The Impact of Irrigation on Agricultural Development: A Case Study of Indi and Sindagi Taluks of Vijayapura District Of Karnataka

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***Abstract:** Today agricultural sector has been witnessing drastic changes both at micro and macro levels. The present study area is also not an exception to this. The trend of the farmers has seen a tremendous change in the crop cultivation. This study throws light on, how far rural economic transformation has taken place at the grass-root level due to irrigation.*

To analyze the impact, Vijayapur district of North Karnataka is purposively chosen for our study as Upper Krishna Project (UKP), which was undertaken by the Government of Karnataka with the World Bank Assistance. To check the validity of the statement, Indi and Sindagi taluks of Vijayapur district of UKP under tail end programme are identified as thrust area of research over period of one year. Thus, during the study period the present study found that, there has been drastic impact on the agriculture sector due to impact of irrigation facility and developed cultivation norms.

***Key words:** Crop cultivation, Agriculture development, Economic transformation.Vijayapur.*
***JEL Classification Code:** Q15*

Introduction:

Agriculture is a land based activity. Hence land and water have been the basic elements of life support system and an important resource for the economic life of majority of people in the world. India with only 23 percent of world's total land area supports 18 percent of human and 15 percent of livestock population in the world. Land use is highly a dynamic process. Land resource constitutes the fundamental base for all human activities. The way and the extent to which the land is utilized set the pace of a country's economic development.

Irrigated agriculture provides 40 percent of world food production on only 17 percent of total cultivated land. The World Food Summit in 1996 estimated that 60 percent of the extra food required to sustain the world in the future must come from irrigated agriculture. It is estimated that about 75 percent of rainfall in India is caused by the south-west monsoons which is active only for 3-4 months in a year. The remaining 8-9 months are marked by dry season, when irrigation is badly needed for successful growth of the crops. The total investment in irrigation sector since first to tenth plan is Rs. 2,47,769 crores. During the XI Plan it is Rs. 6,74,105 crores including irrigation of agriculture and rural development.

The Karnataka state has 60 percent of cultivable land and 72 percent of cultivable area is rainfed, only 28 percent is under irrigation. During 2006-07, 23.21 lakh hectares of land was covered by major and medium irrigation and 9.93 lakh hectares was covered by minor irrigation, constituting a total of 33.14 lakh hectares irrigated area. So the economists, agriculturists, planners and geographers are able to examine agricultural development from electively defined disciplinary base.

The following are the objectives of the present study:

- To study the profile of the sample households of study area..
- To study the impact of irrigation on cropping pattern of tail-end of Upper Krishna Project (UKP).
- To offer suggestions based on the findings of the study.

Methodology:

The methodology of the study is presented under the following heads.

The present study followed the survey method. The primary data has been collected through structured schedules from sample household in selected villages of Indi and Sindagi taluks and previous year's experience of farmers were also collected at the time of interview.

Five village have been selected in each taluk and totally 10 villages have been chosen for our study to examine the cropping pattern and transformation of the rural economy through commercialization of agriculture.

Each village covers 20 farmers of different dimensions viz. 5 Marginal Farmers, 5 Small Farmers, 5 Medium Farmers and 5 Large Farmers.

Table-1.1
Sample Households Selected for the Study from the Villages

Sl. No.	Taluk/Village	Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	Total
	INDI TALUK					
1	Lachyan	05	05	05	05	20
2	Manankalagi	05	05	05	05	20
3	Dhulakhed	05	05	05	05	20
4	Hirebenur	05	05	05	05	20
5	Khedagi	05	05	05	05	20

	Total Sample Farmers	**25**	**25**	**25**	**25**	**100**
	SINDAGI TALUK					
6	Almel	05	05	05	05	20
7	Madnalli	05	05	05	05	20
8	Huvinahalli	05	05	05	05	20
9	Chandakavathe	05	05	05	05	20
10	Moratagi	05	05	05	05	20
	Total Sample Farmers	**25**	**25**	**25**	**25**	**100**

Simple statistical tools such as percentage and average methods are used. The present study covers the financial year of 2011-12.

