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DEVELOPMENT OF AN INDEX TO MEASURE THE SOCIO-ECONOMIC AND TECHNOLOGICAL CONSEQUENCES OF SUJALA WATERSHED PROJECT ON BENEFICIARIES

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ABSTRACT
An index of consequences of watershed was developed for this research study. Based on the review of literature and discussion with the experts, 47 indicators were enlisted. The relevancy rating was obtained from 77 judges in the concerned area. All those indicators with the relevancy coefficient of 0.80 were selected for the inclusion in the consequence index. 34 indicators passed the above criteria. In order to compute the scale values for each of the identified dimensions based on the relevancy percentage, the consequences of watershed was worked out by adopting normalized ranking method recommended by Guilford (1954) and the total scale value was 14.32. The index developed was reliable (0.91) and valid (0.97) with respect to content validity.

INTRODUCTION

Rainfed agriculture constitutes more than half of the net cultivated area in India, which is characterized by low productivity, degraded natural resources, and widespread poverty. Most of the people living in rainfed area depend on agriculture and natural resources for their livelihoods. So development planners are conscious to implement agriculturally productive, environmentally sustainable land and water management systems while focusing on reduction of poverty. Hence, Watershed Developments (WD) are designed to harmonize the use of soil, water, vegetation resources in a way that conserves these resources, while raising agricultural (crop and livestock) productivity. Watershed development has been conceived as a basic strategy for protecting the livelihoods of the people inhabiting the fragile eco-systems who are experiencing soil erosion and moisture stress. The aim has been to ensure the availability of food, fodder, fuel, water and raise farmers' income and employment opportunities through improvements in agricultural production and productivity while restoring ecological balance. Karnataka has huge responsibility of meeting the challenges of food security through sustained agriculture growth. Karnataka implemented a World Bank funded Watershed development project under participatory mode in as many as 742 micro watersheds coming under 77 sub watersheds in 38 taluks of six districts namely Tumkur, Kolar, Chikkaballapur, Chitradurga, Haveri and Dharwad. The project implemented from September 2001 to March 2010. The project covered 5.19 lakh hectares of geographical area, benefited over 4.19 lakh households inhabiting 1270 villages in three phases. The first phase had a modest target of 10 Sub watersheds, while second covered another 20 Sub watersheds. Major part of the project was implemented in phase III covering as many as 47 Sub watersheds (over 67% of the all targeted Sub watersheds and as many as 469 Micro watersheds (out of 742).The project covered about 3.32 lakh hectares of area under all the three phases with an average of 82 percent private and 18 percent common land. Since 1960s, many soil conservation and watershed development projects have been undertaken in the world under diverse agro-climatic conditions. These projects usually aimed at reducing soil erosion and preventing land degradation besides increasing crop and biomass productivity. To achieve these broad objectives, a multitude of activities were undertaken, ranging from bunding, terracing, gully control structures, reforestation and horticulture development, off-farm employment and other livelihood support systems. However, while evaluating these projects, during and post project periods, it was observed that no concrete conclusions could be drawn, mainly due to non-availability of tools and techniques for effective monitoring of project outcomes and impacts (de Graaff *et al*., 2007). Hence, the present study is taken up with the specific objective to develop and standardize an index to measure the consequences of sujala watershed on beneficiaries which involves large number of useful indicators which have the potential to systematically assess the impact of various intervention on socio-economic and technological attributes in the watershed management projects being executed across different regions of the country. The use of appropriate indicators would also help in critically analysing the relative performance of watershed projects in terms of quantifiable benefits under identical agro-climatic settings as well as across different regions of the country.

Consequences of watershed are operationalized as the desirable/ undesirable changes that occur within a farmer in terms of technological, social status and economic aspects as a result of involvement in the watershed development programme. Composite of three dimensions viz., social, economic and technological. Many authors have indicated that the components have been identified were based on secondary data and were also not further operationalized. Hence, the researcher's thrust was to identify the components that truly reflect consequences of watershed. An attempt has been made to develop an index to measure the consequences of watershed on beneficiaries.

Based on the review of literature as well as discussion with the experts in the field, 47 indicators were enlisted in accordance with the situation existed in watershed. These items were mainly concerned with consequences by adopting the watershed technologies covering widely from social effects to the technological aspects. The final list of indicators was subjected to relevancy rating of 77 judges in the concerned area. The judges were belongs to the cadre of Assistant professors and above in the area of Agricultural extension, Agronomy, Soil Science and Horticulture in the university, KVK's and other ICAR institutes. The judges were requested to indicate whether each of the indicators sent to them were relevant and suitable for inclusion in the scale to measure the consequence index of beneficiaries on a three point relevancy continuum viz., Most Relevant, Relevant and Not Relevant with 3, 2 and 1 scores, respectively. They were also requested to add new indicators, which tend to measure the consequences, if any, they consider relevant. The responses had from the judges were scored and the Relevancy Coefficient (RC) of indicator was worked out using the following formula:

$$R.\,C. = \frac{\text{Total score of all the judged on 'i'th indicator}}{\text{Maximum score on the continuum x Total number of judges}} \times 100$$

All those indicators with the relevancy coefficient of 0.80 were selected for the inclusion in the consequence index. 33 indicators selected are listed in Table 1.

