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Socio-economic Impact of Batch–V (2013-14) Pradhan Mantri Krishi Sinchayee Yojana Watersheds in West Godavari District of Andhra Pradesh

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The Pradhan Mantri Krishi Sinchayee Yojana(PMKSY) watershed development programimplemented in the west Godavari district of Andhra Pradesh influencesthe changes in the socio-economic conditions of people.In Ganapavaram, Lakshmi Narayana Devi Peta (LND Peta) and Alliveru mega watershed projects of West Godavari district as a part of the Entry Point Activities (EPAs) component,129 works are executed with an expenditure of Rs.68.65 lakhs which is 4.06 percentof the project cost in three project areas. Besides, underNatural Resource Management (NRM) component,413 works were executed with an expenditure of Rs.730.57 lakhs, which is 43.15 percent of the project cost in project areas and as a part of the PSI component, 856 implementswere supplied with an expenditure of Rs.77.67 lakhs, which is 4.59 percent of the project cost in the project areas.These watershed interventions, bring changes in the socio-economic conditions of people i.e., the average Illiteracy rate declined from 65.83% to 42.75%, safe drinking water supplies improved by 26.54%,the mean gross income of households increased by 58.65 percent, thenumber of person-days/yr/family in agriculture and non-agriculture-related activities during the projectimplementation period increased by 24.34% (31 person-days) and 19.71% (22person-days) respectively also increased theWage earningson an average by Rs.90/- (32.93%) per day for men from Rs.273/- to Rs.363/- and Rs.42/- (25.77%) per day for women from Rs.162/- to Rs.203/- during the project period.Due to the impacts of watershed management interventionsemployment and wage rates were increased, which helped in the reduction of migration from rural to urban areas by 28.18%.

Keywords: Employment; income; migration; socio-economic impact; literacy; watershed.

1. INTRODUCTION

India is predominantly a rural-based agrarian country where agriculture alone employs more than 50% of the total population. Agriculture and allied sectors such as horticulture, livestock, forestry, and fisheries together contribute 17.8% of the country's Gross Value Added for the year 2019-20. Therefore, it is understood that for the economy of the country to thrive and remain healthy, agriculture must be duly taken care of. For sustainable agricultural production of the country irrigation through a permanent water source or rainfall needs to be available. As per the Indian Statistics, 53% of the net sown area in the country is rainfed. Therefore, it implies that all efforts need to be aimed to address the problems of the rain-fed areas. Despite India ranking first in rainfed agriculture globally in terms of area and production, productivity is among the lowest in the world. This is due to issues like the reduction of natural resources, rainwater runoff, soil erosion, and poor quality of soils and water [1]. To address these issues an Integrated Watershed Management approach is found to be an appropriate solution worldwide. It is one of the most effective interventions used to stabilize rainfed agriculture by providing sources of water for small-scale irrigations. It is one of the flagship programs of the Government with substantial budget allocation for poverty alleviation of the rain-fed farmer. The Integrated Watershed Management Programme (IWMP) after approval of PMKSY (Pradhan Mantri Krishi Sinchayee Yojana) is subsumed as one of its components and IWMP is now implemented as WDC-PMKSY w.e.f. 01.07.2015. Department of Land Resources (DOLR) under the Ministry of Rural Development (MoRD) has been implementing the PMKSY-Watershed Programme since 2009. In Andhra Pradesh, the Department of Panchayat Raj and Rural Development through the State Level Nodal Agency (SLNA) isimplementing 372 watershed projects covering an extent of 15.83 lakh hectares in five batches from 2009-10 to 2013-14.

The Ganapavaram, Lakshmi NarayanaDevi Peta and Alliveru mega watershed projects of PMKSY sanctioned for 2013-14 were implemented by the Government of Andhra Pradesh in Buttaigudem and Polavarammandals of West Godavari district with a sanctioned area of 14108 hectares encompassing 14 Micro Watersheds with a fund allocation of Rs.1,69,296/- lakhs. The projects are completed after seven (7) years of implementation in three (preparatory, work and consolidation) phases. The total geographical area of the three mega water sheds is 26,639 hectares. The Ganapavaram mega watershed project is located between latitude 81°15'31" and longitude 17°17'30" at ridge point and between latitude 81°15'59" and longitude 17°16'07" at valley point, Lakshmi Narayana Devi Peta mega

watershed project is located between latitude 81°31'41" and longitude 17°19'27" at ridge point and between latitude 81°31'34" and longitude 17°19'23" at valley point and Alliveru mega watershed project is located between latitude 81°20'15" and longitude 17°17'47" at ridge point and between latitude 81°19'53" and longitude 17°17'47" at valley point.

