**AN ECONOMIC IMPACT OF BOREWELL IRRIGATION ON AGRICULTURAL**

**DEVELOPMENT IN PUDUKKOTTAI DISTRICT, TAMILNADU.**

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**Abstract**

In Tamil Nadu, a sizable share of the population depends on farming for livelihoods. The agriculture sector has been experiencing various problems like floods, drought, crop failure due to climate change, farmer suicide, etc over the years and such problems are very severe today. Water scarcity is a dominant problem that has significant implications for food security and sustainable agriculture. River tanks and wells are the main sources of irrigation. Likewise, the irrigation in Tamil Nadu is largely relays on groundwater. The quantity of ground water is declining in the state but still, the use of this source for irrigation is dominant.

\* Key Words: Irrigation, Climate Change and Water Scarcity

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**1. Introduction**

India being an agrarian country, our farmers depend mainly on groundwater for irrigation. With increasing population, lesser land holdings and urbanisation, deeper borewells are dug for groundwater abstraction. Borewells are very similar. Both are basically vertical drilled wells, bored into an underground aquifer on the earth’s surface, to extract water for various purposes. The difference between the two lies in the type of casing used, the depth of this casing and the type of soil where they are drilled. Casing to support the external surfaces of the borehole against collapse may be needed at certain depths, and usually is made up of PVC pipes. Electrical pumps are usually used to pump out the water from the borewells, though the government is now giving subsidies for solar pumps. This convenience of pumps may increase the depletion of the groundwater at an increased pace**.** Excessive drilling of borewells has led to exploitation of groundwater at higher rates than the rate of water recharge and caused depletion of the groundwater levels. To monitor this many states like Karnataka & Kerala have come up with laws & a statutory authority to regulate and keep tabs on the groundwater utilisation. Some states have implemented groundwater legislation acts which prevent drilling of borewells without the permission of Government Bodies in water scarce regions. However, some states allow only drilling of drinking water borewells without the need for obtaining permission. Therefore, it is advisable to explore the details of it before drilling a borewell.

**Central Ground Water Board (CGWB)** has come up with reports on the groundwater status in the country. Uncontrolled use of bore well technology leads to exploitation of groundwater at higher rates than the rate of water recharge, which may cause drastic depletion of groundwater.

**2. Literature Review**

**Venkatachalam and Balooni (2018) [1]** reveal many Indian states have begun to transfer water meant for irrigation to non-agricultural purposes, but the economic and environmental consequences are not adequately understood. Transfer of water out of water bodies from rural areas not only reduces the economic welfare of the traditional water users but also reduces their incentives to manage these water bodies on a sustainable basis. The study explores the possibility of introducing the mechanism of ‘payment for ecosystem services’ at the grass-roots level in the Indian context as a return for reallocation of water from irrigation to urban uses so that it can produce a non-zero-sum outcome for villagers, farmers, urban consumers, and governments.

**Robert et al, (2018) [2]** suggested agricultural sustainability under climate change is a major challenge in semi-arid countries, mainly because of over-exploited water resources. This article explores short- and long-term consequences of farmers’ adaptation decisions on groundwater resource use, under several climate change scenarios. We model farmer decisions on crop choice, investment in irrigation and water application rates, using a stochastic dynamic programming model with embedded year and season decision stages. Several sources of risk are considered that may impact farmer decisions, with poor rainfall affecting crop yield and market prices, while driving crop and borewell failure probabilities. We further investigate the performance of water management policies for groundwater resource conservation. This is achieved through policy simulations from a calibrated version of the stochastic dynamic model, using data from a field survey in the Berambadi watershed, Karnataka state, southern India. The most relevant and novel aspect of our model is the joint consideration of (i) investment decisions about irrigation over a long-term horizon and with the probability of borewell failure, (ii) several water management policies, and (iii) detailed farmers’ water practices and the representation of crop choice for each agricultural season with crop failure.

**Biswas and Venkatachalam (2015) [3]** the approach toward irrigation management in India has gradually shifted from a government-dominated, supply-side paradigm toward a user-preferred, demand-side paradigm. Yet, decisions regarding water allocation and irrigation charges do not adequately incorporate farmers' preferences and their willingness-to-pay (WTP) for improved irrigation. Since public investment on irrigation projects is sizeable and the opportunity cost of irrigation water is increasing, there exists a need to estimate the economic value of irrigation water to utilize it in an efficient manner. This paper presents results of a contingent valuation (CV) study conducted in a semi-arid region, namely, the Malaprabha Irrigation Project in Karnataka, India, which elicited farmers' preferences and their WTP value for improved irrigation. The results suggest that farmers predict a significant increase in agricultural benefits due to additional irrigation and they are willing to pay significantly higher than what they are currently paying to secure these benefits. It implies that improved irrigation increases not only the farmers' benefits but could potentially increase the government's revenue, resulting in a win–win outcome.