TABLE 1: Indicator wise relevancy score under different dimensions of consequences of watershed (n=77)

		RP	RC	MRS
	I. Social dimension			
1	Occupational pattern	87.45	0.87	2.62
2	Family food security	87.01	0.87	2.61
3	Education	89.18	0.89	2.68
4	Type of house	82.68	0.83	2.48
5	Extension contact	89.18	0.89	2.68
6	Extension participation	87.45	0.87	2.62
7	Social participation	88.31	0.88	2.65
8	Participation in watershed activities	88.74	0.89	2.66
9	Material possession (House hold)	82.25	0.28	2.47
10	Accessibility to livelihoods	88.74	0.89	2.66
11	Quality of life	84.42	0.84	2.53
12	Rationality in decision making	81.82	0.82	2.45
13	Risk taking ability	84.42	0.84	2.53
	II. Economic dimension			
1	Land holding	93.94	0.94	2.82
2	Annual income	93.94	0.94	2.82
3	Livestock possession	90.04	0.90	2.70
4	Farm power	84.85	0.85	2.55
5	Employment generation	87.45	0.87	2.62
6	Farm level risk management	80.52	0.81	2.42
7	Marketing	85.71	0.86	2.57
8	Economic performance	87.45	0.87	2.62
9	Consumption expenditure	81.39	0.81	2.44
10	Income generating activities	90.91	0.91	2.73
11	Profitability of enterprises	91.77	0.92	2.75
12	Financial inclusion	85.28	0.85	2.56

	III. Technological dimension			
1	Knowledge of recommended technologies			
	a) Soil and water conservation practices	95.67	0.96	2.87
	b) Improved crop production practices	92.21	0.92	2.77
	c) Alternate land use system	91.77	0.92	2.75
	d) Drainage line treatment	87.88	0.88	2.64
	e) Common land development activities	84.85	0.85	2.55
2	Adoption of recommended technologies			
	a) Soil and water conservation practices	93.94	0.94	2.82
	b) Improved crop production practices	93.94	0.94	2.82
	c) Alternate land use system	90.91	0.91	2.73
	d) Drainage line treatment	88.31	0.88	2.65
	e) Common land development activities	86.15	0.86	2.58
3	Land use/Land cover	86.58	0.87	2.60
4	Crop productivity	92.21	0.92	2.77
5	Milk yield	81.39	0.81	2.44
6	Fodder yield	81.82	0.82	2.45
7	Cropping pattern	90.04	0.90	2.70
8	Cropping intensity	90.48	0.90	2.71

In order to compute scale values for each of the identified dimensions, their relative importance in consequences of watershed was worked out by adopting normalized ranking method recommended by Guliford (1954). A list of 58 experts working in relevant area was prepared and considered for seeking opinion. The judges were requested to give rank order based on the relative importance of the dimensions to the 3 selected dimensions of consequences of watershed. After receiving ratings from the judges, they were used in calculation of scale values. Ranking the dimensions based on their relative importance-Ranks was converted to rank values using the formula:

Ri= (n-ri+1)
Where, Ri = Rank values
n = Number of dimensions
ri = Ranks given by judges to three dimensions

The calculation of scale values consisted of working out the 'P' based on the formula recommended by Guilford (1954), working out 'C' scale values based on Hull table (Hull, 1928), calculating 'Rj' value and finally determining the scale values (Rc).

$$P = \frac{(Ri - 0.5)100}{n}$$

Rc= 2.357*Rj – 7.01
Where, Where, P= Centile position
C= Values determined to each centile value
Rj = Rank value
n = Number of indicators

Scale values from rank order judgment

ri	Ri	D1	D2	D3	Total	P	C
1	3	13	17	28	58	83.33	7
2	2	8	35	15	58	50.00	5
3	1	37	6	15	58	16.67	3
∑fji		58	58	58	174		
Rj=∑fjiC		242	312	316	870		
R=Rj/∑fji		4.172	5.379	5.448	5		
Rc*		2.824	5.669	5.832	4.775		

Where, ri=Ranks given by judges to 3 dimensions
Ri=Rank values
Rc=2.357*Rj – 7.01
P= Centile position
C= Values determined to each centile value

TABLE 2: Scale values for three dimensions of consequences of watershed

Sl. No.	Dimensions	Final scale values	Ranks
1	Social dimension	2.824	III
2	Economic dimension	5.669	II
3	Technological dimension	5.832	I

An instrument has to be reliable and valid to prove its value as well as its accuracy. This is more so when a composite index is obtained by combining several indicators. Reliability refers to precision of the instrument constructed for any purpose. It is otherwise called the extent to which repeated measurement produces the same result. Any newly constructed index has to be tested for its reliability before it used. In the present study, the reliability of consequence index was determined by split-half method. In order to find out reliability, the consequence index was divided into two halves, based on odd and even numbered questions and administered to 30 respondents. The two sets of scores of same respondents were correlated. The coefficient of correlation was found to be 0.91, which was found to be significant at 1% level of probability, indicating high reliability of an index. It was concluded that the consequence index constructed was reliable.

The true value of the consequence index is reflected by its validity. Also, the usefulness of the index must be evaluated by determining its validity. An index is said to be valid if it stands for one's reasoning. Validity could be established through the following way.

According to Kerlinger (1973) content validity is the representativeness or the sampling adequacy of the contents, the substance, the matter and the topics of a measuring instrument. He further stated that, content validation consists essentially in judgment. Content validity in the current study was established in two ways. First, the items selected for inclusion in consequence index were based on exclusive review of literature. Secondly, the opinion of the panel of judges was obtained to findout whether the items suggested were relevant for inclusion in the index or not. Hence, it was concluded that the index was valid owing to the judgement given by the majority of the judges regarding content validity.

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