vol. 47, No. 1, pp 102-106, 2019
Indian Journal of Soil Conservation
Online URL : http://indianjournals.com/ijor.aspx?target=ijor:ijsc&type=home



Post-adoption behaviour of farmers towards soil and water conservation technologies of watershed management in semi-arid regions of Gujarat

G.L. Bagdi

ICAR-Central Arid Zone Research Institute, Regional Research Station, Bikaner-334004, Rajasthan.

Corresponding author:
E-mail: glbagdi@yahoo.com, Gopal.Bagdi@icar.gov.in (G.L. Bagdi)

ARTICLE INFO

Article history:
Received : February, 2019
Revised : April, 2019
Accepted : April, 2019

Key words:
Post-adoption,
Soil and water conservation,
Watershed management

ABSTRACT

ICAR-Indian Institute of Soil and Water Conservation (IISWC), Research Centre (RC), Vasad in Anand district of Gujarat has developed five model watershed projects in the past and implemented number of soil and water conservation (SWC) technologies for sustainable watershed management. Though many evaluation studies were conducted in the past but post-adoption status of the SWC technologies over a longer period had not been assessed. It was imperative to appraise the behaviour of the farmers with regard to the continuance or discontinuance of the technologies adopted, diffusion or infusion that took place and technological gaps that occurred in due course of time after completion of the project. Therefore, it was realized that the post-adoption behaviour of beneficiary farmers who adopted different SWC technologies during watershed management projects, should be studied in detail. The research study was initiated in 2012 as research project at ICAR-IISWC, RC, Vasad, district Anand, Gujarat, with the specific objective to measure the extent of post-adoption behaviour of farmers towards adopted SWC technologies of watershed management. In the study, various indices regarding continue adoption, discontinuance, technological gap, diffusion, infusion regarding SWC technologies for watershed management were developed. It was revealed that more than three-fourth (79.7%) of SWC technologies were continued and one-fifth (20.3%) were discontinued by the farmers. Out of the total continued adopted SWC technologies by farmers, one-third (33.7%) of technologies were adopted with technological gap. About fifty percent (48.0%) of SWC technologies were also diffused to other farmers' fields in nearby villages and on an average 1.3 number of technologies were also infused from outside by farmers' own efforts in the watersheds.

1. INTRODUCTION

Post-adoption behavior is a decision of farmer regarding whether to continue with an adopted technology with or without technological gap or discontinue for adoption of another new technology or his unwillingness to continue with adopted technology as such. When the farmers are satisfied with whatever new technology they have adopted, they are likely to hold on to it, but if they feel that it does not meet their needs they will discard it (Rogers, 1995). But, in the present times, there are so many other factors, apart from meeting of needs that push a farmer to discard a technology. Van Tongeren (2003) investigated the discontinuance of farming innovations and found that the end of subsidies and educational programming explained the majority of discontinuance. It is believed that an effective way to increase productivity is broad-based adoption of new farming technologies (Minten and Barrett, 2008).

Discontinuance is a decision to reject an innovation after it has previously been adopted (Rogers, 2003), he also reported two types of technology discontinuance (1) replacement discontinuance is a decision to reject an idea in order to adopt a better idea that supersedes it and (2) disenchantment discontinuance is a decision to reject an idea as a result of dissatisfaction with its performance. He

also defined diffusion as the process by which an innovation spreads within a social system. Leuthold (1967) concluded from his study of a statewide sample of Wisconsin farmers that the rate of discontinuance was just as important as the rate of adoption in determining the level of adoption of an innovation at any particular time. In any given year, there were about as many discontinuers of an innovation as there were first-time adopters.

The continued use of SWC technologies seemed mainly determined by the actual profitability and related to that, the labour requirements for recurrent maintenance and use. Moreover, in villages with better future prospects (where SWC was promoted with an integrated development strategy) farmers also performed better maintenance of their measures and replication rates were higher (De Graaff *et al.,* 2008). Adoption of improved technologies will not improve food security and reduce poverty if barriers to their continued use are not overcome (Oladele, 2005). If many farmers in a specific project area or village adopt a certain measure, farmers in neighbouring villages may also adopt the measures without project assistance (spontaneous diffusion), as was experienced in Mali (Bodnar *et al.,* 2006).

