# Factors influencing the adoption of Sujala III watershed interventions and constraints faced by farmers


**ABSTRACT**

The study aims to identify factors associated with the adoption of Sujala III watershed interventions and document the constraints faced by the farmers in adoption watershed interventions. An ex post facto research design was employed in the study. The study was conducted in Dindur sub watershed which belongs to Gadag and Bedwatti sub watershed of Koppal district of Karnataka. A sample of 90 farmers representing each two sub watersheds was selected by simple random procedure making a total sample size of 180. The respondents were interviewed personally using pre tested interview schedule and the data were analyzed using descriptive statistical tools. The study observed that, there was a strong positive and significant relationship between independent variables like land holding, resource base, cropping intensity, scientific orientation, risk orientation and the adoption of Sujala III watershed interventions at one per cent. With respect to constraints in adoption, the highly ranked problem during planning stage was farmers consent was not taken (254). Lack of transparency (288) was the top most problem followed by favorability towards big farmers (231) with second rank faced at implementation stage. The major constraint faced in maintenance was the waste weir damage (174). As of technical issues were concerned, lack of guidance during post project (293) was the major problem followed by lack of knowledge about the management of common properties resources (256). Among the compatibility problems, top ranked problem was the fragmentation of land into unconventional shape (221) and low maintenance by committee (317) was the top ranked community related problem. It is of utmost importance to follow participatory approach in planning and implementation and post project maintenance.




*Keywords: Watershed, Interventions, Constraints, Adoption*

## 1. INTRODUCTION

Agriculture is predominantly reliant on natural resources like soil, water and vegetation which are limited in supply and getting depleted day by day. Agricultural productivity rests on how effectively and efficiently these resources are conserved and managed [1]. Thus, conservation, up gradation and utilization of soil and water got greater importance in Indian economy. There are two possible alternatives exist in order to increase the crop production; one is that, bringing rainfed areas under irrigation which could not cross the 50.00 per cent of the cultivated area. Another alternative is to improve the crop production in rainfed areas by promoting improved watershed technologies [2]. Therefore, improved crop production technologies coupled with efficient utilization of available rain water, plays a significant role in augmenting crop yield per unit area in rainfed areas. The challenge before Indian farming is to transform rainfed agriculture into more sustainable and productive systems through participatory watershed development with emphasis on integrated farming systems for augmenting productivity, income and livelihood security in a sustainable manner to provide better support for the population dependent upon it.

Watershed is a geo-hydrological unit or a section of land that drains at a common point. Watershed is a geographical area drained by stream of connecting streams in such a way that all precipitation in this area leaves the area in a concentrated flow through a single outlet [3]. Watershed management has been defined in India as a rational utilization of resources like land and water for sustained production with minimal hazard to natural resources. It is principally associated with soil and water conservation [4].

The primary responsibility of implementing watershed development programmes rests with the State Government. The Central Government may provide coordination, technical guidance, financial assistance, training and research inputs besides monitoring the progress of implementation and evaluating the impact of major programmes [5]. More than 70.00 per cent of Karnataka's major agricultural area falls under semi-arid zone, with the average precipitation ranging from 400 mm to 750 mm per year [6]. These lands are subject to periodic droughts, erratic rainfall, severe soil erosion and depleting ground water thereby eroding the natural resource base and significantly hindering agricultural productivity. Official figures show that close to 80.00 per cent of agricultural land in Karnataka is drought-prone [7].

The watershed projects have resulted in the augmented cropping intensity by way of soil and water conservation [8-10]. The farmers who adopt watershed interventions in terms of soil and water conservation measures witness improvement in crop productivity [11-14]. Hence, the World Bank assisted Sujala III project was implemented in 2015 aimed to come out with site specific information at watershed level, mainly on soil and site characteristics for watershed development in Karnataka. Therefore, the research has made an attempt to analyse the factors determining the adoption of interventions made by Sujala III project and constraints that come in the way of adoption.

## 2. Material and methods

### 2.1 Research design

An Ex-post research design was used in the present study. The *Ex post-facto* design was selected because research, rather than evolving a remedy, evaluate the influence of a naturally occurring phenomenon after it occurs [15].

