CHAPTER I

INTRODUCTION

When water fails, functions of nature cease, you say;
Thus when rain fails, no men can walk in 'duty's ordered way'.

- Thiruvalluvar

1.0 Introduction

Safe drinking water supply and basic sanitation are vital human needs for health and efficiency. Water needs are complexly linked with the daily life, especially of the poor communities. Through its widespread linkages, water plays an important role in the welfare societies. We may list at least three such linkages. First, the availability of water is essential for production and income generation. Second, water for domestic purpose and sanitation improves the quality of life and finally, water should be sufficient for sustainable environmental management.

As a ‘basic need’, water has a two-fold role: in its availability per se and being accessible to all sections of people in an equitable manner. Although consumption of water varies across different sections of the society, water may not be mere consumption good in the case of the poor, but a key source of their livelihood. Hence, water policy has assumed priority in the political agenda of our nation in recent years. But, as long as water is available in abundance, people do not have any concern over its consumption of conservation. The last few decades of development have caused serious depletion of water resources around the world. Increasing population and intensifying development activities have made water a scarce commodity thereby assuming an economic value as well. In addition, pollution of the available water resources has aggravated the problem of lowering the water quality. Growing demand for a limited supply of water in the last few decades has led to inter-state and international friction and competition among different sectors. Considering the importance of water for human health and well-being, governments have allocated enormous amount of money for providing adequate quantity

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1 Frederiksen et al (1993) have pointed out that growing competition for water pollution has pervasive externalities.
of safe drinking water\textsuperscript{2}. Yet, majorities of the poor people in the developing countries are living without sufficient safe drinking water and sanitation facilities. Out of the six billion people in the world, at least 1.1 billion do not have access to safe drinking water\textsuperscript{3}.

Provision of water and sanitation services is the responsibility of the state in India. A number of rural water supply policies and programmes have been initiated by central and state governments since independence. They were added to the national agenda during the First Five Year Plan period. The Government of India launched the National Water Supply and Sanitation Programme in 1954 as part of the government’s health plan. Accelerated Rural Water Supply Programme (ARWSP) was introduced during the Fourth Five Year Plan (1969-74), while during the Fifth Five Year Plan (1974-79) it became the part of the Minimum Needs Programme. During the Sixth plan period, the government established the National Drinking Water Mission renamed as Rajiv Gandhi Drinking Water Mission which aimed at providing technical and scientific assistance to states and to ensure availability of adequate water of acceptable quality on a long term basis. The main objective of the government is the provision of the basic amenity of potable water supply to every citizen, especially in the rural areas. But, despite concerted efforts for over five decades, vast rural areas face acute shortage of water. Eighth Five Year Plan for instance, found 75,782 not-covered and 3.32 lakh partially-covered habitations which did not have access to a minimum supply of water. Even among the households which benefited from piped water supply service there was no easy access the near the household premises\textsuperscript{4}. According to Eleventh five year plan (2007 – 2012), the status of the provision of water and sanitation has improved slowly. According to Census 1991 about 55.54 percent of the rural population had access to an improved water source. The Department

\textsuperscript{2} Allocation of water supply and sanitation for instance in India was 2.47 percent during the First Five year plan and rose to 4 percent in the sixth plan and subsequently to 4.82 percent in the ninth plan. The total plan outlay up to eighth plan on urban and rural water supply and sanitation was 15,100 crores and 19,300 crores respectively (Gol, 1997). Even though, plan outlay to the water supply and sanitation sector varies in different five year plans, the government of India allocated a minimum of nearly 2-3 percent of total plan outlay to the water supply and sanitation sector.

\textsuperscript{3} Health, Dignity and Development: What will it take? UN Millennium Project task force on water and sanitation, Final report, \url{www.energyandenvironment.undp.org}

\textsuperscript{4} According to 2001 census 62.3 percent of the rural households were covered under piped water supply. Among these households only 23 percent were getting water within their household premises and 39.6 percent were getting water near their household premises. In urban areas 83.6 percent of the households were covered under piped water supply and among them 60.8 percent were getting water within their household premises.
of Drinking Water Supply’s figure shows that out of a total of 1,507,349 rural habitations in the country, in which 1,121,366 habitations (74.39 percent) are fully covered and 220,165 habitations (14.64 percent) are partially covered.

