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IMPACT OF WATERSHED INTERVENTION TECHNOLOGY ON AGRICULTURAL FARM HOUSEHOLDS – AN APPLICATION OF ECONOMIC SURPLUS MODEL

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ABSTRACT

Watershed Intervention Technology (WIT) is a composite approach to an efficient use of land and water resources so as to get optimum production from them and also to preserve the soil from deterioration and future utility (Ministry of Water Resources,2010). Watershed development structures play a significant role in groundwater recharge. These structures enhance soil moisture regime, enrich soil fertility and thereby promote ecological balance through conservation of eco system. The International Water Management Institute (IWMI) forecasts that by the year 2025, 33 per cent of India's population will live under absolute water scarcity condition. Further the World Bank estimates that by the year 2025, one person in three, i.e, 3.25 billion people in 52 countries will live under conditions of water shortage. Watershed development is gaining momentum and the farmers adopt various watershed intervention technologies for their farm activities. Hence this study is an attempt to assess how the watershed intervention technology is carried out in selected blocks in Coimbatore district. To evaluate the impact of watershed intervention technology on the economic welfare of the farm households. The model is based on the Marshallian theory of economic surplus (demand and supply). The study established that with WIT the farmers as 'producers' realise 'surplus' compared to farmers as 'consumers', leading to socio economic upliftment of the farmers. Further the study reveals that participatory watershed management could be a viable strategy of rural development for achieving sustainable rural livelihoods in India.

Keywords: WIT, Economic Surplus Method

INTRODUCTION:

Watershed Intervention Technology (WIT) is a composite approach to an efficient use of land and water resources so as to get optimum production from them and also to preserve the soil from deterioration and future utility (Ministry of Water Resources,2010). Watershed development structures play a significant role in groundwater recharge. These structures enhance soil moisture regime, enrich soil fertility and thereby promote ecological balance through conservation of eco system. Rain fed agriculture in India is characterised by low productivity, degraded natural resources and widespread poverty, most of the millions of people living in our country depend on agriculture and natural resource management for their livelihoods watershed has become an acceptable unit for planning soil and water resources conservation. The rain fed agriculture mainly depends upon receipt of adequate rainfall that should be evenly distributed. Even if normal rainfall is received, rainwater should be conserved most effectively (Palanisami, et al., 2006). It directly leads to improved utilization of the rainfall and crop drainage, stabilization of the area under cultivation and increased production, reducing flooding and water-logging, reducing soil erosion, increased agricultural productivity and augmenting and facilitating dependable water supply for domestic and industrial uses.

Besides, indirect benefits such as control of sedimentation of reservoirs, prevention of flooding of downstream areas involving houses, villages, agricultural lands, increased availability of food and non-food crops to the society due to enhanced production and productivity, improved quality of life in rural area on account of employment generation and income, prevention of environment degradation and soil erosion, scientific use of water between irrigated crops and rain fed crops, prevention of rural exodus to urban centres, and increased income, cash flow to the farmers and agricultural labourers also would result from watershed development programmes (Palanisami, et.al, 2008).

The International Water Management Institute (IWMI) forecasts that by the year 2025, 33 per cent of India's population will live under absolute water scarcity condition. Further the World Bank estimates that by the year 2025, one person in three, i.e, 3.25 billion people in 52 countries will live under conditions of water shortage. Water is mainly used for (i) domestic consumption, (ii) agricultural production (iii) irrigation and (iv) for industrial production. Competition among agriculture, industry and cities for limited supply of water is constraining the development efforts. The statistics on water use by different sectors in India reveals that 82 per cent of water is used for irrigation, 10 per cent for domestic purposes and 8 per cent for industrial activities. With the rise in population, the demand for water has been increasing on all fronts throughout the world. Agriculture has been the single largest user of water, especially in the developing countries. In the Indian context, the projections made by the National Commission for Integrated Water Resource Development Plan indicate that water requirements for the irrigation sector would rise by more than 50 per cent by 2050 when compared to the level in 2000. It was estimated that by 2050, India's population would be between 1349 million and 1980 million (United Nations Report, 2010). In India the food grain availability is at present around 525 grams per capita per day, whereas the corresponding figures in China and USA are 980 grams and 2850 grams respectively. Assuming the same level of consumption, which although is supposed to rise with improvement in economy and resultant higher standard of living, the annual food grain requirement will be about 315 million tonnes . If small raise is made in per capita consumption to 650 grams, the food grain requirement will be about 390 million tonnes. Taking the projection of about 1800 million by 2050 AD as reasonable, it would require about 430 MT of good grains annually at the present level of consumption, (Ministry of Agriculture, 2010).