The main objective of the PMKSY-Watersheds is to improve water conservation, irrigation facility and land use pattern which would lead to an improved biophysical and socio-economic environment through increased agriculture productivity in rainfed areas. The benefits due to watershed development activities include improved crop yields, employment generation and augmentation of income of the project area's inhabitants. In the project areas, there is an increased focus on the sustainable use of water and other natural resources.

The main objective of the present study is to analyze the socio-economic impact of watershed based developmental interventions in Ganapavaram, Lakshmi Narayana Devi Peta and Alliveru water shed projects of West Godavari district, Andhra Pradesh. The socio-economic indicators viz. employment, migration from rural to urban areas, wage structure, drinking water supply and household income were studied for impact assessment of watershed interventions. The gross returns per annum of households based on the size of land holding of beneficiary farmers from farming, dairying and wage labour are calculated. The main reason for selecting the watersheds of Batch-V (2013-14) in West Godavari district isthe projects that have been completed, and the project period of treatment with various interventions.

2. MATERIALS AND METHODS

2.1 Sample Selection

Sample Households were randomly selected from the watershed community including OC, BC, SC, ST, and minorities, women-headed households, landless households, marginal, small and big farmers representing all hamlets/villages in each micro watershed.

2.2 Sample Size

The household survey covered 100% of mega project areas with five percent of total Households in each micro watershed. Out of 10,948 HHs in three projects, a total of 548 HHs (5%) are selected (Table 1).

2.3 Data Collection

The survey-based approach was adopted in the present study conducted in 2021 for data collection, comprising open-ended questionnaires. Two independent sets of questionnaires were used to collect data, which were developed by Monitoring, Evaluation Learning and Documentation (MEL&D) Agency as per the indications/parameters suggested by the State Level Nodal Agency (SLNA). Two questionnaires were prepared to find out changes that occurred due to the interventions implemented in the PMKSY watershed. Two participatory methods used in the data collection were survey and focused group discussions.

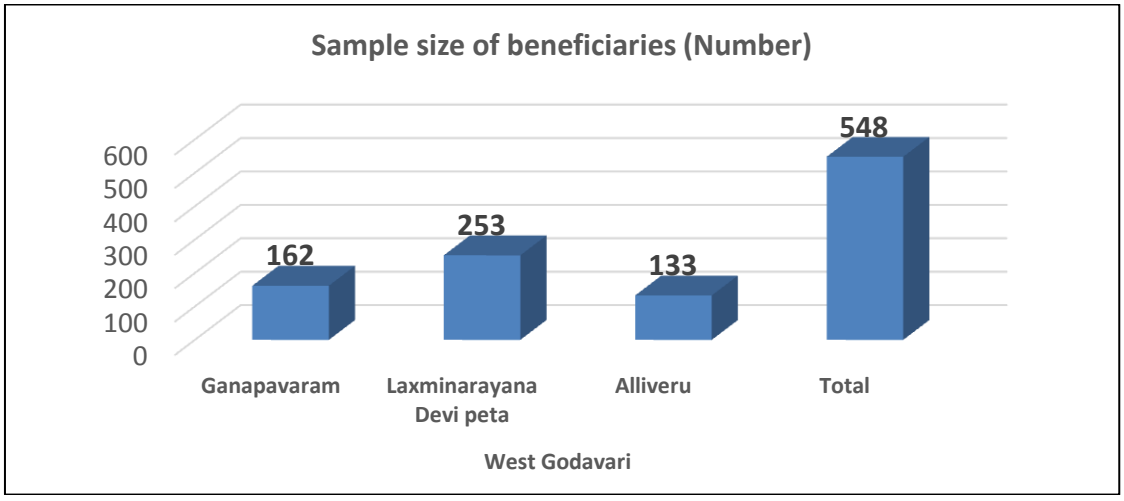

Fig. 1. Sample size distribution of beneficiaries in West of Godavari

Table 1. Sample design

Sl. No.	Name of Project	Number of the MWS covered	No. of households evaluated during the pre-project period	5% of households randomly assessed during the post-project period
1	Ganapavaram	3	3232	162
2	LND Peta	6	5059	253
3	Alliveru	5	2657	133
	Total	14	10948	548