### 2.2 Sampling procedure

The study was conducted in Gadag and Koppal districts of Northern Dry zone of Karnataka by covering Dindur and Bedwatti sub watersheds from respective districts. From each sub watersheds, 3 micro watersheds were selected. Thirty farmers were selected from each micro watershed by simple random procedure constituting a sample of 180 farmers.

### 2.3 Data collection and analysis

The data were collected using pre tested structured interview schedule. Statistical tools like correlation and regression were used to analyse data. The constraints were ranked based on the total score obtained on three point continuum as high, moderate and never with the score of 2, 1 and 0 respectively.

## 3. RESULTS AND DISCUSSION

### 3.1 Factors influencing the adoption of Sujala III watershed development interventions

Results in the table 1 illustrated the 'r' values depicting the association of adoption of watershed interventions with independent variables. Among the independent variables land holding, cropping intensity, extension participation, scientific orientation and risk orientation were positively and significantly correlated with the adoption of Sujala III watershed development interventions at one per cent significant level. Whereas, education, annual income and resource base were positively correlated at five per cent significance level. Remaining variables such as age, farm experience and mass media exposure were not significantly correlated with the adoption of the watershed intervention in Dindur sub watershed.

In Bedwatti sub watershed, independent variables like education, resource base, scientific orientation and risk orientation were highly and positively correlated with the adoption of Sujala III watershed development interventions at one per cent significance level. While, land holding and cropping intensity were significantly correlated with the adoption of Sujala III watershed development interventions at five per cent level of significance. Remaining variables such as age, farm experience, annual income and mass media exposure were not significantly correlated with the adoption.

Overall, there was a positive and significant relationship between independent variables like land holding, resource base, cropping intensity, scientific orientation, risk orientation and the adoption of Sujala III watershed interventions at one per cent level of significance. The variables like education, annual income and extension participation were significantly correlated with adoption at five per cent. While, age, farming experience and mass media exposure had no relationship with the adoption of watershed interventions.

Education widens the horizons of an individual to gain better knowledge of watershed practices which results in better adoption. Hence it was positively correlated with adoption. The findings are in line with Manjunath [16] and inconsistent with Nkhoma [17]. Further, big farmers having large holdings with well economic conditions, better resource base and cropping intensity had more opportunities to try out new interventions which give them a better exposure and access to extension. It was obvious that with larger land holdings, higher resource base and cropping intensity, extent of adoption of watershed interventions had increased. Sujala III watershed project had conducted series of training programmes and interaction with beneficiary farmers, educated farmers with higher resource base had taken advantage of them. Similar observations were found in the study by Graff [18], Kerse [19], Padmaja [20] and Rajendra [21].

Annual income was identified to be positively correlated with adoption of watershed interventions. The possible reason attributed to such relationship is that the farmers with more annual income will be

having higher risk bearing ability and be able to bear the cost of maintenance of soil and water conservation measures. The results are in accordance with Kudachi [22]. Taking active participation in extension activities like training, demonstrations, field visits etc. provides a farmer with technical know-how of watershed interventions which resulted in positive relationship between extension participation and adoption. Education, extension participation helps farmers to get exposed to new knowledge and develop scientific orientation. Further, the study area is featured predominantly by rainfed condition thet associates with higher risk of rainfall and other climatic variations leading them for better adoption of Sujala III watershed interventions. Farmers with high scientific and risk orientation tend to have higher adoption of watershed interventions. The results are in conformity with that of Manjunath [16].

