

**CHANGING CONSUMER BEHAVIOUR THROUGH WATER  
POLLUTION: A CASE STUDY ANALYSIS**

**BY**

**KAUMUDI MISRA**

**(Reg. No: 12PEC006)**

**A DISSERTATION SUBMITTED TO THE AVINASHILINGAM  
INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR  
WOMEN, UNIVERSITY  
COIMBATORE-641043**

**IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE  
DEGREE OF MASTER OF ARTS IN ECONOMICS**

**MARCH 2014**

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**CERTIFIED AS BONAFIDE RESEARCH WORK**

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THE HEAD OF THE DEPARTMENT**

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## **CHAPTER – I**

### **INTRODUCTION**

Water is one of the most precious gifts of nature without which no life could survive on earth. When our population was limited, its bountiful supply seemed endlessly renewable. We could then afford to foul one water source, abandon it, and move to another. This, however, is no longer possible since the exponential growth rates of human population, industries, and farms have already reduced the availability of water to below its minimum per capita daily requirement of about 23 litres. Consequently, any further expansion of our activity will depend upon how well are we able to prevent the loss and the contamination of the available water resources. All life on earth depends on water. Man uses water for many purposes drinking, irrigation, fisheries, industrial processes, transportation and waste disposal.

Earth is a watery place, unlike most other planets in our solar system. Water covers over 70 percent of the earth's surface. It's everywhere - not only on the surface, but also underground and in the atmosphere. Out of all the water on earth, 97 percent is salt water, like oceans. That means only three percent of all the water on the earth is fresh water. Of the three percent fresh water, two percent is solid frozen in icecaps and glaciers. One of all the water on earth, only one percent is drinkable, and half of this drinkable water is found below the earth's surface.

Water found on the surface of earth in lakes, rivers and oceans is called surface water. The ground soaks up water like a sponge. The soaked up water is called groundwater. It fills the space around sand, gravel and rock below the earth's surface. Groundwater can come to the surface in rivers or natural springs. Because of the underground water supply, some rivers, streams, ponds and lakes can remain full even when it doesn't rain or snow. The other half of our drinking water comes from ground water sources such as these. We draw the water up to the surface through wells, or use it as it comes to the surface on its own, in springs. Water is not only essential to life but is the predominant inorganic constituents of living matter, forming in general nearly three quarters of the weight of the living cell. (Kumar.U, 2011)

Water is one of the most important natural resources for all the living organisms, whether unicellular or multicellular, since it is required for their various metabolic activities. In addition, water is required in various domestic purposes, irrigation, shipping, sanitation,

power generation and industries. About 73 percent of the earth is covered with marine and freshwater, which is present in oceans, lakes, ponds, glaciers etc. Out of the total global water content, only three per cent is freshwater suitable for human use. The stupendous increase in world's population resulting in spurt in urbanisation, industrialisation, agriculture etc., has put tremendous pressure on the limited fresh water resource thereby threatening the fresh water bodies with pollution. One would agree that most of the problems of water pollution are man-made and are result of indiscriminate and rich use of water bodies and its mismanagement. (Misra.S.R, 2009)

Fresh water resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. The main source of freshwater pollution can be attributed to discharge of untreated waste, dumping of industrial effluents, and run-off from agricultural fields. Industrial growth, urbanisation and the increasing use of synthetic organic substance have serious and adverse impacts on fresh water bodies. Water scenario is now fast changing as a result of increasing population, rising demand for irrigation to raise high yielding varieties of crops, rapid urbanisation and industrialisation, electricity generation, impact of global warming and erratic rainfall. (Gopal Kolkoti, 2013). Water pollution is a serious threat around the globe. Water pollution may be defined as, ' a natural or induced change in the quality of water which renders it unusable or dangerous as regards food, human and animal health, industry, agriculture, fishing or leisure pursuits'.

### **Ground Water and its Contamination**

Many areas of groundwater and surface water are now contaminated with heavy metals, POPs (Persistent Organic Pollutants), and nutrients that have an adverse affect of health. Water-borne diseases and water-caused health problems are mostly due to inadequate and incompetent management of water resources. Safe water for all can only be assured when access, sustainability, and equity can be guaranteed. Access can be defined as the number of people who are guaranteed safe drinking water and sufficient quantities of it. There has to be an effort to sustain it, and there has to be a fair and equal distribution of water to all segments of the society. Urban areas generally have a higher coverage of safe water than the rural areas. Even within an area there is variation: areas that can pay for the services have access to safe water whereas areas that cannot pay for the services have to make do with water from hand pumps and other sources.

## **Causes of Water Pollution**

Surface water contained in rivers, lakes, ponds and oceans along with the groundwater forming the water table gets polluted by various sources. Various factors which cause the pollution of these water bodies are enumerated below:

### **Sewage Waste**

Sewage waste is the result of urbanisation and is mostly discharged into water bodies. With the increase in the pollution, the quantity of sewage produced and discharged into the water bodies has also been increasing.

### **Industrial Effluents and Heavy Metal**

The oceans, the rivers and the ponds are mostly used as sink for dumping off effluents from industries. Industrial effluents which contain a variety of organic and inorganic chemicals and industrial wastes viz., acids, alkalise, phenols, chemical dyes, cyanides, oil, grease, plastic materials, suspended solids, and heavy metals are regarded as the major source of these water bodies.

### **Agrochemicals**

To meet the growing demands of increasing population agrochemicals have been in use for augmenting food production. These include two major categories of compounds viz. Chemical/ artificial fertilizers and Biocides.

### **Radioactive Wastes**

Marine ecosystems are mainly the victims of the radioactive pollutants which include a variety of radioisotopes. They reach the oceans directly or indirectly.

### **Population Explosion and Anthropogenic Interference**

Indiscriminate use of natural water reservoirs and major rivers for various human requirements e.g. drinking, irrigation, navigation, fishing, recreational purpose (picnic spots) etc., have also added to the problem of water pollution. Enormous harvesting of other natural resources (e.g. deforestation) has caused eco degradation of terrestrial ecosystems. It has resulted in soil erosion and heavy silting of the rivers and lakes thereby disturbing the species diversity and affecting the ecological balance of rivers and lakes.

### **Availability of Water in the World**

The world has entered the new millennium with an enormous challenge safe drinking water for all. In many parts of the world, drinking water has been acknowledged as a fundamental right. However, the poor continue to be most vulnerable to changes in water resource availability. The **United Nations** has proclaimed the year 2003 as the International Year of Freshwater with the slogan “**Water-Two billion people are dying for it**”.

Almost 85 percent of drinking water needs are met from groundwater. Only 5 percent of total groundwater extraction is needed for domestic water supply while irrigation accounts for 90 percent and the industry takes the remaining 5 percent. The rapid exploitation of groundwater has caused depletion resulting in shortage of water supply and damage to its quality. (Chandrakuma,G. and Mukundan,N. 2006). Globally, all future population growth will take place in cities, especially in Asia, Africa, and Latin America. In Asia and Africa, this growth will signal a shift from rural to urban growth, changing a millennia-long trend. Between 2000 and 2030, the urban population in Africa and Asia is set to double. Asia's urban population will grow from 1.4 billion to 2.6 billion. Africa's will surge to more than twice its size, from 294 million to 742 million. Latin America and the Caribbean will see its urban population rise from 394 million to 609 million. By 2030, 79 percent of the world's urban dwellers will live in the developing world's towns and cities. And Africa and Asia will account for almost seven in every 10 urban inhabitants globally.

Most urban growth is due to natural increase (more births than deaths) rather than migration. (Parmasivan.G and Socratees.J, 2013). The Global water and Sanitation 2000 shows that 1.3 billion people lack access to improved water supply and 3.5 billion to improved sanitation, (Dwarikanath.H.D, 2013). According to Global Water Supply and Sanitation Assessment Report (2000), prepared by United Nations International Children's Emergency Fund (UNICEF) – World Health Organisation (WHO) – Water Supply Sanitation Collaboration Council (WSSCC), over one billion people across the world do not have access to adequate and safe drinking water facilities. It is also predicted that it would become there fold within the next two decades. Most of these people live in Asia, Africa and Latin America. Nearly 3.4 million people in the world, most of them children die every year from diseases associated with lack of safe drinking water, inadequate sanitation and poor hygiene. Worldwide, three-fourths of all current population growth in urban area; cities are gaining an estimated 55 million people per year. The world's population, however, is quickly becoming urbanized as people migrate to the cities. In 1950, less than 30 percent of the world's population lives in cities. This number grew to 47 percent in the year 2000 (2.8 billion people), and it is expected to grow to 60 percent by the year 2025. Developed nations have a higher percentage of urban residents than less developed countries. However, urbanization is occurring rapidly in many less developed countries, and it is expected that most urban growth will occur in less developed countries during the next decades.

## Global Water Shortage

The amount of water in the world is finite. A third of the world's population lives in water-stressed countries. Table 1 explains the domestic water demand in Asian countries.

**TABLE - 1**  
**DETAILS OF DOMESTIC WATER DEMAND IN ASIAN COUNTRIES, 1995 AND 2025**

Country	Domestic Water Demand(Km <sup>3</sup> )			
	1995 Baseline Estimates	2025 Projections		
		BAU	CRI	SUS
Asia	79.1	156.7	113.0	143.9
China	30.00	59.4	42.3	54.3
India	21.0	40.9	27.7	42.0
Southeast Asia	13.9	30.4	23.6	23.8
South Asia excluding India	7.0	16.2	11.1	15.3
Latin America (LA)	18.2	30.7	24.7	22.8
Sub-Saharan Africa (SSA)	9.5	23.9	15.2	23.8
West Asia/North Africa (WANA)	7.1	13.1	9.9	11.2
Developed Countries	58.7	68.6	62.8	65.8
Developing Countries	110.6	221.0	159.7	198.7
<b>World</b>	<b>169.3</b>	<b>289.6</b>	<b>222.5</b>	<b>264.5</b>

Source: (Bancil.P.C, 2004), BAU: business-as-usual scenario, CRI: Water crisis scenario and SUS : Sustainable water use scenario.

By 2025, this is expected to rise to two-thirds. There is more than enough water available, in total, for everyone's basic needs. The UN recommends that people need a minimum of 50 liters of water a day for drinking, washing, cooking and sanitation.

In 1990, over a billion people did not have even that. Providing universal access to that basic minimum worldwide by 2015 would take less than 1 percent of the amount of water we use today. But we're a long way from achieving that. Total domestic demand under CRI is 60 cubic kilo meters in developing countries including India. Urbanization and rapid growth in urban population can dramatically increase per capita use of freshwater. Fast

population growth with accelerated urbanization, combined with scarce water supplies means that the governments all over the world often cannot supply enough water to meet demand.

### **Water in India**

In India the pumping of underground water is now estimated to be double the rate of aquifer recharge from rainfall. The International Water Managements Institute, the world's premier water research group, estimates that India's grain harvest could be reduced by up to one fourth as a result of aquifer depletion, in a country adding 18 million people per annum.

In addition to population growth, urbanization and industrialization also expand the demand for water. Industrialization takes even more water than urbanization. Some 70 percent of the water consumed worldwide, including both that diverted from rivers and that pumped from underground, is used for irrigation, while some 20 percent is used by industry, and 10 percent for residential purposes. In the increasingly intense competition for water among sectors, agriculture almost always loses. The 1,000 tons of water used in India to produce one ton of wheat worth perhaps \$200 (Rs.10,000) can also be used to expand industrial output by \$10,000 (Rs. 5,00,000), or 50 times as much. This ratio helps explain why, in the American West, the sale of irrigation water rights by farmers to cities is an almost daily occurrence.

In India, overall water demand will increase from 552 BCM in 1999 to 1050 BCM by 2025, which will require the use of all the available water resources in the country. Of the present water usage, 92 percent is devoted to agriculture, with roughly 3 percent used in industry and only 5 percent for domestic purposes like drinking water and sanitation. Demand from the industrial and domestic sectors is expected to increase with the growing population, urbanization and industrialization.

The problem of water pollution is world-wide and it could draw the attention of scientists only when it became hazardous for human health. In India too, it started long back but intensified during the last few decades and the situation became alarming. Consequently studies on the major river ecosystems by Roy (1955), Motwani et.al (1956), Venkateswarlu (1969a, 1970), Bapat and Mandalpure (1974), Rai (1975), Upadhyaya et al (1987), Srivastava et al.(1992) were undertaken which have clearly shown that the major Indian rivers are grossly polluted. Besides this, the pollution in tributaries (Sinha et al. 1985; Misra et al. 1991) of the major rivers also contributed sufficient amount of pollutants into them thus increasing the pollution load of major rivers.

## **Demand of Water**

Asian Development Bank in its report on “Water Operational Framework 2011-2020” explicitly cautioned that by 2030 water shortages are likely to aggregate 40 percent in developing Asia and in India demand will exceed supply by 50 percent. In 2005, a World Bank document recommended that ‘if India is to have sustainable economic growth, the role of the Indian water state must change from that of a builder and controller to creator to an enabling environment and facilitator of the actions of water users large and small’.

In India the holy river of Ganga is getting polluted through household and industrial sewages, and also by throwing dead bodies (around 20,000 in a year) in the river. The Government of India is trying hard to save Ganga through Ganga Action Plan (GAP). Not only Ganga, all the rivers of India is badly affected due to pollution. In Tamil Nadu Koovam in Chennai and Noyyal river in Tiruppur were completely polluted. In China, the famous yellow river is getting polluted due to open defecation (the rural people consume intoxicating chemicals and their faecal waste is getting mixed in the river water). Hence, the use small water bodies are becoming vital in all the places. Central Ground Water Board in 2025 which revealed extremely alarming and deteriorating condition of ground water in country’s 1645 blocks as compared to 4078 safe blocks. There are 839 blocks over exploited, 226 blocks critical, 550 blocks semi-critical and 30 blocks saline.

Shri Atal Bihari Vajpayee former Prime Minister of India, remarked at the 11<sup>th</sup> meeting of the National River Conservation Authority in New Delhi on 16<sup>th</sup> June 2003 thus: “With the phenomenal increase in population and the dramatic rise in living standards of people in many parts of the world, there has been a sharp increase in the demand for fresh water. The total availability of freshwater on the other hand has not increased. To make the matter worse, the availability has actually dipped on account of manmade pollution. Water sustains life. Now the time has come for us to sustain the availability of clean water”

## **Indian Facts**

When humans use more water than we used to, it can cause problems. Below are the facts projected by the National Training Project and Administration Institute.

- In India about 303.6 million cubic of water is received by the Asian rivers from Himalayan glaciers
- By the end of the year 2100 glaciers of Himalaya will dry up
- About 4.4 million of Indian population is drinking polluted water
- About 70 percent of water is obtained from groundwater resources

- About 80 percent of water supply is done from groundwater resources
- In India, there are about 190 million of tube wells
- About 39 percent of families of India have developed their own drinking water resources in their house premises; and
- Drinking water is not available to about 2 lacks students in schools

The Government of India indicates the major problems faced by the country in the context of water. These are the highlighted problems:

### **Not Enough Rain or Drought**

This is the most common problem. It happens when there is less rain than would normally be expected. It might be a short problem caused by a change in the weather, or it could be a longer problem caused by changes in an area's climate.

### **Changes to a River Basin**

For example if a river is dammed the areas below the dams might get a lot less water. If people living further up the river take a lot of water out, there is sometimes nothing left for people further down.