Focused group discussions (FGDs) were conducted in all 14 micro watersheds of three (3) watershed projects with the support provided by the staff of respective micro watersheds. The participants in the discussion were Sarpanches, Members of Gram Panchayat, the Watershed Committee, User Groups, Village Organizations and Watershed Assistants. Wherever necessary, the support of RBKs (RytuBharosaKendras) was taken to improve the accuracy of the data. The opinion of the participants was collected on three main indicators/parameters viz. cropping pattern, yield and landholdings of selected House Hold before and after IWMP interventions through interaction in group discussions and transact walk in watershed areas as well as in the villages. Primary data was collected from five (5) percent sample households from the families in Detailed Project Report (DPR) for both pre and post-project periods. Primary information was recorded from respective Sarpanches, Members of Gram Panchayat, Watershed Committee, User Groups and Watershed Assistants. Secondary information was collected from the unpublished records of WCCs. The data thus collected was analyzed. The pre and post-project changes have been attributed to the impact of the interventions implemented during the project period. West Godavari District has been assigned the following three projects under Batch-V (2013-14) PMKSY-Watersheds.

2.4 Analytical Techniques and Methods

The present study used average and percentage techniques to study the impact of watershed development programs on socio-economic indicators viz. employment, migration from rural to urban areas, wage structure, drinking water supply and household income were studied for impact assessment of watershed interventions. The gross returns per annum of households based on the size of land holding of beneficiary farmers from farming, dairying and wage labour are calculated.

3. RESULTS AND DISCUSSION

The present study is focused mainly on the activities implemented under IWMP i.e., EPA, PSI and NRM works and their effect on the socio-economic impacts in the watershed area.

3.1 Activities Implemented under IWMP in West Godavari District, A.P

3.1.1 Entry point activities (EPAs)

Introducing watershed development programs to the community have always been recognized as an important activity for not only improving the natural resources but also for livelihood development. In Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) Projects, Entry Point Activities (EPA) are carried out to establish togetherness with the community and strengthen and sustain it throughout the program and beyond. The details of physical and financial achievements under the EPA component are detailed in Table 2. In the Ganapavaram project, 53 works under the Integrated Water Management Program (IWMP) are executed with an expenditure of Rs.22.03 lakhs, which is 3.91 percent of the project cost. Besides, 31 works are executed with an expenditure of Rs.23.34 lakhs, which is 4.31 percent of the project cost in the LND Peta project, 45 works are executed with an expenditure of 23.28 lakhs, which is 3.96 percent of the project cost in Alliveru project respectively. All 129 works under Integrated Water Management Program (IWMP) are executed with an expenditure of Rs.68.65lakhs, which is 4.06 percent of the project cost.

3.1.2 Natural Resource Management (NRM):

Natural Resource Management (NRM) is the major thrust area of the watershed program for the works such as land development, soil moisture conservation, water harvesting structures and afforestation etc. The details of physical and financial achievements under the

NRM component are detailed in Table 3. In the project of Ganapavaram 93 works under Integrated Water Management Program (IWMP) are executed with an expenditure of Rs.207.89 lakhs, which is 36.85 percent of the project cost. Besides 169 works are executed with an expenditure of Rs.291.00 lakhs, which is 53.79 percent of the project cost in the LNDPeta project 151 works are executed with an expenditure of 231.68 lakhs, which is 39.41 percent of the project cost in the Alliveru project respectively. All 413 works under Integrated Water Management Program (IWMP) are executed with an expenditure of 730.57 lakhs which is 43.15 percent of the project cost. Effective management of natural resources (soil, water and vegetation)supported by other interventions of the watershed project resulted in increased cultivation of agriculture and horticultural crops with enhanced productivity per unit area.