ICAR-IISWC, RC, Vasad, in Anand district of Gujarat have developed many watershed projects successfully in Gujarat in the past and implemented number of SWC technologies for watershed management. Continued adoption or discontinuance of SWC technologies *viz.,* contour bunding, land levelling, terracing, check dam, trenching, farm pond, vegetative barriers etc. depends on availability of resources with adopter farmers and also suitability to their field conditions. Therefore, it was realized that the post-adoption behaviour of beneficiary farmers who have adopted different SWC technologies for watershed management should be studied in detail regarding their present status of continue-adoption, discontinuance, technological gap, diffusion and infusion. Keeping these points in mind this research study was framed with the major objective to measure the extent of post-adoption behaviour (*i.e.* continue-adoption, discontinuance and technological gap, diffusion and infusion) of farmers regarding adopted SWC technologies of watershed management.

2. MATERIALS AND METHODS

Study Area

The research study was carried out during 2012 to 2015 at ICAR-IISWC, RC, Vasad, (Gujarat). The watersheds developed by IISWC, RC, Vasad (three years after completion) were selected for the study. Therefore, five watersheds namely Navamota watershed in Khedbrahma taluka of Sabarkantha district, Rebari watershed in Kalol taluka of Panchmahal district, Sarnal watershed in Thasra taluka of Kheda district, Antisar, and Vejalpur-Rampura watersheds from Kapadvanj taluka of Kheda district were selected from the Gujarat state for the study.

Selection of Respondents

The stakeholder farmers of selected watersheds, who had adopted SWC technologies were selected as respondents for the study. At least 50 respondents were selected from each watershed comprising from all the existing categories of farmers in the watersheds. A list of SWC technologies which were implemented during the each watershed development programme was prepared. With the help of detail project report (DPR), SWC technology-wise inventory of respondent farmers who had adopted them was prepared. In the inventory, listed out the name of farmers along with size of land holding, who had adopted a particular technology in the watershed and likewise prepared lists or inventories of farmers for all technologies adopted by them during watershed development programme. Stratified proportionate random sampling plan was adopted to select respondents from different inventories or lists of farmers. At least 50 respondents were selected from each watershed comprising from all the existing categories of farmers in the watershed. A detail structured interview schedule was developed by the investigators and data regarding personal, psychological and post-adoption behaviour variables were recorded by interviewing the respondents personally.

Categorization of Respondents

The respondents were categorized into three categories in relation to the data regarding variables like continue adoption, discontinuance, technological gap and diffusion towards SWC technologies for watershed management with help of following criteria:

Range of score	Category
a) < Minimum score + CI	Low
b) > Minimum score + CI to < Maximum score - CI	Moderate
c) > Maximum score - CI	High

Where, CI = Class Interval, Class Interval (CI) was computed with the help of following formula:

$$CI = \frac{Maximum\ Score - Minimum\ Score}{Number\ of\ Classes}$$

Measurement of Post-Adoption Behavior of Farmers

To measure the extent of post-adoption behaviour variables *viz.,* continue adoption, discontinuance, technological gap, diffusion and infusion, a detail methodology was developed such as data collection schedules, scoring procedure and data analysis with the following developed indices by the author:

(i) Technology Continue Adoption Index (TCAI): Number of technologies continued adopted by a farmer out of total

initially adopted SWC technologies and it was worked out as given below:

$$TCAI = \frac{\text{Number of SWC technologies continue adopted by a farmer}}{\text{Number of SWC technologies initially adopted by a farmer}} \times 100 \quad ...(1)$$

Overall Technology Continue Adoption Index: Watershed level

$$Overall\ TCAI = \frac{\sum_{i=1}^{N} TCAI_i}{N} \quad ...(2)$$

Where, $\sum_{i=1}^{N} TCAI_i$ = Sum total of technology continue adoption indices of i[th] farmers, N = Total number of farmers.

(ii) Technologies Discontinuance Index (TsDI): Number of technologies discontinued by a farmer out of total initially adopted SWC technologies and it was worked out as given below:

$$TsDI = \frac{\text{Number of SWC technologies discontinued by a farmer}}{\text{Number of SWC technologies initially adopted by a farmer}} \times 100 \quad ...(3)$$

Overall Technologies Discontinuance Index (OTsDI): It can be worked on watershed level including all farmers as given below:

$$OTsDI = \frac{\sum_{i=1}^{N} TsDI_i}{N} \quad ...(4)$$

Where, $\sum_{i=1}^{N} TsDI_i$ = Sum total of technology discontinuance indices of i[th] farmer, N = Total number of farmers.