### **Wells Run Dry**

In many parts of the world humans rely on water from an underground source. Underground reservoirs, called aquifers, often take millions of years to fill up. If people remove the water faster than the aquifer can refill, it can cause wells to dry. About 28 percent of families are procuring drinking water from a distance of more than 500 meters and only 22 percent of families have tap water families. In 140 blocks of India the groundwater level is in dangerous zone. About 23297 villages are using ground waters which have high level of fluoride in Rajasthan..The table 2 states that the population of India is witnessing a continuous increase. As per the census of India, the total population was 439.23 million in 1961 which increased to 844.32 million in 1991 and further to 1210.19 million in 2011. The rate of growth of urban population was much higher because of the migration of the people from rural to urban areas.

**TABLE - 2****DETAILS ON PERCENTAGE OF POPULATION COVERED WITH WATER  
SUPPLY IN INDIA**

<b>Year</b>	<b>Total population (million)</b>	<b>Urban population (million)</b>	<b>% of urban to total population</b>	<b>%of population covered with water supply</b>
1961	439.23	78.94	17.97	NA
1971	598.15	109.11	19.91	82
1981	683.32	159.00	23.34	78
1991	844.32	217.11	25.72	84
2001	1027.01	285.35	27.78	89
2011	1210.19	377.10	31.16	NA

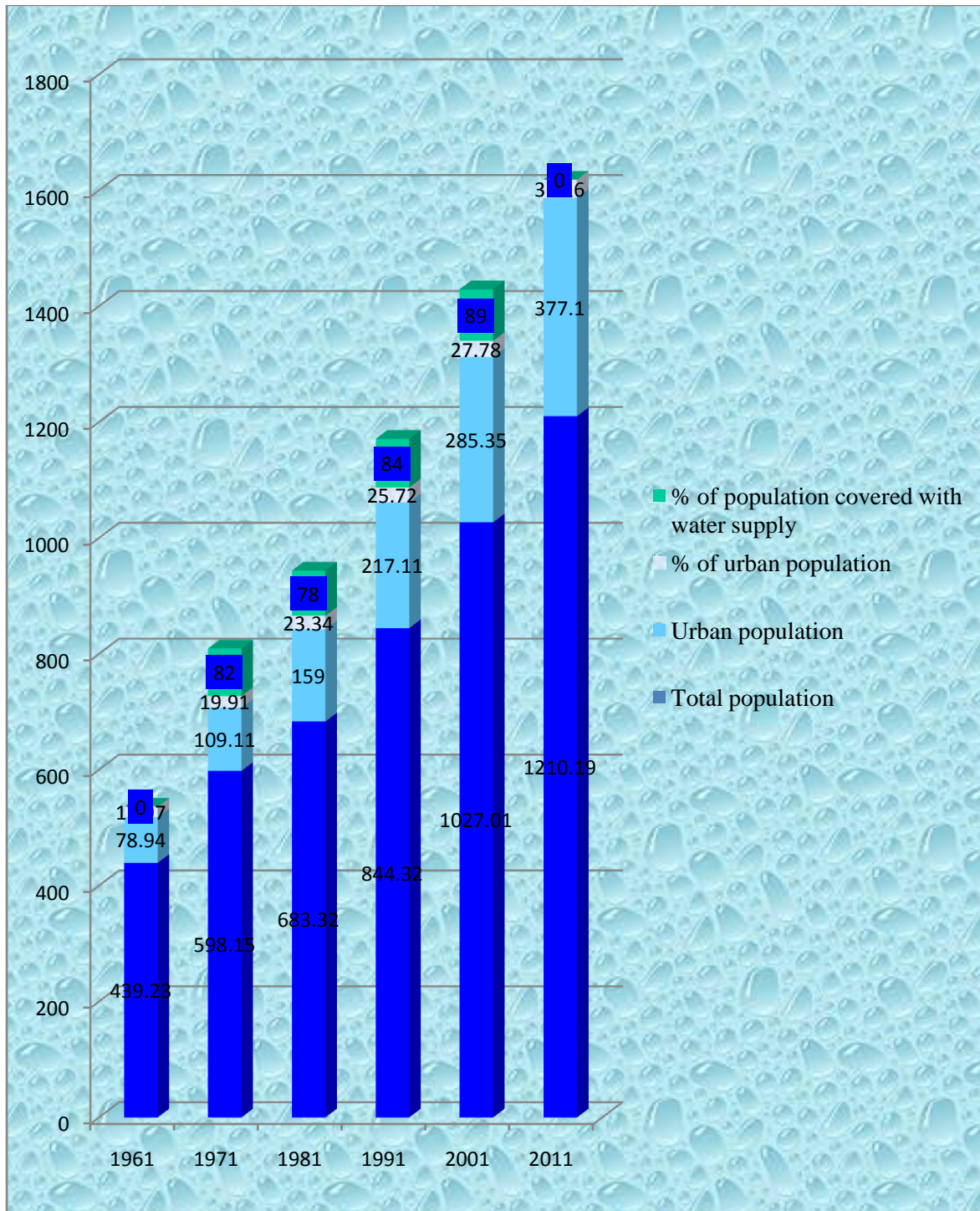
Source: 2011 Census, NA: Not Available

Table 2 represents the percentage of population covered with water supply in India. In 1961, the proportion of urban population in the total population was 17.97 percent and it went up to 25.72 percent in 1991 and 31.16 percent in 2011.

A continuous effort was made to supply drinking water to the urban population through various policies and programmes.

A remarkable achievement has been made but still a portion of the urban population is devoid of safe drinking water. By 1971 about 82 percent of urban population was availing the facility of institutional drinking water supply which increased to 84 percent in 1991 and 89 percent in 2001.

## PERCENTAGE OF POPULATION COVERED WITH WATER SUPPLY IN INDIA



**FIGURE: 1**

Figure 1 explains the percentage of population covered with water supply in India.

## Consumption of Water

In the twenty-first century, water the basic need of life is likely to surpass the scarcity of many other commodities. It will be a great challenge to meet increased demand for water due to increasing population, economic growth and technological changes. The opportunities to enhance the supply are becoming limited day by day (Marothia, 2003). This is more so in the developing countries due unchecked population growth, interest groups competition and conflict (Ballabh, 2003), expansion of economic activities (Biswas 1993, Narayanomorthy 2003) along with lack of institutional framework and policies for water management. The emerging scarcity of water of water has also raised a host of issues related to sustainability of the present form of economic development, sustained water supply , equity and social justice, water financing, pricing, governance and management. The quantity of water consumed in most of the Indian cities is not determined by the demand but the supply. People attempt to adjust to the quantity as well as quality of water supplied.

## Economic Status and the Principal Source of Water

The coverage of population with water supply has been increasing over the years but due to financial and technological problems the water supply services are less than satisfactory for all sections of the society. But for the poorer sections of the society conditions are comparatively worse. The equity principle in water distribution has not been followed. Since the water is a basic necessity; it is the duty of the government to provide drinking water in required quantity and quality to all the sections of the society. There should not be any discrimination on any grounds i.e. whether rich versus poor; large versus small plot sizes; posh or slum localities, etc. Water should be equitably distributed between the rich and poor households.

**TABLE - 3**

### **ECONOMIC STATUS AND THE PRINCIPAL SOURCE OF WATER – URBAN INDIA**

<b>Economic Status of Households</b>				
<b>Source</b>	<b>Low</b>	<b>Medium</b>	<b>High</b>	<b>Total</b>
<b>Tap</b>	66	74	80	70
<b>Others</b>	34	26	20	30
<b>Total</b>	100	100	100	100

Source: (Bedi.J.K, 2013)

The table 3 depicts the economic status and principal source of water in urban India. The ration of tap users to others is nearly 1:4.

## **Treatment of Water**

Water treatment describes those processes used to make water more acceptable for desired end use. These can include use as drinking water, industrial processes, medical and many other uses. The goal of all water treatment process is to remove existing contaminants in the water, or reduces the concentration of such contamination so the water becomes fit for its desired end use. One such use is returning water that has been used back in to the natural environment without adverse ecological impact.

## **Water Purification**

The processes involved in treating water for drinking purpose may be solids separations using physical such as settling and filtration, chemicals such as disinfection and coagulation. Biological processes are also employed in the treatment of waste water and these processes may include, for example, aerated lagoons, activated sludge or slow sand filters. Water purification is the process of removing undesirable chemicals, materials, and biological contaminants from raw water. The goal is to produce water fit for a specific purpose. Most water is purified for human consumption but water purification may also be designed for a variety of other purposes, including meeting the requirements of medical, pharmacology, chemical and industrial application.

In general the methods used in general include physical process such as filtration and sedimentation, biological processes such as slow sand filters or activated sludge, chemical process such as flocculation and chlorination and the use of electromagnetic radiation such as ultra violet rays. The purification process of water may reduce the concentration of particulate matter including suspended particles, parasites, bacteria, algae, viruses, fungi; and range of dissolved and particulate materials derived from the surfaces that water may have made contact with after falling as rain. The standards for drinking water quality are typically set by government or by international standards. These standards will be typically set minimum and maximum concentration of contaminants for the use that is to be made of the water. It is not possible to tell whether water is of an appropriate quality by visual examination. Simple procedures such as boiling or the use of a household activated carbon filters are not sufficient for treating all the possible contaminants that may be present in water from an unknown source.

Even natural spring water – considered safe for all practical purposes in the 18<sup>th</sup> century - must now be tested before determining what kind of treatment, if any, is needed. Chemical analysis, while expensive, is the only way to obtain the information necessary for deciding on the appropriate method of purification. According to the World Health

Organisation Report 2007, 1.1 billion people lack access to an improved drinking water supply, 88 percent of the 4 billion annual cases of diarrheal disease are attributed to unsafe water and inadequate sanitation and hygiene, and 1.8 million people die from diarrheal each year. The WHO estimates that 94 percent of these diarrheal cases are preventable through modifications to the environment, including access to safe water. Simple techniques for treating water at home, such as chlorination, filters, and solar disinfection, and storing containers could save a huge number of lives each year. (Gajraj Singh, 2012)

### **Filtration**

After separating most floc, the water is filtered as the final step to remove remaining suspended particles and unsettled floc. The most common type of filters is a rapid sand filter. Water moves vertically through sand which often has a layer of layer of activated carbon or anthracite coal above the sand. The top layer removes organic compounds, which contribute to taste and odour. The space between sand particles is larger than the smallest suspended particles, so simple filtration is not enough. Most particles pass through surface layers but are trapped in pore spaces or adhere to sand particles. Effective filtration extends into the depth of the filter. This property of the filter is the key to its operation: if the top layer of sand were to block all the particles, the filter would quickly clog.

To clean the filter, water is passed quickly upward through the filter, opposite the normal direction to remove embedded particles. Prior to this compressed air maybe blown up through the bottom of the filter to break up the compacted filter media to aid the backwashing process: this is known as air sourcing. The contaminated water can be disposed of along with the sludge from the sedimentation basin, or it can be recycled by mixing with the raw water entering the plant. Some water treatment plants employ pressure filters. This work on the same principles as rapid gravity filters, differing in that the filter medium is enclosed in a steel vessel and the water is forced through it under pressure.

### **Technology Mission for Drinking Water**

During International Water Supply Decade (1980-90) a mission was launched called “**Technology Mission on Drinking Water Management**”. The Technology Mission for Drinking Water actively functioning in the in the 90’s reported that if even 10 percent of the monsoon rain is trapped for recharging the underground aquifers, it will solve the drinking water problem in most of the states. The mission accordingly suggested the construction of as many as 10000 water conservation structure sell over the country to minimise the rain water

runoff. The water conservation structures proposed were small and medium check dams, percolation dams, nalla bindings and gully bindings and underground rubble trenches.

### **National Drinking Water Mission**

In 1986, the Government of India created a National Drinking Water Mission, which in 1991 has been named as Rajiv Gandhi Drinking Water Mission, with the mandate to provide financial, policy and technological support. It also helps to develop a multi programme approach relating to the rural water supply sector.

### **Rajiv Gandhi National Drinking Water Mission**

Rajiv Gandhi National Drinking Water Mission was launched with the following objectives:

- To cover all no source problem habituation
- To supply 40 lpcd water in all areas for human beings and additional 30 lpcd in desert areas for cattle, within accessible reach
- To evolve cost effective appropriate technology to solve specific problems
- To take conservation measures for sustained supply of water
- To improve conservation measures for sustained supply of water
- To improve performance and cost effectiveness of ongoing programmes
- To create awareness on use of safe drinking water; and
- To promote community participation.

### **Emerging Challenges**

During Tenth Five Year Plan, Rs. 62,614 crore has been spent on providing safe drinking water, one would argue that the expenditure is huge but improvements have been slow that due to difficulty in delivering services and in promoting development at district and local levels to enforce and monitor the large programs. Water systems are not properly monitored and are hindered by poor finances and community involvement. Water contamination continues to cause water related diseases even in large cities such as Mumbai, Chennai, Jaipur, Hyderabad and Delhi because most municipalities do not have proper systems for monitoring water quality.

In this context of obligation to provide drinking water arrangements, the recent years India has developed a twist in its strategy from state as the service provider to state as the facilitator. This facilitating role envisages more decentralization of the drinking water sector the shift from a supply based approach to demand driven strategy seeks for community participation. The externally funded water supply and sanitation projects speak about public private participation to improve rural drinking water supply. (Dwarikanath H.D, 2013)

## **Concept of Consumer Behaviour**

A consumer is defined as the end user of any product. In simple words the individual who derives utility from any given product is called a consumer. Any rational consumer changes his/her pattern of consumption with the changes taking place around him/her. The only concern of any consumer is to gain utility from the product he/she purchased. Based on various factors the consumers modify their demand pattern in such a way that gives them maximum satisfaction.

Theory of demand deals primarily with factors determining the individual demand for a commodity or service. Conceptually, the term “demand” implied a “desire” or “want” for a commodity backed by the ability and willingness to pay for it. The term “demand” for a commodity (i.e., quantity demanded) always has a reference to “a price”, “a period of time” and “a place”. The concept of utility can be looked upon from two angles. From the commodity angle, utility is the want satisfying property of a commodity. From the consumer’s angle, utility is a psychological feeling of satisfaction, pleasure, happiness or well-being which a consumer derives from the consumption, possession or the use of a commodity.

The neo-classical economists, especially Alfred Marshall, devised a method of measuring utility. According to Alfred Marshall, utility of a commodity for a person equals the amount of money he/she are willing to pay for a unit of the commodity. In other words, price one is prepared to pay for a unit of the commodity equals the utility he expects to derive from the commodity. Cardinal Utility Approach, attributed to Alfred Marshall and his followers, is also called the Neo-Classical Approach or Marshallian Approach. The Cardinal Approach analyses the utility of the consumer to understand his/her behaviour. The study of Neo-Classical demand theory serves as a foundation for understanding the advanced theories of consumer behaviour. In the following study we will first discuss the theme of consumption theory by analysing the “utility maximising behaviour” of the consumer. The fundamental postulate of the consumption theory is that all the consumers – individuals and households – aim at utility maximization and all their decisions and actions as consumers are directed towards utility maximization. On the basis of this postulate, consumption theory explains how a consumer attains the level of maximum satisfaction under the following assumptions:

## **Rationality**

It is assumed that the consumer is a rational being in the sense that he/she satisfies his/her wants in the order of their preference. That is, he/she buys the commodity first which yields the highest utility and that last which gives the least utility

## **Maximisation of satisfaction**

The cardinalists assumed that utility is cardinally measurable and that utility of one unit of commodity equals the money a consumer is prepared to pay for it

## **Utility is Additive**

Cardinalists assume not only that utility is cardinally measurable but also that utility derived from various goods and services by a consumer can be added together to obtain the total utility.

