An Economic Efficiency Of Ground Water In Pudukottai District, Tamil Nadu

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Abstract
Ground water has made significant contributions to the growth of India's Economy and has been an important catalyst for its socio economic development. The State has as an area of 1.3 Lakh sq.km with a gross cropped area of around 63 L. Ha.. The Government's policy and objectives have been to ensure stability in agricultural production and to increase the agricultural production in a sustainable manner to meet the food requirement of growing population and also to meet the raw material needs of agro based industries, there by providing employment opportunities to the rural population. Tamil Nadu has all along been one of the states with a creditable performance in agricultural production with the farmersrelativelymoreresponsiveandreceptivetochangingtechnologies and market forces. Water used for irrigation should be essentially in good quality to grow good quantity crops, for the maintenance of soil productivity and for the protection of the environment. Physical and mechanical properties of soil, soil structure and permeability are very sensitive to the type of exchangeable ions present in irrigation water. Today, groundwater irrigation is becoming the cornerstone of providing water for agriculture, resulting in an overall exploitation rate of over 85%of the total available resources. Declining rates of tank and canal irrigation and overexploitation of groundwater are so critical that the state needs new policy interventions to tackle a pending water crisis. This policy brief recommends some development and investment options for the irrigated sector in Tamil Nadu.

Introduction
Groundwater has emerged as the primary democratic water source and poverty reduction tool in India's rural areas. On account of its near universal availability, dependability and low capital cost, it is the most preferred source of water to meet the requirements of various user sectors in India. Ground water has made significant contributions to the growth of India's Economy and has been an important catalyst for its socio economic development. Its importance as a precious natural resource in the Indian context can be gauged from the fact that more than 85 percent of India's rural domestic water requirements, 50percen to fit urban water requirements and more than 50percent to fit irrigation requirements are being met from ground water resources. The increasing dependence on ground water as are liable source of water has resulted in its large-scale and often indiscriminate development in various parts of the country, without due regard to their charging capacities of aquifers and other environmental factors.
However, the development of ground water in the country is highly uneven and shows considerable variations from place to place. As a part of their source estimation following the GEC norms, the assessment units have been categorized based on the stage of ground water development and long term declining trend of ground water levels Agriculture continues to be the most predominant sector of the State economy, as 70% of the population is engaged in Agriculture and all directivities for their livelihood. The State has as an area of 1.3 Lakh sq.km with a gross cropped area of around 63 L.Ha.. The Government's policy and objectives have been to ensure stability in agricultural production and to increase the agricultural production in a sustainable manner to meet the food requirement of growing population and also to meet the raw material needs of agro based industries, thereby providing employment opportunities to the rural population. Tamil Nadu has all along been one of the states with a creditable performance in agricultural production with the farmer s relatively more responsive and receptive to changing technologies and market forces. The Agriculture Department has taken up the challenge to achieve higher growth rate in agriculture by implementing several development schemes and also propagation of relevant technologies to step uptheproduction.IntensiveIntegratedfarmingsystem,massiveWastelandDevelopment Programme, comprehensive watershed development activities, water management through Micro irrigation systems, Organic farming, Soil health improvement through Bio-fertilizer including Green Manu ring, adoption of Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) technologies are given priority through various programmes, besides crop diversification to fetch better return and value addition to agricultural produce are also given priority to improve the economic status of the farming community.

Ground water in Tamil Nadu
Nearly 73% of the total area of the State is occupied by a variety of hard & fissured crystalline rocks like char neckties, gneisses and granites. The depth of open wells varies from 6 to 30mbgl. While the depth of borewells generallyvariesfrom30-100m. The sedimentary formations consist of sand stones, limestone sand shales whereas

Quaternary sediments in the State represented by Older alluvium and Recent alluvium and coastal sands. In the Cauvery delta of Thanjavur district, the artesian pressure head ranges between 4.5 m to 17 ma gl with free flow up to 270 m3/hr. The yield of wells in the alluvium varies form27 to 212 m3/hr. The yield of wells in the fissured formations varies from 7 to 35m3/hr. The State Government of Tamil Nadu has passed an Act "Tamil Nadu Ground Water (Development and Management) Act, 2003"on 04.03.2003 which includes provision of Tamil Nadu Ground Water Authority to regulate and control water development in the State of Tamil Nadu. Framing of rules and constitution of State Ground Water Authority is under consideration of State Govt. New provisions of the Model Bill, 2005 circulated by MoWR would be incorporated at appropriate time. ide Ordinance No. 4 of 2003 dated July, 2003laws relating to Municipal Corporations and Municipalities in the State have been amended making it mandatory for all the existing and new buildings to provide RWH facilities. The State has launched implementation of RWH scheme on massive scale in Government buildings, private houses / Institutions and commercial buildings in urban & rural areas. The State Government has achieved cent percent coverage in roof top RWH.