(iii) Technological Gap Index (TGI)

$$TGI = \frac{\sum_{i=1}^{N}\left[\frac{R-A}{R}\right]}{N} \times 100 \quad ...(5)$$

Where, R = Maximum possible score on complete adoption of a technology as per the design suitable in the watershed (*i.e.*10), A = Score obtained by a beneficiary farmers on his incomplete adoption of a technology, N = Total number of technologies adopted.

Overall Technological Gap Index: Watershed level

$$Overall\ Technological\ Gap\ Index = \frac{\sum_{i=1}^{K} TGI_i}{K} \quad ...(6)$$

Where, $\sum_{i=1}^{K} TGI_i$ = Sum total of Technological Gap Indices of k[th] farmers, K = Total number of farmers.

(iv) Technology Diffusion Index (TDI):

$$TDI = \frac{\text{Number of SWC technologies diffused by a farmer}}{\text{Number of SWC technologies initially adopted by a farmer}} \times 100 \quad ...(7)$$

Overall Technology Diffusion Index:

$$Overall\ Technological\ Diffusion\ Index = \frac{\sum_{i=1}^{N} TDI_i}{N} \quad ...(8)$$

Where, $\sum_{i=1}^{N} TDI_i$ = Sum total of technology diffusion indices of i[th] farmers, N = Total number of farmers.

3. RESULTS AND DISCUSSION

Levels of Continue Adoption of SWC Technologies by Farmers

The data in Table 1 shows the levels of continue adoption of SWC technologies by farmers in the watersheds developed by ICAR-IISWC, Research Centre, Vasad in Gujarat state. It was revealed that the majority of farmers continued adoption of SWC technologies at high level in all the watersheds-Rebari (84%), Antisar (84%), Navamota (60%), Sarnal and Vejalpur-Rampura (54%) followed by moderate and low levels. The pooled data also revealed that majority (67.2%) of farmers continued adoption of SWC technologies at high level for natural resource conservation for sustainable management of watersheds. Whereas, 24.4% of farmers continued adoption of SWC technologies at moderate level followed by only 8.4% of farmers continued adoption of SWC technologies at low level.

Levels of Discontinuance of SWC Technologies by Farmers

The data in Table 2 revealed that the majority of farmers have discontinued SWC technologies in all the watersheds at low level, in Rebari (84%), Antisar (84%), Navamota (64%), Vejalpur-Rampura (56%) and Sarnal (54%) followed by moderate and high levels. Similarly, pooled data also revealed that more than two-third (68.4%) of farmers discontinued SWC technologies at low level. Whereas, about one-fourth (24.4%) of farmers discontinued SWC technologies at moderate level and only 7.2% of farmers discontinued SWC technologies at high level due to non-suitability to their field conditions or inability to continue the adopted technologies in various watersheds.

Table: 1
Levels of continue adoption of SWC technologies by farmers in different watersheds implemented (n = 250)

Levels	Watersheds					Pooled (n=250)
	Navamota (n=50)	Rebari (n=50)	Sarnal (n=50)	Antisar (n=50)	Vejalpur-Rampura (n=50)	
Low	6 (12)	1 (2)	7 (14)	2 (4)	5 (10)	21 (8.4)
Moderate	14 (28)	7 (14)	16 (32)	6 (12)	18 (36)	61 (24.4)
High	30 (60)	42 (84)	27 (54)	42 (84)	27 (54)	168 (67.2)

Data in parentheses are in percentage

Levels of Technological Gap of SWC Technologies by Farmers

The Table 3 revealed that the majority of farmers have adopted SWC technologies with technological gap at moderate level in the watersheds Navamota (56%), Sarnal (52%), and Vejalpur-Rampura (50%) while in Rebari watershed majority (66%) of farmers adopted SWC technologies with technological gap at high level. In the Antisar watershed, maximum (44%) farmers have adopted SWC technologies with technological gap at low level. Majority of farmers of Antisar watershed were taking care by repair and maintenance of breached out SWC structures adopted at their farm, whereas farmers from Navamota, Sarnal and Vejalpur-Rampura watersheds were taking care of SWC structures at moderate level and majority of farmers from Rebari watershed were taking care of SWC structures at low level.

Similarly, pooled data also revealed that majority (44.4%) of farmers adopted SWC technologies with technological gap at moderate level, followed by 28% of farmers adopted SWC technologies with technological gap at high level and also 27.6% of farmers adopted SWC technologies with technological gap at low level in the watersheds.