**3. Statement of the Problem**

Irrigation is the major input for agriculture. The development of agriculture is mainly depends on proper utilization of various sources of irrigation. The development of agriculture or mechanization and modernization of agriculture depends on the availability of irrigation facilities. The level of ground water depends on rainfall and tank irrigation. Due to the uneven rainfall in the country, it is necessary to improve the canal source of irrigation through proper utilisation of rainfall. Paddy, vegetables, and sugarcane are crops of about one year duration and it has to pass through all the seasons of the year irrespective of the time of planting. Some months are moisture deficit, some are with adequate moisture supply and in some there is moisture surplus. Water requirement of the crop is high during the deficit period compared to the surplus period. Providing optimum soil moisture conditions throughout its growing period is of paramount importance to realise high yields. Water is a prime resource and at the same time, it is an over exploited resource due to rapid commercialization of agriculture and urbanisation. The ground water in Tamil Nadu has been exploited to the tune of 80-85 per cent of its potential. Many areas have slipped into 'Black Zone' from 'White' and 'Grey'.

**4. Research Gap**

**Gap 1:** Factor influencing borewell irrigation education among farm-land owned farmers is not fully explored and not much has been done in Indian context.

**Gap 2:** Very little literature is available on Factor influencing borewell irrigation education among farm-land owned farmersin Indian context.

**5. Research Objectives**

Keeping in view scope and the expected contribution of the proposed study the broad objectives of the study are:

* To study the demographic profile of the farm-land owned farmers in Pudhukottai District.
* To study the personal profile of the farm-land owned farmers in Pudhukottai District.
* To identify the factors influencing borewell irrigation education among farm-land owned farmers in Pudhukottai District.
* To examine the factors influencing borewell irrigation education among farm-land owned farmers in Pudhukottai District.
* To suggest a strategic model related to the factors influencing borewell irrigation education among farm-land owned farmers in Pudhukottai District

**6. Research Hypotheses**

**(H1) :** There is significant difference regarding demographic profile and

factors influencing borewell irrigation education among farm-

land owned farmers

**(H2) :** There is significant difference regarding personal profile and

factors influencing borewell irrigation education among farm-

land owned farmers

**(H2) :** Impact or effect of factors influencing on borewell irrigation ` education

**7. Methodology**

The data will be collected from the 600 farm-land owned farmers in Pudhukottai District those who are using bore well for irrigation by using questionnaire method. The appropriate statistical tools will be used based on the research gap and objectives.

**8. Sampling**

The sample size is a representative frame of the universe which was so designed by keeping in view time and resources constraints and would justify the objectives of the study. Therefore the universe of sample was determined based on the government reports. The survey will carried out over a period of four months at different destinations of Pudhukottai district. Out of sample population only 600-1000 will be choosen based on the sample size determination formula. The data will be collected from the farm-land owned farmers in Pudhukottai District as on the basis of stratified random sampling.

**9. Data Collection**

**Kumar and Phrommathed (2005)** describe the survey method to be best suited for eliciting fresh perceptions on the basis of empirical evidence lending consistency and robustness to the research findings . The task of data collection depends upon the definition of the research problem and the research design. The topic of this study was to Factor influencing borewell irrigation education among farm-land owned farmersin Pudhukottai District. For the collection of primary data the questionnaires will be developed for collecting information from the tourists of three regions of the state. The questionnaire will be finalized after pre-testing by personally contacting sample respondents of different destinations of the study.

**10. Processing Data**

**Miles and Huberman (1994)** developed an analysis model for qualitative data, which consists of three stages: data reduction, data display, and conclusion drawing/verification. Data reduction is the process of selecting the data to make it sorted, focused and organized in order to be able to draw and verify conclusions. The authors explained that the data display is a way to organize and compress the reduced data for the purpose of simplifying the conclusion drawing. In the last stage (conclusions and verifications), researchers note regularities, patterns, explanations, and possible configurations, casual flows and propositions.

When it comes to quantitative data analysis, there are many different ways of analyzing the data. Descriptive statistics is one way of doing so, which help to describe raw data and these methods include: numerical counts of frequencies; percentages, measures of central tendency (mean, mode, median); and measure of variability (range, standard deviation, variance) **(Taylor-Powell, ).**

The most commonly used from previously mentioned methods are numerical counts of frequencies and percentages. Counts of frequencies tell how many times something occurred or how many responses fit into a particular category. Percentages express information as a proportion of a whole, they tend to be easy to interpret; they are a good way to show relationships and comparisons; and they are also useful when researchers want to display a frequency distribution of grouped data. The analysis techniques presented previously involve calculating numbers by using actual data that is gathered. Rankings, on the other hand, are not actual measurements but rather created measures to impose sequencing and ordering. Ranking indicates where one value stands in relation to other values or to the total. The third data analysis method comes from **Taylor-Powell, 1996** who propose two techniques that can be implied in the analysis of the collected data.

First is the data comparison to the used theory, and the second is cross-case analysis, where data is compared from one case to another. When it comes to this thesis, all of the previously mention data analysis methods were used. Interviews were analyzed according to where patterns and similarities were found. From the surveys, different percentages and rankings together with tables and figures were presented. Both data, qualitative and quantitative, were also analyzed, compared and combined with relevant theory.

**11. Proposed Theoretical Model**

Borewell irrigation education for farm-land owned farmers

Factor influencing borewell

 irrigation education

Personal Profile

Demographic Profile

**12.Research Process**

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**FIGURE 1: Research process**

**13. Statistical Tools and Packages will be used**

The data will be analyzed by using various statistical tools like Cross Tabulation, ANOVA,‘t’ test, Analytical Hierarchy Process (AHP), Structural Equation Modeling, Partial least square, and Regression. The researcher will perform the pilot data with help of SPSS and AMOS package for testing the data validity and fitness of the data.

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