The total available water on earth is estimated at 1,370 km$^3$. Out of this, 1,336 million km$^3$ (or 97.5 percent) is contained in the oceans and seas which being saline is unfit for domestic and agricultural purposes. The remaining 34 million km$^3$ (or 2.5 percent) is the available fresh water. The fresh water stocks found in lakes, rivers, soil, atmosphere, and vegetation and exploitable underground aquifers are estimated to be around 1.4 million km$^3$. This is a very small fraction, only around 0.1 percent of the global obtainable water has to sustain all the terrestrial forms of life on this planet.

India shares 16 percent of the world’s land resources and 4 percent of its water resources. The growing accessible water resource of India is 2,384 km$^3$, while the annual utilizable water resource of the country is estimated to be only 1086 km$^3$.

1.1 Water Demand

Demand for water is primarily for protecting water, for domestic use, irrigation, livestock, industries, hydel power generation and for recreational activities. Academic institutions in several countries are engaged in projecting future demands for water. According to the National Commission on Integrated Water Resources Development the total water requirement of India by the year 2050 will be about 1,180 km$^3$ against a total stock of 1,086 km$^3$. United Nations expects that by the year 2025, 3 billion people in 52 countries will be affected by water scarcity and they will not have enough water to drink, for sanitation, or for household use. The water requirement of Tamil Nadu is also escalating in a similar fashion.

1.2 Drinking water

Water is a direct multi-purpose resource. Among its numerous multitude of uses, requirement of safe and protected water drinking purpose figures high on the national agenda of every country. Article 21 Constitution of the India, Access to clean and protected drinking water has been treated as a fundamental right of all the people.
United Nations contends that, “All people, whatever their stage of development and their social and economic conditions have the right to have access to drinking water in quantities and of a quality equal to their basic needs” (United Nations, 1997).

Percent of population with access to safe drinking water during the decade of 1990 and 2000, global coverage rose from 77 per cent to 82 per cent. This means that nearly 1 billion more people gained access to improved drinking water sources during the 1990s. Coverage remains low, especially in poor rural areas of Africa and in informal peri-urban settlements. Water quality problems have grown more severe, as dangerous levels of arsenic in groundwater have emerged in several Asian countries during the decade.

Access to safe drinking water refers to “the percentage of people with reasonable access to an adequate amount of safe drinking water in a dwelling or within a convenient distance of their dwelling” (The World Bank, 1998). After the concerted efforts in India during the UN International Drinking water Decade, 1980-1990, 18 percent of the country’s rural population is deprived of access to safe drinking water. Nearly 1.1 billion people in South Asian countries do not have access to safe drinking water (U.G. Sha, 2004). According to Census 2001 data, 26 percent of households in India lack access to safe drinking water sources, like tap, hand pump and tube well. The coverage based on village/hihabitation as the unit, however, tell us another story. The Rajiv Gandhi National Drinking Water Mission has conducted a census in all the States and Union Territories with habitation as the unit. The results of the Census indicate that about 50 percent of the population and 45 percent of the habitations in India do not have access to safe drinking water (Pushpangathan, 1996).

Health hazards that would accompany a situation of drinking water shortage are beyond quantification. According to World Health Organization, 80 percent of all diseases in developing countries in some way or another are related to water and sanitation. Over a million Asian children die every year from water borne or water related diseases (United Nations, 1991).

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The quality of drinking water is a powerful environmental determinant of health. Drinking water quality management has been a key pillar of primary prevention for over one-and-a-half centuries and it continues to be the foundation for the prevention and control of waterborne diseases. Water is essential for life, but it can and does transmit disease in countries in all continents from the poorest to the wealthiest. The most predominant waterborne disease, diarrhea, has an estimated annual incidence of 4.6 billion episodes and causes 2.2 million deaths every year (WHO 2010). Poor or no access to safe water supply can result in many diseases including diarrhea, fluorosis, cholera, hepatitis, trachoma, etc. These ailments potentially constrain human resource development and productivity, especially of the poor. Over 750 persons per lakhs population suffered from diarrhea in India during 1998, attributable to poor water quality drinking water (Puttaswamaiah, 2005).