A number of studies have been undertaken on the issue of water, its demand and supply. But there exists a literature gap when consumer behaviour is taken into account. Nowadays many consumers have shifted to consume purified packaged water. It was noted that there existed a regular supply of water from the corporation, yet the residents were unwilling to consume that water. The consumers preferred to invest their money in purified water systems such as aqua guards and packaged drinking water. This was because the satisfaction level of the consumers was maximised here.

With this background the major areas affected due to water pollution were listed out and household consumers were selected from the Coimbatore district. An attempt was made to analyse the “**Changing Consumer Behaviour through Water Pollution: a Case Study Analysis**”, with the following objectives:

1. To study the current scenario of water pollution in India
2. To study the socio-economic background for the selected households
3. To study the water supply in the selected households in the Coimbatore district
4. To analyse the water pollution and changing consumer behaviour of selected households in the Coimbatore district
5. To find out the problem of water usage

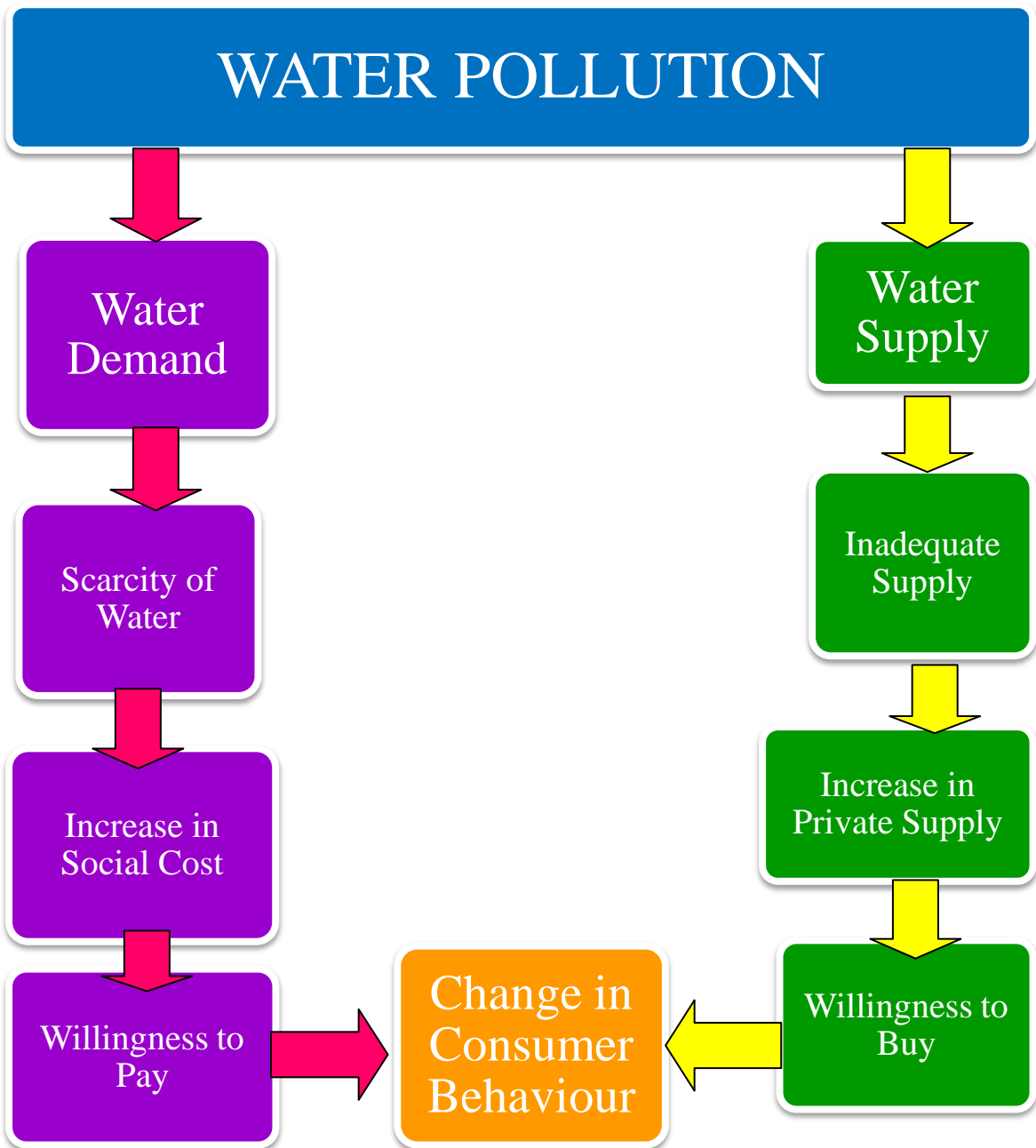
## **Hypotheses**

The following null hypotheses were tested in the course of the study

1. The usage of private water supply
2. An increase in willingness to pay and willingness to accept
3. The change in consumer behaviour
4. An increase in consumer's satisfaction; and
5. Change in the consumption pattern

## **Conclusion**

Considering the importance, the study was done on changing consumer behaviour through water pollution in selected areas in Coimbatore district. An attempt was made to analyse the current demand and supply and the consumer's willingness to pay and accept the private and social cost. Further the study aimed to analyse the satisfaction level of the private water consumers and the problems they faced.



**FIGURE: 2**

## CHAPTER II

### REVIEW OF LITERATURE

The review of literature pertaining to the current study “**Changing Consumer Behaviour Through Water Pollution: A Case Study Analysis**” is discussed under the following heads:

- 2.1 Historical background of the study
- 2.2 Importance of the study
- 2.3 Impact of water pollution
- 2.4 Problems due to water pollution
  - 2.4.1 Climate change and water problems
- 2.5 Consumption of water
- 2.6 Other related studies
  - 2.6.1 Indian studies
  - 2.6.2 International studies

#### **2.1 Historical background of the study**

The history of water pollution goes with the history of man itself when he first arrived at this planet. All the activities of early man like clearing of trees, burning, cultivation and piling of middens influenced the bodies of water. The cutting of forests resulted in an increased run off altering the river biology. Agriculture caused an increased erosion of soil causing greater silting and increase of salt in streams. Natural sources of pollution like leave fall in forested areas increased the organic matter in water bodies to affect fish. Such conditions might be prevailing, beyond doubt, throughout the history since invasion of plants on the earth, even much before the arrival of man. However the most serious problem of water pollution resulted by human activities.

With the civilization, large settlements and towns began to appear that gave rise to the problem of waste disposal. References in history indicate that the use of earth – pits was a common practice for waste disposal, while several ancient cities even developed elaborate sewer systems. Evidences show that the civilisation like Mohan-Jo-Daro and Harappa had drains for collection of waste water. The reference of white colour (sewage fungus) and small red colour threads (sludge worms) in the foul mud in the writings of Aristotle indicate that the effects of sewage were known to the ancient people. As there was no treatment facility for

these wastes at that time, it is quite certain that these wastes might have brought quite severe problems of river and ground water pollution. (Goel.P.K, 2009)

In the beginning, man was not concerned with trying to keep water in any particular place. He merely built his various civilisations where water was present. His home was first a tree or a cave and later a small hut or shelter of varying design. When these were damaged or destroyed by high water, he quickly rebuilt or moved to higher ground. Since his home was simple in any event, he seldom experienced problems with wet or unstable foundations. When this contingency occurred, it was easier to move than to solve the problem by ingenuity. The exact time when man was first faced with the problem of moving water any appreciable distance is open to some debate. If we believe the writings of Plato, this may well have occurred some 12500 years ago on the lost island of Atlantis. Of course, to accept such an account, it is necessary to believe in the existence of this island. At any rate, modern historians seem agreed on one thing: man early became concerned with water conveyance and storage because of his agricultural needs. (William Kays, 1977)

Most rivers, which are now highly polluted, were full of fishes at that time. If pollution had been recognised then a serious problem, one could hardly have written a book on fresh water fishing without mentioning it. (Walton, 1653)

**Divya.T and Rakhi.B (2011)** in their study on “Water Quality of the River Pandu at Panki Frontage, Kanpur” analysed the major causes of pollution and deterioration in the quality of the river Pandu. The study revealed that at Panki frontage, Kanpur, it receives effluents from diverse sources like Panki thermal power plant, Duncans Industries Limited , LPG bottling Plant , Lohia Machine Limited , dyeing, printing and chemical pesticides. Effluents that are discharged into the river usually contain nutrients, heavy metals, pesticides and other toxicants. All this contaminates the Ganga in the downstream

**Yadav et.al, (2013)** in their study on “Ground Water Quality Monitoring of Ujjain City at Madhya Pradesh, India” stated that due to the increased urbanisation and industrialisation surface and ground water pollution has become a crucial problem. The study also highlighted that the ground water contamination is caused due to use of fertilisers in farming, industrial effluents and over population. The study concluded by revealing that the water of the city is suitable for drinking purposes. Proper environment management plan must be adopted to control drinking water pollution. Ground water requires some degree of treatment before drinking and it needs to be protected from contamination in order to prevent adverse health effects on human beings.

**Khurana and Sen (2008)** in their study on “Drinking Water Quality in Rural India: Issues and Approaches”, revealed that water quality is affected by both point and non-point sources of pollution. These include sewage discharge, discharge from industries, run-off from agricultural fields and urban run-off. Water quality is also affected by floods and droughts and can also arise from lack of awareness and education among users. The need for user involvement in maintaining water quality and looking at other aspects like hygiene, environment sanitation, storage and disposal are critical elements to maintain the quality of water resources. The government policies and programmes has also undergone a series of transition ever since independence. To begin with, the emphasis was on setting up physical infrastructure in form of hand pumps. Thereafter one has seen a transition from technology measures to a socio- technological approach seeking close participation of people. A national water policy was drafted in 1987 which was subsequently revised in 2002. For ensuring sustainability of the systems, steps were initiated in 1999 to institutionalise community participation in the implementation of rural drinking water supply schemes through the sector reforms project.

**Guruswami.K and Balanga Gurunathan.K (2012)** in their study on “A Need for Organic Farming Practices to Control Pollution in Water, Soil and Environment” focused on the excess usage and exploitation of water for the purpose of farming. The study also revealed that agriculture is polluted by the effluents from over usage of chemical fertilizers, pesticides and weed killers. The study concluded that organic farming is the solution to this problem as it generates more profit, better environment and more satisfaction. Proper monitoring is the need of the hour.

**Sandhya Suri (2010)** in her study on “Water Resource Management in India-An Analysis” pointed out that the existing water resources are unable to meet the requirement of the rapidly growing population in the country. The study provided solution to this problem by taking steps to conserve water through flood management, drought management, ground water management, watershed management and rainwater harvesting. The study revealed that 96.13 percent of the rural habitation has been fully covered with drinking water facilities on 1<sup>st</sup> April 2005. The study concludes by urging the government to take further steps to improve the supply of water in the rural areas.

## 2.2 Importance of the Study

There is a widespread view that a water crisis is looming on the horizon. The National Commission on Integrated Water Resources Development Plan (NCIWRDP), in its report submitted to the government of India in 1991, projected a difficult situation requiring urgent measures, but did not use the term crisis.

John Briscoe of the World Bank talks about a 'turbulent future' (Briscoe and Malik, 2006), according to him the importance of the study is so high that it has divided the world into two wide groups, both groups have multiple sub-groups. One consists of International Conferences on water such as 'the World Water Forum, the Annual Stockholm Water Week; International Water Institutions such as World Water Council, Global Water Partnership etc., and the Corporate. This group argues for water being regarded as a tradable commodity, water markets, globalisation, privatisation, corporatisation, public-private partnership, and so on, and of course for big projects. The other is a loose group of NGO's, social activists, civil right people, left-wing intellectuals, and so on. Their concerns vary widely but they tend to come together on certain beliefs and predilections: e.g., treating water as a basic human right, a Common Pool Resource and not a tradable commodity; a feeling that the profits motive is irreconcilable with that view: a deep suspicion of the corporate; and a strong sympathy with the community and civil society as against the state.

**Dash.D and Sathapathy.K.D (2004)** in their study on "Public Participation in Environmental Protection: An Analysis of the Attitude and Concern of Women in Orissa" stated that a nation's ability to develop sustainability depends on the capacity of its people to understand the complexity of the human-environment interaction and their ecofriendliness. This can only be possible by stimulating people's sensitivity, their love and affection towards nature and environment. Concern for environment among women is the outcome of their perception and attitude towards environmental issues. It was noted that literate women had more favourable attitude towards environment than illiterate women. The study also revealed that urban women held a favourable attitude towards all the five dimensions of environment – natural resources and biodiversity balance of nature; conservation of natural resources; pollution control; and environmental sanitation, whereas rural women favoured all other dimensions except environmental sanitation.

**Vidah Upadhyay (2004)** in his study on "National Environmental Policy 2004- A Critique of the Draft", emphasized on the principles of the draft national environmental policy. According to him the policy views the environment as a subset of the large 'sets' of poverty and development, and addresses sustainable development from an essentially

anthropocentric and utilitarian view. The silence of the draft on how customary rights of access to and use of environmental resources are to be integrated with formal policy, law and the rights framework is deafening

**Rohini Chaturvedi (2004)** in her study on “Environmental Hearing: Participatory Forums or a Mere Procedure” stated that the statutory environmental public hearing is the first step towards recognising the local community as stakeholders in environmental development. But the law falls short of that stakeholder views are incorporated in the final decision. In order to develop partnership among the public industry and government with the aim of assuring sustainable development, the public hearing processes needs to be strengthened.

**Maruthi.T.R and Nagaraju.D (2007)** in their study on “Legal Aspects of Marine Pollution” defined marine pollution as ‘the introduction by man, directly or indirectly of substances or energy into the marine environment, industry, estuaries affecting living resources and marine life and causing hazardous to human health, hindrance to marine activities including fishing land and other legitimate areas of the sea impairment of quality for the use of sea water and reduction of amenities’. The study also revealed that many people around the world depend on the ocean, which covers 70% of the earth’s surface, for survival through fishing, marine trade and revenue from related tourism, besides playing a crucial role in sustaining life on earth.

**Singley.J.E and Black.A.P (1972)** in their study on “Water Quality Treatment: Past Present and Future” stated that the history of water treatment dates back the Marxist period. According to the study the rate of population growth coupled with increased urbanisation has created the problem that is most critical today and will become increasingly so in the future - the fact that the best waters have been used first coupled with ever- greater demands for better quality as the available water decreases. This study also stressed on the point that ‘engineers should recognise the water treatment plant design and must include positive means for disposal of sludge.’ At the same time, engineers should consider economy as a basic consideration in the selection and design of disposal methods’. The study concluded that the waters of wells, lakes, and streams contain the three materials – calcium, magnesium and carbon dioxide.

**Jack.E.McKee (1966)** in his study on “Better Tools for Water Resources” revealed that the total supply of fresh water available to each continent is governed by the hydrologic cycle and by geographic factors, and is relatively fixed with respect to location for long periods of time. The study revealed that the major problems of water resources relate to the geographic

and temporal distribution of fresh water. The study laid stress on the duty of water resources engineer to make fresh water available in adequate quantities at the right place and the proper time. The problem with fresh water is that there is an ever increasing demand with no adequate supply back up. Any increase in municipal demand are bound to be accompanied by equal or greater increases by industry, by agriculture and by power requirements, all of which are essential to support the population growth. The study concluded by providing the most important tool as early cultivation of brainpower.

### **2.3 Impact of Water Pollution**

Water pollution has its impacts on many areas. It not only harms one's health but also decreases the availability of freshwater in the world. Due to excess of water pollution a major section of the society now depend on the private sector for their water supply. Usage of aqua guards have now become common and moreover a necessity.

