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Minor Irrigation and Farm Income: An Empirical Study

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Abstract

Irrigation is defined as "Artificially supplying and systematically dividing of water for agriculture and horticulture in order to obtain higher or qualitatively better production and higher farm income. Water is essential to plant growth & for millenniums. The paper is an attempt to study the impact if Minor Irrigation on Farm Income of different categories of farmers. The survey of literature found that there are no empirical studies on above mentioned topic. In order to fulfill the literature gap the empirical study was conducted in the Koilkonda Village of Mahabubnagar District and Telangana state. The study makes use of primary and secondary data for the analysis of the objective. The structured questionnaire was employed to elicit the primary information among the 40 members of the different categories of farmers and statistical tools like mean, median, minimum and maximum were also utilized. Finally it is found that there are significant differences in mean income, mean cost and surplus income of four size of farmers among different sources of irrigation.

Key Words: Minor Irrigation, Farm Income, Tank Irrigation, Tube Well, Cost, Surplus, Mean and Median.

Introduction

Agriculture is a spinal card of Indian Economy in which the production and productivity has been directly associated with Irrigation. Developing infrastructure for the water resources and their management have been the common policy agenda in many developing economies, particularly in the arid and semi-arid tropical countries like India. A study by the International Water Management Institute (IWMI) has shown that around 50 per cent of the increase in demand for water by the year 2025 can be met by increasing the effectiveness of irrigation (Seckler*et al.*, 1998).Irrigation is defined as "Artificially supplying & systematically dividing of water for agriculture & horticulture in order to obtain higher or qualitatively better production. Water is essential to plant growth & for millenniums. Successful farmers have used different methods to apply water to their crops. This artificial addition of water is called irrigation. Irrigation is essentially the artificial application of water to overcome deficiencies in rainfall for growing crops. Irrigation is a basic determinant of agriculture because its

inadequacies are the most powerful constraints on the increase of agricultural production. In traditional agriculture, irrigation was recognized for its protective role of insurance against the vagaries of rainfall & drought. But now, adoption of high yielding varieties, chemical fertilization & multiple cropping highly used controlled irrigation for increasing productivity. In India, Minor Irrigation (MI) structure is defined as one with command area of less than 2000 hectares. Ministry of water resources (MOWR) considers five types of MI structures in its census enumeration which include dug wells, shallow tube wells, deep tube wells, surface lift systems, and surface flow systems. In all MI census, ground water structures (dug wells, shallow tube wells, and deep tube wells) have accounted for more than 90 percent of all structures. These also account for the entire ground water irrigation in India.

Minor irrigation development in India is as old as civilization itself. India's irrigated agriculture sector has been fundamental to India's economic development and poverty alleviation. Water, the most precious natural resource covers almost three-fourths of earth's surface. Its abundance as well as scarcity has been greatly instrumental in shaping the life style and culture of the people inhabiting the earth. For all types of agriculture such as geoponic, aeroponic and hydroponics water is a basic component.

As one of the world's largest agrarian economies, the agriculture sector in India accounted for 14.2 per cent of the gross domestic product (GDP), at constant 2004-05 prices during 2010-11 as per Central Statistics Office (CSO) of India. Irrigation has played a major role in increasing the agricultural output of the country. The Government of India has recognized that the development and management of water resources is of vital importance for the continued growth in irrigation facility and hence in the agriculture production. The government had invested huge sums of money in the development of large, medium and minor irrigation projects across the country. Amongst the types of irrigation projects, it is generally considered that Minor irrigation projects are more sustainable and eco-friendly. Sustained growth in minor irrigation projects needs to be monitored and nurtured as the net irrigated area is (still) only 39 percent of net sown area in the country.

Survey of literature

Saikia, Hemanta et.al[1] (2011) have found that in Assam, although attempts are made at micro level to increase production and productivity in agriculture by adopting modern technology in the form of improved seeds and fertilizers, nothing substantial has been achieved in the region. So for sustainable

[1]Saikia, Hemanta et.al, "Restructuring flood damaged rural agriculture sector of Assam through minor irrigation", JOURNAL OF RURAL DEVELOPMENT, 30(1), 2011(January-March): 45-54

development of agricultural sector, particularly in winter season, availability of irrigation facility is undoubtedly the most important prerequisite in the development into flood damaged areas. The modernization of agricultural practices vis-à-vis increase in the productivity of crops cannot be visualized in the absence of assured irrigation facilities. At the same time one should also note that it has the potentiality to produce multiple crops with the use of HYV seeds if it is backed by adequate minor irrigation facility since natural fertility of flood-prone areas is higher as compared to other areas. Therefore, effects of such disasters on the agriculture of Assam can be minimized by following appropriate alternative agricultural practices where minor irrigation can be an alternative of them.