1.3 Statement of the Problem

The availability of potable drinking water in India has remained a challenge. There have been several programmes and policies of the government exclusively dealing with providing safe drinking water to the people. But over a period of time it has been seen that, the same problem persists even after implementation of different plans and programmes in the State. Even if the State’s allocation on water sector has increased enormously, but simultaneously it is found that a large segment of population in the country is deprived of their basic right to drinking water. Census 2001 data indicate that all India level, the coverage of safe drinking water in the rural areas is around 73.23 percent only. Safe drinking water includes the sources of tap (piped water), hand pump, tube well, well, tank/pond/lake, river and canal, spring and any other source. National Family Health Survey (NFHS) recommendation is that only water from the sources like pipes, hand pumps, covered well or tanker-track can be considered as safe for drinking purposes.

The socio-economic, technological and environmental issues involved are profound, as many of them still remain unresolved. Whether water is treated as an economic good or social good or both. Whether the provision need be demanded responsive or supply based. What is the extent of subsidy the state can provide for rural water supply? If cost sharing is agreed in principle, whether to start with sharing capital...
cost or sharing operation and maintenance cost. Who should decide on the technology and its cost if costs are to be shared? The role of women and the community participation in managing water supply unfolds issues like time spent, distance travelled and the involvement of local people in organizing the facility.

1.4 Objectives

The objectives of the study are to:

- Estimate the demand for water for domestic purposes in the study area
- Analyze the cost aspects, factors influencing water use, distance travelled, time spent and the problems confronting rural households in procuring water at the household level and to outline an alternative method of calculating tariff for rural water supply.
- Understand the ecological dimensions of drinking water with respect to depletion of groundwater resources, degradation of water quality and the health impacts thereof, and the ecological conflicts owing to the distribution of water.
- To examines the environmental and economic component to calculate the treatment cost of waterborne disease posed by the poor water quality in the study areas of Coimbatore district.

1.5 Hypotheses

- All the regions received potable water for drinking and cooking purposes in equal proportion.
- The family size, land holding, per capita income, female head education, occupation, house value, area (wet, mixed, dry and hill) cooking trip per day, distance and time are the key determinants of consumption of water.
- Area, Family size, Per capita consumption of water, Total family income, total time spends for water collection and House value are the key determinants of willingness to pay for improved water supply.
- Family size, Expenditure for medical, Total expenditure per month, LPCD, Affected person Men, Affected person children, Waterborne disease cholera & Diahorrea, hepatitis, jaundice, where do you get treatment for waterborne disease,
distance move for treatment, the amount spent for diseases affected by chemical parameters, taste of hand pump water, taste of gravity water are the key determinants of treatment cost of waterborne diseases.

1.6 Methodology

In order to realize the set of objectives, Coimbatore district in the state of Tamil Nadu is chosen. This is one of the thirty two districts in the state, comprising of 6 taluks, 12 blocks, 229 village Panchayats and 1941 habitations. Of which 342 sample village households were selected across 4 taluks, 3 blocks, 4 village Panchayats and 31 habitations.

1 6.1 Method of sample selection

The present study has used multistage sampling methods namely systematic, proportionate, stratified random sampling methods to select the sample villages. To identify the study area lots of inputs has been used. The variables including water level, Rainfall, Litre Per Capita per Day (LPCD), Water quality, Percentage of cultivated area, an area less irrigated, area which is partially irrigated, and, partially less irrigated and percentage of water intensive crop cultivated were used in order to identify and fix the sample villages. These areas can be divided according to the nature of soil persistence, ground water availability and the produce. Totally four villages were selected and grouped under four categories namely Wet, Mixed (partially wet & partially dry), Dry (arid) and Hilly region. Of the total households, in the four selected villages, 10 per cent of the sample households were chosen proportionately (see figure. 1). This land nature reveals the importance of availability, affordability and accessibility of water for various uses.