**Table 1. Factors influencing the adoption of Sujala III watershed development interventions**

**n=180**

| Sl. No. | Independent Variables | 'r' Value | | |
|---|---|---|---|---|
| | | Dindur SWS, Gadag ($n_1$=90) | Bedwatti SWS, Koppal ($n_2$=90) | Overall (n=180) |
| 1 | Age | $0.082^{NS}$ | $0.123^{NS}$ | $0.972^{NS}$ |
| 2 | Education | 0.262* | 0.356** | 0.299* |
| 3 | Land holding | 0.383** | 0.262* | 0.374** |
| 4 | Farm experience | $0.137^{NS}$ | $0.168^{NS}$ | $0.129^{NS}$ |
| 5 | Annual income | 0.216* | $0.134^{NS}$ | 0.197* |
| 6 | Resource base | 0.132* | 0.373** | 0.385** |
| 7 | Cropping intensity | 0.474** | 0.250* | 0.406** |
| 8 | Mass media exposure | $0.102^{NS}$ | $0.155^{NS}$ | $0.135^{NS}$ |
| 9 | Extension participation | 0.292** | $0.176^{NS}$ | 0.203* |
| 10 | Scientific orientation | 0.351** | 0.367** | 0.391** |
| 11 | Risk orientation | 0.417** | 0.507** | 0.484** |

** - Significant at 1 per cent * - Significant at 5 per cent $^{NS}$ - Non-significant

## 3.2 Overall contribution of independent variables to the adoption of Sujala III watershed development interventions by the farmers

Multiple linear regression was employed to measure the extent of contribution made by independent variables to the adoption of Sujala III watershed development interventions and the results were displayed in table 2 according to which land holding, resource base, cropping intensity and risk orientation had highly significant contribution to the adoption of watershed interventions at one per cent. While, risk orientation was found to have significant contribution at five per cent. The $R^2$ value is 0.619 which means all the independent variables put together contributed to 61 per cent of the variation in the adoption of watershed interventions.

### 3.2.1 Contribution of independent variables to the adoption of Sujala III watershed development interventions by the farmers of Dindur sub watershed of Gadag

It is clear from the result of table 3 that land holding and cropping intensity were highly contributing to the adoption of watershed development interventions at one per cent significance level. Whereas, resource base and scientific orientation were contributing to adoption at five per cent level of

significance. The $R^2$ value is 0.685 which means 68 per cent of the variation in the dependent variable is due to the change in the selected independent variable.

### 3.2.2 Contribution of independent variables to the adoption of Sujala III watershed development interventions by the farmers of Bedwatti Sub watershed of Koppal

Data in the Table 4 indicated the regression analysis of independent variables with adoption. Results revealed that education, land holding, resource base and risk orientation were highly significant at one per cent level of significance. Whereas, cropping intensity was significantly contributing at five per cent significance level. Further, the $R^2$ value is 0.598 which clearly indicates that 59 per cent of the variation in the dependent variable was due to the change in the selected independent variable.

In Dindur sub watershed, land holding and cropping intensity were highly contributing to the adoption of watershed development interventions at one per cent significance level. Whereas, education, land holding, resource base and risk orientation were highly significant in Bedwatti sub watershed. Overall, land holding, resource base, cropping intensity and risk orientation were highly significant. This indicates that, farmers with large land holdings and higher cropping intensity in Dindur and farmers with more education, land holding, resource base and risk orientation in Bedwatti sub watershed had adopted more Sujala III watershed interventions. However in overall, the farmers with larger holdings, high resource base, cropping intensity and risk orientation had higher adoption of watershed interventions. Therefore, these variables are possibly considered as predictors of variation in adoption of watershed interventions in respective sub watersheds. Land holding and resource base are interrelated and have effect on cropping intensity. Such farmers with higher land other resources shown more interest to adopt possible interventions such as trench cum bund and farm ponds which further enhanced their resource base as well as good condition for crop production.

**Table 2. Overall contribution of independent variables to the adoption of Sujala III watershed development interventions by the farmers**

**n=180**

| Sl. No. | Independent Variables | Regression coefficient | Standard error | 't' Value |
|---|---|---|---|---|
| 1 | Age | 1.042 | 0.462 | 0.219$^{NS}$ |
| 2 | Education | 3.142 | 0.233 | 1.971* |
| 3 | Land holding | 2.968 | 0.436 | 2.853** |
| 4 | Farm experience | -0.081 | 0.148 | 0.384$^{NS}$ |
| 5 | Annual income | 0.163 | 0.201 | 1.925$^{NS}$ |
| 6 | Resource base | 3.126 | 0.231 | 2.939** |
| 7 | Cropping intensity | 1.437 | 1.613 | 3.416** |
| 8 | Mass media exposure | 0.108 | 0.071 | 0.485$^{NS}$ |
| 9 | Extension participation | 0.056 | 0.201 | 0.276$^{NS}$ |
| 10 | Scientific orientation | 0.417 | 0.410 | 1.347$^{NS}$ |
| 11 | Risk orientation | 0.631 | 1.092 | 2.038$^{**}$ |