Radhakrishnan, S.A[2](1978) has observed that in Tamil Nadu state, since most of the surface water resources are already tapped, there is a dire need for development of ground water resources. The ground water potential of an area is at present determined by the State Ground Water Directorate based on certain assumptions and field observation. It is established beyond doubt that detailed hydro-geological studies should be made for estimating ground water potential, more precisely. There are a number of problems to be sorted out while introducing ground water discipline.

D. Suresh Kumar and K. Palanisamy[3](2010) have found that the adoption of drip irrigation technology has increased the net sown area, net irrigated area and thereby has helped in achieving high cropping intensity and irrigation intensity. It has been found that there is a significant shift towards crops such as coconut, grapes and banana from annual crops like vegetables, sugarcane and the like. The main reasons have been found as scarcity of human labour and water. As the cropping pattern decides the adoption and suitability of drip irrigation, widespread adoption of micro irrigation could be promoted in the regions where shift towards crops like coconut, banana and grapes are common. The analysis of economics of crop cultivation under drip and control has revealed that the drip method of irrigation has a significant impact on resources saving, cost of cultivation, yield of crops and farm profitability. The physical water and energy productivity is significantly high in drip over the flood method of irrigation. One could conclude that the drip has a significant bearing on the private costs and benefits and hence on profit of farmers. Thus, our policy focus may be tilted towards the promotion of drip irrigation in those regions where scarcity of water and labour is alarming and where shift towards wider-spaced crops is taking Place.

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[2]RADHAKRISHNAN, S.A, "Formulation on minor irrigation schemes - Data requirements and problems", INDIAN JOURNAL OF AGRICULTURAL ECONOMICS, 33(4), 1978, (October-December): 191-203

[3] D. Suresh Kumar and K. Palanisamy, "Impact of drip irrigation on farming system: Evidence from southern India", Agricultural economics research review, Vol.23, July-December 2010, pp 265-272.

S. N. Srinivas and C K Jalajakshi[4] (2004) have observed that usually all members of a family operate the pump. However, the head of the family operates it more. Women generally operate only on a stop-gap basis. However, in a few cases, labour is being hired to operate the pump. The wages of hired labour varied from Rs 15 to 25 per day. It was left that TP (Treadle Pump) operation is much easier than other types of manual irrigation systems in the study area. On average, a TP is operates for about 100 days in a year. More than 60 percent of households owning TP have been using it for more than or equal to three hours on an operating day. It was found that the discharge from all types of TPs is higher than other manual irrigation systems like the swing basket, tenda and dhekuli, which are common in the study area. On average well maintained TPs give a discharge of about 50 to 90 liters per minute at a depth of about 4.54 m. TPs were found to be effective to operate a command area of about one acre. It is most suited for marginal and small farmers. The design of the TP is more improved and convenient to operate in comparison with other type of devices using human power. A comparison of system efficiencies indicates that it is much more efficient than a diesel pump. It also scores over other manual - irrigation devices with much higher system efficiencies. The study results show that the system efficiency for a diesel engine in the comparable field situation has been only 3.64 per cent, whereas for TPs it was over 40 per cent. The system efficiency of dhekuli was over 6 per cent, however, dhekuli generally cannot be operated for longer duration because the operator gets too tired and the water table in the well goes down. Among the other devices, the swing basket can only lift water from surfaces such as channels. In addition, it requires two persons to operate. Tenda, common in Orissa, can lift water from the surface and the operation is also strenuous.

Natarajan, V.K[5] (1982) has observed that minor irrigation schemes were planned to augment the irrigation potential, increase in gross irrigated area and intensity of cropping. Accordingly, the implementation of this programme gave rise to a higher intensity of cropping, changes in the cropping pattern, changes in the gross irrigated area, increase in annual income and employment, more particularly of the weaker sections. However, it was noticed that failure of power supply, steep increase in oil prices and strains in the management of community wells have affected the programme, to some extent.

Dinesh Kumar, M[6] (2013) has observed that there are complex considerations involved in

[4] S N Srinivas and C K Jalajakshi, "Alternatives to Micro-Irrigation: Evaluation of the Treadle Pump", Economic and political weekly, September 18-2004, pp 4271-4275

[5]Natarajan, V.K, "Minor irrigation under W.V.D.P.: an appraisal", KURUKSHETRA, 30(16), 1982(May 16): 11-13 & 18.
[6]Dinesh Kumar, M, "Analysis of India's minor irrigation statistics: faulty analysis, wrong inferences", ECONOMIC AND POLITICAL WEEKLY, 48(45-46) 2013(November): 76-78

understanding the performance of ground water irrigation systems, and our understanding cannot be based on the simple criteria of "well numbers", and "how many of them are electrified". It is important to know where these wells are located (the aquifer characteristics, particularly the geological and geo hydrological environment), the well characteristics, the quality of power supply, the amount of land available for cultivation and finally the amount of land irrigated and the cropping system adopted by the irrigators. In the research on irrigation and rural poverty, the question that needs to pose is what proportion of the small and marginal farmers. The abysmally low number here is the primary factor responsible for the inquiry in access to ground water resources in the country. This inquiry is alarming and is growing. How to address this inequity should be the concern of researchers and policy makers.

