CHAPTER V

Summary of Findings and Concluding Observations
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Efficiency is a very important factor for productivity growth, in an economy, where resources are scarce and opportunities to use new technologies are limited. Resource use studies indicate the potential possibility to raise productivity by improving efficiency. The estimation of use of resources and the related studies are very important to identify the potential increase in production with minimum cost for farm inputs.

Agriculture is an organic economic activity which is highly correlated with land, water and energy. Land and water resources and the way they are used are central to the challenge of not only improving the productivity measured in terms of yields per unit of land and water and also for the challenge of improving food security particularly in developing countries. In the present crowded world with populations still rising and consumption patterns changing, it is highly essential to plan and manage the use of land and water resources efficiently. It is observed that today we are using the equivalent of 1.5 planets Earths to support our activities. If the current trend of population growth, consumption patterns and climate change continue we need the capacity of two earths by 2030 to keep up with natural resource consumption.

The observations of the current research on the use of resources suggest that the strategies which exclusively focus on growth do not deliver unless they are accompanied by deliberate measures, that ensure a good degree of equity in access to, and control over resources particularly in irrigation systems. It is also observed that poverty, a state of multidimensional deprivation is very often correlated to deprivation from water in sufficient quantity and quality. It is true that deprivation from access to water for productive uses particularly access to irrigation water to cultivate crops – acts as a strong bottleneck preventing poor people from fulfilling their basic income needs and escaping income poverty.

Unequal access to land and water resources is the primary contributing factor for low yields and low incomes for the people of rural India. The ability of agriculture to contribute directly to the economic development and welfare of farm families is
dependent on the level of irrigation and the resultant incomes from cultivation of crops. Under these circumstances attention should necessarily be focused on improving the productivity of irrigated areas where the users of small quantities of water cultivate the crops, so as to assess the productivity of low irrigated areas. It is a known fact that the low irrigated areas are the home to a large number of poor people with small holdings. To enhance the overall performance of irrigated areas, in terms of productivity, equity and profitability and to estimate the relative performance of highly irrigated areas and low irrigated areas it is necessary to analyse and estimate the impact of unequal access to irrigation water.

The present research work primarily focuses on the impact of unequal access to irrigation and farm size on the use of resources, productivity and farm income distribution with special reference to one of the drought prone backward regions – Chittoor district – in Andhra Pradesh.

The study is a micro level study carried out at district level and exclusively depends upon primary data collected from 120 farmers in highly irrigated areas where in the proportion of net area irrigated to net area sown is more than 50 per cent and 120 farmers who are operating and cultivating crops in low irrigated areas, where in the proportion of net area irrigated to net area sown is less than 30 per cent. Attention was paid to assign due importance to farm size and social status of the farmers in the selection of sample farmers. The total size of the sample farmers for the present study is 240 comprising 102 marginal and small farmers, 84 medium farmers and 54 large farmers representing both highly irrigated and low irrigated land holdings, selected in 12 villages and 6 revenue mandals of Chittoor district. Further, the present research is conducted to evaluate and estimate the resource use productivity and farm income distribution with particular reference to paddy, groundnut and sugarcane crops cultivated in highly and low irrigated landholdings. An individual farmer's schedule was designed and administered to the selected 240 farmers in Chittoor district and the primary data collected refers to the agricultural year 2010-11. The thesis is organized into five chapters.
5.1 OBJECTIVES AND METHODOLOGY:

The present research work is an exploration into the irrigation resource use productivity and farm income distribution in a backward region, chittoor district. It also attempts to analyse some of the related issues which have been subject to debate in recent literature, viz the nature of relationship between farm size and productivity, farm size and profitability and the impact of unequal access to irrigation water on the yields of selected crops. The major object of the study is to provide the statistical evidence to assess and analyse the impact of level of irrigation on resource use productivity and the distribution of farm income from the cultivation of sample crops both in highly irrigated, low irrigated landholdings.

5.2 METHODOLOGY:

In testing the impact of level of irrigation on resource use productivity and farm income distribution, the production function technique has been employed. As many researchers have resorted to Cobb-Douglas type of production function, it is found quiet appropriate to choose Cobb-Douglas production function for the present research to estimate the contribution of resources and inputs employed in the cultivation of sample crops – paddy, groundnut and sugarcane. One way ANOVA technique is employed to test the hypotheses formulated for the present study.

5.3 SUMMARY OF FINDINGS:

The major findings of the present research work are recalled in the following paragraphs so as to present some of the concluding observations which may be used for policy formulation.