The population cannot be contained and the requirement of water may go up. It was also shown that for lower population estimate of 1350 million, the water requirement is only 973 km^3/ year well within the estimated utilizable water resource of 1122 km^3/year (surface water 690 km^3 + groundwater 423 km^3). Therefore it is necessary that a significant national effort has to be devoted to limit the population growth and further India as a nation has to initiate action on all fronts for developing its water resources. The priority of action, however, must be for rain water harvesting and groundwater recharge. Hence watershed intervention technology has the added relevance to conserve the scarce water resources and sustain the cultivation of crops (Sreedhar et.al. 2007). All these factors warranted a judicious use of ground water which is essential for livelihood. In this context, watershed development is gaining momentum and the farmers adopt various watershed intervention technologies for their farm activities. Hence this study is an attempt to assess how the watershed intervention technology is carried out in selected blocks in Coimbatore district.

REVIEW OF LITERATURE:

The literature pertaining to the current study discussed here. Thamodaran, R, et al., (1982) made an analysis of water management systems in southern Tamil Nadu. The major objectives of the study were (1) to investigate the economic feasibility of the concrete and silt systems compared to the existing traditional field situation, (2) to investigate the nature of production function relationships for paddy and banana crops under different water management systems and to compare the productivity of resources such as fertilizer, irrigation, and labour among systems, (3) to investigate whether there was any technological break-through in production function relationship, if so, whether it was factor-neutral or biased and (4) to obtain the profit maximizing combination of systems for small, medium or large farms under existing resources-production constraints and also for alternative expected resources scenarios. The study pointed that both concrete and silt systems were economically feasible in the agro-climatic situation. The silt system was more profitable. The technological change in production relationships for paddy and banana was neutral. Under the existing resource constraints a farmer could bring all the land into the silt system with banana as the major crop to maximize profits. If there was any significant and favourable change in water prices or availability of water, a concrete system would be a competitive alternative to the silt system.

Souvik Ghosh, et.al (2004) analysed the "Participatory Water Management for Suitable Development in the Coastal Belt Area of Orissa". The study reported farmers' participation was essential to make any programme sustainable. Participation of farmers by paying a portion of the cost of water resources development had provided them a kind of ownership rights. The groups of farmers have cultivated different crops irrigating them from created water resources. The irrigated area had increased about five times resulting into increased cropping intensity. The positive impact was realized with increase in productivity and income.

Swarn Lata Arya and Samra (1994) analysed Haryana's experience with four selected watershed development projects- Sukomajri, Bunga,Chowki and Tibbi. The paper tried to identify the determinant's of people's participation in them and drawing lessons useful for securing people's involvement in watershed development and management programmes. The paper revealed that farmers were not interested in long- terms gains from any project and were not willing to sacrifice especially if they were living on the margin of subsistence. Only with increased productivity of crops and increased milk yields resulting from supplemental irrigation made possible by the reservoir water the villagers would be ready to invest in the soil and watershed intervention technology and to participate in the programme.

Sivanappan, R.K. (2007) in his article on "The Impact of Farm Ponds" suggested that governments and international agencies should pay more attention and sanction substantial amount for land development works (soil and water conservation and water harvesting) in the dry lands and waste lands to increase agricultural production for food security at least in the coming years. Further, due to rapidly progressive loss of land and water resources by erosion, urgent action was needed. The study observed that people's participation was very essential in soil conservation and water harvesting works and also to increase production from the rain fed lands. Above all, there was an urgent need for establishing effective co-ordination and co-operation in the fields of research, training and exchange of experiences. The author suggested to have intensive research on;

- Optimising production with limited water supply.
- Reducing cash inputs.
- Refinement of the technology for water harvesting, storage and efficient use of stored water.
- Developing drought resistant and high yielding crop varieties.
- Development of dry lands on watershed basis. Developing energy efficient and low cost irrigation method.
- Cheap/cost-effective soil and water conservation structures.