**Gupta et.al (2009)** in their study on “Environmental Aspects of Groundwater Resources Deterioration in the City of Taj”, stated that ground water deterioration is caused due to pollution both from natural and anthropogenic sources. The study concluded that the current trend of ground water level deterioration and over exploitation of groundwater resources is causing drought situation in Agra area. The study suggested some remedial measures such as implementation of a scheme to develop rain water harvesting through a forestation, proper management of ground water reservoirs and launching awareness programmes.

**Paul Wrywoll (2012)** in his study on “India's Ground Water Crisis ”, revealed that utilisation of ground water facilitates irrigated agriculture in areas far from rivers; this was the key to the agricultural “ green revolution” that occurred in 1960's. In places where surface water is available but unsafe for drinking and farming – more than 70 percent of India's surface water resources are polluted by human waste or toxic chemicals- ground water has often been seen as a safe alternative. The study also depicted that in Delhi the local government estimated that 40 percent of water transmitted through the main system is lost through leakage, for many the only alternative water are expensive supplies purchased from water trucks.

**Lakshminarayanan.M.R (2013)** in his study on “Need for Water Management in Tamil Nadu” analysed that due to scarcity of rain water acute drought and improper price brought by the agriculture produce farmers are compelled to move towards town or cities to survive. Another reason for deterioration of water resources is the mixing of effluent water

with that of rivers, ponds and lakes. Hence this water cannot be used for agricultural purposes. The study concluded by focusing on more of awareness programmes regarding the various problems given birth due to poor water management.

**Dandapani.C (2013)** in his study on “Water Resource Management in India: Challenges and Strategies” revealed that there has been an increase in the agricultural sector. Further the quantum of water utilised for agriculture i.e. irrigation is expected to increase by 68.5 trillion litres between 2000 and 2025. The study also stated that the industry and domestic sector consume approximately 11 percent of available water in India. The study concluded by urging the water policies to be reviewed and modified. Suggestions were made towards usage of surplus flood water.

**Ranjan Babu.A (2013)** in his study on “Watershed Management Programme in India” defines watershed as water management through natural system, human activity and water resources management programme as soil conservation, land improvement, pasture development and forestry development. The study indicated the need for watershed management arises due to climate change, growing demand for water due to population explosion and urbanisation, increased supply of waste water and due to overuse and misuse of available water. The study concluded by highlighting climatic change as the major cause for all the various problems of water and water management.

**Bedi.J.K (2013)** in her study on “Quantitative, Qualitative and Equity Issues in Urban Domestic Water Supply in India” concluded that although the drinking water supply in the urban areas as well as in the rural areas was accorded priority in various plans, policies and programmes, but still the situation is far from satisfactory. The study also revealed that a large part of the rural areas do not have access to drinking water. Many states suffer from water borne diseases as a result of supply of poor quality water.

**Jonathan Isham and Satu KohKonon (2013)**, in their study on “Institutional Determinants of the Impact of Community Based Water Services; Evidence from Sri Lanka and India”, discussed the role played by development agencies and donors who promote community based approach to the provision of rural water services. This calls for joint effort from both the community and the government. The study raises the question – “under what circumstances is the community based approach most likely to succeed? The study revealed that a well designed and a well constructed water services lead to improved household health and reduced water collection time. Good and timely maintenance is the only answer to the above raised questions.

**Rangarajan.C (1992)** in his study on “Better Water Management” stated that the environmental impact on account of deforestation and erosion in catchment areas and of water logging / salinity arising from poor management of irrigation and the rehabilitation of people line public issues. According to the study ‘maintenance of the existing irrigation systems in good order is absolutely essential if the country is to reap full benefits of the capital that has been invested and we need to find a satisfactory solution to this problem.

**Agnihotri and Singh (2010)** in their study on “Potability of Drinking Water at Various Sites in Sagar City, Madhya Pradesh” tested if the provision of safe drinking water is a adequate basic necessity for the well-being and socio-economic development of the community. The study emphasized on the fact that both nationally and internationally a reliable and safe water supply is an essential basic requirement for development and stability. The study area comprised of four sampling sites surrounding the Sagar city. The study concluded by stating that the physio-chemical properties of water changed due to the addition of organic and inorganic compounds as well as by the presence of microorganisms in water.

**Zivin et.al (2011)** in their study on “Water Quality Violations and Avoidance Behaviour: Evidence from Bottled Water Consumption” examined the impact of poor water quality on avoidance behaviour by estimating the change in bottled water purchases in response to drinking water violations. Using data from a national grocery chain matched with water quality violations, the study found an increase in bottled water sales of 22 percent from violations due to microorganisms and 17 percent from violations due to elements and chemicals. The study linked to water violations by matching water districts with stores that were located in the zip code that is served by the district. In the study a standard utility maximization setup was used ,where the demand for bottled water was taken as a function of the price of bottled water, the price of tap water, the price of substitutes (all quality-adjusted), income, and both time-varying and time-invariant individual preferences. The study concluded by stating that even if bottled water purchases captured most of the behavioural response to violations, it understates the willingness to pay to avoid water violations because it ignores the health consequences faced by those who did not limit their exposure (Harrington and Portney, 1987).

**Hoque (2012)** in her study on “Urban Water Sector Reforms in India: Financing Infrastructure Development through Market – based Financing and Private – Public Partnerships” reasoned out that a huge population size, a rapidly growing economy and increasing levels of urbanization, coupled with the dwindling sources of freshwater, have made management of urban water supply one of the most important priorities in the

development agenda of India. The study also revealed that water supply in India is mainly a responsibility of the individual state governments which in turn delegate powers to the urban local bodies for provision of water and sanitation services to people at the city level. Water utilities in India are grappling with the problem of poor and ageing infrastructure, high levels of unaccounted-for water, intermittent supplies, poor water quality and low tariff rates. The paper aimed to discuss the gradual reforms that have been taking place in the Indian urban water supply sector since the 1990s, with specific reference to changes in legal and institutional frameworks and how these have been incorporated practically in the various forms of water supply projects conducted in the past decade. Using cities from the South Indian States of Tamil Nadu and Karnataka as examples, the paper highlights the various approaches undertaken by the state governments and other agencies to augment water supply in their areas. Two main aspects of project financing – the market-based financing mechanism and the development of private – public partnerships – have been explored in detail through the above mentioned case studies.

**Nkuepo.H.J (2011)** in his study on “Natural Resources, Intergenerational Injustice, Environmental Degradation, Water Pollution and the Right to Healthcare” discussed the impact of extraction and trade in natural resources. The study highlighted the fact that the world has witnessed three major ecological catastrophes caused by the extraction of and trade in natural resources in the recent years. The Niger delta oil spills, the Deep-water horizon oil spill (Gold of Mexico) and the New Zealand's oil spill. The principal objective of the paper was to show how the improper regulation or the lack of regulations of the extraction and transport of and trade in natural resources diminish the capacity of current generations to meet their objectives of sustainable development and to respect their intergenerational obligations. The study concluded by stating that the degradation of the environment is caused by human activities and that we need appropriate policies and programs to address the problem of climate change.

**Murty.M.N and Surender Kumar (2011)** in their study on “Water Pollution in India: An Economic Appraisal” pointed out that water pollution is a serious problem in India as almost 70 per cent of its surface water resources and a growing percentage of its groundwater reserves are contaminated by biological, toxic, organic, and inorganic pollutants. In many cases, these sources have been rendered unsafe for human consumption as well as for other activities, such as irrigation and industrial needs. The study revealed that there is an urgent need of increasing the number of monitoring stations in India to levels found in developed nations for effective monitoring. The study concluded by stating that Measuring

water pollution, estimating benefits from reduced pollution, and designing regulatory instruments for environmental improvements require inter-disciplinary approaches. Detailed studies are needed to establish relationships between pollution at sources and ambient pollution of surface water bodies and ground- water resources.

## **2.4 Problems Due to Water Pollution**

In a developing country like India, there are many villages and cities either with scarce water supply or without any source of water. If there is no source of potable water within 2.5 kilometres, then that village becomes a 'no source water village'. With such poor conditions, the available water is being over used and exploited. There is a lack of civic conscience, and people today prefer to fulfil their present needs neglecting the thought of the future. If this trend continues there is soon be scarcity of water and around the world. This is to be realised and immediate steps should be taken to spread awareness regarding the seriousness of the problem and the consequences if the needful is not done.

**Munde.B.M and Gosavi Sunil (2013)**, in their study on "Perspectives of Water in Maharashtra: A Study", pointed out the major problems of distribution and efficient management of water. The main objectives of the study were availability of water, utilisation pattern and problems of water management. The study noted that during a period of nine years on an average only 37.38 percent potential was utilised. The study concluded that to reduce the problem of water in future there is an urgent need to complete various projects within time , increase the irrigation potential , accept water saving models for irrigation , increase the scope of water refilling programme, implement river joint projects with due consideration to the environmental balance.

**Krishnan.S.M and V.Shanthi (2013)** in their study on "Water Management in India" stated that the demand for water is increasing rapidly due to growing population, rapid urbanisation, rapid industrialisation and economic development. There exist inequalities in distribution and also lack of unified perspective in planning, management and use of water resources. The study also found that India receives an average annual precipitation of about 400 billion cubic metres (BCM) but utilises only 1122 BCM. The study suggested Integrated Water Resource Management (IWRM) is the only solution to manage the problem of water in the country.

**Dinesh Kumar Mishra (2013)** in his study on “Problems in Flood Prone River Basins” emphasised on the fact that water logging is one of the major problems of land degradation in India. The study suggested the government to work on improving the drainage, widening the span of culverts and bridges and remove impediment to the flow of water to the maximum extent possible.

**Shri Krishnan (2011)** in his study on “Water Harvesting Traditions and the Social Milieu in India: A second look” analysed the various water harvesting traditions across India. The study revealed that the traditional methods are now extinct due to over pollution and exploitation of water. The study concluded by suggesting usage of traditional methods and policy formation to sustain and the quality of water.

**Radha Krishnan.N (2006)** in his study on “Distributional and Availability Problem of Piped Water in an Urban Centre in Kerala: Findings of a Micro Level Research Study” stated that by most standards Indian cities rate among the lowest in the world with regard to the availability of potable water to the citizens. The United Nations World Water Development Report shows that India is on the 133<sup>rd</sup> place in world ranking in terms of income per capita availability of water. The study also noted that water availability problem differs among different size class of population in the city (Kerala). The study also revealed the key challenge of urban water supply as sensitising water consumers on scarcity of water and equitable distribution of water among every citizen at an affordable price. The study concluded by suggesting a change in attitudes from a ground level.

**Parekh Jigar and Lalani.A.I (2011)** in their study on “Urban Water Supply: Reform Options” aimed to examine the patterns in household water delivery across different geographic and socioeconomic dimensions. The study discussed the current state of urban water provision with respect to, water availability, water sector efficiency and pricing structures. The study emphasised that a standard indicator of inefficiency is the percentage of water produced that does not reach water board customers. There are unaccounted water results both from leakages and illegal connections. In addition to the financial costs to the water utility, high levels of unaccounted for water are also a major reason for intermittency in the supply of water, since leaks and illegal connections lower water pressure in the distribution system. The study concluded by stating that the current structure of water tariffs do not provide any economic incentives in terms of recovering costs - both operation and maintenance and depreciation of capital - in the urban areas; rather, they provide incentives for over consumption and inefficient use while not reflecting the scarce conditions of water availability.

### **2.4.1 Climate Change and Water Pollution**

Climate change is the result of over exploitation of the available resources and population explosion all around the world. Climate change is expected to increase global average temperatures, as well as the number and intensity of heat waves. Climate change is also predicted to result in changes in precipitation patterns, with more pronounced extremes such as flooding or drought expected. Precipitation may increase in one season and decrease in another. Flows in rivers may change in areas where rivers are fed by snowmelt or glaciers. As a result of extreme climate change the glaciers and icecaps have started to melt as a result of which there is an increase in the sea level. Climate change not only affects the humans but also calls for trouble for the animals and plants.

**Velu Suresh Kumar (2010)** in his study on “Climate Change: Its Impact on India” pointed toward the global air and ocean temperatures, widespread melting of snow and ice and rising sea level. The study also predicted that if the production of green house gases soars, global temperatures would rise up to 6.5 degrees Celsius by the end of this century. The study also revealed that India has the world’s second largest population and is the third largest emitter of CO<sub>2</sub> after USA and China according to the United Nations Environment Programme, 2002. According to the study the major impact of climate change is the rise in sea level. The study concluded that impact of climate change could be reduced by preventing hazards. The emission of green house gases must be mitigated.

**Satya Sundaram.I (2013)** in his study on “Contours of Climate Change ” stressed on the fact that too much stress on economic development often ignores environmental degradation. The study also predicted that climate change would affect all four dimensions of food security- food availability, access to food, stability of food supplies and food utilisation. The study highlighted the fact that India is not in a happy position. The country’s average annual surface air temperature could go up by four degree Celsius by the end of this century at the current rate of emissions of GHG.

**Eshraghi et.al (2008)** in their study on “Evaluation of Climate Effects on Tourism” stated the need for quality climate indices to measure the climate variables. Tourism is highly dependent on the climatic conditions as the body require time to adjust to abrupt temperature changes. The intensity radiation is also an important attribute of climate change. UV- B radiation harms the skin, eyes and also causes cancer. Some other features that effect tourism are wind, humidity and tropical cyclones. The study concluded that TCI (tourism and climate

index) is an important tool and needs to be utilised efficiently to measure the climatic changes in the country.

**Abdul Raheem.A (2012)** in his study on “The Economics of Climate Change” focused mainly on three problems – under developing countries will grow rapidly which implies it will contribute an increased proportion of GHG, second- is the need for abatement and lastly equity in cost internally, for abatement of gases. These problems could be solved by implementing a common tax on emissions or a global system of tradable carbon emissions permits. The study also predicts that India and China would together contribute 38 percent of annual CO<sub>2</sub> emissions by 2050.

**Noor Mohamed.A and Sreemathi (2008)** in their study on “Climate Change – Needs International Effort” revealed that the earth’s temperature has been increasing continuously from times as early as 30,000 years ago. This is so, as the earth’s atmosphere traps solar radiation and reflects it backwards on the earth (19<sup>th</sup> century). By 1950’s and 1960’s it was found that temperature was increasing because of the emission of GHG. The study concluded by giving a solution to reduce the emission of carbon gases. The study suggested “decarbonising” the economy as the best alternative solution.

**Vandana Shiva (2013)** in her study on “Green Revolution and Climate Change” stated that intensification of drought, floods and cyclones is one of the predictable impacts of climate change and climate instability. The study also revealed that the failure of monsoon and the consequent drought has impacted two third of India, especially the bread baskets of India’s fertile gangetic plains. According to the study Bihar has 43 percent rainfall deficit, Jharkhand 47 percent, Uttar Pradesh 64 percent, Haryana 61 percent, Punjab 26 percent, Himachal Pradesh 63 percent and Uttarakhand 42 percent. The study concluded that long term ecological security, food security and water security need the following transitions:

- Conservation and large scale distribution of open pollinated varieties/open source seeds of water prudent crops
- The promotion of organic agriculture to increase climate resilience and food and water security
- Incentive to farmers for a shift from water guzzling green revolution agriculture to water conserving bio-diverse organic farming.

The immediate emergency need is to provide food, fodder and water to the drought hit areas.