- Chittoor district is the study area for the present research work. It is one of the districts of Rayalaseema region, where droughts are recurrent feature. In 2009-10 all the 66 revenue mandals were declared drought affected by the Govt. of Andhra Pradesh.
- Chittoor district is an agriculture-dominant district in which more than 66 percent of the work force depends upon agricultural sector.
- It has a literacy rate of 72.4 percent and 71.0 percent of the population reside in rural areas.
- The net area sown accounts for 3.5 lakh hectares with a low cropping intensity of 1.15 percent.
The district receives a normal rainfall of 934 mm annually and it is almost
deficient to raise the crops.

Of the total 3.5 lakh hectares of net area sown, net area irrigated accounts for
1.5 lakh hectare (2011-12) accounting for 41.2 percent of the net area sown.

The statistics show that the net area sown has decreased by 77,824 hectares and
irrigated area by 28,388 hectares in 2011-12 compared to 2000-01.

Dug-wells and tube-wells are the chief sources of irrigation (84.0 percent)
followed by tanks (15.0 percent).

The average size of the land holdings in the district is only 0.94 hectares as per
2010-11 census.

The land use statistics indicate that the land underutilized in Chittoor district has
been growing for the past 12 years and the total area underutilized was
estimated as 3.35 lakh hectares in 2011-12.

All the above statistics reveal that Chittoor district is a backward region
characterized by recurrent droughts and inefficient management of land and
water resources. As a result, the level of irrigation exerts a significant influence
on the use of resources, productivity of crops and distribution of farm income in
the district.

Chapter – III provides an analysis of socio-economic profile of sample farmers
selected for the study. Many research studies proved the fact that the productivity of
crops cultivated, to some extent, depends upon social status, literacy status, age, sex,
value of assets and ownership of land exert a telling effect on the economics of
cultivation of crops. The observations recorded about the socio-economic profile are
presented briefly in the following paragraphs.

Of the total 240 sample farmers, 92.5 percent of the farmers belong to the age
group of more than 30 years (table 3.2).

There is dominance of forward castes among the sample farmers. 49.2 percent
and 46.7 percent of the sample farmers in highly irrigated and low irrigated
areas belong to forward (OC) castes (table 3.3).

The sample farmers belonging to SC, ST social groups represent 13.3 percent of
the total sample farmers. Higher number of SC/ST farmers were found in low
irrigated areas (17.5 percent) compared to highly irrigated areas (9.1 percent) (table 3.3).

- A look at the social status of the sample farmers reveals the fact that access to irrigation has a positive correlation with that of social status.
- The details of average size of sample households show that farmer families in low irrigated areas have higher number of members (4.18 persons) per family as against 3.94 members per family in highly irrigated areas (table 3.4).
- An overview of the literacy status of sample farmers reveal that illiteracy was high in low irrigated areas (35.0 percent), and low in highly irrigated areas (20.0 percent). Similarly the persons with graduation and higher studies accounted for 10.8 percent in highly irrigated areas whereas this proportion of sample farmers accounted for only 5.8 percent in low irrigated areas (table 3.5).
- The proportion of families who have secondary occupation were found high at 72 sample households (60.0 percent) in low irrigated areas, while this proportion was very low at 19 sample households (15.8 percent) in highly irrigated areas (table 3.6). This observation leads us to conclude that irrigation plays a crucial role in deciding the structure of primary and secondary occupations in the study area.
- Productivity of crops to the significant extent depends upon fixed farm assets in agriculture. The data collected about the value of fixed capital assets indicate that the sample farmers in highly irrigated areas have higher value of farm machinery and implements (Rs. 22,703-00) compared to the sample farmers in low irrigated areas (Rs. 8011-00) (table 3.7).
- The average value of irrigation assets was found high at Rs. 1,09,137-00 on an average per household in highly irrigated areas where as it was found low at Rs. 86,540-00 per household in low irrigated areas (table 3.7).
- The average value of all fixed assets was found high at Rs. 1,40,475-00 per household in highly irrigated areas as against low average value of all fixed capital assets at Rs. 99,110-00 per household in low irrigated areas (table 3.7). It could be inferred that level of irrigation had a significant effect on fixed capital assets in the study areas.
- To sum up, a significant positive impact on all socio-economic factors was found due to level of irrigation in the study area. Higher access to irrigation
favourably influences the occupational structure, ingredients of human
development, value of fixed capital assets and the economic status of sample
farmers in the study area.