REVIEW OF LITERATURE

Groundwater irrigation, driven by both demand side and supply sidefactors,hasexperiencedexplosivegrowthduringthepastfewdecades,andnowit plays an important role in the agricultural development of India (Shah, Singhand Mukherji 2006; Shah 2009; World Bank 2010; GoI 2014; Kulkarni andShankar 2014; Zaveri et al. 2016). Availability of better drilling and pumpingtechnologies, subsidised energyfor extraction,flexibility andtimelinessofsupply,andpoordeliveryofpublicwatersupplysystemhavecontributedtoraising groundwater consumption in farming. This helped the farmers optimiseinput use, diversify to high value crops, and achieve higher water productivity(Shahetal.2007;WorldBank2010).Whilethisledtoreductioninruralpovertythrough various pathways (Hussain and Hanjra 2004; Narayanamoorthy 2007),thehighlyintensivedevelopmentofgroundwateralsoresultedinoverexploitation,declineingroundwaterlevelsincertain areasandseawaterintrusionincoastalareas(Dhawan1989;Chopra2003;Bhandhopadhyay2007).

STATEMENT OF THE PROBLEMS

As the water crisis manifests itself in the form of depleting water tablesandwaterrelatedconflictsbetweenstates,itishightimethatwateruseefficiencybecomes a focal agenda in the irrigation management Policy of India. Propermanagement of existing irrigation systems is critical for the success of thisagenda. It would also require integration and adoption of multidimensionalapproaches that canmanagedemand byincreasing water use efficiencyinagriculture. While the most obvious way to increase water use efficiency wouldbe to increase crop Yields through development of high Yielding varieties andefficient use of farm inputs, revision of electricity pricing to farming sector andreuseofwaste waterin agriculturecan bealso looked upon.

ThepresentlevelofefficiencyoftheirrigationsysteminIndiaisrelatively low and there is considerable scope for improvement. The NationalCommission for Integrated Water Resources Development has assessed thatirrigation efficiencies from surface water in India can be improved from thepresent level of 35 to 40% to about 60% and ground water from 65% to about75%. With the improvement in efficiency both through efficient end water useaswellasbyimprovingtheefficiencyoffacilitiescreatedforirrigation.Measures such as proper operation and maintenance, extension, renovation andmodernization of projects, repair, renovation and restoration of water bodies onthe one hand and use of agricultural practices such as moisture conservation,micro-irrigationetc.ontheotherhandarerequiredtobe adoptedurgently.

Consequently,thecurrentwateruseefficiencyofcanalirrigationisabout35 per cent - among the lowest in the world. It is estimated-that a 10 percentincreaseinwateruseefficiencycanbringaboutanadditional14millionhectaresunderirrigatedcultivation.Itisunderstoo dthattheapplicationefficiencyofdripirrigationisfoundtobethehighestinrelationwithothermethods.multaneously,itisnecessar ytoensurefinancialsustainabilitythroughregularrevisionofwaterrate andpromotingparticipatorymanagement by encouraging formationofWaterUsers'Association etc.

It is very important that best technologies and practices are transferred tothe farmers to enable them to translate the slogan "More crop and income perdropofwater"intoreality.MinistryofWaterResourcesisimplementing"Farmers'ParticipatoryActionResearchProgramm e(FPARP)"throughAgricultureUniversitiesandagriculturalresearchinstitutestodemonstrateavailabletechnologiesforincrea singproductivityandprofitabilityofagriculture.

Afterrealizingthesignificanceoftheroleofirrigationforthedevelopment of the society, it is felt that a study on minor irrigation assumesconsiderableamount of importanceandrelevanceandthepresent studyisinitiated. In order to avoid duplication in research efforts and to identify theaspects covered and gaps if any, a modest attempt is made to review the earlierstudiespresented inthesubsequentsection.

Objectives

- Tostudythedemographicandpersonalprofileoffarmersin PudhukottaiDistrict
- Toidentifyvariousimportantfactorsleadstoimplementborewellirrigationin agriculturedevelopmentin

PudhukottaiDistrict.

- Toexaminevariouschallengesfacedbyfarmerstoadoptborewellirrigationin PudhukottaiDistrict.

DemographicProfileof therespondents

Table1 -Frequencies forageoftherespondents

Age	Frequency	Percent	ValidPercent	CumulativePercent
<21Years	15	3.571	3.571	3.571
21-30Years	89	21.190	21.190	24.762
31-40Years	128	30.476	30.476	55.238
41-50Years	120	28.571	28.571	83.810
>50Years	68	16.190	16.190	100.000
Total	420	100.000		

The above table is inferred that majority of the farmers in the selected locationarebelongstoagegroupbetween41to50yearsandsecondmajoritygonetoagegroupbetween 31 to 40 years. Which reveals that more than 30 years of age group farmersareverymuchinterestedtodoagricultureastheirprimebusiness.Theleastpartoftheagegroup belongstolessthan 21years.

Table2-FrequenciesforGender

Gender	Frequency	Percent	ValidPercent	CumulativePercent
Male	404	96.190	96.190	96.190
Female	16	3.810	3.810	100.000
Total	420	100.000		

The majority of the farmers are belongs to male gender (N=404, 96%) andsecond majority only goes to female gender (N=16, 3.8%). Which stated that malefarmers are having own lands and females are working as an agricultural supportingworker.