**Sundar.I (2010)** in his study on “Climate Change and Threatened Rural Livelihoods” pointed out that climate change and increased climate variability is inevitable, and is occurring and will likely accelerate over the next 50 years. The study revealed that the impact of climate change will be felt worldwide, but those impacts would be most severe in the developing world where impoverished and vulnerable communities are already struggling to deal with current climatic hazards. According to the study adaptation could be both autonomous and planned. Autonomous adaptation is the ongoing implementation of the existing knowledge and technology in response to the changes in the climate experienced; and planned adaptation is the increase in adaptive capacity by mobilising institutions and policies to establish or strengthen conditions that are favourable to effective adaptation and investment in new technologies and infrastructure. The study suggested that development of water-saving technologies and natural resource management systems that contribute to high water use efficiency in agriculture and the energy sector and this minimises disruption to the global biogeochemical cycles.

**Renu Rakesh (2010)** in her study on “In Desert Country, Climate Change Clouds the Future” stated that more than 70 percent of agricultural production in India is done in rain-fed regions where farming is largely dependent on the monsoon. The study revealed that the major problems reported were:

- Increasing climate variability
- The impact of unpredictable weather on agriculture and food security and
- Increasing imbalance between food demand and supply.

The study founded that women suffered more than men did as a result of climate change. The study concluded by warning that climate change will worsen the life conditions of farmers, fisher folk and forest dependent people, who were already vulnerable and food insecure. The study also said that more frequent and extreme weather events will make life impossible for the vulnerable groups.

## **2.5 Consumption of Water**

**Upali,et.al, (2005)** in their study on “Spatial Variation in Water Supply and Demand across River Basins of India” stated that in 1995, about 75 percent of the Indian population was rural, and projected that a substantial proportion of the population is expected to live in urban areas by 2025. The study said that earlier there was a shortage for irrigation but now daily consumption of fresh water has become an alarming issue. The study disclosed that the

major problems of water for consumption arise due to the skewed distribution of the population along the river tributaries. The study highlighted the fact that in the Ganga basin, which accounts for only about a quarter of the total drainage area, has about 40 percent of the total population of India. The next five largest basins—Mahanadi, Brahmaputra, Krishna, Godavari, and Indus— cover 46 percent of the drainage area, but have only 30 percent of the population. About 75 percent of the people in all the river basins still live in rural areas and the livelihoods of most of them depend on agriculture. Therefore the development and management of available water resources are crucial factors in rural development and poverty alleviation in India.

**Abdul Shaban (2008)** in his study on “Water Poverty in Urban India: A Study of Major Cities” said that increased demand with population rise, economic development, and shrinking supplies due to over exploitation and pollution. The study covered domestic households in seven major Indian cities, Delhi, Gr. Mumbai, Kolkata, Hyderabad, Kanpur, Ahmadabad and Madurai, was conducted in March 2005. The data was collected through a structured schedule and target respondents were the housewives. The study also revealed that the importance of supply/availability of clean water in economic and health spheres has been the main motivating factor for the present study. The study estimates that about 70% of diseases in human being are due to consumption of unclean water. The study concluded by emphasizing the fact that although recycled by the Nature, the fresh water is a limited resource. The high water consuming economic activities and population explosion are responsible for declining per capita water availability. To consume more is emerging main goal of societies, more so of the ‘privileged’, thus putting further pressure on this diminishing natural resource. Indian cities have been appropriating water resources traditionally meant for ‘subsistence’ in rural areas.

## **2.6 Other Related Studies**

### **Indian Studies**

**Shivanand.Y.A (2009)** in his study on “Domestic Water Recycle” , suggested that usage of recycled water for non potable (not for drinking) purposes , such as agriculture, landscape, public parks, cooling and watering plants , toilet flushing, dust control, construction activities, concrete mixing and formation of artificial lakes will be very helpful for sustaining the environment and saving water.

**Sinha.S.K (2012)** in his study on “Potable Water Quality in Patna “, analysed the access of drinking water quality in Patna. The study indicated existence of high value coli form bacteria in drinking water. The study advised to chlorinate the water before drinking because lack of adequate supply of pure drinking water causes various diseases.

**Mala et.al (2012)** in their study on “Multivariate Statistical Study on Evaluation of Water Quality of Vaigai River –Tamil Nadu” used a complex data matrix to assess the quality the quality of water and to measure multiple parameters. The study has applied different multivariate statistical techniques such as duster analysis and principle component analysis to analyse the integrated interpretation of complex data matrix. The study concluded that the Vaigai river samples contain higher load of organic matter and other physio-chemical concentration. The study concluded by suggesting a periodical monitoring of ground water quality around high exposure areas in the future.

### **International Studies**

**Peterson and Posner (2008)** in their study on “Global Water Futures- A Roadmap for Future US Policy” said that what is now a global challenge will soon be a global crisis. According to the Organisation of Economic Cooperation and Development the number of persons in water stressed countries is expected to increase to nearly 4 billion- almost half the worlds projected population by the year 2030. The study revealed that the US is in critical need of long-range integrated strategy for international water.

**Kathrine.A.Bliss (2009)** in her study on “Enhancing US Leadership on Shrinking Water and Sanitation- Opportunities within Global Need Programme” revealed that nearly ten percent of the global burden of disease can be attributed to water. The study also pointed out that some of the key challenges faced by the world are – climate change, lack of sanitation, and safe drinking water, urbanisation and chemical contamination. The study concluded by highlighting the fact there are so many different government entities that conduct international work related to water and sanitation access which results in underscoring the importance of effective communication and coordination among the various agencies.

**Katrina Kosec (2013)** in her study on “The Child Health Implication of Privatising Africa’s Urban Water Supply”, questioned that - can the Private Sector Participation (PSP) in the urban piped water sector improve child health? The study revealed that each year, one in the 10 child deaths – roughly 800000 in total – is a direct result of diarrhoea (UNICEF and WHO 2009). The study used child level data from 39 African countries during the time

period of 1986 – 2010 to test whether private sector participation (PSP) affects the prevalent diarrhoea in the urban-dwelling children under the age of five. The results of the study depicted that PSP decreases diarrhoea by 2.6 percent, which is a 16 percent decrease in its mean prevalence.

**CSIS and the Sandya National Laboratories (2007)** conducted a study on “Addressing Our Global Water Future”. The study stated that water scarcity and poor water quality could lead to increased potential for domestic instability and heightened trans-national tensions. The study also predicted that effective integrated water resource management relies upon community participation. The study concluded by disclosing that the varying competencies of government agencies, non governmental agencies, the private sector and academic institutions can all provide specific expertise to addressing water challenges in situations across the globe. But no single organisation can effectively address these challenges without the support and cooperation of the others.

**David Hall and Emanuele Lobina (2010)** in their study on “Water Privatisation”, examined the expansion of private water companies since 1989 and its withdrawal from developing countries from 2003 onwards, and the economic impact of privatisation. Privatisation involved major multinational companies and international institutions, consumers, trade unions and social movements. The study also revealed that despite the expansion of the 1990s, water supply services remain overwhelmingly dominated by the public sector. Around 90% of the 400 largest cities in the world, with populations of over 1 million, are served through public sector operators. The proportion is around 85% for these largest cities in high income countries, including Western Europe and North America: some estimates for the water sector in Europe offer a figure as low as 55%, but only by treating as ‘private’ cooperatives and operators controlled by the public sector but with some minority private shareholding. In Africa and Latin America the proportion is also around 85%, while in south and east Asia it is over 90%. The study concluded by stating that private companies can operate and invest in a water system based on market principles, where customers are connected according to their willingness and ability to pay.

**David Seckler,et.al, (1998)** in their study on “World Water Demand and Supply, 1990 to 2025: Scenarios and Issues”, discussed the problem of severe water shortage. The study said that the world figures disguise enormous differences among countries (and among regions within countries). The study also disclosed that many of the most water-scarce countries already have highly effective irrigation systems, so this will not substantially reduce their needs for development of additional water supplies. On the other hand, most of the

world's gain in irrigation effectiveness would be in countries with a high percentage of rice irrigation. The study projected that there would be an increasing number of water- deficit countries and regions including not only West Asia and North Africa but also some of the major breadbaskets of the world such as the Indian Punjab and the central plain of China. There would be some major shifts in world cereal grain trade as a result. The study concluded by stating that around 50 percent of the increase in demand for water by the year 2025 can be met by increasing the effectiveness of irrigation. While some of the remaining water development needs can be met by small dams and conjunctive use of aquifers, medium and large dams will al- most certainly also be needed.

### **Conclusion**

The above studies indicated that one of the major challenges for the entire world is the problem of water and water pollution. As a result of extreme water pollution there is a significant change in the consumer behaviour. There is a need for immediate steps to be taken by the government to ensure proper water supply not only for this generation but also for the generations to come.

## **CHAPTER III**

### **METHODOLOGY**

The methodology implemented in the present study “**Changing Consumer Behaviour Through Water Pollution: A Case Study Analysis**” is discussed in the following headings:

- 3.1 Selection of the problem
- 3.2 Selection of the sample
  - 3.2.1 Selection of the study area
  - 3.2.2 Profile of Coimbatore district
  - 3.2.3 Selection of the consumers
- 3.3 Selection of the sample units
- 3.4 Source of collection of data
- 3.5 Quantitative tools
  - 3.5.1 Correlation
  - 3.5.2 Simple percentage method
  - 3.5.3 Graph
  - 3.5.4 Multiple regression model
  - 3.5.5 Likert scaling technique
  - 3.5.6 Theoretical framework
- 3.6 Limitations of the study

#### **3.1 Selection of the Problem**

Water is the essence of life, there is no life without water. Water was once upon a time a free commodity. Slowly it became an economic resource, and now it is on the path of scarcity. All this is due to human activities. Urbanisation, industrialisation and population explosion are the main causes of water pollution. Water pollution is not merely a problem of India but is common around the globe. Another major factor that accelerates the severity of water problems is the climatic changes occurring all over the world. Climatic changes occur due to a lot of factors like air pollution, green house effect, industrial pollution etc. Due to climate change a lot of changes can be seen, especially in the poles. This climatic changes cause the sea level to rise, which will in turn cause unusual floods and other natural

calamities. While accessing drinking water continues to be a problem, assuring that it is safe is a challenge by itself. Water quality problems are caused by pollution and over-exploitation. The rapid pace of industrialisation and greater emphasis on agricultural growth combined with financial and technological constraints and non-enforcement of laws have led to generation of large quantities.

### Climate Change

Intensification of drought, floods and cyclones is one of the predictable impacts of climate change and climate instability.

**TABLE - 4**  
**DETAILS OF TEMPERATURE PREVAILED DURING 2012-13 IN INDIA**

S.No	Months	Maximum ° C			Minimum ° C		
		Actual	Normal	%Deviation	Actual	Normal	% Deviation
1	April '12	35.4	29.4	20.4%	24.0	17.9	34.1%
2	May '12	34.5	31.8	8.5%	42.1	18.5	127.6%
3	June '12	32.4	34.5	-6.1%	23.8	20.5	16.1%
4	July '12	31.3	35.2	-11.1%	23.6	23.8	-0.8%
5	August '12	31.2	34.0	-8.2%	23.0	23.2	-0.9%
6	September '12	32.4	31.0	4.5%	22.6	22.9	-1.3%
7	October '12	30.6	30.1	1.7%	22.3	22.2	0.5%
8	November '12	30.7	30.1	1.9%	20.5	22.2	-7.6%
9	December '12	30.5	31.6	-3.5%	20.3	21.8	-6.9%
10	January '13	31.6	30.9	2.3%	19.0	21.4	-11.3%
11	February '13	31.9	29.2	9.2%	20.7	20.2	2.5%
12	March '13	34.2	29.4	16.3%	22.8	17.9	27.3%

Source: Tamil Nadu Agriculture University, (2013)

The failure of monsoon in India and the consequent drought has impacted two third of India, especially the bread baskets of India's gangetic plains. Monsoon failure and widespread drought implies a deepening of the already severe food crisis. It also implies a deepening of water crisis. (Vandana Shiva, 2013).

Table 4 depicts the change in temperature in India in the year 2012. Changes in temperature are seen in two ways, maximum mean and minimum mean. In the category of maximum mean the month of April experienced the highest deviation with a deviation of 20.40 percent whereas July experienced a negative deviation of -11.10 percent. There were severe changes in the minimum mean category where the month of May '12 experienced a massive deviation of 127.60 percent. Here the month of January 2013 faced negative deviations of -11.30 percent. As a result of over pollution and population the world has been experiencing severe climate change. Coimbatore is no exception to this phenomenon.

### **Rainfall in India**

Rainfall in India as in all tropical countries is confined mainly to the South East Monsoon months of June and September. The all India average rainfall is 1,194 mm but it varies from 100 mm in the western deserts to 11,000 mm in the North-eastern region. Irrigation is therefore since time immemorial, been recognised as a vital input, contributing not only directly by meeting the evaporation needs of plants but also indirectly recharging ground water.

Over population and water pollution has taken its toll on climate change which results in poor rainfall. There are deviations from the normal rainfall and that we receive in the current period. This is shown in table 5. The month of April '12 experienced an enormous deviation from its normal rainfall. There was an increase of 460 percent during this month of the year. Both the months of February and March experienced a negative deviation from the normal rainfall with a -100 percent.

**TABLE - 5****DETAILS OF RAINFALL PATTERN: 2012 – 2013 IN INDIA**

S.No	Month	Rainfall in mm		
		Actual	Normal	% Deviation
1	April '12	78.4	14.0	460%
2	May '12	25.6	9.2	178%
3	June '12	11.1	17.0	-34.7%
4	July '12	27.5	52.7	-47.8%
5	August '12	28.3	66.5	-57.4%
6	September '12	6.1	42.8	-85.7%
7	October '12	165.2	68.5	141.1%
8	November '12	22.4	30.1	-25.5%
9	December '12	6.9	68.0	-89.8%
10	January '13	0.0	146.0	-100%
11	February '13	99.8	118.0	-15.4%
12	March '13	0.0	41.4	-100%

Source: TNAU, (2013)

### 3.2 Selection of the Sample

The city of Coimbatore was selected for the study. The city has experienced population explosion in the past two decades which has given rise to a lot of pollution. The city is facing a lot of pollution from various sectors such as industries, agriculture, hospital wastes and domestic discharge. The Coimbatore Corporation has taken lot initiatives in providing its people with safe drinking water. Yet some of the places suffer due to poor supply of water.

Based on these facts four areas in Coimbatore city were selected. The areas are Tudiyalur, Podanur, Karumbakadai and Ukkadam.

### 3.2.1 Selection of the Study Area

In general the water scarcity is one of the most severe problems in Tamil Nadu. Water scarcity leads many adversities such as health problems, agriculture and so on. Water is the life line for any living being. This problem is not merely to man but it also has its ill effects on the animals and plants. Many of these have become extinct due to the regular activities of man. The water that is collected in the ground water is not sufficient for the usage of the people. The reason for water scarcity in Tamil Nadu is because of the development taking place in the state. Another aspect leading to the scarcity is the recent increase in the population in the state. Population if controlled within time will help in enhancing the resources. It must be understood that natural resources cannot be increased when population increases. It is fixed by nature.

**TABLE - 6**  
**DETAILS OF WATER DEMAND OF INDIA IN THE NEXT FIFTY YEARS**

SECTOR	YEAR		
	2000	2025	2050
<b>Domestic</b>	42 (6.6%)	73 (6.7%)	102 (7%)
<b>Irrigation</b>	54 (85.3%)	910 (83.3%)	1072 (74.4%)
<b>Industry</b>	8 (1.3%)	22 (2%)	63 (4.4%)
<b>Energy</b>	2 (.3%)	15 (1.4%)	130 (9%)
<b>Others</b>	41 (6.5%)	72 (6.6%)	80 (5.5%)
<b>Total</b>	634 (100%)	1092 (100%)	1447 (100%)

Source: Chandrakumar.G and Mukundan.N , ( 2006).