Research Gap:

Some studies have been undertaken in this area on "Resource Use Efficiency in UKP Command Area" and "Irrigation Management in UKP Command Area". But the study on "The Impact of Irrigation on Agriculture" has not been undertaken so far, and hence this study is taken to fill this gap.

REVIEW OF LITERATURE:

The present study is designed to examine the Impact of Irrigation on Cropping Pattern and Commercialization of Agriculture in Indi and Sindagi Taluks of Vijayapur District. A comprehensive review of relevant literature in the area of research is essential as it places the research study in its proper perspective by indicating the amount of work already done in the related area of the study. An attempt is made here to give a brief account of the literature related to the present research work.

Leeden (1975), Williams (1983) and Sandra L. Postel (1984) – Without the irrigation yields in the critical crop growing areas of northern China, north western India and the western US Great Plains will reduce to one third to one half. During the time period from 1950 until the late seventies irrigated area more than doubled. Today, farming accounts for some 70% to global water use.

Sandra L. Postel (1984) and Rangeley (1987) – "Water for Agriculture: Facing the Limits" states that most of the vast quality of water diverted by and for farmers never benefits a crop, because the efficiency of widely used surface methods of irrigation hardly exceeds 50%. The technologies and knowhow exist to boost that figure substantially. What most needed are policies arid incentives that foster efficiency instead of discouraging it.

Von Braun (1995), Pingali & Rosegrant (1995), Ramesh Chand (1996) and Ron & Spancer (2001), in their micro level studies support that "Diversification of agriculture in favour of more competitive of high value commodities is reckoned an important strategy to overcome many of the emerging challenges by farmers".

Singh (2000) analyzed the environmental consequences of agricultural development in Haryana and reported that, with 82 per cent of the geographical area already under cultivation, approximately 60 per cent of the geographical area faces soil degradation due to water logging, salinity and alkalinity. Since 1985, the water table has risen more than one meter annually, and patches of salinity have started to appear at the farm level. The situation is worse in high rainfall areas where water- logging follows shortly after the rains.

Ramesh and Gowda (2001) in their study on the economic analysis of the watershed development programme reported that the small and large group of farmers in the Kabbalanla watershed area of Karnataka obtained comparatively higher productivity out of scarce resources than their counterparts in the non- watershed areas. But these studies have also not considered the influence of non-economic factors in deciding the participation of farmers in such programmes.

Behera and Reddy (2002) estimated the impact of water pollution on crop productivity and area under cultivation in Andhra Pradesh. The study reported that the farmers had incurred substantial losses in both area and yield. Yield loss was about 76 per cent as against 14 per cent of area loss. In general, marginal farmers had suffered maximum loss in terms of area (33%) as well as yield (80%). This was because the marginal farmers had no access to well irrigation.

Sridhara (2002) evaluated the study on watershed programme and found that, the productivity increased in the post project period by virtue of implementation of District Water Development Plan. It could be inferred that percentage increase in productivity obtained by the farmers was considerably higher than the pre project period. The study observed that 43 per cent of the respondents belonged to the income group of Rs 11,001 to Rs 22,000 per annum in the post project period compared the pre-project period.

Nirmala (2003) in her study on the impact of watershed development programme on socio-economic dimensions of beneficiaries revealed that the productivity obtained under the watershed area was higher as compared to those in the non-watershed area in all the crops, both in kharif and rabi seasons. However, she did not give emphasis on the analysis of the impact of socio-economic factors on determining the outcome of irrigation projects.

Tanwar and Biswas (2005) reported that land in India is suffering from varying degrees of degradation. Nearly 57.1 percent of the geographical area suffers from one or the other forms of degradation of which salinization and severe nutrient depletion account for about 14.8 million hectares and water logging to the extent of 11.8 million hectares. As a result of irrigation development, the problems of rising water table and salinity development have emerged in the Indira Gandhi Nahar Pariyojna (IGNP) area.