Further, as per data classified the ‘Anamalai’ Block was chosen under Hill and Wet area categorization, where the villages namely ‘Nedungundra’ was selected under Hill area category, where the Scheduled Tribes population is located, and, ‘Subbegoundanpudur’ was selected under Wet area. The ‘Ambothi’ Village in ‘Annur’ Block has an acute dry nature, hence the Village was selected under Dry area. In the Mixed area (partially wet and partially dry) classification ‘Thondamuthur’ block was chosen in which ‘Madampatti’ village was selected as Study area (Figure 1).
Household list and caste particulars were collected from the village Panchayat office and the landholders list and land less particulars are obtained from the Village Administrative Officer (VAO). Total household population is classified on the basis of community like Schedule Caste / Tribes (lower caste) and Other Communities (upper caste). The percentage wise calculation is being made within the community and landholding in order to get samples more precise.

Landholders and landless are the two major classifications. The landholders are then divided into three groups i.e. the first group is less than 1.1 to 2.5 acres, the second group is 2.51 to 4 acres and above 4.1 acres is the third group. The selected 10 percent of sample households are proportionate to the actual percentage of land holdings by the households across communities to the total village households. Analysis of data is carried out at two levels. The habitation wise resurvey data are analyzed based upon the secondary sources of information which was collected at the first level and the household wise data is analyzed at the second level with the help of primary data collected from field survey. The essential statistical tools such as Analysis of Variance, Regression Model and ‘t’ test are used to validate and prove the hypotheses and in order to reach the objectives.

1.6.2 Data source

Secondary information on the status of drinking water provision in Coimbatore District, the district chosen for study, across 1941 habitations were collected from the Tamil Nadu Water supply and Drainage (TWAD) Board. These habitations are spread across 229 village Panchayats, 12 blocks (Panchayat union), and 6 taluks. A broad profile with the available information is attempted with the help of secondary information. The rural water supply distribution system is analyzed to check the reliability and validate the secondary information availed from the TWAD board with the help of primary data.

1.6.3 Primary household survey period

The primary household survey was conducted with the help of a detailed interview schedule during first April 2010 to end of September 2010. The survey period covered summer and rainy seasons as well.
1.6.4 Tools of Analysis

The Statistical Package for Social Science (SPSS) version 16 for Windows was used for analyzing the data collected during the questionnaire survey. The respondents were given numbers for identification purposes. The region and the village each respondent was living were coded with numbers so that the situation in each region or village under the different questions in the questionnaire can be analyzed. Each question in the questionnaires was identified by a variable name and within variables there were values and value labels for identification of responses from the respondents. After coding the information from the questionnaires, template for entering data into the computer program was created. Simple statistical tools such as t’ test, regression model and ANOVA for the testing of hypotheses, mean, standard deviation and co-efficient of variation are used along with bar and pie diagrams. The regression model is used to analyze primary sources of information. In the preliminary analysis, a large number of variables are included, however only five to six variables were used for the actual analysis.

The correlation matrices are used to drop less important variables and thereby avoid multi-colleniarity problems. For the final regression analysis number of different combinations are tried to arrive at a final list of variables with a good fit in terms of explanatory power. Block rate pricing method is used to estimate the tariff rates for pipe service connections with the help of the actual village level data.

In sum, the actual data analysis of both secondary and primary information has been carried out at different levels, presented in third, fourth and fifth chapters of the present study. First, the NSSO data were analyzed with a hypothesis testing using paired ‘t’ test. Secondly the TWAD Board re-survey data were analyzed. Thirdly, primary household survey information was analyzed through regression equation and Duncan test to test the stated hypothesis. And finally Block rate pricing method was applied to estimate the rural water tariff for house service connections.

1.7 Organization of the thesis

This thesis is made up of five chapters, where as per the thesis framing methods the first chapter is introduction. Second chapter sets out the conceptualization of the problem and
review of literature. The secondary data information on National, State and District scenarios of rural water supply is presented and analyzed in the Third chapter. The Fourth chapter includes the profile of the study area (Coimbatore district) and analysis has been done on rural water supply at the habitation level of the study villages. The Fifth chapter contains the results of the household survey and the environmental dimensions of rural water supply. Findings, policy implications, summary and conclusion were given in the last chapter.