Souvik Ghosh, et al., (2008), analysed watershed programmes in Gujarat state. The authors stated that farmers' participation was essential to make any programme sustainable. Participation of farmer paying 40 per cent of the cost of water harvesting structures in the year 2005 and 67 per cent of the cost in the year 2006 gave them the ownership feeling and they do not take it as government donation or work. Farmer's paying capacity was increased from the system to make it more sustainable. Since participatory development and management of water resources had successful with resource poor farmers of coastal waterlogged area, it would also work in all similar areas. The groups of farmers have cultivated different crops irrigating from created water resources. The irrigated area had been increased about five times resulting into increased cropping intensity. The positive impact had been realized through the increase of productivity and income. That gives a new insight for development of small-scale water resources in risk prone waterlogged coastal areas to enhance the farm productivity and empower the weaker, socially and economically poor, small and marginal farmers.

METHODOLOGY:

Out of 385 blocks in Tamil Nadu,180 blocks have almost exploited the potential and out of the 1.8 million wells in state about 12 per cent are dried up or abandoned due to ground water over-exploitation (Government of TamilNadu,2003). Out of the 31 districts in the state, 9 districts are (Coimbatore, Dharmapuri, Madurai, Ramanathapuram, Salem, Trichy, Tirupur, Tirunelveli and Kanyakumari) identified as ground water over exploited. Among the 9 districts, ground water exploitation is more pronounced in Coimbatore district. Hence Coimbatore district was chosen for the study. Coimbatore district lies between 10"-10' and 11"-30' northern latitude and 76"-40' and 77"-30' eastern longitude. The geographic area of the district is 7,47,079 hectares, of which, the net sown area is 314957.62 hectares, forests accounted for 158803.00 hectares, barren and uncultivable lands account for 7643.53 hectares, land put to non-agricultural uses is 106025.24 hectares, 13996.74 hectares are cultivable waste, permanent pastures and other grazing land account for 85.03 hectares, 3383.10 hectares are grooves and included in the area sown, 84524.14 hectares are current fallow land and 57840.60 hectares are other fallow land (District profile 2008-2009). The total gross irrigated area of the district in 1,87,266 hectares, of which, the net area irrigated was 1,77,383 hectares, private canals account for 664 hectares, tanks account for 555.43 hectares and other wells contribute to 96356.54 hectares. (Department of Statistics and Economics, Government of Tamil Nadu, 2007-2008).

For the study, using stratified sampling technique Thondamuthur and Periyanaickenpalayam blocks in Coimbatore district in which groundwater was over exploited were selected. From these two blocks, the farmers systematic who satisfy the following criteria were selected; the chosen farm households must be adopting WIT only from 2009-10. As this is an impact assessment study, impact of WIT on these farm households was assessed by making a 'before and after' approach; i.e.; before the adoption of WIT in 2008-09 and after the adoption of WIT in 2009-10. From each block 250 farm households making a total of 500 farm households were selected using systematic sampling technique. Data collection was carried out by administering a pretested interview schedule to the sample farm households during August to December 2010.

APPLICATION OF ECONOMIC SURPLUS METHOD TO WATERSHED EVALUATION:

Watershed programmes play a dual role of safeguarding the interest of the producers as well as consumers, as in several locations, the drought-proofing aspects of the watershed programmes are easily felt (Palanisami and Suresh Kumar, 2007). In the case of producers, they can change the crop pattern due to increased water levels in their wells, moisture conservation in the soil, increase water use for the existing crops, increase the number of livestock and fodder production. There is also a change in the cost of production of the commodities in the watershed. Over the years, there is an increase in technology adoption due to watersheds programmes. In the case of consumers, the increased crop production in the watershed results in availability of produce at lower prices. Consumption levels also get increased among the consumers. Labour employment is increased due to increased land and crop production and processing activities in the watershed. Hence, for the purpose of the analysed, it was assumed that, the output supply curve shifts gradually over time when the benefits from the watershed development activities start benefitting the agricultural sector through water resource enhancement. The supply shift factor due to technological change, in our case, watershed intervention, is known as K. this factor varies in the time depending on the dynamics of the rainfall, adoption, dissemination of soil and moisture conservation technologies and maintenance activities undertaken in the watershed. The supply shift factor (K) can be interpreted as a reduction of absolute costs for each production level, or as an increase in production for each price level (Libardo et al., 1999).