Savita (2008) found that the difference in crop productivity in the pre and post project period, in case of sugarcane increased from 35 tonnes/acre to 40 tonnes/acre i.e. with a boost of 5 tonnes/acre. Similarly, in case of red gram there was an increase from 3.5 quintals /acre to 6.0 quintals/acre (rising by 2.5 quintals/acre) and jowar increased from 8 quintals/acre to 13 quintals/acre (rising by 5 quintals /acre). It was observed that, the annual income of the beneficiaries, in the case of marginal farmers, increased from Rs. 8,000 to Rs. 17000, followed by semi medium from Rs. 13,000 to Rs. 26,000, medium from Rs. 19,000 to Rs. 37,000 and with regard to the big farmers the income rose from Rs. 29,000 to Rs. 54,000, after the implementation project.

Reddy and Behera (2009) using 'before and after' and 'with and without' methods assess the economic and ecological impacts of tank restoration in three villages in Andhra Pradesh, India. This study finds a positive impact of tank restoration on economic and ecological indicators that unequivocally support the rationale for tank restoration in the drought-prone regions. Moreover, the impact is greater in the case of small and marginal farmers when compared to large farmers, indicating a positive effect/influence on poverty.

Profile of the Study Area:

The present study was conducted in Vijayapur (old Bijapur) district of Karnataka during the year 2011-12. Vijayapur district is in northern part of Karnataka. It is located well in the interior of the Deccan Peninsula. The Vijayapur district lies between 16° 50′ North Latitude and 75° 43′ North Longitude and Latitude of about 593 meters above the mean sea level and is about 130 miles from the West Coast. We selected Indi and Sindagi taluks of Vijayapur district for our study purpose concern to tail-end area (taluks) of Upper Krishna Project (UKP). Selected Indi taluk of Vijayapur district lies between minimum 17° 07′ 00″ maximum 17° 19′ 00″ of latitude and minimum 75° 47′ 16″ maximum 76° 06′ 00″ longitude and 459.08 meters height above the sea level.

Profile of respondent farmers in the study area:

Profile of the study area has been analysed based on three criteris of the respondents. A. Gendear wise Distribution. B. Age Group. C. Education Status.

A.Gender-wise Distribution:

Responses about the impact of irrigation on cropping pattern and commercialization of agriculture in India and Sindagi taluks of Bijapur district were obtained from a sample of 200 farmers who has availed of the irrigation from the Upper Krishna Project in the district. The sample of the study covered 85 male and 15 female farmers in Sindagi taluks accounting for 85% and 15% of the total respectively. Similarly, 89 male and 11 female respondent farmers accounting for 89% and 11% respectively in Indi taluk were covered by the study. There is a greater weightage for male respondent farmers compared to female farmers. This is in conformity with the traditionally male dominated agriculture in our country, where females rarely manage the agricultural operations. This very factor has been responsible for high percentage of male respondent farmers covered by the study.

B.Age Group:

The field survey in the two study taluks of Sindagi and Indi has revealed that majority of 104 respondent farmers availing irrigation under the Upper Krishna Project were in the youthful age group of 28-37 years. A substantial number of 40 respondent farmers in the two taluks were found to be in the still younger age group of 18-27 years. Thus large majority of respondent farmers in the study area have been in the younger age groups. Further, 36 respondent farmers cultivating irrigated land in the two taluks belonged to the middle age group of 38-47 years. However, a small number of 20 respondent farmers involved in farming the irrigated land belonged to advanced age group of more than 48 years. The pattern of the number of respondent farmers engaged in farm operations in the irrigated areas of the two taluks was largely similar. The age composition of the respondent farmers in the study areas indicates that younger farmers have been taking up irrigated farming. Hence, the farming could be more imaginative and better managed with the younger generation who are supposed to be more conversant with modern scientific method of agriculture.