Chapter – IV deals with the detailed discussion on the impact of level of
irrigation on resource use productivity and farm income distribution in the study area –
Chittoor district. This chapter is divided into 3 sections. Section I presents the agro-
hydrological features of six sample mandals selected for the present study. Section II
deals with the agro - features of 240 sample farmers selected in Chittoor district having
highly and low irrigated landholdings. Section III presents the detailed analysis of the
impact of level of irrigation on resource use productivity and profitability with
reference to the 3 selected crops – paddy, groundnut and sugarcane.

The discussion presented in the three sections of Chapter IV leads to the
following concluding observations:

- The average size of the operational holdings per sample farmer household was
  worked out to 7.4 acres (3.0 hectares) in highly irrigated areas and 6.7 acres
  (2.71 hectares) in low irrigated areas. This means that the size of the
  operational holdings in highly irrigated areas is high (table 4.7) compared to
  low irrigated areas.

- Three cost concepts – Cost A, Cost B and Cost C were estimated to assess the
  use of resources and inputs employed in the cultivation of sample crops, five
  farm income measures were estimated to workout the profitability of
  cultivation of sample crops and also to arrive at net income generated by the
  cultivation of sample crops in both the areas. Productivity of sample crops were
  worked out to estimate the impact of level of irrigation and also inter-farm
  correlation was worked out to find out the relation between farm size and
  productivity in both the areas.

- The level of irrigation had a significant effect on the cost of cultivation of paddy
  crop. Significant variations were found in the amount of paid out costs. The
  average cost of cultivation per acre was found higher by Rs. 4014-00 in highly
  irrigated areas compared to low irrigated areas indicating a net additional
  average cost of cultivation by 25.0 percent compared to low irrigated areas.
  (Table 4.13).
Average yield of paddy per acre was found high at 1915 kgs per acre in highly irrigated areas as against 1259 kgs per acre in low irrigated areas, which indicates a net increase of 52.0 percent in highly irrigated areas (table 4.15).

The cultivation of paddy crop was found more profitable in highly irrigated areas with an average net income of Rs. 13096-00 per acre compared to Rs. 5503-45 per acre in low irrigated areas. (Table 4.17 and 4.18).

The level of irrigation had a significant effect on the cost of cultivation of groundnut crop. The average cost of cultivation of groundnut per acre was estimated higher by Rs. 944-00 in highly irrigated areas over low irrigated areas. (table 4.21).

The average yield of groundnut per acre in highly irrigated areas was found higher at 582 kgs per acre compared to low irrigated areas (388.06 kgs per acre). (Table 4.23).

Cultivation of groundnut crop was found unremunerative both in highly irrigated and low irrigated areas. Large farmers and marginal and small farmers incurred losses due to the cultivation of groundnut crop and it was less remunerative for medium farmers who have realized an average net income of Rs. 440-00 per acre (at cost C). As a result on an average each sample farmer household could get negligible net income of Rs. 111-00 per acre in highly irrigated areas, where as it was highly unremunerative in low irrigated areas since a sample farmer household has incurred a loss of Rs. 3463-44 per acre by cultivating the groundnut crop (at cost C) (table 4.25 and 4.26).

The level of irrigation had an increasing effect on cost of cultivation of sugarcane crop in the study area. The average cost of cultivation of sugarcane crop per acre was found higher by Rs. 5319-00 in highly irrigated areas over low irrigated areas (Table 4.29).

The sample farmers in highly irrigated areas got an additional yield of 3697 kgs per acre by cultivating the sugarcane crop compared to low irrigated areas. A positive correlation of average yield per acre was found with the farm-size in the cultivation of sugarcane cop in both the areas. As the farm-size increased, the average yield per acre has also increased in both highly irrigated and low irrigated areas. (Table 4.31).
The cultivation of sugarcane crop was found highly remunerative in highly irrigated areas with the net income of Rs. 16423-05 per acre compared to low irrigated areas at Rs. 13000-85 per acre (tables 4.33 and 4.34).

However, viewed from the incremental average gross value of output per acre calculated for the sample crops reveals that paddy crop occupies dominant place with 53.1 percent in highly irrigated areas over low irrigated areas. Groundnut crop occupied second place with 42.3 percent of additional average gross value of output in highly irrigated areas over low irrigated areas. Though net income of sugarcane crop was estimated higher (Rs. 16423.05) in highly irrigated areas compared to low irrigated areas (Rs. 13000-85) the addition of average gross value of output in highly irrigated areas has increased only by 15.3 percent in highly irrigated areas over low irrigated areas.