Micro economic theory defines consumer surplus (individual or aggregated) as the area under the (individual or aggregated) demand curve and above a horizontal line at the actual price (in the aggregated case: the equilibrium price). Following IEG, World bank, 2008, the demand curve is assumed to be log-linear with constant elasticity. Thus, the demand equation for this demand function can be written as:

$$P = g\,Q^{\eta} \quad \ldots\ldots\ldots\ldots (2)$$

Where, ŋ is the elasticity and g is a constant. Once, the parameters ŋ and g are estimated, then consumer surplus could be estimated by Equation (3):

$$CS = \int_{Q_o}^{Q_1} gQ^{\eta}\, dQ - (Q_1 - Q_o)\, P_1 \ldots\ldots\ldots\ldots (3)$$

Combined, the consumer surplus and the producer surplus make up the total surplus.

ESTIMATION OF BENEFITS:

Following the theory of demand and supply equilibrium, economic surplus (benefits) as a result of watershed development intervention is measured by equation

$$B= K * P_0 * A_0 * Y_0 * (1 + 0.5 Z * \varepsilon_d) \quad \text{.........................(4)}$$

Where, K is the supply shift due to watershed intervention.

$$K= \nabla * p * \Psi * \Omega \text{ ....(5).}$$

The supply shift due to watershed intervention can be mathematically represented by the equation (5):
Where, k represents the vertical shift of supply due to intervention of watershed of watershed development technologies and is expressed as a proportion of initial price. is the net cost change which is defined as the difference between reduction in marginal cost and reduction in unit cost. The reduction in marginal cost is defined as the ratio of relative change in yield to price elasticity of supply (ε_s). Reduction in unit cost is defined the ratio of change in cost of inputs per hectare to (1+ change in yield). *p* is the probability of success in watershed development implementation. Psi represents adoption rate of technologies and Ω is the depreciation rate of technologies.
Z represents the change in price due to watershed interventions. Mathematically, Z can be defined by equation (6):

$$Z = K * \frac{\varepsilon_s}{(\varepsilon_d + \varepsilon_s)} \quad \text{............................(6)}$$

Where, p_0, A_0 and Y_0 represent prices of output, area and yield of different crops in the watershed before implementation of watershed development programme. If we use the 'before' and 'after' approach, then these represent area, yield and price of crops in control village. Change in consumer surplus was calculated as

$$\Delta CS= P_0 Q_0 z (1+0.5 Z_\eta)$$

Change in producer surplus was calculated as

$$\Delta PS= P_0 Q_0 (K-Z) (1+0.5 Z_\eta).$$

And change in total or economic surplus was calculated as

$$\Delta TS= \Delta CS+ \Delta PS = P_0 Q_0 K (1+0.5 Z_\eta).$$

ECONOMIC SURPLUS MODEL:

To evaluate the impact of watershed intervention technology on the economic welfare of the farm households (Moore et al., 2000, Maredia et al., Swinton 2002 and Wader et al., 2004) the Economic Surplus Approach is widely used (Palanisami, K. et. al., 2009). The model is based on the Marshallian theory of economic surplus (demand and supply).
The advantage of the economic surplus approach lies in the fact that the distribution of benefits to different segments of the society could be estimated. The watershed development could be treated as a 'public good' and covers both the private and public lands. Moreover, the benefits due to watershed development activities are not restricted to the producers alone. Increased supply and hence changes in price of the agricultural products will also benefit the consumers positively. The economic surplus approach captures the impact of watershed development activities in a holistic manner (Palanisami et.al, 2009).
The supply curve equation is calculated as

$$S_o = c (P_o - P_{io})^d \quad \text{.....................(1)}$$

Where, S_o = initial supply before watershed intervention technology.
C&d = constants
P_o = price of product and
P_{io} = maximum price that producers are willing to offer.

The demand equation written as

$$P = gQ^\eta \quad \text{.........................(2)}$$

Where, η is the elasticity and g is a constant. Once the parameters η and g are estimated then the consumer surplus could be estimated by equation (3).

$$CS = \int_{Q_0}^{Q_1} gQ^{\eta}\, dQ - (Q_1 - Q_0) P_1 \quad \ldots\ldots\ldots\ldots\ (3)$$

Combined, the consumer surplus and the producer surplus make up the total surplus (economic surplus).
In the selected blocks, the impact of watershed intervention technology on crop yields and cost were estimated and are presented in the following table 1.