C.Educational Status:

It is significant to find from field survey that majority of 66 respondents – 42 in Sindagi and 24 in Indi – had primary education. A substantial number of 54 respondent farmers – 23 in Sindagi and 31 in Indi taluks – had secondary education. A lesser number of 24 respondent farmers – 11 in Sindagi and 13 in Indi taluks – had Pre University level of education. A still smaller number of 14 respondent farmers – 5 in Sindagi and 9 in Indi taluks – had degree level of education. A small number of 11 respondents – 7 in Sindagi and 4 in Indi taluks – had other level of education.

Following are the major aspects of the research area:

- Size of land holdings of respondent farmers cultivating irrigated land in the study area.
- Crops grown earlier and the present farm yield during the post irrigation period.
- Cropping pattern in the post irrigation period in the study area.
- Adequacy of irrigation water for the farmers.

Results and Analysis:

The analysis is based on the data obtained from the respondent farmers in the irrigated areas covered by the project in the two taluks of Sindagi and Indi in Vijayapur district of Karnataka state.

Table 1: Annual Income of Respondent Farmers

Annual Income	Sindagi	Indi	Total
Less than 10000	18	28	46
10001-20000	29	36	65
20001-30000	34	28	62
30001-40000	11	5	16
40001-50000	6	3	9
More than 50001	2	0	2
Total	**100**	**100**	**200**

Source: Autors calculation based on primary data.

The field survey has positively indicated that there has been an increase in the yield per acre of agricultural and horticultural crops after availing of the irrigation facilities in the study areas of Sindagi and Indi taluks of Vijayapur district. The study covering jowar and wheat among food crops and horticultural crops and sugarcane among commercial crops have indicated an increase of yield per acre ranging between 21.43% to 56.52% in Sindagi taluk and between 33.33% to 65.79% in Indi taluk. The survey has revealed that highest percentage of increase in yield per acre in Sindagi taluk was 56.52% in case of jowar, followed by 35.14% for wheat, 32.67% for sugarcane and a minimum of 21.43% increase in yield per acre in case of horticulture crops. However, the study has revealed 50% increase in yield per acre in other crops. In Indi taluk yield per acre after irrigation rose by 47.06% in case of jowar, 45.05% in case of sugarcane, 43.75% in case of wheat and minimum of 33.33% increase in yield per acre after availing irrigation in case of horticulture crops. For other crops the increase in yield per acre after availing irrigation was maximum at 65.79%.

The varying level of increase in yield per acre after availing irrigation in the two taluks covered by the study is also caused by other factors like the soil condition, quality of other inputs, climate, etc. The following table provides the details.

Table 2: Yield per acre after Availing Irrigation of farmers

Crops	Sindagi			Indi		
	Before Irrigation	After Irrigation	Percentage Increase (%)	Before Irrigation	After Irrigation	Percentage Increase (%)
Jowar	10	23	56.52	18	34	47.06
Wheat	24	37	35.14	27	48	43.75
Horticulture Crops	33	42	21.43	34	51	33.33
Sugarcane	68	101	32.67	61	111	45.05
Others (specify)	7	14	50.00	13	38	65.79

Source: Autors calculation based on primary data.

The responses of the farmers covered by the study in Sindagi and Indi taluks have clearly indicated positive change in the cropping pattern relating to each crop grown by them. Majority of respondent farmers have indicated change in cropping pattern relating to different crops. Change has taken place in case of the area covered under different crops viz. wheat, maize, jowar, paddy, sugarcane, pulses, groundnut and others. The change is more pronounced in case of maize, jowar, sugarcane and groundnut. Greater area is now used for commercial crops compared to other crops. The following table provides the details.

Table 3: Crop wise Change in Cropping Pattern after Irrigation

Crops	Sindagi			Indi		
	Before Irrigation	After Irrigation	Percentage Increase (+/-)	Before Irrigation	After Irrigation	Percentage Increase (+/-)
Wheat	78	94	+	91	111	+
Maize	91	115	+	88	135	+
Jowar	137	167	+	133	177	+
Paddy	0	0	-	0	2	+
Sugarcane	117	188	+	109	190	+
Pulses	49	74	+	51	78	+
Groundnut	77	98	+	67	94	+
Others	39	41	+	33	44	+

Source: Autors calculation based on primary data.