$R^2$ = 0.619 F value = 5.36**

** - Significant at 1 per cent * - Significant at 5 per cent $^{NS}$ - Non-significant

**Table 3 Contribution of independent variables to the adoption of Sujala III watershed development interventions by the farmers of Dindur sub watershed of Gadag**

**n=90**

| Sl. No. | Independent Variables | Regression coefficient | Standard error | 't' Value |
|---|---|---|---|---|
| 1 | Age | -0.004 | 0.222 | 0.020$^{NS}$ |
| 2 | Education | 0.165 | 0.142 | 1.513$^{NS}$ |
| 3 | Land holding | 2.985 | 0.525 | 2.876** |
| 4 | Farm experience | -0.062 | 0.277 | 0.223$^{NS}$ |
| 5 | Annual income | 0.192 | 0.125 | 1.413$^{NS}$ |
| 6 | Resource base | 0.077 | 0.041 | 1.857* |
| 7 | Cropping intensity | 3.341 | 1.789 | 1.866** |
| 8 | Mass media exposure | 0.021 | 0.063 | 0.402$^{NS}$ |
| 9 | Extension participation | 0.018 | 0.132 | 0.130$^{NS}$ |
| 10 | Scientific orientation | 0.512 | 0.410 | 1.506* |
| 11 | Risk orientation | 2.932 | 2.197 | 1.334$^{NS}$ |

$R^2$ = 0.685 F value = 6.41**

** - Significant at 1 per cent * - Significant at 5 per cent $^{NS}$ - Non-significant

**Table 4. Contribution of independent variables to the adoption of Sujala III watershed development interventions by the farmers of Bedwatti Sub watershed of Koppal**

**n=90**

| Sl. No. | Independent Variables | Regression coefficient | Standard error | 't' Value |
|---|---|---|---|---|
| 1 | Age | -0.016 | 0.315 | 0.253$^{NS}$ |
| 2 | Education | 3.142 | 0.233 | 2.927** |
| 3 | Land holding | 2.968 | 0.436 | 2.794** |
| 4 | Farm experience | -0.081 | 0.148 | 0.179$^{NS}$ |
| 5 | Annual income | 0.163 | 0.201 | 1.128$^{NS}$ |
| 6 | Resource base | 3.126 | 0.231 | 1.742** |
| 7 | Cropping intensity | 1.437 | 1.613 | 1.492* |
| 8 | Mass media exposure | 0.108 | 0.071 | 0.296$^{NS}$ |
| 9 | Extension participation | 0.056 | 0.201 | 0.128$^{NS}$ |
| 10 | Scientific orientation | 0.417 | 0.410 | 1.136 $^{NS}$ |
| 11 | Risk orientation | 0.631 | 1.092 | 2.399$^{**}$ |

$R^2$ = 0.598 F value = 4.14**

** - Significant at 1 per cent * - Significant at 5 per cent $^{NS}$ - Non-significant

## 3.3 Constraints faced by farmers in adoption of Sujala III watershed development interventions

The problems faced by farmers in adoption of Sujala III watershed interventions were studied under different headings such as problems at planning stage, problems at implementation stage, maintenance problems, technical problems, compatibility problems, and community related problems. It is pointed in table 5 that, among the problems at planning stage 'farmers consent was not taken' (254) was the major problem which ranked highest followed by 'lack of interest among farmers' (198). Among problems at implementation stage 'lack of transparency' (288) was the top most problem

followed by ‘favorability towards big farmers’ (231) with second rank, ‘lack of people participation’ (201) ranked third and ‘difficult to mobilize people’ (195) was ranked at last.