3.1.3 Production System Intervention (PSI)

Production System Intervention (PSI) activities to establish custom hire centers, provide implements and high-cost farm machinery to individual farmers, and supply micro-irrigation systems and water-carrying pipes. The details of physical and financial achievements under the PSI component are detailed in Table 4. In the project of Ganapavaram, 372 implements under the Integrated Water Management Program (IWMP) are executed with an expenditure of Rs.27.33 lakhs, which is 4.84 percent of the project cost. Besides 242 implements are executed with an expenditure of Rs.27.38 lakhs which is 5.06 percent of the project cost in the LNDPeta project 242 implements are executed with an expenditure of Rs.22.96 lakhs, which is 3.91 percent of the project cost in Alliveru project respectively. All 856 implements under Integrated Water Management Program (IWMP) are executed with an expenditure of Rs.77.67 lakhs which is 4.59 percent of the project cost. Effective management of natural resources (soil, water and vegetation) supported by other interventions of the watershed project resulted in increased cultivation of agriculture and horticultural crops with enhanced productivity per unit area.

3.2 Socio-economic Impact

The socio-economic status of the sample households regarding the social composition of their families, education, drinking water, household income, employment, wage structure, farm implements and assets across watersheds.

Table 2. Entry Point Activities (EPAs) Physical and Financial achievements

Sl. No.	Name of the project	Name of the Activity	Executed	
			Phy (No.)	Fin (Rs. Lakh)
1	**Ganapavaram**	Cattle/goat/sheep trough	24	4.77
		Extension of the pipeline for drinking water	1	0.59
		Glsr	1	1.91
		Installation of trevices	2	0.3
		OHSR	5	10.99
		RO plants	2	3
		School related like furniture,shed,buildingrepair,lab	18	0.47
		Total	**53**	**22.03**
2	**LNDPeta**	Cattle/goat/sheep trough	10	1.59
		Extension of the pipeline for drinking water	4	3.3
		Mini water tank	7	9.24
		RO plants	4	8.25
		School related like furniture,shed,buildingrepair,lab	6	0.96
		Total	**31**	**23.34**
3	**Alliveru**	Cattle/goat/sheep trough	19	3.85
		Extension of the pipeline for drinking water	3	2.2
		Glsr	1	2
		Ohsr	4	8.84
		RO plants	3	6
		School related like furniture, shed, building repair,lab	15	0.39
		Total	**45**	**23.28**
		Grand Total	**129**	**68.65**

Table 3. Natural Resource Management (NRM) Physical and Financial achievements

Sl. No.	Name of the activity	Ganapavaram		LND Peta		Alliveru	
		Expenditure		Expenditure		Expenditure	
		Phy (No.)	Fin (Rs.lakh)	Phy (No.)	Fin (Rs.lakh)	Phy (No.)	Fin (Rs.lakh)
1	**Land development works**						
	The threshing floor in community lands	0	0.00	4	5.13	0	0.00
	Total	**0**	**0.00**	**4**	**5.13**	**0**	**0.00**
2	**Soil moisture conservation works**						
	Staggered trenches(hillock areas)	0	0.00	1	0.38	0	0.00
	Water absorption trench at foothills	0	0.00	7	6.06	0	0.00
	Loose boulder structure	7	1.34	68	25.13	45	19.00
	Gabion smc	9	4.51	1	0.61	8	1.36
	Sandbag structures	0	0.00	1	0.18	0	0.00
	Total	**16**	**5.85**	**78**	**32.36**	**53**	**20.36**
3	**Water harvesting structures**						
	Farm pond	1	0.36	0	0.00	6	2.26
	Mini percolation tank	5	4.74	1	0.70	2	1.70
	Dugout pond	1	0.61	0	0.00	0	0.00
	Percolation tank	34	93.15	37	110.31	44	95.39
	Check dam	32	92.24	34	124.66	43	111.77
	Gabion whs	0	0.00	8	7.21	3	0.14
	Total	**73**	**191.10**	**80**	**242.88**	**98**	**211.26**
4	**Repairs to existing WHS**						
	Repairs to existing percolation tank	4	10.94	3	9.74	0	0.00
	Total	4	10.94	3	9.74	0	0.00
5	**Afforestation works**						
	Raising of Udyanavanam	0	0.00	0	0.00	0	0.06
	Total	**0**	**0.00**	**0**	**0.00**	**0**	**0.06**
6	**Livestock related works**						
	Cattle troughs	0	0.00	4	0.89	0	0.00
	Total	**0**	**0.00**	**4**	**0.89**	**0**	**0.00**
	Grand total	**93**	**207.89**	**169**	**291.00**	**151**	**231.68**
	Total Project area:	**14108 ha**					
	Total Project cost	**1692.96 Lakhs**					