The rise in income after availing irrigation was 96% and 95% in case of respondents of Sindagi and Indi taluks respectively. Increase in family savings was 56% and 67% of respondents of Sindagi and Indi taluks respectively. There has been a decrease in borrowings from money lenders by 71% and 88% of respondent farmers in Sindagi and Indi taluks respectively after availing of irrigation facility. Purchase of additional level was reported by 29% and 37% of respondents in Sindagi and Indi taluks after availing irrigation facility. There has been increase in consumption expenditure by 71% and 88% according to respondent farmers in Sindagi and Indi taluks after availing irrigation facility. There has been increase in purchase of vehicles by 67% and 74% according to respondent farmers in Sindagi and Indi taluks after availing irrigation facility. The increase in additional expenditure on health, education and expenditure on marriage was 51% and 64% according to respondent farmers in Sindagi and Indi taluks respectively after availing irrigation facility. The above details clearly

indicate substantial improvement in the economic status of respondent farmers in the study area after availing of irrigation facility. The following table provides the details.

Table 4: Impact of Irrigation on Economic Status of Respondent Farmers

Particulars	Percentage Change After Use of Irrigation	
	Sindagi	Indi
Rise in Income (Family Income) (%)	96	95
Increase in Family Savings (%)	56	67
Increase in Consumption Expenditure (%)	71	88
Decrease in the Incidence of Borrowing from Private Money Lenders (%)	69	71
Purchase of Additional Land for Agriculture (No. of Acres)	29	37
Purchase of Vehicles (Number)	67	74
Additional Expenditure on Health, Education, Marriage of Children etc. (%)	51	64

Source: Autors calculation based on primary data.

Findings of the study:

- In India only 23 percent of world's total land area supports 18 percent of human and 15 percent of livestock population in the world.
- Irrigated agriculture provides 40 percent of the world food production on only 17 percent of total cultivated land. The World Food Summit in 1996 estimated that 60 percent of the extra food required to sustain the world in the future must come from irrigated agriculture.
- Irrigation can change the cropping time table to take advantage of good weather conditions or avoid periods with hazards like hail or heavy rainfall. Irrigation can also increase output and value through intensification of cropping and innovation in crop choice. Irrigation can extend the cropping season to allow multiple cropping, improve the quality of produce and permit new commercial crops and varieties to be grown.
- Government has taken various development processes. Tremendous changes have taken place in the agricultural economy. Agriculture is no more a way of life, but it has slowly become a commercial profession. India has a diversified cropping pattern with considerable variation from region to region.
- Farmers are gambling with monsoon and hence irrigation is everything in India. Water is more valuable than land. Irrigation emphasizes new agricultural strategy, which is leading to the mechanization and commercialization of agriculture. The total investment in irrigation sector since First Five Year Plan to Tenth Plan was Rs. 2, 47,769 crores. During the XI Plan it was Rs. 74,105 crores including irrigation and rural development.
- Agriculture is major occupation of people in Bijapur district. The cultivable area in the district is 74 percent. Rest is covered by forests, cultivable waste, fallow land, etc. The total area under irrigation is 17.3 percent of the net cultivable area.
- The two taluks of Indi and Sindagi are the beneficiaries of canal irrigation from Upper Krishna Project (UKP). These two taluks are in the tail-end area of Upper Krishna Project.
- Vijayapur district has few industries. There are 51 factories, 4 industrial estates, 70 sheds and 147 plots. There are 9017 small scale industries. There are 98 branches of Nationalised Banks, 60 branches of Grameen Banks, 28 DCC Banks and 5 KSCARD Banks. There are 502 Credit Cooperative Societies and 21 Cooperative Banks. The district has 17 Regulated Markets including 2 main and 14 sub markets.
- There are large number of primary and secondary schools in Vijayapur district and good number of PU colleges and degree colleges in Arts, Commerce, Science, Education, etc. Professional colleges in the district include Engineering, Medical, Law and Management. There is a Women's University in Vijayapur and a PG Centre of Rani Chennamma University of Belgaum. There is a Deemed University of Medical Sciences.
- There is a higher representation of male farmers in the irrigated areas of Indi and Sindagi taluks of Vijayapur district covered by the study. This trend is in conformity with the general trend of male domination in farm management in the country in general. Maximum number of respondent farmers in the study areas of Indi and Sindagi are in the younger age group of 28-37 years. Educational status of respondent farmers in the study area indicates that majority of them had primary and secondary education while very few had higher education. However, it is significant to find that a good number of respondents were illiterates. It is further observed that, large majority of the respondent farmers were married and a very few respondents were unmarried or widowed.
- Irrigation has a direct benefit of increasing production as water is the major input for crops. Irrigation provides more investment opportunities to people and generate more employment. It helps in promoting processing industries and improves standard of living of people.
- Majority respondent farmers in the study taluks of Indi and Sindagi had a moderate amount of annual income in the range of Rs. 10,001-20,000 and Rs. 20,001 to 30,000, followed by good number of respondent farmers with annual income of Rs. 10,000 of less. Very few respondent farmers had higher annual income of more than Rs. 30,000 per year.
- Major food crops grown by the respondent farmers in the study area were Jowar, Wheat and Maize. Major commercial crops grown in the area are Sugarcane, Grapes, Pomegranate, Red grams, Grams, Onion, Groundnut, Cotton and Sunflower.
- The impact of irrigation facility is found beneficial in creating more employment opportunities in the study areas. This has been affirmed by maximum number of 178 respondent farmers. However, a small number of 22 respondents did not occur with the majority opinion. The increase in employment due to the benefit of irrigation is experienced by both family workers as well as hired