Table – 1: Impact of Watershed Intervention Technlogy on Yield and Cost in The Selected Blocks

Crops	Change in yield(%)	Reduction in marginal cost(%) C_m	Reduction in unit cost(%)C_u	Net cost change (%) C_m-C_u= ΔC_n
		Thondamuthur		
Paddy	29.41	32.6	4.4	28.2
Banana	23.45	35.2	2.5	32.7
Coconut	22.72	29.8	7.8	22.0
Maize	12.05	11.3	0.6	10.7
Cash crops	8.19	6.4	1	5.4
F,F&V	4.62	2 3	0.5	1.8
Cereals	22.92	35.4	3.3	32.1
Onion	7.61	76.8	11.6	65.2
Pulses	-	-	-	-
Oil seeds	-	-	-	-
All	**29.67**	**25.4**	**3.2**	**22.2**
		Periyanaickenpalayam		
Paddy	18.01	24.8	4.5	20.3
Banana	29.21	37.3	2.8	34.5
Coconut	20.21	26.8	6.8	20.0
Maize	40.86	42.3	2.2	40.1
Cash crops	35.42	24.0	0.4	23.6
F,F&V	11.76	8.2	4.8	3.4
Cereals	61.54	63.4	5.2	58.2
Pulses	-	-	-	-
Oil seeds	-	-	-	-
All	**31.29**	**27**	**2**	**25**

Source: calculations based on Field Survey, 2009, SF- Small Farmers, MF – Medium Farmers, LF – Large Farmers, FF&V – Fruits, Flowers and Vegetables.. Cash Crops – sugar cane, arecanut, cotton, Fruits, Flowers and Vegetables – grapes, guava, sappota, mango, jasmine, rose& brinjal, tomato, ladies finger, chillies, Cereals – cholam, Cumbu, ragi, Pulses – Bengal gram, green gram and red gram, oilseeds – groundnut, gingelly, sunflower.

To find out the net cost change, first reduction in marginal cost C_m and then reduction in unit cost C_u were calculated using the following formulae,

$$\text{Reduction in marginal cost } C_m = \frac{\text{Relative change in yield}}{\text{Price elasticity of supply } (\varepsilon_s)}$$

$$\text{Reduction in unit cost } C_u = \frac{\text{Change in costs of inputs per hectare } (C_i)}{1+ \text{change in yield}}$$

$$\text{Net cost change } \Delta C_n = C_m - C_u$$

Taking all the crops together, In the Thondamuthur block the change in the yield due to watershed intervention technology across crops varied from 7.61 per cent for onion to 29.41 per cent for paddy. Reduction in marginal cost due to supply shift ranged from 2.3 per cent in fruits, flowers and vegetables to 76.8 per cent in onion.

Reduction in marginal cost was the ratio of relative change in yield to price elasticity of supply. Net cost change varied from 1.8 per cent in fruits, flowers and vegetables to 65.2 per cent in onion. In the case of Periyanaickenpalayam block the change in yield due to water shed intervention technology across the crop varied from 11.76 per cent in fruits, flowers and vegetables to 61.54 per cent in cereals. It was maximum change in the yield due to watershed intervention technology. Reduction in marginal cost due to supply shift ranged from 8.2 per cent in fruits, flowers and vegetables to 63.4 per cent in cereals. Net cost changed varied from 3.4 per cent in fruits, flowers and vegetables to 58.2 per cent in cereals.

The economic surplus was calculated for ten major crops cultivated in the two study blocks. The ten crops selected for calculation are paddy, banana, coconut, maize, cash crops, fruits, flowers and vegetables, pulses, cereals, onion and oil seeds. The estimated total surplus due to watershed intervention technology was presented in the following tables 2 and 3 for the selected major crops produced by the farmers. In the Thondamuthur block, the calculated economic surplus exceeded `. 3,00,000 for all the crops excepting for the cash crops. Being the major rain fed crops, these nine crops benefited from the implementation of the watershed intervention technology. Even the cash crops also registered an economic surplus `.5,708. The higher economic surplus was realized from banana. The change in economic surplus due to watershed intervention technology was decomposed into change in "consumer surplus" and change in "producer surplus". It was evident that the producer surplus was higher than the consumer surplus for all the crops excepting for cereals.