Viewed from the employment generation, the level of irrigation had a beneficial effect recording higher number of person days of employment in all the farm sizes and for all sample crops.

Particularly the level of irrigation had favourably influenced the generation of employment in medium sized (5.01 to 10.0 acres) and large sized holdings (10.1 and above) compared to marginal and small farmers.

5.4 COBB-DOUGLAS PRODUCTION FUNCTION:

In order to study the resource use productivity according to the size of the farmers of the sample farmers, we have divided the sample farmers into three groups – marginal and small, medium and large farmers, based on the size of their farms. Cobb-Douglas production function was fitted to the sample crops considering gross value of output of crop as dependant variable (Y) and nine independent variables were considered in the estimation of production function.

The estimated elasticities for land (X1), hired human labour (X2) and irrigation expenditure (X8) were found as the most significant contributors to the dependent variable (Y) viewed from the values of $R^2$, a significant proportion of variability for all the crops both in highly irrigated and low irrigated areas was explained by the nine independent variables considered for the production function. The estimated $R^2$ ranges from 0.879 to 1.000 for the sample crops and the results of Cobb-Douglas production function are significant 1.0 percent level.
5.5 TESTING THE HYPOTHESIS

For the present study four hypotheses were formulated and these hypotheses were tested by fitting one way ANOVA (F-test). The results of the ANOVA test reveals that:

1. Ho = When inputs in the cultivation of crops are calculated by imputing the values, the cultivation of selected crops seems unremunerative.
   Ha = The above hypothesis was found false and the hypothesis was rejected.

2. Ho = The second hypothesis was that the profitability of selected crops increases with level of irrigation.
   Ha = The above hypothesis was found true and this hypothesis was accepted.

3. Ho = The third hypothesis was formulated is that productivity of selected crops per acre is high in highly irrigated holdings and low in low irrigated holdings.
   Ha = The above hypothesis was found true and the hypothesis was accepted.

4. Ho = The fourth hypothesis was formulated that there exists inverse relationship between farmsize and productivity of selected crops in both highly and low irrigated landholdings.
   Ha = The above hypothesis was found false and the hypothesis was rejected.

5.6 CONCLUSION:

An overview of the analysis made in Chapter II, III and IV leads us to conclude that Chittoor district is a drought prone area with significant deviations in the normal rainfall. Though surface irrigation, particularly tanks is also available, the district is heavily dependant on groundwater irrigation sources. The reports and records amply demonstrate that the groundwater levels have depleted from 16.85 mts in May 2013 to 13.86 mts as on January 2014. It is evident from the data on operational holdings that the average size of holdings has been declining and at present it is estimated as 0.94 hectares. A look on land use pattern in Chittoor district reveals that 22.1 percent of the geographical area represents underutilization of land in the forms of culturable wastes, current and other fallows. As a result the cropping intensity in the district is only 1.15 and the irrigation intensity is very low at 1.25. These two important indicators which measure the resource use efficiency in the district are at low level, as compared to the Rayalaseema region and Andhra Pradesh as a whole.
Similarly the discussion of socio-economic features of the sample farmers reveals that there is a strong correlation between the level of irrigation (access to irrigation water) and the social status and literacy status. Higher number of sample farmers were found disadvantaged in access to irrigation water and they belong to SC/ST social groups. In Chittoor district it is found that access to irrigation has a positive correlation with that of social status. It is observed that the access to irrigation (highly irrigated and low irrigated areas) decides and directs the diversification of occupational structure and investment on capital assets, which improve and accelerate the productivity of crops cultivated.

The detailed estimations of amount of resources and inputs used in the cultivation of crops vary significantly being influenced by the level of irrigation. It is also evident from the analysis that farm income has significantly increased with higher level of access to irrigation and it is proved that productivity has a direct positive correlation with that of level of irrigation. The cultivation experiences of sample farmers strongly revealed that the level of irrigation must be complemented with the other supporting inputs and infrastructure. The case of sample farmers, who have cultivated groundnut crop supports this complementarity between level of irrigation and productivity. Poor quality of seeds supplied, absence of timely supply of fertilizers and pesticides and frequent power cuts have disabled the sample farmers from getting optimum production of the crop and are left with losses or unreasonable margins.