workers in both Indi and Sindagi taluks as indicated by majority of 118 respondent farmers. A small number of 24 respondents did not agree with the majority opinion.

- A large majority of 185 respondent farmers have agreed with the view that availability of irrigation has led to the following of better methods of cultivation. These methods include intercropping, crop rotation, horticultural farming and floriculture, etc. according to majority of respondent farmers.

The present study has suffers from following limitations:

- This study is confined to financial year 2011-12 only. Hence the result are subjective in nature
- Present study pertains to two taluks of Vijayapur district viz. Indi and Sindagi only for purposes of convenience and availability of data.
- Due paucity of time the present study covers only select districts with particular target group which may represent the entire population. So, results are not generalized in nature.

Following are the major suggestions of the study:

- Immense potentials of irrigation could be properly exploited and realized with appropriate policy measures and technology absorption in the farm operations in the irrigated farming. The farmers need proper guidelines and training in the art and science of water use and the use of other farm inputs. There is need for appropriate mechanism to be evolved to involve the agricultural scientists, administrators and the Non Government Organizations (NGOs) in imparting necessary training of farmers in the scientific farming and planning of their cropping pattern. Periodical visits by these experts to the centres of irrigation and to identify the areas of improvements in the farming methods and practices.
- Necessary infrastructure by way of providing good roads, transport, electricity and marketing, storing facilities would be useful in the direction of realizing the benefits of irrigation and scientific cropping.
- Farmers need proper education in the use of chemical fertilizers like NPK and pesticides. Excess use of these chemical inputs should be avoided.
- Farmers should be guided by the officials and agricultural scientists by highlighting the importance of bio-compost fertilizers.
- Importance of crop rotation and multiple cropping on scientific lines should be highlighted through appropriate guidance and through mass media.
- There is need for ensuring adequate and timely supply of quality seeds for enhancing better yield and price for the farm produce.
- Farmers should be enlightened about the Integrated Pest Management (IPM) for controlling the menace of pests and insects affecting the crops.
- Necessary and timely supply of information on agricultural prices, marketing facilities, storage, etc. should be ensured to the farmers in the irrigated areas.