Table- 2: Impact of Watershed Intervention Technology and Economic Surplus in the Thondamuthur Block

(in Rupees)

Crops	Change in economic Surplus (ΔTS)	Change in consumer surplus (ΔCS)	Change in producer surplus (ΔPS)
Paddy	619542 (100.00)	287123 (46.35)	332419 (53.65)
Banana	6189118 (100.00)	2498834 (40.37)	3690284 (59.63)
Coconut	3897720 (100.00)	1414746 (36.3)	2482974 (63.7)
Maize	416388 (100.00)	186900 (44.89)	229488 (55.11)
Cash crops	5708 (100.00)	16809 (29.49)	40209 (70.51)
F,F&V	415152 (100.00)	139239 (33.54)	275913 (66.46)
Cereals	349440 (100.00)	217280 (62.18)	132160 (37.82)
Onion	917168 (100.00)	224200 (24.44)	692968 (75.56)
Pulses	952070 (100.00)	329035 (34.56)	623035 (65.44)
Oil seeds	355500 (100.00)	143100 (40.25)	212400 (59.75)

Source: calculations based on Field Survey, 2009, SF- Small Farmers, MF – Medium Farmers, LF – Large Farmers, FF&V – Fruits, Flowers and Vegetables.. Cash Crops – sugar cane, arecanut, cotton, Fruits, Flowers and Vegetables –grapes, guava, sappota, mango, jasmine, rose& brinjal, tomato, ladys finger, chillies, Cereals – cholam, cumbu, ragi, Pulses – Bengal gram, green gram and red gram, oilseeds – groundnut, gingelly, sunflower.

The producer's surplus was high for onion which was worked out to be 75.56 per cent. The estimated producers' surplus exceeded 60 per cent for coconut, cash crops, fruits, flowers and vegetables, onion and pulses.

Table- 3: Impact of Watershed Intervention Technology and Economic Surplus in Periyanaickenpalayam Block

(in Rupees)

Crops	Change in economic Surplus (ΔTS)	Change in consumer surplus (ΔCS)	Change in producer surplus (ΔPS)
Paddy	596560 (100.00)	201680 (50.86)	194880 (49.14)
Banana	6296400 (100.00)	1449150 (23.02)	4847250 (76.98)
Coconut	4164420 (100.00)	1389622 (33.37)	2774798 (66.63)
Maize	559152 (100.00)	247016 (44.18)	312136 (55.82)
cash crops	104328 (100.00)	28620 (27.43)	75708 (72.57)
FF & V	1034153 (100.00)	266246 (25.75)	767907 (74.25)
Cereals	142443 (100.00)	78948 (55.22)	63495 (44.58)
Pulses	840192 (100.00)	411264 (48.95)	428928 (51.05)
Oilseeds	308880 (100.00)	155012 (50.19)	153868 (49.81)

Source: calculations based on Field Survey, 2009, SF- Small Farmers, MF – Medium Farmers, LF – Large Farmers, FF&V – Fruits, Flowers and Vegetables.. Cash Crops – sugar cane, arecanut, cotton, Fruits, Flowers and Vegetables –grapes, guava, sappota, mango, jasmine, rose& brinjal, tomato, ladies finger, chillies, Cereals – cholam, cumbu, ragi, Pulses – Bengal gram, green gram and red gram, oilseeds – groundnut, gingelly, sunflower.

In the case of Periyanaickenpalayam block this trend was different. The change in economic surplus far exceeded ` 3,00,000 for banana, coconut, fruits, flowers and vegetables, pulses, maize, paddy and oilseeds. Being the major rain fed crops, these crops benefited from the application of the watershed intervention technology. It was evident that the producer surplus was higher than the consumer surplus for banana (76.98 per cent), fruits, flowers and vegetables (74.25 per cent), cash crops (72.57 per cent), coconut (66.63), maize (55.82 per cent) and pulses (51.05 per cent). But for the crops like, cereals, paddy and oilseeds the consumer surplus exceeded the producer surplus.

`The analysis reveals that

★ The producers' surplus exceeded that of the consumer surplus for most of the crops.

★ The farmers as producers benefit from watershed intervention technology.

Thakur, D. et.al (2000), observed that the impact of irrigation was viable in terms of notable increase in the yields of all the crops and that increase was found higher in commercial crops (vegetables). Per farm production and marketable / marketed surplus of food grains after the project was quite higher than before the projects installation. Similarly, the production and market surplus of vegetables (Kharif and rabi) had shown about two to three fold increase after the watershed project.