Table: 2
Levels of discontinuance of SWC technologies by farmers in different watersheds implemented (n = 250)

Levels	Watersheds					Pooled (n=250)
	Navamota (n=50)	Rebari (n=50)	Sarnal (n=50)	Antisar (n=50)	Vejalpur-Rampura (n=50)	
Low	32 (64)	42 (84)	27 (54)	42 (84)	28 (56)	171 (68.4)
Moderate	13 (26)	7 (14)	16 (32)	6 (12)	19 (38)	61 (24.4)
High	5 (10)	1 (2)	7 (14)	4 (4)	3 (6)	18 (7.2)

Data in parentheses are in percentage

Table: 3
Levels of technological gap of SWC technologies by farmers in different watersheds implemented (n = 250)

Levels	Watersheds					Pooled (n=250)
	Navamota (n=50)	Rebari (n=50)	Sarnal (n=50)	Antisar (n=50)	Vejalpur-Rampura (n=50)	
Low	16 (32)	1 (2)	9 (18)	22 (44)	21 (42)	69 (27.6)
Moderate	28 (56)	16 (32)	26 (52)	16 (32)	25 (50)	111 (44.4)
High	6 (12)	33 (66)	15 (30)	12 (24)	4 (8)	70 (28)

Data in parentheses are in percentage

3.4 Levels of Diffusion of SWC Technologies by Farmers

It was found out that in Navamota watershed the majority (56%) of farmers diffused SWC technologies to other farmers at high level and similarly majority (52%) of Rebari watershed farmers also diffused SWC technologies to other farmers at high level. Majority (50%) of farmers of Sarnal watershed diffused SWC technologies to other farmers at moderate level. Whereas, majority of farmers diffused SWC technologies to other farmers at low level in Antisar (62%) and Vejalpur-Rampura (48%) watersheds (Table 4). Pooled data revealed that maximum (41.2%) farmers diffused SWC technologies at low level, followed by 30.8% at high level and 28% of farmers diffused SWC technologies at moderate level from those watersheds.

Post-Adoption Behaviour of Farmers towards SWC Technologies

The data in Table 5 reveals the extent of post-adoption behavior of farmers towards SWC technologies implemented during various watershed development programmes. TCAI values show that more than ninety per cent of SWC technologies were continued adopted by farmers in the Antisar (95.44%) and Rebari (92.45%) watersheds and more than two-third of SWC technologies were continued adopted by farmers in Navamota (74.19%),

Table: 4
Levels of diffusion of SWC technologies by farmers in different watersheds programmes implemented (n = 250)

Levels	Watersheds					Pooled (n=250)
	Navamota (n=50)	Rebari (n=50)	Sarnal (n=50)	Antisar (n=50)	Vejalpur-Rampura (n=50)	
Low	10 (20)	18 (36)	20 (40)	31 (62)	24 (48)	103 (41.2)
Moderate	12 (24)	6 (12)	25 (50)	13 (26)	14 (28)	70 (28)
High	28 (56)	26 (52)	5 (10)	6 (12)	12 (24)	77 (30.8)

Data in parentheses are in percentage

Table: 5
Extent of post-adoption behaviour of farmers towards SWC technologies in watershed programmes implemented (n = 250)

Extents	Watersheds					Pooled (n=250)
	Navamota (n=50)	Rebari (n=50)	Sarnal (n=50)	Antisar (n=50)	Vejalpur-Rampura (n=50)	
TCAI	74.19	92.45	66.09	95.44	70.25	79.7
TsDI	27.64	7.54	33.91	4.56	27.92	20.3
TGI	24.65	46.29	46.50	20.84	30.19	33.7
TDI	68.63	60.61	38.56	30.45	41.50	48.0
Technology Infusion (mean number of technologies)	1.74	0.82	2.72	0.76	0.52	1.3

Data in parentheses are in percentage

Vejalpur-Rampura (70.25%) and Sarnal (66.09%) watersheds. The pooled TCAI value also shows that overall 79.7% of SWC technologies were continued adopted by farmers.

According to TsDI values, one-third (33.91%) of SWC technologies were discontinued by farmers in the Sarnal watershed and more than one-fourth technologies discontinued in Vejalpur-Rampura (27.92%) and Navamota (27.64%) watersheds. Whereas, very less number of SWC technologies were discontinued by farmers in Rebari (7.54%) and Antisar (4.56%) watersheds. Accordingly, overall TsDI value shows that one-fourth (20.3%) of SWC technologies were discontinued by farmers due to its non-suitability in the watersheds. Woldeamlak Bewket (1998) also reported that the major factors that were discouraging the farmers from adopting the introduced SWC technologies on their farms were found to be labour shortage, land tenure insecurity and problem of fitness of the technologies to the farmers' requirements and to the farming system circumstances.