The major constraint faced in maintenance was ‘waste weir damage’ (174) which ranked top followed by ‘breach of bund’ (173) which ranked second, ‘sedimentation of farm pond’ (110) which ranked third. As of technical issues were concerned, ‘lack of guidance during post project’ (293) was the major problem being ranked at first followed by ‘lack of knowledge about the management of common properties resources’ (256) in second position, ‘inadequate training of the farmers about the use of watershed’ (249) in the third position and lastly ‘lack of field visits to successfully implemented watershed areas’ (236) in the fourth position. Among the compatibility problems, top ranked problem was the ‘fragmentation of land into unconventional shape’ (221) followed by ‘obstruction for cultural operations’ (216, II rank), ‘loss of cultivable area’ (210, III rank) and ‘water stagnation near bunded area’ (84, IV rank). Lastly in the community related problems ‘low maintenance by committee’ (317) considered as top most problem followed by ‘ineffective functioning of watershed committee’ (168, II rank), ‘lack of cooperation by neighbors’ (122, III rank) and ‘local leaders are less interested in programme’ (85, IV rank).

Though Sujala III watershed project had followed participatory approach, it is unfortunate that farmers were not satisfied hence the problems such as no consent taken and lack of transparency were expressed by farmers. It is important that farmers’ participation should be ensured and made responsible for post project management. The other most challenging problem was fragmentation of land into unconventional shape. This is because of small holdings their cultivable area could be divided into fragments on construction of trench cum bund and farm ponds. Low maintenance by committee followed by ineffective functioning of watershed committee was the problem majorly facing by farmers which calls for regular monitoring and follow-up activities by the project officials which enable them to know the real time problems faced by farmers.

**Table 5. Constraints faced by the farmers of Sujala III watershed in adoption of watershed development interventions**

**n=180**

| Sl. No. | Problems | Total score | Rank |
|---|---|---|---|
| **A** | **Problems at planning stage** | | |
| 1 | Farmers consent was not taken | 254 | I |
| 2 | Lack of interest among farmers | 198 | II |
| **B** | **Problems at implementation stage** | | |
| 1 | Lack of people participation | 201 | III |
| 2 | Difficult to mobilize people | 195 | IV |
| 3 | Lack of transparency | 288 | I |
| 4 | Favourability toward big farmers | 231 | II |
| **C** | **Maintenance problems** | | |
| 1 | Breach of bund | 173 | II |
| 2 | Waste weir damage | 174 | I |
| 3 | Sedimentation of farm pond | 110 | III |
| **D** | **Technical problems** | | |
| 1 | Lack of guidance during post project | 293 | I |

| | | | |
|---|---|---|---|
| 2 | Lack of knowledge about the management of common properties resources | 256 | II |
| 3 | Lack of field visits to successfully implemented watershed areas | 236 | IV |
| 4 | Inadequate training of the farmers about the use of farmers about the use of watershed | 249 | III |
| **E** | **Compatibility problems** | | |
| 1 | Obstruction for cultural operations | 216 | II |
| 2 | Water stagnation near bunded area | 172 | IV |
| 3 | Fragmentation of land into unconventional shape | 221 | I |
| 4 | Loss of cultivable area | 210 | III |
| **F** | **Community related problems** | | |
| 1 | Lack of cooperation by neighbours | 122 | III |
| 2 | Local leaders are less interested in programme | 85 | IV |
| 3 | Ineffective functioning of watershed committee | 168 | II |
| 4 | Low maintenance by committee | 317 | I |

## 4. CONCLUSION

We could conclude that the variables that influence the adoption are very context-specific, and that generalisation is not possible [23]. Nevertheless, the common and important factors for the adoption are the land holding, resource base and cropping intensity. The farmers with larger holdings, higher resource base and cropping intensity inclined towards higher adoption. Hence these are the determinants of adoption of watershed development interventions. From the findings, it can be seen that farmers were not satisfied with participatory approach. Major watershed development interventions related constraints were low maintenance by committee, lack of guidance during post project, lack of transparency. Formation of user groups and watershed committees should be encouraged and made responsible for watershed management.



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