3.2.1 Change in literacy status

Literacy status is an important consideration for evaluating the impact of the watershed development program. The information regarding the educational status of the farmers was obtained. The average illiteracy rate of selected respondents was 65.83% during the pre-project period and which was reduced to an extent of 42.75% at the end of the project period. At the same time, it was found an increase in primary, secondary and higher education among the beneficiaries due to increased income and awareness has motivated them to educate their child. Previously they do not have employment due to which all the members of the family had to earn. Now as employment is provided in the village itself with the help of agricultural and allied sectors, they can have more income. Thus the need to send the children to work is not very urgent. The beneficiaries send their children to the school. Hence it can be concluded that literacy hasa positive impact on the adoption of the watershed development program. The data is presented in (Table 5).

Table 4. Production System Improvement (PSI) Physical and Financial achievements

Sl. No.	Name of activity	Ganapavaram		LNDPeta		Alliveru	
		Physical (Beneficiaries)	Financial (Rs. in Lakhs)	Physical (Beneficiaries)	Financial(Rs. in Lakhs)	Physical (Beneficiaries)	Financial (Rs. in Lakhs)
1	**Diesel Engines**	82	16.41	99	18.09	71	14.85
2	**Sprayers**	92	3.64	38	1.45	69	2.73
3	**Tarpaulins**	165	2.35	60	0.99	72	1.29
4	**Water Carrying Pipes**	25	3.28	31	4.06	28	3.68
5	**Cultivators**	8	1.65	14	2.79	2	0.41
	Total	**372**	**27.33**	**242**	**27.38**	**242**	**22.96**

Table 5. Educational status – (Number)

Sl. No.	Name of the project	Pre-project				Total	Post project				
		Illiteracy	Primary	Secondary	And Above		Illiteracy	Primary	Secondary	And Above	Total
1	**Ganapavaram**	331	142	46	6	525	214	269	65	16	564
	%	63.05	27.05	8.76	1.14	100	37.94	47.7	11.52	2.84	100
2	**LNDPeta**	553	222	67	8	850	428	351	88	22	889
	%	65.06	26.12	7.88	0.94	100	48.14	39.48	9.9	2.47	100
3	**Alliveru**	368	128	26	5	527	216	257	66	15	554
	%	69.83	24.29	4.93	0.95	100	38.99	46.39	11.91	2.71	100
	Total	**1252**	**492**	**139**	**19**	**1902**	**858**	**877**	**219**	**53**	**2007**
	%	**65.83**	**25.87**	**7.31**	**1**	**100**	**42.75**	**43.7**	**10.91**	**2.64**	**100**

Table 6. Availability of drinking water (l/day)

Sl.No.	Name of Project	Pre-Project	Post Project	Increased	(%)
		l/day	l/day	l/day	
1	**Ganapavaram**	41838	52456	10618	25.38
2	**LNDPeta**	57425	72369	14944	26.02
3	**Alliveru**	34356	44256	9900	28.82
	Total	**133619**	**169081**	**35462**	**26.54**

3.2.2 Drinking water

The availability of safe and clean drinking water is necessary for a healthy life. An attempt was made to study the availability of clean drinking water to the beneficiaries. The drinking water supplies improved by 25.38% in the post-project period from 41,838 l/day to 52,456 l/day in the Ganapavaram project. Besides 26.02% in the post-project period from 57,425 l/day to 72,369 l/day in the LND Peta project, 28.82% in the post-project period from 34,356 to 44,256 l/day in Alliveru project respectively. In all, the drinking water supplies improved by 26.54% in the post-project period from 1,33,619 l/day to 1,69,081 l/day due to watershed interventions such as the creation of new water sources, installation of R.O. plants, laying of water supply pipes and mini water tanks which is adequate to meet the requirement of the population(Table 6) [2-7].