Regarding TGI, it was found out that little less than 50% of SWC technologies were adopted along with technological gap by the farmers in the Sarnal (46.5%) and Rebari (46.29%) watersheds and less than one-third in Vejalpura-Rampura (30.19%) watershed. Whereas, more than one-fifth of SWC technologies were adopted along with technological gap by the farmers in the Navamota (24.65%) and Antisar (20.84%) watersheds. The pooled TGI data also revealed similar findings that one-third (33.7%) of SWC technologies were adopted with technological gap by farmers out of total continued adopted technologies in the five watersheds.

Diffusion of SWC technologies was also studied by TDI and it was found out that about two-third of SWC technologies were diffused from Navamota (68.63%) and Rebari (60.61%) watersheds and one-third technologies diffused from Vejalpur-Rampura (41.5%), Sarnal (38.56%) and Antisar (30.45%) watersheds to farmers' fields in nearby areas from the fields of farmers who adopted SWC technologies during the watershed development programmes. Similarly, the pooled TDI data also revealed same trend that about fifty per cent (48%) of SWC technologies were diffused to farmers' fields in nearby areas from those watersheds.

The data presented in Table 5 also revealed that on an average about 2 number of SWC technologies were infused in the Sarnal (2.72) and Navamota (1.74) watersheds and less than one technology was infused in Rebari (0.82), Antisar (0.76) and Vejalpur-Rampura (0.52) watersheds by farmers with their own efforts. The pooled data also revealed that on an average 1.3 number of technologies were infused into the farmers' fields from outside by farmers' own efforts or through other organizations.

4. CONCLUSIONS

The study revealed that 79.7% of SWC technologies were continued adopted by beneficiary farmers in the watershed programmes developed by ICAR-IISWC, Research Centre, Vasad in the Gujarat for the cause of natural resources conservation. The farmers discontinued 20.3% of SWC technologies in the watersheds due to non-suitability to their field conditions or inability to continue with the technology. It was also found that out of total continued adopted technologies 33.7% technologies were adopted with technological gap by farmers The diffusion of adopted SWC technologies was also occurred and about 48% of SWC technologies were diffused to other farmers' fields in nearby areas for natural resource conservation on watershed approach. It was also revealed that on an average 1.3 number of technologies were infused into the farmers' fields in the watersheds from outside by farmers' own efforts or through other organizations. Therefore, it could be concluded from the study that in the government sponsored watershed development programmes, more than three-fourth of SWC technologies were continued adopted for natural resources conservation and one-fifth of technologies were discontinued due to their non-suitability or inability of farmers to continue the technologies. Out of the total continued adopted technologies, about one-third of technologies were adopted with technological gap. About 50% of technologies were diffused in nearby areas and only about one or two number of SWC technologies were infused through farmers' efforts in the watersheds or through other organizations.

REFERENCES

Bodnar, F., Schrader, T. and van Campen, W. 2006. Choices in project approach for sustained farmer adoption of soil and water conservation measures in southern Mali. *Land Degrad. Dev.,* 17: 479-494.

De Graaff, J., Amsalu, A., Bodnar, F., Kessler, A., Posthumus, H. and Tenge, A. 2008. Factors influencing adoption and continued use of long-term soil and water conservation measures in five developing countries Factors influencing adoption and continued use of long-term soil and water conservation measures in five developing countries. *Appl. Geogr.,* 28: 271-280.

Leuthold, Frank O. 1967. Discontinuance of Improved Farm Innovations by Wisconsin Farm Operators. Ph.D. diss., University of Wisconsin, Madison. RS (E).

Minten, B. and Barrett B.C. 2008. Agricultural technology, productivity, and poverty in Madagascar. *World Dev.*, 36(5): 797-822.

Oladele, O.I. 2005. A to bit analysis of propensity to discontinue adoption of agricultural technology among farmers in southern Nigeria. *J. Cent. Eur. Agri.*, 6(3): 249-254.

Rogers, E.M. 1995. Diffusion of Innovations. The Free Press.

Rogers, E.M. 2003. Diffusion of Innovations. The Free Press, 21-38.

Van Tongeren, P. 2003. Assessing Agricultural Development Interventions in the western highlands of Guatemala: A farmer centered Approach.Unpublished master's thesis, Michigan state university, East Lansing.

Woldeamlak Bewket. 1998. Land degradation and adoption of conservation technologies in the Digil watershed Northern Highland of Ethopia. Retrieved from (accessed on 25/08/2014).