It seems the sample farmers are efficient enough to realize higher yields compared to the average level of production for the year 2010-11 for district as a whole. However, compared to Nizamabad, Guntur and Kurnool which have recorded highest yields in the cultivation of sample crops – Paddy, Groundnut and Sugarcane respectively, the sample farmers could get 81.6 percent of the highest yields of paddy (Nizamabad), 50.0 percent of the highest production of groundnuts (Guntur) and 84.0 percent of the highest yield of sugarcane crop (Kurnool). Viewed from this potentiality, the sample farmers have yet to improve the resource use efficiency in the cultivation of crops and the resultant improvements in the yields certainly spirals the virtuous cycle of eradication of rural poverty through poverty irrigation water nexus. Proper public policy intervention is highly essential for improving the resource use efficiency in Chittoor district.
5.7 RECOMMENDATIONS:

On the basis of the analysis presented in thesis and the observations made from the analysis it is inferred that the sample farmers are generally efficient in the use of resources and inputs currently at their disposal. We feel that these concluding observations have significant implications for the development of agriculture in Chittoor district in general and resource use efficiency in particular. An attempt is made to make some recommendations and to suggest scope for future research so that efforts may be initiated towards this direction.

- Much attention should be paid on the land use management in general. No doubt, the increasing population, industrialisation and use of land for non-agricultural uses are putting heavy pressure on the use of land available. In Chittoor district land not available for cultivation has been continuously increasing, and this must be paid immediate attention to monitor these pressures.
- Sincere efforts are to be made to bring current fallows and other fallows in to cultivation as a land expanding measure.
- Cropping intensity and irrigation intensity must be improved.
- Water-sheds are to be constructed at suitable places, so that the water levels of tanks, dug-wells and tube-wells may be improved.
- Public investment must be increased for the development of irrigation infrastructure.
- Provision of qualitative seeds at required quantity is essential for the improvement of productivity of crops.
- Supply of fertilizers and pesticides at required times and in adequate quantities is highly necessary.
- Land use pattern of marginal and small farmers must be paid proper attention so that land use efficiency is improved, particularly in low irrigated sample mandals – Irala, Pulicherla and Nimmanapalle.
- Suitable yield improving irrigation-techniques like drip irrigation, sprinkler irrigation may be introduced in low irrigated areas to optimize the use of irrigation water available.
- It is highly essential that suitable policy amendments may be made to implement the MGNREG programme which complements the agricultural operations in both Kharif and Rabi seasons, so as to erase the labour shortages for crop operations.
5.8 FUTURE RESEARCH:

It is true that deprivation from irrigation water in sufficient quantity certainly perpetuates poverty, which prevents the farmers from fulfilling their basic income needs and escaping income poverty. Research must be directed to evaluate the poverty-irrigation water nexus at district level. If the primary objective of promoting and catalyzing economic development in rural areas is to be a success, must be given priority and irrigation systems studies must be initiated at field level of determine what can realistically be done to improve the returns to poor farmers in the low productivity and low irrigated areas.

- A vision document that throws light on sufficient deployment of term loans for financing the fixed capital assets, particularly irrigation assets, is to be prepared with particular reference to irrigation-poor farmers in low irrigated areas.
- Mandal specific operation and maintenance institutions for irrigation systems may be established with suitable public policy intervention. The governments have to prepare suitable guidelines for this programme.
- Preparation of “Crop Plans” based on water availability and the number of irrigations to be provided must be prepared for the improvement of resource use efficiency in the study area.
- Research efforts which analyse the net working and increasing the knowledge levels that enable the farmers to exploit opportunities in their environment are essential. Studies explaining the impact of information technology in closing the knowledge gap certainly exert a critical bearing on agricultural productivity. Research must be carried out for establishing information technology as an important lever to improve the productivity of crops.

A variety of correlations between the farm-size and productivity of selected crops are observed in the study area - both in highly and low irrigated areas. An inverse relation is found between the farm size of paddy and groundnut and the positive correlation was found for the sugarcane crop. In low irrigated areas, an inverse relation was found between the farm size and productivity of paddy crop. Whereas the positive correlation was observed for groundnut and sugarcane crops. To resolve this, studies are to be conducted in other revenue mandals of Chittoor district which aim at explaining the relation between farm size and productivity. This is the another researchable area.
In sum, the findings and recommendations presented in the thesis are based on the observations related to six revenue mandals and hence they have to be considered as suggestive rather than definite for agricultural policies at state or at national levels.

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