3.2.3 Gross income of households

The mean gross income of households increased by 58.65 percent from Rs.96,736/- to Rs.1,53,473/- at the end of the project period. The gross income based on the size of the land holding of beneficiary farmers is presented in Table 7. In all the annual household income of marginal farmers after the project period is Rs.95,511/- which is 66.42 percent higher than the pre-project period. The annual gross income of small farmers increased by 59.90 percent over the pre-project period raising to Rs.1,55,382/- and the gross income of large landholders increased by 55.72 percent over the pre-project period reaching Rs.2,55,591/- Theannual gross income of landless households from subsidiary activities like rearing of milch animals and wage income from agriculture and non-agricultural activities increased to Rs.1,07,406/- in the post-project period showing an increase of 57.38 percent [2-7].

3.2.4 Impact of employment

The number of person-days/yr/family in agriculture and non-agriculture-related activities during the project implementation period increased by 24.34% (31 person-days) and 19.71% (22 person days) respectively. The impact of watershed interventions was observed in the enhancement of employment opportunities in agriculture and non-agriculture employment due to increased agricultural activities, NRM works, PSIsupport activities and other line departments/schemes (Table 8) [2-7].

3.2.5 Wage structure

Wage earnings increased on an average by Rs.90/- (32.93%) per day for men from Rs.273/- to Rs.363/- and Rs.42/- (25.77%) per day for women from Rs.162/- to Rs.203/- during the project period. In lean months, these persons were engaged in NRM and MGNREGS works, where they received more wages compared to agricultural operations [6-7] (Table 9).

3.2.6 Impact on out-migration

The status of migration is one of the indicators of assessment of a rural development project. The increase in migration indicates the failure of the

Table 7. Gross income of households (Per anum)

Sl.No.	Name of the project	Pre-Project				
		Marginal	Small	Big	Landless	Average
1	**Ganapavaram**	57924	97256	160125	68456	95940
2	**LNDPeta**	58123	98145	165125	67158	97138
3	**Alliveru**	56125	96125	167147	69125	97131
	Average	57391	97175	164132	68246	96736
		Post-Project				
1	**Ganapavaram**	95123	154258	252125	107975	152370
2	**LNDPeta**	96145	156255	257895	106258	154138
3	**Alliveru**	95265	155632	256754	107985	153909
	Average	95511	155382	255591	107406	153473
		Increased (%)				
1	**Ganapavaram**	64.22	58.61	57.46	57.73	58.82
2	**LNDPeta**	65.42	59.21	56.18	58.22	58.68
3	**Alliveru**	69.74	61.91	53.61	56.22	58.46
	Average	66.42	59.9	55.72	57.38	58.65

Table 8. Employment in farm and non-farm activities in the study area (Man-days per year per household)

Sl. No.	Name of the project	Pre-Project		Post-Project		Increased man-days		Increased (%)	
		Ag	Non-Ag	Ag	Non-Ag	Ag	Non-Ag	Ag	Non-Ag
1	**Ganapavaram**	126	112	156	134	30	22	24	20
2	**LND Peta**	127	113	158	134	31	21	24	19
3	**Alliveru**	125	110	156	133	31	23	25	21
	Average	126	112	157	134	31	22	24.34	19.71

Table 9. Gender-wise wage structure in the study area (Rs. /Per day)

Sl.No.	Name of the project	Pre-Project		Post-Project		Increased		Increased (%)	
		Male	Female	Male	Female	Male	Female	Male	Female
1	**Ganapavaram**	275	160	360	200	85	40	30.91	25.00
2	**LND Peta**	275	165	370	210	95	45	34.55	27.27
3	**Alliveru**	270	160	360	200	90	40	33.33	25.00
	Average	**273**	**162**	**363**	**203**	**90**	**42**	**32.93**	**25.77**

Table 10. Reduction in migration from Rural to Urban area

Sl.No.	Name of the project	Pre-project	Post-project	Reduction in migration	%
1	**Ganapavaram**	35	24	11	31.43
2	**LNDPeta**	48	32	16	33.33
3	**Alliveru**	98	74	24	24.49
	Total	**181**	**130**	**51**	28.18

project in the project area and decrease shows the otherwise. Moreover, the migration status implies the level of drudgery amongst the respondents due to project activities intervention. In the study area, there is a reduction in migration from rural to urban areas to an extent ranging from 24.49% in Alliveru to a low of 33.33% LNDPeta during the project period. Earlier, the villagers used to go either to Hyderabad or Visakhapatnam in search of work and at present due to the creation of on-farm and off-farm employment in the project area people have slowly stopped migrating to other places (Table 10).