References:

- Acharya, S.S. (2003): Crop Diversification in Indian Agriculture. Agriculture Situation in India, Special Number, 239-250.
- Anonymous (2005): The Impact of Subsidy Policy on Sustainable Agricultural Products of Date Palm in the UAE (PAM approach). Dirasat Agricultural Sciences, 21(3), 21-28.

1) Batla Seema (2008): Regional dimensions of inter crop diversification in India: Implications for Production and Productivity Growth. Agriculture Situation in India, 64(12): 601-620.
2) Channaveer (2011): Economic Impact of Developmental Programmes in Peri-urban Area of Bangalore Metropolis, Karnataka. M.Sc. Thesis (Unpublished), University of Agricultural Sciences, Bangalore.
3) Dhawan, B.D. (1991): Developing Groundwater Resources: Merits and Demerits. Economic and Political Weekly, 26(8):425-429.
4) Dinesh, K., Marothia, Singh, R.K. and Koshta, A.K. (2007): Crop Diversification: Post-reform Lessons Learnt from Chattisgarh. Agricultural Situation in India, 64(5):215-226.
5) Fan Shenggen and Mukherjee Anit, 2005, Rural and Urban Dynamics and Poverty: Evidence from China and India. International Food Policy Research Institute, DSG Discussion Paper No. 32.
6) Joseph, K.J. (1996): Kerala's agriculture: Its Evolving Structure with respect to Cropping Pattern Changes – A Markov Chain Analysis. Paper presented, the Eighth Kerala Science Congress, Kochi, 169-171.
7) Kebebe, Ergano, Mehta, V.P. and Dixit (2000): Diversification of Agriculture in Haryana: An Empirical Analysis. Agriculture Situation in India, 57(8):459-463.
8) Kolavalli, S. and Chicoine, D.L. (1989): Groundwater Markets in Gujarat. Indian Institute of Management, Ahmedabad, Mimeo.
9) Mahesh, R. (1999): Causes and Consequences of Change in Cropping Pattern: Location – Specific Study. Discussion Paper, Kerala Research Programme on Local Level Development, Centre for Development Studies, Thiruvananthapuram.
10) Manech, M. (1992): Drawing Down the Buffer: The Science and Politics of Groundwater Management in India. Economic and Political Weekly, 27(13):7-14.
11) Mani, K.P. and Jose P.P. (1997): Shift in Cropping Pattern in Kerala – An Inter-District Analysis. Indian Journal of Agricultural Economics, 52(3):433.
12) Meenakshi, R. and Indumathy, R. (2009): Land Utilization and Cropping Pattern in Tamil Nadu. Indian Journal of Agricultural Economics, 64(1):145-153.
13) Bansil P.C. (2002: Eco-Problems of Indian Agriculture. CBS Publication.
14) Bilgrami (SAR) (2000): Introduction to Agricultural Economics. Himalaya Publishing House, Mumbai.
15) R. Chand (1999): Agricultural Diversification in India. Mittal Publications, New Delhi.
16) R.G. Desai (2001): Agricultural Economics – Model, Problems and Policy Issues. Himalaya Publishing House, Mumbai.

17) Government of India (2006): Household Consumer Expenditure in India 2004-05. NSO, Ministry of Statistics and Programme Implementation, March 2006.
18) Ramachandran, V.K. and Rawal, Vikas (2010): The Impact of Liberalization and Globalization on India's Agrarian Economy. Global Labour Journal, Vol. 1, No. 1, pp. 56-91.
19) D. Lenka (2002): Irrigation and Drainage. Kalyani Publishers, Ludhiyana, New Delhi.
20) Karnataka at a Glance 2011-2012, Directorate of Economics and Statistics, Govt. of Karnataka, Bangalore.
21) Vijayapur at a Glance 2010- Zilla Panchayat, Vijayapur
22) Vijayapur at a Glance 2011-12,