Dr. Anju Bhatia and Shreya Vyas[7](2010) have noted that the prevailing scenario in which water consumption is increasing and the ground water table is fast depleting brings forth the need for reviving old RWH structures. Modern materials and technology can be used to give a facelift to old RWH structures. Although efforts have been initiated in this regard yet they require scaling up and sustainability. For revival of RWH structures, two aspects are crucial. First, the community requires to be sensitized and mass awareness needs to be created regarding the alarming situation of water and the need for, harvesting every drop of water even when the other sources of water are available in their village. Second, maintenance of community tanks should be under the gram Panchayat or other local community agencies. Government agencies, non-government-organizations, activists, media and academic institutions, especially institutes of technology need to Work together and create a synergy effect to march towards a common goal, which is to save our thousand years old heritage. Rainwater is considered as the purest form of water. However, when collected in RWH structures, its quality depends upon the care taken in cleaning and preparing the catchments area, the RWH structure as well as its maintenance.

Objectives of the Study

1. To assess the differences in income flows of different strata of farmers
2. To analyze the variations in the mean incomes per acre owing to different sources of irrigation.
3. To study the impact of minor irrigation on the growth of off farm activities.

[7]Dr. Anju Bhatia and Shreya Vyas, "Present condition of traditional rain water harvesting systems-case study of a village in western Rajasthan", Kurukshetra, May 2010, pp 19-22

Hypotheses of the Study

Ho 1: There is no significant difference in the mean incomes of farmers under different sources of irrigation.

Ho 2: There is no significant difference in the mean incomes of different strata of farmers in the arena of minor irrigation.

Methodology

The following methodology has been adopted for the present study.

Sample Design

For the purpose of the present study, 40 farmers from Mahabubnagar district will be selected mostly by adhering to the principles of stratified random sampling. The composition of farmers would be 10 from each category namely marginal, small, medium and big farmers, aggregating to 40 farmers. The criteria of stratification are farm size, type of minor irrigation and social category and place.

Sources of the Data

The present study will make use of both primary and secondary sources of data. The secondary sources of data include reports and records from Project Director, DWMA, Mahabubnagar and Panchayat raj departments. The primary sources of data will be collected from the sample farmers directly by administering a pre designed questionnaire.For the purpose of the present study, 10 year period covering 2003-4 to 2012-13.

Scope of the Study

The present study is confined itself to understand the influence of irrigation on farm economy. It does not cover the technical and managerial aspects of irrigation are not considered for this analysis.

Techniques of Analysis

The present study will make use of various tools of statistics including simple percentages, frequency distribution, coefficient of correlation and regression technique, Chi-Square statistic, Lorenz curve and Gini coefficient will also be employed to test the significance of relation between two qualitative variables.

$Y=a + bx$

Where (Y = Average income, X = Average investment and ‘a’ and ‘b’ = regression Coefficients)

Results and Discussion

Towards the end of the objectives mentioned, and in order to study the impact of minor irrigation on agriculture productivity, data are collected from 40 farmers (10 from each category of farmers and 20 each from different sources of irrigation) drawn from Koilkonda Mandal of Mahabubnagar district. The data is collected from the farmers directly by administering a pre designed questionnaire. The results and findings are discussed and presented below.

Table-1: Income per acre of different strata of farmers

Size of the farmer	Mean	Median	Minimum	Maximum
Marginal	12985(2713.8)	11650	9800	17890
Small	13250(2891.23)	12000	10060	17890
Medium	13476(3108.9)	12105	9950	17800
Big	14008(3065.32)	13425	9950	17890

Source: primary data (Figures in the parenthesis are standard deviations)

The above table provides information on Income differences among the different strata of farmers in selected area of the study. The mean values has been taken to differentiate the income gaps among the farmers. It is found that mean income of medium farmers is higher than large and other strata of farmers. Since the median as a criteria the large income group stood at highest income among different strata of farmers. There is a significant difference between the mean incomes per acre under different sources of irrigation. There is a significant difference between the mean incomes per acre of marginal and small farmers.There is a significant difference between the mean incomes per acre of marginal and medium farmers.

Table-2: Cost per acre of different strata of farmers

Size of the farmer	Mean	Median	Minimum	Maximum
Marginal	6063(1395)	5300	4800	8150
Small	4982(1485)	5250	4560	8200
Medium	6098(1615.8)	5150	4500	8230
Big	6344(1585)	6425	4600	8100

Source: primary data (Figures in the parenthesis are standard deviations)

Data in the above table shows that cost variation per acre among different farm size. It also tells there is a significant variation in cost per acre, the mean cost per acre of cultivation is highest(Rs 6344) in large farmers and followed by medium (Rs 6098)farmers. Surprisingly it is evidenced that mean cost per acre of marginal farmers has higher than small farmers.