Table 3 - Frequencies for Type of farmer

Type of farmer	Frequency	Percent	Valid Percent	Cumulative Percent
First generation	104	24.762	24.762	24.762
Second generation	316	75.238	75.238	100.000
Total	420	100.000		

The majority of the farmers are doing agriculture as a second generation practices (N=316, 75%) and second majority farmers are first generation farmers (N=104, 24.7%). Which stated that majority the farmers in the selected location are second generation farmers.

ECONOMIC IMPACT OF BOREWELL IRRIGATION ON AGRICULTURAL DEVELOPMENT

Table 1 – Mean and Standard deviation for economic impact of borewell irrigation on agricultural development

Code	Statements	Mean	Std. Deviation
EI1	The economy and water are inextricably linked.	3.3762	1.10170
EI2	Agricultural development and reduced investment risks depend on reliable and sufficient water supplies.	3.5214	1.11703
EI3	Bore water supply and its quality are critical agriculture risks.	3.4857	1.09992
EI4	Bore water is the key to eradicating poverty in the present situation.	3.4238	1.10387
EI5	It is an essential resource in places without other alternatives to water.	3.6286	1.13404
EI6	Bore well irrigation has contributed to significant resource savings in terms of cost of cultivation, overall farm profitability and crop	3.5262	1.12756

	yields.		
EI7	Bore well irrigation provides opportunities for crop expansion.	3.8762	1.08203
EI8	The expansion of bore well irrigation resulted in water savings when land was limited.	3.4452	1.12016

The respondents strongly agreed in the following areas of "economic impact of borewell irrigation on agricultural development" variables with the highest mean score. Bore well irrigation provides opportunities for crop expansion (3.872) which is the highest, it is an essential resource in places without other alternatives to water (3.628), Agricultural development and reduced investment risks depend on reliable and sufficient water supplies (3.521). The respondents agreed in the following areas of "economic impact of borewell irrigation on agricultural development" variables with the mean score.

Table 1 – Differential Statistics between economic impact of borewell irrigation on agricultural development and annual Income (in rupees)

		Sum of Squares	Df	Mean Square	F	Sig.
EI1	Between Groups	1.148	2	.574	.472	.624
	Within Groups	507.414	417	1.217		
	Total	508.562	419			
EI2	Between Groups	6.360	2	3.180	2.568	.608
	Within Groups	516.447	417	1.238		
	Total	522.807	419			
EI3	Between Groups	5.923	2	2.962	2.465	.186
	Within Groups	500.991	417	1.201		
	Total	506.914	419			
EI4	Between Groups	.927	2	.464	.379	.685
	Within Groups	509.635	417	1.222		
	Total	510.562	419			
EI5	Between Groups	1.916	2	.958	.744	.476
	Within Groups	536.941	417	1.288		
	Total	538.857	419			
EI6	Between Groups	5.999	2	3.000	2.375	.094
	Within Groups	526.713	417	1.263		
	Total	532.712	419			
EI7	Between Groups	1.057	2	.528	.450	.638
	Within Groups	489.505	417	1.174		
	Total	490.562	419			
EI8	Between Groups	8.054	2	4.027	3.244	.140
	Within Groups	517.687	417	1.241		
	Total	525.740	419			

To measure the variance between economic impact of borewell irrigation on agricultural development factors and annual income (in rupees), out of 8 factors shows none of the variables are have significant difference with the annual income (in rupees) of the respondents. Hence null hypothesis is accepted, which means that on an annual income of the farmers have the significant association towards economic impact of borewell irrigation on agricultural development.

Conclusion

Water used for irrigation should be essentially in good quality to grow good quantity crops, for the maintenance of soil productivity and for the protection of the environment. Physical and mechanical properties of soil, soil structure and permeability are very sensitive to the type of exchangeable ions present in irrigation water. Irrigation water quality is determined by physical and chemical methods of analysis. The most important factors determining the suitability of

water used in agriculture are pH, EC Salinity hazard, Sodium hazard, Sodium Adsorption Ratio (SAR), Carbonate, Bicarbonates in relation with Ca, Mg content and other captions and anions. In this point of view, present study is designed to monitor all the parameters by measuring the quality of irrigation bore well water in major rice growing area of Pudhukottai District. Pudhukottai district consists of eight taluks and five hundred and eighteen revenue villages. Most of the farmers utilize ground water for irrigation. In this juncture it is very essential to monitor the quality of irrigation water. In this proposed work water samples have been collected in all eight taluks of Pudhukottai District to monitor irrigation water quality parameters. Irrigation is the lifeblood of agriculture, rural livelihood and food security in Tamil Nadu. Centuries-old tanks, and reservoirs and canals were the dominant features in irrigation till the mid-twentieth century. Irrigation landscape, however, began changing with private investments in minor irrigation, particularly in groundwater. Today, groundwater irrigation is becoming the cornerstone of providing water for agriculture, resulting in an overall exploitation rate of over 85%of the total available resources. Declining rates of tank and canal irrigation and overexploitation of groundwater are so critical that the state needs new policy interventions to tackle a pending water crisis. This policy brief recommends some development and investment options for the irrigated sector in Tamil Nadu.

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