CONCLUSION:

Watershed development and management, rather a multi-disciplinary activity represents a dynamic strategy, which was much more multifaceted than mere soil and water conservation Dhruvanarayana, et.al (1987) rightly endorsed that watershed management was a holistic approach aimed at optimizing the use of land, water, vegetation and all associated components in an area which could alleviate drought, moderate floods, prevent soil erosion, improve water availability, increase fuel, fodder and agricultural production on a sustainable basis. It was proved that water harvesting structures play a complimentary role in augmenting yield and age and life of wells. Hence, a large proportion of water harvesting structures preferably must be located closer to cultivated lands, to realize greater economic impact on irrigated farms. The study established that with WIT the farmers as 'producers' realise 'surplus' compared to farmers as 'consumers', leading to socio economic upliftment of the farmers. Further the study reveals that participatory watershed management could be a viable strategy of rural development for achieving sustainable rural livelihoods in India.

REFERENCES:

[1] Adhikari, R.N., Singh, A.K., Math, S.K.N., Mishra, P.K., and Reddy, K.K. (2008), "Response of Water Harvesting Structures on Groundwater Recharge Process in Red soil of Semi Arid Region of Andhra Pradesh," Journal of Indian Water Resources Society ,Vol.28, No:2, Pp.1-5.

[2] Government of India (2006), "Report of the Working Group on Water Resources for the XI Five Year Plan (2007-2012). New Delhi: Ministry of Water Resources, Government of India.

[3] Mahnot, S.C, Singh, P.K and Yogesh Sharma (1992) "Socio-Economic Evaluation of watershed Management Project – A Case Study", Journal of Rural Development, Vol: 11, No:2, Pp. 219-227.

[4] Ministry of Water Resources (2010), Government of India.

[5] Narayanamoorthy, A. (1995) "Status of Indian Irrigation", Man and Development, Vol : XVII, No: 4, Pp. 49-56.

[6] Pacheco, D., Lynam, J.K. and Jones, P.G (1987) "The Distribution of Benefits From Technical Change among Class of Consumers and Producers; an ex-ante analysis of beans in Brazil. Research policy, 16; Pp. 279-285.

[7] Pachuri,R.K. (2008) "Impact on agriculture and Water Resources", Indian Farming, Vol.52, Pp.15-16.

[8] Palanisami .k and Suresh kumar .D (2009), "Impacts of Watershed Development Programmes: Experiences and Evidences from Tamil Nadu", Agricultural Economic Research Review, Vol:22, No:45, Pp. 387-396.

[9] Palanisami, K. Ramasamy, C. and Cheiko Umetsu (2008), "Groundwater Management Policies", Macmillan India Limited, Delhi.

[10] Paudal, G.S. (1998), "Approaches to Watershed Management in Developing Countries", AJT Special Study, Bangkok, Thailand.

[11] Saleth, R. Maria (1996), "Water Institutions in India: Economics, Law and Policy", Commonwealth Publishers, New Delhi.

[12] Sivanappan, R.K. (2007) "Water Harvesting and Conservation for increasing Production in Dry lands on Watershed basis", Financing agriculture an in-house Journal of Agricultural Finance Corporation Ltd., Vol:32, Pp. 36-43.

[13] Souvik Ghosh, RavenderSingh, D.K. Kundu and Ashwani Kumar (2008) "Farmers participation in irrigation management", Journal of Rural Development, Vol.27, No.2, Pp. 231-244.

[14] Swarn Lata Arya and Samra, J.S. (1994), " Determinants of People's Participation in Watershed Development and Management – An exploratory case study in Shiwalik Foothill Villages in Haryana", Journal of Rural Development, Vol: 13, No: 3, Pp.411-422.

[15] Thamodaran, R. Bhide, S. and Heady, E.O. (1982), " An Economic analysis of Water Management Systems in Southern TamilNadu – Production Function and Programming Approach", Indian Journal of Agricultural Economics, Vol : 37, No: 1, Pp.43-56.

[16] Thakur, D.R. Thakur, D.C. and Saini, A.S. (2008) "Impact of Irrigation on Farm Production of sample farmers in Himachal Pradesh", Agriculture Situation in India, Vol: LVII, No, 8, Pp. 447-452.

[17] Upadhyaya, A. Singh, A.K. and Sikka, A.K. (2007) "Integrated water Management for Waterlogged Command Areas" International journal of Tropical Agriculture, Vol.25,No.1-2 , Pp.175-187.