Table above table predicts the increasing water demand from 2000 to 2050. In 2000 the total water demand was 634, which is likely to increase to 1092 in 2025. In the year 2050 this demand increases to 1447 which is more than the double of the demand in 2000. Due to over population and exploitation of natural resources the world is facing such a problem. One must realise that no matter how much the demand increases with time, the supply of water will always be fixed or in the worst cases it would decrease. The only result of this is that sectors will have to be prioritised in order to manage the shortage of water.

### 3.2.2 Coimbatore district profile

Coimbatore is known as the Manchester of Tamil Nadu. Coimbatore is a city in the city of Tamil Nadu. The geographical area of the city is between: North Latitude between 11°00'58" and 11°01'61" East Longitude between 76°58'16" and 76°09'71". The city is governed by Coimbatore Local Planning Authority. The city collector is Archana Patnaik. According to the 2011 census the total area covered by the city is 4,850 km<sup>2</sup> (1,870 sq mi) with a density of 572/km<sup>2</sup> (1,480/sq mi). Tamil is the official language of Coimbatore. The city has a sex ratio of Male -50.81 percent/Female -49.19 percent. On an average 69 percent of the population are literates. Among the literates 77 percent are males while the females are lagging behind with 64 percent. The population of the city is 3,472,578 of which 1,735,362 are males and 1,737,216 are females. Of the total population only 854489 (29 percent) reside in rural areas, the remaining 2,06,2131 (71 percent) live in the urban areas. The SC/ST population of the city accounts for 20 percent of the population of which 59 percent are males and 41 percent are females.

The Coimbatore Corporation is responsible for the supply of water in the city. The city is divided into five zones namely Central, North, South, East and West. Tamil Nadu Water Supply and Drainage Board (TWAD) is the water delivering authority to the various parts of the city.

**TABLE – 7**  
**DETAILS OF REVENUE DIVISIONS OF COIMBATORE DISTRICT**

S.No	Revenue Division	No. of taluks	No. of zones	No. of firkas	No. of revenue villages
1	Coimbatore	5	6	21	163
2	Pollachi	3	4	12	131
	Total	8	10	33	294

Source: District Statistics Office, (2013)

The details of revenue divisions, taluks, firkas and revenue villages is given in table 7. Coimbatore is divided into 5 taluks, 6 zones, 21 firkas and has a total of 163 revenue villages according to the Coimbatore district profile. The city is divided into two revenue divisions namely, Coimbatore and Pollachi. The revenue division of Pollachi is further divided into 8 taluks, 4 zones, 12 firkas and 131 revenue villages. In total there are 8 taluks, 10 zones, 33 firkas and the total number of revenue villages is 294.

# COIMBATORE DISTRICT MAP

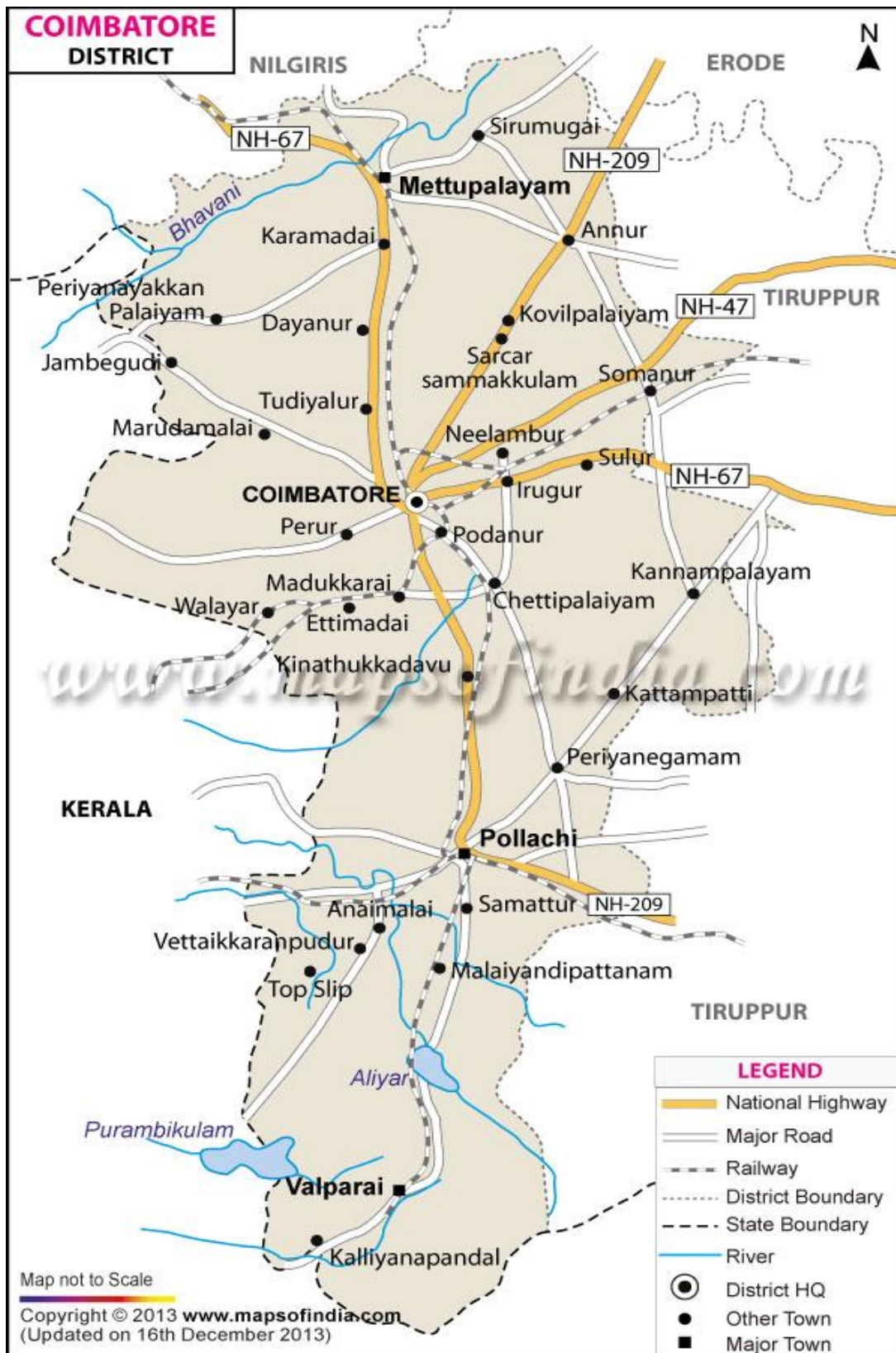


FIGURE: 3

The below table 8 depicts the taluk details of the Coimbatore district as per the 2011 census.

**TABLE - 8**  
**TALUK DETAILS OF THE COIMBATORE DISTRICT: CENSUS 2011**

S.No	Name of taluk	Total area in ha	Taluk head quarters
1	Coimbatore north	88437	Coimbatore
2	Coimbatore south	32401	Coimbatore
3	Mettupalayam	64545	Mettupalayam
4	Pollachi	116551	Pollachi
5	Sulur	58496	Sulur
6	Valparai	66964	Valparai
7	Coimbatore corporation	10560	-
8	Pollachi municipality	1386	-
9	Mettupalayam municipality	720	-

Source: District Statistics Office, (2013)

The Coimbatore district has been divided into nine Taluks namely Coimbatore north, Coimbatore south, Mettupalayam, Pollachi, Sulur, Valparai, Coimbatore Corporation, Pollachi Municipality and Mettupalayam Municipality. The largest area is covered by Coimbatore North (8437 ha). The city of Coimbatore has experienced an enormous population explosion as a result of which the consumption pattern of its people has been experiencing drastic changes. People have started to opt for private supply for drinking water as the increase in population has lead to deteriorating quality of water. Due to high level of water pollution the fresh water resources of the city has become scarce.

### **3.2.3 Selection of the Consumers**

Coimbatore district was selected for the current study. According to the 2011 census the population of the city is 3,472,578 of which 1,735,362 are males and 1,737,216 are females. Of the total population only 854489 (29%) reside in rural areas, the remaining 2,06,2131 (71%) live in the urban areas. Water problem is not faced by the entire city but there are places which are badly hit by the problem of water scarcity. In some areas such as Tudiyalur the supply of drinking water is only once in two weeks. Other areas have poor quality water supply.

### 3.3 Selection of the Sample Units

Coimbatore district was selected for the current study. In Coimbatore four areas were selected namely, Tudyialur, Podanur, Karumbukadai and Ukkadam. The selected areas badly affected due to the problem of water scarcity. In Tudyialur there was poor and irregular water supply. A total of 31 samples were selected from Tudyialur. In the remaining three areas there was poor quality of water supply due to which consumers were forced to depend on private water supply for drinking purpose. From Podanur 56 households were selected whereas 7 households were selected from Karumbukadai and 6 from Ukkadam. Thus the total sample units selected were 100.

**TABLE – 9**  
**WARD DETAILS OF THE SELECTED AREAS**

Areas	Zone	Zonal Accesses	Ward no.	Ward Accesses
Tudyialur	North	88962	1	1396
Podanur	South	85307	95	7030
Karumbukadai	South	85307	86	4539
Ukkadam	Central	72092	84	2880

Source: Coimbatore Corporation, (2013).

The above table describes the ward and zone details of the selected areas. The city of Coimbatore is divided into five zones namely, East, West, North, South and Central. The current study selected consumers from four severely affected areas of the city. The selected areas came under the following zones. Tudyialur fell in the ambit of the North zone, Podanur and Karumbukadai belonged to the South zone, whereas Ukkadam came under the Central zone. The total number of zonal accesses for the above mentioned zones is 88,962, 85,307 and 72,097 respectively. The city is further divided into wards in order to simplify the administration. Tudyialur belongs to ward 1 which has a total number of accesses of 1,396. Podanur came under ward number 95 whose total number of accesses is 7,030. Karumbukadai fell under the ward number 86 where the total accesses were 4,539. Ukkadam belonged to the 84<sup>th</sup> ward having the total number of accesses of 2,880.

### 3.4 Sources of data collection

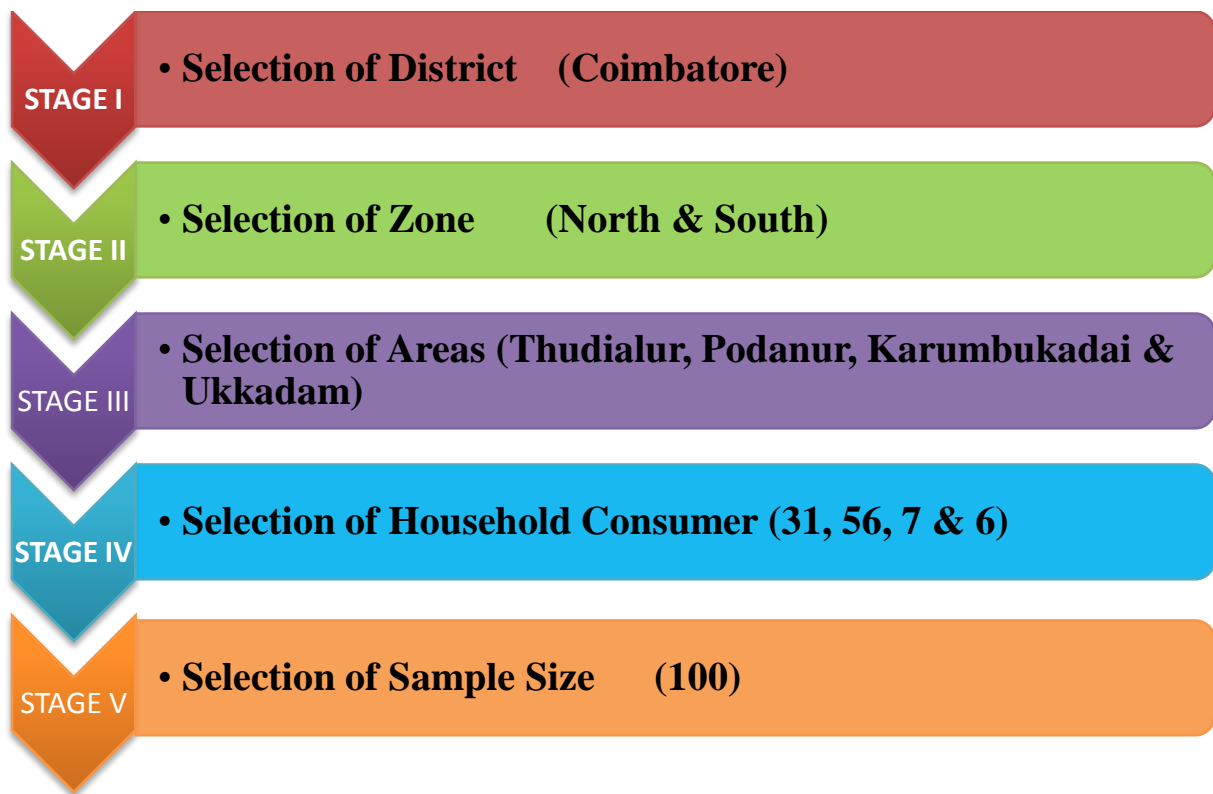
In the current study both primary and secondary data was collected. Multi-stage sampling technique was used to select the samples for the current study. A pilot study was conducted to understand the major problems of water pollution, to filter the most affected areas and to identify the gaps in the interview schedule. Primary data was collected by the personal

interview method from the selected households. Interview schedule was used to collect the details related to the study from the sample households. On the basis of the observations, during the pilot study, the schedule was modified (Appendix – 1) and the survey was conducted between October to December 2013.

The secondary data was collected from the following sources

- Official Documents of Coimbatore Corporation
- Tamil Nadu Water Supply and Drainage Board
- District Statistics Office Coimbatore
- Tamil Nadu Agriculture University
- Pollution Control Board Coimbatore

### MULTI STAGE SAMPLING TECHNIQUE



**FIGURE: 4**

Multi stage sampling technique was used in the current study. In the first stage Coimbatore district was selected for the current study. The second stage comprised of selecting the zones for the study. Here Coimbatore north and Coimbatore south was selected for the analysis. In the third stage the major areas affected by water pollution was selected.

The selected areas are Tudiyalur, Podanur, Karumbukadai and Ukkadam. In the final stage sample consumers were selected for the current study. Thirty one samples were selected from Tudiyalur, 56 from Podanur, 7 from Karumbukadai and 6 consumers from Ukkadam.

### **3.5 Quantitative Tools**

The data collected were arranged and tabulated for giving precise and concise information. Further, the following tools were applied to analyse the data.

The following statistical tools were used for this analysis

- i. Correlation
- ii. Simple percentage method
- iii. Graphs
- iv. Multiple regression model
- v. Likert 5 Point rating scale
- vi. Theoretical framework

#### **3.5.1 Correlation analysis**

**“Correlation analysis attempts to determine the ‘degree of relationship’ between variables” (Ya Lun Chou)**

The degree of relationship between the variables under consideration is measured through the correlation analysis. The correlation analysis refers to the techniques used in measuring the closeness of the relationship between the variables. The current study adopted the Karl Pearson’s coefficient of correlation to analyse the relationship between the cost and incomes the selected areas.

#### **3.5.2 Simple percentage method**

The absolute figures could not help to infer either exact or correction, therefore percentage is applied. The simple percentage method was widely used throughout the current study. The percentage of any value is calculated using the following formula:

$$\% = \frac{\text{favourable number}}{\text{total}} * 100$$

#### **3.5.3 Graphs**

There are numerous ways in which statistical data may be displayed pictorially such as different types of diagrams, graphs and maps.