Table-3Surplus per acre of different strata of farmers

Size of the farmer	Mean	Median	Minimum	Maximum
Marginal	6922(1441.34)	6650	5000	9990
Small	7205(1499)	7000	5400	10000
Medium	7378(1684.41)	7260	5000	10000
Big	7674(1605)	7225	5150	9990

Source: primary data (Figures in the parenthesis are standard deviations)

The table gives information on surplus value per acre cultivation, (Income-Cost). The surplus value of

big farmers is recorded Rs 7674 as highest and marginal farmers Rs 6922 is lowest. The median values also indicating the same ranks among the different categories of the farmers. It concludes that there is a significance difference in surplus value of farmers.

Table-4: Income per acre of different sources of irrigation

Measures of average income	Tank	Tube well
Mean	13417.5(3019.4)	13442(2767.4)
Median	11925	11925
Minimum	9800	9950
Maximum	17800	17890

Source: primary data (Figures in the parenthesis are standard deviations)

The above table reveals that the income differences under different sources of irrigation. There is a significant difference between the mean incomes per acre under different sources of irrigation. The mean income of all categories of farmers is recorded Rs 13,417 under the Tank Irrigation and Rs 13,442 under Tube Well Irrigation respectively. The minimum income of Tank and Tube Well irrigation are Rs 9800 and Rs 9950 respectively.

Table-5: (Cost per acre of different sources of irrigation)

Measures of average cost	Tank	Tube well
Mean	6262.5(1530)	6007.5(1430)
Median	5275	5325
Minimum	4500	4600
Maximum	8200	8230

Source: primary data (Figures in the parenthesis are standard deviations)

The mean cost per acre under Tank Irrigation is higher than the mean cost per acre of Tube Well Irrigation i.e., Rs 6262.5 and Rs 6007.5 respectively. There are differences among median value of cost of cultivation among different sources of irrigation.

Table-6: (Surplus per acre of different sources of irrigation)

Measures of average surplus	Tank	Tube well
Mean	7155(1593.9)	7434.5(1479.3)
Median	6950	6995
Minimum	5000	5000
Maximum	10000	10000

Source: primary data (Figures in the parenthesis are standard deviations)

The surplus of value of per acre under different sources of irrigation is significantly irregular. Mean value of surplus per acre through Tube Well irrigation is higher than Tank irrigation in the selected area i.e. Rs. 7434.50 and Rs. 7155.00 respectively.

Null hypothesis (Ho) is tested to know whether the differences in mean incomes of different strata of farmers are significant or not. For this purpose the following formula is used.

Observed Value= Difference of mean incomes/Standard error

Ho1: μm- μs=0
H1: μm- μs≠0
Ho2: μm- μM=0
H2: μm- μM≠0
Ho3: μm- μB=0
H3: μm- μB≠0
Ho4: μs- μM=0
H4: μs- μM≠0
Ho5: μs- μB=0
H5: μs- μB≠0
Ho6: μM- μB=0
H2: μM- μB≠0

Where (m=marginal farmers, S=Small farmers, M=Medium farmers, B=Big farmers)

Ho is rejected in the case of all null hypotheses and hence it is found that

1. There is a significant difference between the mean incomes per acre of marginal and big farmers.
2. There is a significant difference between the mean incomes per acre of small and medium farmers.
3. There is a significant difference between the mean incomes per acre of small and big farmers
4. There is a significant difference between the mean incomes per acre of medium and big farmers

Thus, both the null hypotheses are rejected.

Ho 1: There is no significant difference in the mean incomes of farmers under different sources of irrigation.

Ho 2: There is no significant difference in the mean incomes of different strata of farmers in the arena of minor irrigation.

Conclusion

Irrigation is essentially the artificial application of water to overcome deficiencies in rainfall for growing crops. Irrigation is a basic determinant of agriculture because its inadequacies are the most powerful constraints on the increase of agricultural production.The earlier literature does not given any kind of empirical explanation on the impact of minor irrigation on agriculture productivity in the Mahabubnagar village of Telangana state. The paper has reveals the empirical results on the mentioned topic. There is a significant difference between the mean incomes per acre under different sources of irrigation.There is a significant difference between the mean incomes per acre of marginal and small farmers. It is found that a significant difference between the mean incomes per acre of marginal and medium farmers, study also reveals significant difference between the mean incomes per acre of marginal and big farmers.There is a significant difference between the mean incomes per acre of small and medium farmers. And also, there is a significant difference between the mean incomes per acre of small and big farmers.

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