In Conclusion, the impacts of watershed management interventions were observed in the increase of cultivation area, expansion of water bodies, and better soil moisture in the profile.The water resources improved through soil and water conservation measures, groundwater recharge, and harvesting of rainwater. Higher crop and milk yields, and an increase in employment and wage rates helped in the reduction of migration and higher income to households in the watershed project. These positive outcomes ofthe successful implementation of the watershed program were translated into sustainable livelihoods [7].

3.2.7 Income from Different sources:

Generally, agriculture plays a major role in contributing to the income of a farmer. Similarly, in the study area also the major share of the total income during pre and post-periods of the project was from agriculture alone to the extent of 64.35% and 58.08% respectively followed by wages from agricultural crops, MGNREGS, watershed programs, horticulture etc. Another important feature noticed in the study area was the increase in the incomes from dairying and goat/sheep during the post-project compared to the pre-project period. This increase is due to the supply of milch animals and goats/sheep in the study area. The project also generated on-farm and off-farm employment in the form of petty business, construction works etc. Thus, the project played a major role in generating additional income for the households by not solely depending on agriculture but following the farming systems approach [7] (Table 11).

Table 11. Income from different source

Sl. No.	Name of Project	Pre-Project					Others	Total
		Agriculture	Wage Agriculture/ EGS/Watershed	Dairy	Livestock	Petty business		
1	**Ganapavaram**	64.25	22.53	5.45	1.78	2.54	3.45	100
2	**LNDPeta**	65.25	22.42	5.26	1.17	2.45	3.45	100
3	**Alliveru**	63.54	23.21	5.12	1.21	2.36	4.56	100
	Average	**64.35**	**22.72**	**5.28**	**1.39**	**2.45**	**3.82**	**100**
	Post-Project							
1	**Ganapavaram**	58.56	24.12	10.23	2.56	3.26	1.27	100
2	**LND Peta**	58.23	24.56	10.03	2.14	3	2.04	100
3	**Alliveru**	57.45	23.95	10.1	2.45	3.89	2.16	100
	Average	**58.08**	**24.21**	**10.12**	**2.38**	**3.38**	**1.82**	**100**

Table 12. Farm implements and machinery

Sl. No.	Name of Project	Pre-Project					
		Tractors	Sprayers	Cultivators	Ploughs	Oil Engines	Others
1	**Ganapavaram**	4	32	10	118	14	96
2	**LNDPeta**	8	65	16	156	31	105
3	**Alliveru**	5	38	25	115	13	89
	Total	**17**	**135**	**51**	**389**	**58**	**290**
	Post-Project						
1	**Ganapavaram**	12	79	18	61	46	26
2	**LNDPeta**	28	24	29	106	125	61
3	**Alliveru**	13	74	15	148	39	90
	Total	**53**	**177**	**62**	**315**	**210**	**177**

Table 13. Household assets

Sl. No.	Name of project	Pre-Project					
		Motor Cycle	Cycle	T.V.	Fridge	Washing Machine	Mobile
1	**Ganapavaram**	24	31	25	6	0	31
2	**LNDPeta**	65	102	46	12	0	61
3	**Alliveru**	21	34	22	6	0	28
	Total	**110**	**167**	**93**	**24**	**0**	**120**
		Post-Project					
1	**Ganapavaram**	36	22	72	27	5	168
2	**LNDPeta**	61	86	121	46	12	241
3	**Alliveru**	35	23	69	23	4	156
	Total	**132**	**131**	**262**	**96**	**21**	**565**

3.2.8 Farm implements and machinery

An increase from pre to post-project periods in the case of tractors, and cultivators and a marginal increase concerning oil engines was observed among the respondents during the survey periods because of the shortage in labour availability, high labour wages and adoption of mechanized technology. Moreover, there is a reduction in traditional implements like ploughs, sickles, crowbars etc., at the end of the project in both the watershed areas among the farming community. This is due to the impact of the implementation of the PMKSY-Watershed program in the selected watersheds due to the non-availability of labour and availability of subsidiesed farm implements and machinery with low cost compared with labour costthrough PSI component of the Watershed project [7] (Table 12).