One of the convincing and most appealing ways in which statistical results may be presented is through diagrams and graphs. Diagrams and graphs are extremely useful as they

give a bird's eye view of the entire data and, therefore, the information presented is easily understood. It is a fact that as the number and magnitude of figures increases they become more confusing and their analysis tends to be more strenuous. Pictorial presentation helps in proper understanding of the data as it gives an interesting form to it.

In the current study graphs and pie charts are used to present the data in a more effective and understanding manner.

#### **3.5.4 Multiple regression model**

The multiple regression models were used to determine the level of changes made to the dependent variable due to the explanatory variables. In the current study multiple regression analysis was used to understand the factors determining the cost of drinking water. The explanatory variables taken were education, income, age and occupation.  $R^2$  is defined as the percentage change occurring in the dependent variable due to the explanatory variables.

Here the R Square is calculated to understand the percentage changes in the dependent variables caused by the independent variables. The values of  $\beta$  are calculated to determine the exact unit of changes occurring in the cost due to changes in the independent variables. The t values of  $\beta$  are also calculated to analyse the significance of the study.

$$t \beta = \frac{\beta}{S.E \beta}$$

Where S.E = Standard error

#### **3.5.5 Likert rating**

Likert rating was used to analyse the satisfaction level of the selected consumers. The consumers were asked to give their opinions on the satisfaction level with the consumption of aqua guard water system and packaged water system, using the Likert 5 point rating scale. They were asked to list down their views as 'highly satisfied', 'satisfied', and 'neutral', 'dissatisfied' and 'highly dissatisfied'. The scores assigned to these views were 2,1,0,-1 and -2 respectively.

### 3.5.6 Theoretical framework

From economic point of view, a consumer is a utility maximising entity. From theoretical point of view, therefore, a consumer is said to have reached his equilibrium position when he has maximised the level of his satisfaction, given his resources and other conditions. Technically, a utility position when allocation of his consumption expenditure is such that the last Rupee spent on each commodity yields the same utility.

**Multi-Commodity Case:** in real life, however a consumer consumes multiple numbers of goods and services. In this section, we explain consumer's equilibrium in the multi-commodity case. The law of equi-marginal utility explains the **consumer's equilibrium in a multi-commodity model**. This law states that a consumer consumes various goods in such quantities that the MU derived per unit of expenditure on each good is the same. In other words, a rational consumer spends his income on various goods he/she consumes in such a manner that each rupee spent on each good yields the same MU.

Let us now explain consumer's equilibrium in a multi-commodity. For the sake simplicity of, however, we will consider only a two-commodity case. Suppose that a consumer consumes only two commodities, X and Y their prices being  $P_x$  and  $P_y$  respectively. Following the equilibrium rule of same type commodity case, the consumer will distribute his income between commodities X and Y, so that

$$MU_x = P_x (MU_m), \text{ and}$$

$$MU_y = P_y (MU_m)$$

Given these conditions, the consumer is in equilibrium where:

$$\frac{MU_x}{(P_x)(MU_m)} = \frac{MU_y}{(P_y)(MU_m)}$$

#### Limitations of the study

1. The study conducted was at a micro level , thus the findings of the study may not be applicable for the macro level
2. Many of the selected variables are qualitative in nature, hence the measurement of the variables may be impossible

## **CHAPTER IV**

### **RESULTS AND DISCUSSION**

The results of the undertaken study on “**Changing Consumer Behaviour Through Water Pollution: A Case Study Analysis**” are represented under the following headings:

- 4.1 Socio economic characteristics
- 4.2 Sources of water
- 4.3 Use of water
- 4.4 Frequency of water supply
- 4.5 Multi-commodity model of consumer behaviour
- 4.6 Preference of consumers for purified water systems
  - 4.6.1 Aqua guard
  - 4.6.2 Packaged drinking water
- 4.7 Cost of purified water systems
  - 4.7.1 Aqua guard
  - 4.7.2 Packaged drinking water
- 4.8 Correlation between cost and income for purified water systems
- 4.9 Determination of willingness to pay and accept for purified water systems
- 4.10 Satisfaction of consumers for purified water systems

#### **4.1 Socio-Economic Characteristics**

The socio-economic characteristics are an important aspect in any study. It not only gives the basic details regarding the concerned but also gives us a glimpse of the living conditions of the selected areas. Socio-economic characteristics such as gender, religion, occupation and income determine an individual’s behaviour and influences his/her decision making perception. The socio-economic characteristics of the current studies are given in table 10.

The socio-economic characteristics of the selected samples are discussed in table 10. Gender is a vital factor that has been dominating the Indian society from generation. It is only now that the trends have started to revolutionalise. Tudiyalur 29 percent of the samples were males and a majority of 71 percent were females. In the city of Podanur 26.79 percent are

males and 73.21 percent of the samples are females. In Karumbakadai the males 71.43 percent and females are only 28.57 percent. Males in Ukkadam constitute 33.33 percent of the sample size. India is a multi-religious nation, one often says that India is a country where there is “unity in diversity”, and religion plays an important role in the current study also. In Tudiyalur has 83.9 percent of Hindus and only 16.1 percent of Christians. The city of Podanur consists only of Muslims. Muslims in Karumbakadai constitute for 85.7 percent, while the Hindus are merely 14.3 percent.

**TABLE - 10**  
**SOCIO-ECONOMIC CHARACTERISTICS OF THE SELECTED HOUSEHOLD**  
**CONSUMERS**

Particulars	Tudiyalur	Podanur	Karumbakadai	Ukkadam	All
<b>Religion</b>					
<b>Hindu</b>	26 (83.9%)	0 (0.00%)	1 (14.3%)	0 (0.00%)	27 (27.00%)
<b>Muslim</b>	0 (0.00%)	56 (100%)	6 (85.7%)	6 (100%)	68 (68.00%)
<b>Christian</b>	5 (16.1%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	5 (5.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>
<b>Gender</b>					
<b>Male</b>	9 (29%)	15 (26.79%)	5 (71.43%)	2 (33.33%)	31 (31.00%)
<b>Female</b>	22 (71%)	41 (73.21%)	2 (28.57%)	4 (66.67%)	69 (69.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>
<b>Age</b>					
<b>20-30</b>	4 (12.90%)	15 (26.79%)	2 (28.56%)	2 (33.33%)	23 (23.00%)
<b>30-40</b>	5 (16.13%)	10 (17.86%)	3 (42.86%)	2 (33.33%)	20 (20.00%)
<b>40-50</b>	6 (19.35%)	13 (23.21%)	0 (0.00%)	0 (0.00%)	19 (19.00%)
<b>50-60</b>	7 (22.32%)	10 (17.86%)	1 (14.29%)	2 (33.34%)	20 (20.00%)
<b>Above 60</b>	9 (29.03%)	8 (14.28%)	1 (14.28%)	0 (0.00%)	18 (18.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Continued...

Particulars	Tudiyalur	Podanur	Karumbakadai	Ukkadam	All
<b>Occupation</b>					
<b>Government</b>	12 (38.71%)	6 (10.71%)	0 (0.00%)	1 (16.67%)	19 (19.00%)
<b>Private</b>	19 (61.29%)	49 (87.5%)	7 (100.00%)	5 (83.33%)	80 (80.00%)
<b>Joint</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
<b>MNCs</b>	0 (0.00%)	1 (1.79%)	0 (0.00%)	0 (0.00%)	1 (1.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>
<b>Income ( in Rupees)</b>					
<b>Up to 60000</b>	2 (6.45%)	1 (1.79%)	0 (0.00%)	0 (0.00%)	3 (3.00%)
<b>60000-100000</b>	7 (23.33%)	0 (0.00%)	1 (14.29%)	0 (0.00%)	8 (8.00%)
<b>100000-150000</b>	6 (1.94%)	4 (7.14%)	1 (14.28%)	1 (16.67%)	12 (12.00%)
<b>150000-200000</b>	7 (23.33%)	13 (23.21%)	2 (28.57%)	3 (50%)	25 (25.00%)
<b>200000-250000</b>	2 (6.45%)	21 (37.5%)	3 (42.86%)	2 (33.33%)	28 (28.00%)
<b>Above 300000</b>	7 (23.33%)	17 (30.36%)	0 (0.00%)	0 (0.00%)	24 (24.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>
<b>Education</b>					
<b>Illiterate</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0
<b>Primary</b>	1 (3.23%)	2 (3.57%)	1 (14.29%)	0 (0.00%)	4 (4.00%)
<b>Secondary</b>	11 (35.48%)	26 (46.43%)	4 (57.14%)	4 (66.67%)	45 (45.00%)
<b>Graduate</b>	10 (32.26%)	20 (35.71%)	2 (28.57%)	2 (33.33%)	34 (34.00%)
<b>Others</b>	9 (29.03%)	8 (14.29%)	0 (0.00%)	0 (0.00%)	17 (17.00%)
<b>All</b>	<b>31</b> <b>(100.00%)</b>	<b>56</b> <b>(100%)</b>	<b>7</b> <b>(100.00%)</b>	<b>6</b> <b>(100.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, ( 2013). MNCs: Multi National Corporations.

In Ukkadam the entire samples are Muslims. Occupation determines the sector in which one is employed. It plays a significant role in analysing the changing the consumption

pattern of the individuals. In Tudiyalur the 61.29 percent of the samples are employed in the private sector and only 38.71 percent are employed in the government sector. The private sector dominates even in Podanur constituting to 87.5 percent. There are 10.71 percent working in the government sector and a bare minimum of 1.79 percent works in MNCs. The entire samples of Karumbakadai work in the private sector. The private sector dominates in Ukkadam also with a majority of 83.33 percent and 16.67 percent of the samples are government employees. Income of an individual is a very important factor that determines the consumption pattern of the individual and family. In the city of Tudiyalur 6.45 percent of the samples earn an annual income 60 thousand and 2.5lakhs respectively. A minimal of 1.94 percent receives an annual income of 1.5lakhs. A majority 23.33 percent obtains an annual income of 2lakhs and above 3lakhs respectively. Education is base of any individual's basic growth and development of knowledge.

Education plays a crucial role in determining one's consumption behaviour as it enhances the decision making power of an individual. In the area of Tudiyalur 3.23 percent of the selected samples were educated till the primary level, 35.48 percent till the secondary level, 32.26 percent of them are graduates and the remaining 29.03 of the selected samples have done other studies. In Podanur, 3.57 percent of the samples are educated till the primary level, 46.43 are educated till secondary level, 35.71 are graduates and the remaining are educated in other areas such as diplomas. In Karumbakadai 14.29 percent of the selected samples are educated till the primary level, 57.14 of them are educated till the secondary level and the remaining are graduates. In Ukkadam the majority of the population, 66.67 percent are educated till the secondary level whereas 33.33 percent of them are graduates.

#### **4.2 Source of Water**

The major source of water in India is the rainfall. In the earlier days there were natural sources of water such as lakes and rivers. It was available in abundance, but now due to over population, urbanisation, and migration and most importantly due to pollution of water; water has become scarce and economic good. It has now become the responsibility of the government to provide its people with water for daily activities and for survival.

It is the government's responsibility to provide its people with proper water facilities for all purposes. The corporation provides water at a regular basis yet the consumers prefer to opt for aqua guard water systems and packaged water systems in order to maximise their satisfaction.

**TABLE - 11****DETAILS OF SOURCE OF WATER FOR SELECTED HOUSEHOLD CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbukadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Government</b>	31 (100%)	36 (64.29%)	0 (0.00%)	0 (0.00%)	67 (67.00%)
<b>Private</b>	0 (0.00%)	5 (8.93%)	3 (42.86%)	0 (0.00%)	8 (8.00%)
<b>Own</b>	0 (0.00%)	15 (26.78%)	4 (57.14%)	6 (100%)	25 (25.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

The table 11 portrays the source of water for the selected household consumers. The study revealed that the residents of Tudiyalur depend completely on the corporation supply for water. In Podanur 64.29 percent of the samples depend on corporation water supply. A smaller amount of 8.93 percent of the samples prefer private water supply. An average of 26.78 percent of the samples has their own supplies in form of tube wells and bore wells. The majority of 57.14 percent have their own supplies while 42.86 percent of the samples depend on private water supply. In Ukkadam all the samples have access to water in form of their own bore wells and tube wells.

## SOURCE OF WATER

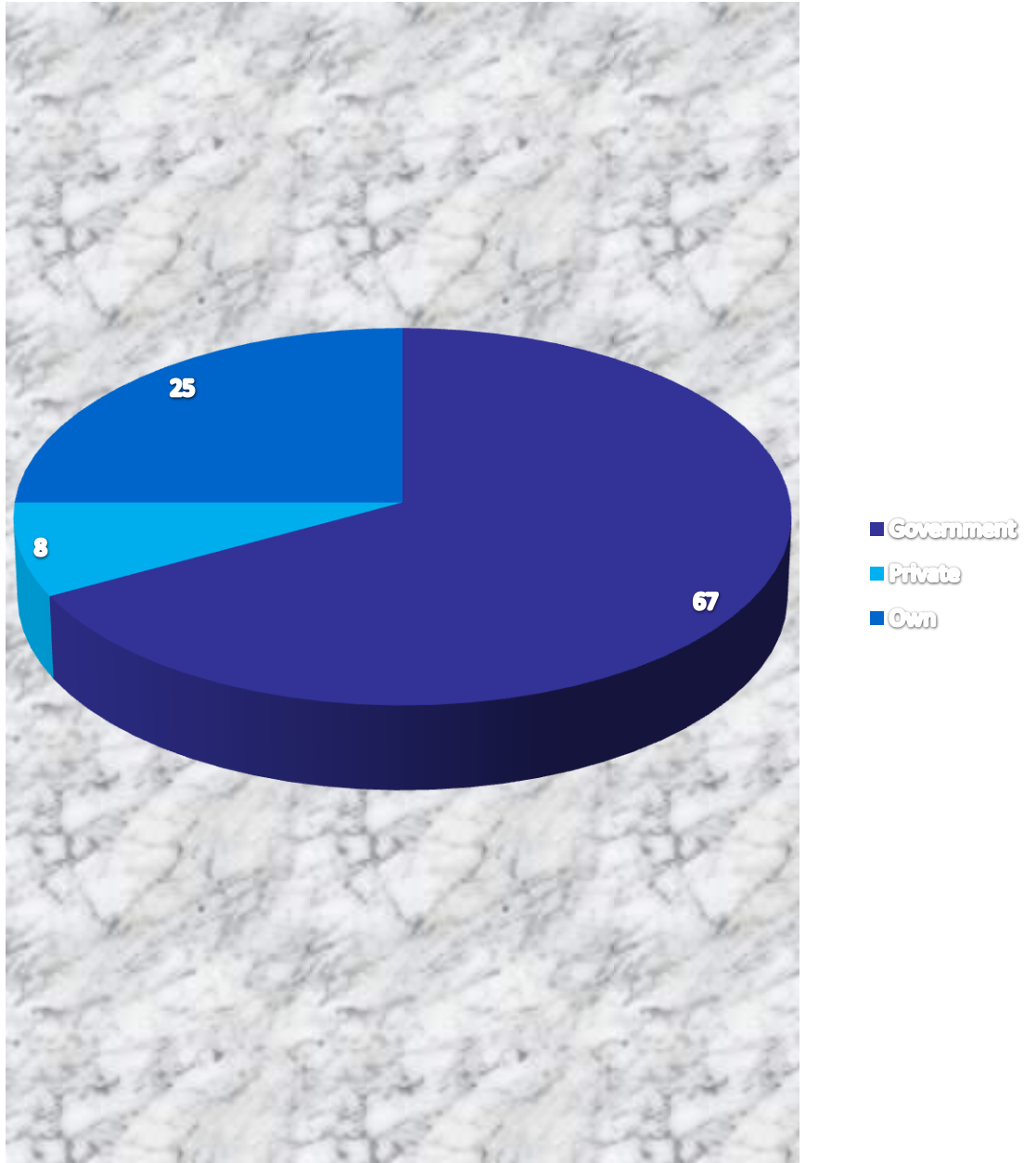


FIGURE: 5

### 4.3 Use of Water

Water is used for various purposes throughout the day; water is used for cooking, drinking, washing, agriculture and other activities. Water is not only used by humans but the animals and plants also depend on water for their survival. Nowadays the water supplied by the corporation is not of good quality and is irregular in supply resulting in water scarcity. As a result of water pollution the quality of water has dropped so much that consumers are more comfortable using the corporation water for domestic and other uses and depend on the private sector for drinking purpose.