3.2.9 Household assets

This includes owning motorcycles, cycles, TVs, Fridges, washing machines and mobiles which are useful in day-to-day work. Among these, some which are considered luxuries have now become necessities in the maintenance of a family. The possession of mobiles increased substantially at the end of the project almost every selected household is having a minimum of one or more irrespective of land holdings. Similarly, more than 68% of the respondents possess Televisions. There is a reduction in owning cycles and at the same time, an increase in motorcycles was observed. This shows an increase in the standard of living from pre to post-periods among the respondents. This change could be due to an increase in incomes derived from the infrastructure created by the watershed staff in the selected region in the form of agricultural income, dairying, labour wages, etc. (Table 13).

4. CONCLUSION

Several socio-economic indicators including changes in Literacy, drinking water, household assets and income, employment generation, out-migration, etc. were considered in the present study for assessing the impact of watershed development programs on the beneficiary households. The Batch–V PMKSY watershed programs have shown a positive impact on socio-economic indicators in the West Godavari district of Andhra Pradesh due to sustainable developmental activities taken up during the project period. The study concludes that after the watershed program, the beneficiaries can take more than a single crop on the same piece of land due to the availability of water. Hence for the farmers, there is work in the field throughout the year. Along with agriculture, they have started allied economic activities which have positively resulted in increased income. The study states that the watershed development program not only helps in the improvement of soil and water conservation but also helps in the development of the beneficiaries socially and economically. The overall findings of the study suggest that the watershed development program has significantly leads to a positive change in their income, and other basic infrastructural facilities like availability of drinking water, availability of electricity etc.

Due to the PMKSY water shed programs, the economic as well as their social status has also changed. The decision-making power, participation in public activities and awareness about the current schemes and policies of the government have also improved. The impact of the watershed development program can also be seen in that the confidence of the beneficiaries has increased so that they can take the risk and start any kind of business. The literacy status of the beneficiaries also changed positively. The

overall conclusion of the watershed development program can be stated as it has touched almost every part of the beneficiary's life and has leads to the desired change in the socio-economic parameter of their life.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

REFERENCES

1. Government of India. 49th Report of Standing Committee on Rural Development (for 2017-18 submitted to Lok Sabha), Ministry of Rural Development (Department of Land Resources); 2018.
2. Govind Bate RK, Babu Singh. Socio-economic Impact of Watershed Development in Kanpur. Agricultural Economics Research Review. 2004;17:125-130.
3. Kuppannan Palanisami, Suresh Kumar. Impacts of watershed development programmes: experiences and evidences from Tamil Nadu. Agricultural Economics Research Review. 2009;22:387-396.
4. Biswajit Mondal, Alka Singh, Girish Kumar Jhaand, Kalra BS. Socio-Economic Impact of Watershed Development Programmes in Bundelkhand region of Madhya Pradesh, India. International Journal of Agriculture and Statical Science. 2014; 10(1):181-187.
5. Reena, Manoj Siwach, Abhey Singh. Impact of watershed development programmes on livelihood conditions of farmers in Haryana. Journal of Rural Development. 2019;38(1):144-170.
6. Arcana O Tripathi, Jahagirdar DV, Anurag V Tiwari. Socio-economic Impact of NABARD supported by Watershed Development in Amravati District. Agro Economist-An International Journal. 2020;7(1):63-70.
7. Venkataram Muni Reddy P, Kona Sasidhar, Reddy CP, Sagar Kumar Reddy RV, Janardhan Reddy B, Shilpa Deshpande. Resuscitating ecological balance in Palnadu District watershed development programme using micro-watershed approach. International Journal of Environment and Climate Change. 2022;12(12):1547-1560.

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