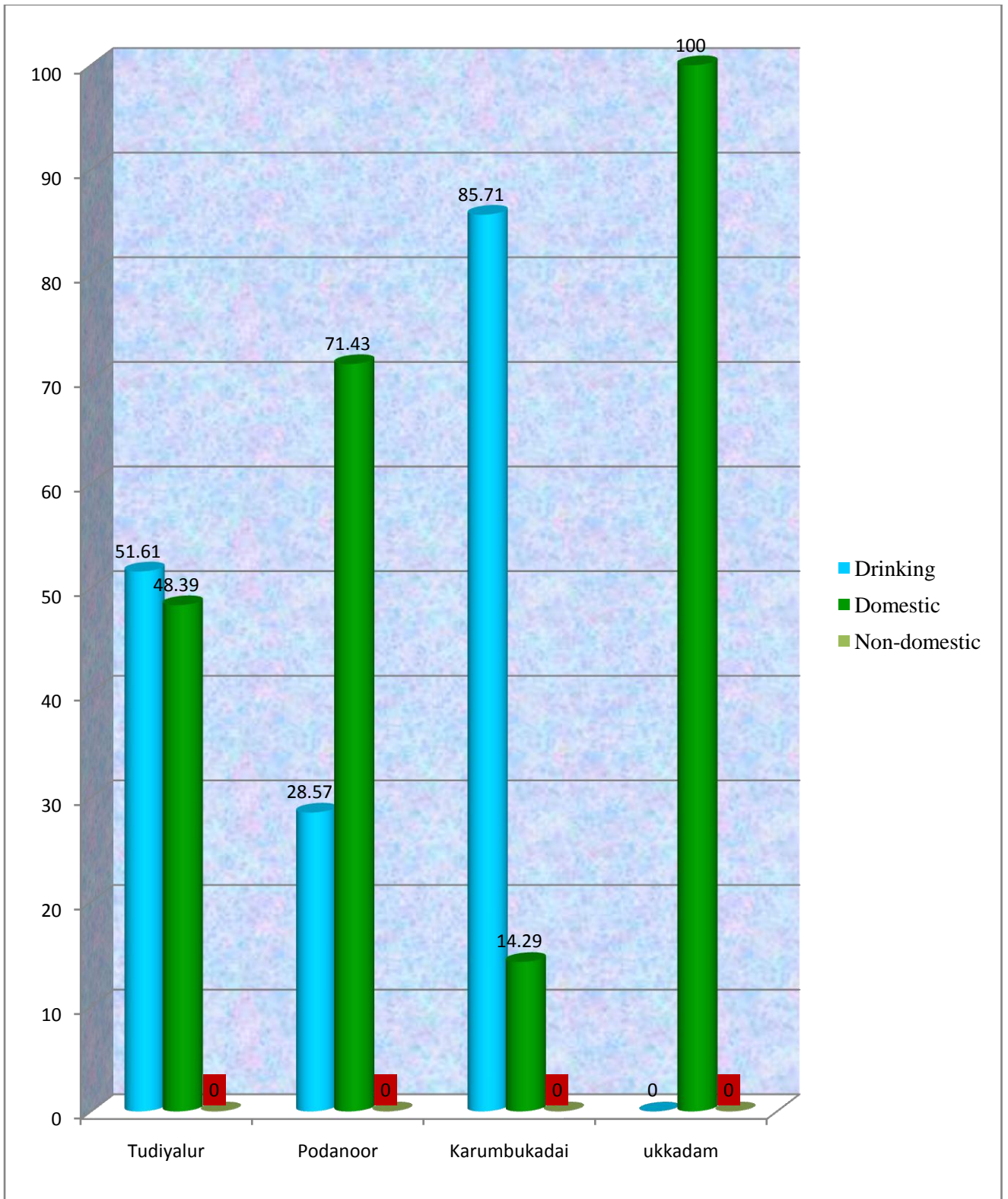
**TABLE - 12**  
**DETAILS ABOUT THE USAGE OF WATER BY THE SELECTED HOUSEHOLD**  
**CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbakadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Drinking</b>	16 (51.61%)	16 (28.57%)	6 (85.71%)	0 (0.00%)	38 (38.00%)
<b>Domestic use</b>	15 (48.39%)	40 (71.43%)	1 (14.29%)	6 (100%)	62 (62.00%)
<b>Non domestic</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
<b>Other</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

Due to water pollution now the trends are so that now the people prefer use the corporation water for domestic purpose or other uses. The quality of water has deteriorated significantly and the trend would continue if necessary steps are not taken. The table 12 explains the usage of water by the selected household consumers. In Tudiyalur 51.61 percent of the samples use corporation water for drinking purpose whereas 48.39 percent uses the corporation water for domestic purpose. In Podanur the 71.43 percent uses corporation water for domestic use and 28.57 percent of the selected household consumers use the corporation water for drinking purpose after boiling it. In Karumbakadai the majority use the corporation water for drinking purpose after boiling it and only 14.29 percent use it for domestic purpose. In Ukkadam all the selected samples use the corporation water for domestic usage

## USAGE OF WATER BY THE SELECTED HOUSEHOLD CONSUMERS



**FIGURE: 6**

#### 4.4 Frequency of Water Supply

The major water sources in Coimbatore are Siruvani, Athikadavu and Pilloor dams. Water is supplied regularly in a systematic manner to the residents of Coimbatore. By frequency of water supply the study refers to the consistency of supply of water by the corporation to its consumers. Due to grave water pollution there is a scarcity of freshwater in the world. Coimbatore is no exception to this fact. As a result of which there is irregular water supply in some of the areas of the city.

**TABLE - 13**  
**DETAILS ABOUT THE FREQUENCY OF WATER SUPPLY FOR THE SELECTED**  
**HOUSEHOLD CONSUMERS**

Particulars	Tudiyalur	Podanur	Karumbukadai	Ukkadam	All
<b>Daily</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
<b>Weekly thrice</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
<b>Weekly twice</b>	0 (0.00%)	9 (16.07%)	0 (0.00%)	5 (83.33%)	14 (14.00%)
<b>Once a week</b>	31 (100%)	47 (83.93%)	7 (100%)	1 (16.67%)	86 (86.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

The table 13 represents the frequency of water supply in the selected areas. As a result of high population and excess of water pollution there has been a scarcity of water supply in the city of Coimbatore. The study analysed the frequency of corporation water supply and the following were the obtained results: The residents of Tudiyalur revealed that water was supplied only once a week, this leads to a lot of distress among the residents. In Podanur 16.07 percent of the samples responded to the fact that water was supplied twice a week while the remaining samples complained that water was supplied only once a week. In Karumbakadai the residents were unhappy as water was supplied only once a week. In Ukkadam 83.33 percent of the samples were of the opinion that water was supplied only twice a week while in some areas water was available only once a week.

#### 4.5 Multi-Commodity Model of Consumer Behaviour

A consumer is a prime character in any economy. It is consumer for whom commodities are produced. It's the consumers' demand that determines the market behaviour of any economy. But now due to changing environmental conditions such as change in climatic conditions and water pollution the consumers have to change their consumption behaviour. Earlier water was consumed from rivers, lakes and other natural sources.

In the current study consumer behaviour is taken into account. In this context the consumers now have a choice of consuming water from aqua guard water system and packaged water system. The consumer aims at gaining the maximum satisfaction of whatever it consumes. By this we mean that consumers aim at maximising its satisfaction. Here **“willingness to pay”** and **“willingness to accept”** also plays an important role. A consumer is said to have reached his equilibrium position when he has maximised the level of his satisfaction, given his resources and other conditions. Technically, a utility position when allocation of his consumption expenditure is such that the last rupee spent on each commodity yields the same utility.

The undertaken study deals with a multiple good model where the two goods are aqua guard and package drinking water systems. A consumer would attain equilibrium when a consumer consumes various goods in such quantities that the Marginal Utility (MU) derived per unit of expenditure on each good is the same. In other words, a rational consumer spends his income on various goods he consumes in such a manner that each rupee spent on each good yields the same MU.

Let  $A_x$  be the price of aqua guard water system and  $P_x$  be the price of packaged water system, then a consumer distributes his income in this way

$$MU_{ag} = P_{ag} (MU_m), \text{ and}$$

$$MU_p = P_p (MU_m)$$

Given these conditions, the consumer is in equilibrium where:

$$\frac{MU_{ag}}{(P_{ag})(MU_m)} = \frac{MU_p}{(P_p)(MU_m)}$$

Here ag represents aqua guard: p represents packaged water and MU represents Marginal Utility. Nowadays consumers give more importance to welfare and they are ready to pay the price for their taste and preferences to in order to maximise their satisfaction level.

The willingness of the consumer to pay plays an important role in the consumption behaviour. Only when the above condition is fulfilled will a consumer attain maximum satisfaction.

#### 4.6 Preference of Consumers for Purified Water Systems

Sources of water are plenty. Water is a natural resource and was once found in abundant quantity. With an increase in the population and development of all the sectors water has now become a scarce resource. Nowadays consumers depend on private sector for freshwater. Table 14 represents the consumer's usage of aqua guard water system or packaged water for private water system.

**TABLE - 14**  
**DETAILS ON THE SOURCE OF PURIFIED WATER SYSTEMS BY THE**  
**SELECTED HOUSEHOLD CONSUMERS**

<b>Systems</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbakadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Aqua guard</b>	15 (48.4%)	40 (71.43%)	1 (14.29%)	6 (100)	62 (62.00%)
<b>Packaged water</b>	16 (51.6%)	16 (28.57%)	6 (85.71%)	0 (0.00%)	38 (38.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

Privatisation of water has now become a vogue. People are very conscious in the present world. Factors such as quality of water, health issues and regularity of supply play significant roles in determining one's consumption decision. Nowadays water is supplied in bottles and packaged containers. Many families prefer the usage of aqua guards as it guarantees purity of water.

The study undertaken showed the following results. A majority of 51.6 percent of the selected samples in Tudiyalur depend on packaged water for drinking needs. The remaining 48.4 percent use aqua guard. In Podanur the majority of 71.43 percent use aqua guard for purifying the water and 28.57 percent of the selected samples depend on packaged water for drinking purpose. In Karumbakadai a diminutive amount of 14.29 percent uses aqua guard while the remaining invests in packaged water. In Ukkadam all the selected samples depend on aqua guard for drinking water. Most households have installed aqua guards or purchase packaged drinking water on a regular basis for the purpose of consuming safe and pure water.

# SOURCE OF PURIFIED WATER SYSTEMS FOR SELECTED HOUSEHOLD CONSUMERS

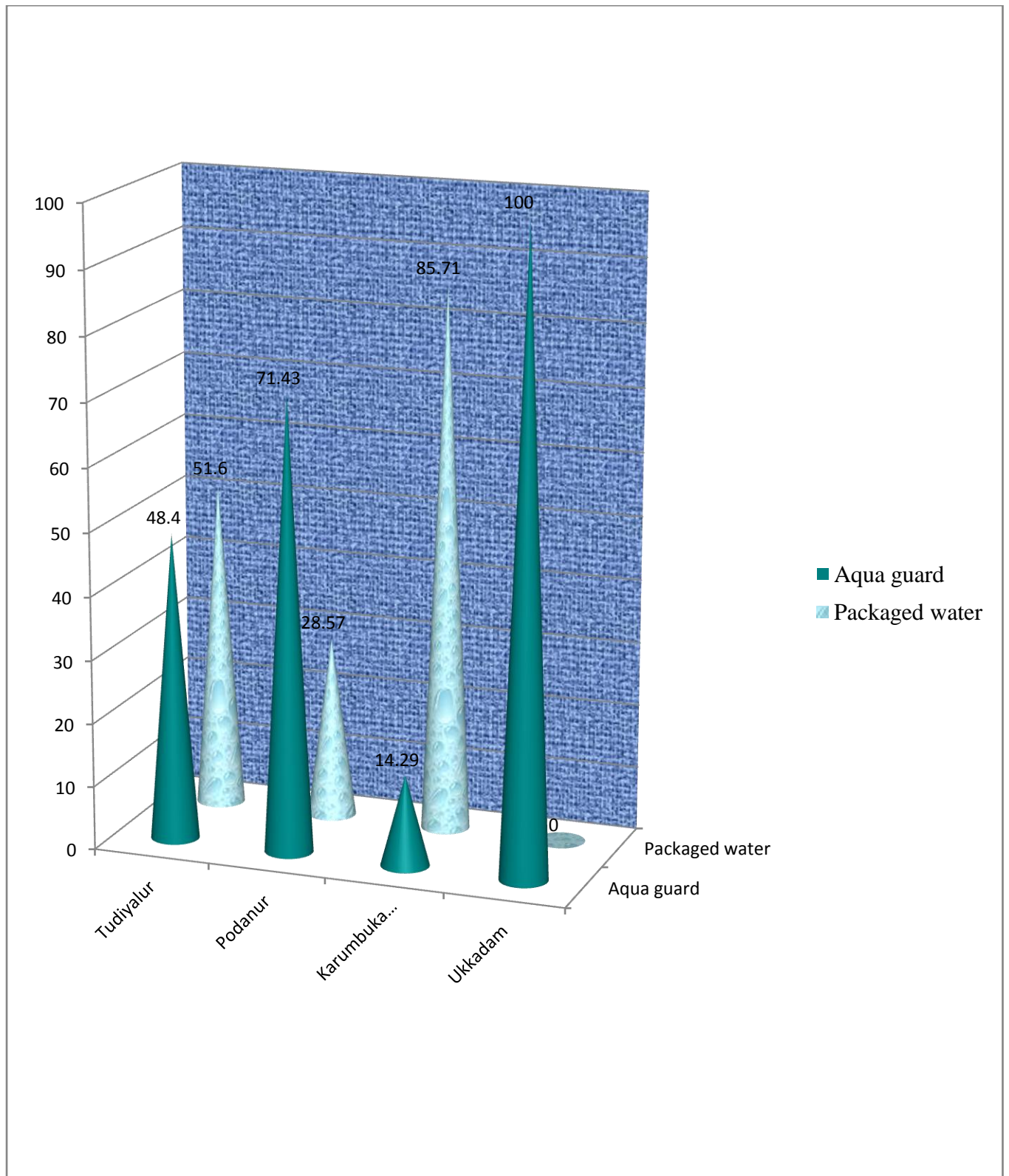


FIGURE: 7

Table 15 denotes the source of drinking water by the selected household consumers in the selected areas.

**TABLE - 15**  
**DETAILS ON THE SOURCE OF DRINKING WATER FOR THE SELECTED**  
**HOUSEHOLD CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbukadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Government</b>	4 (12.90%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	4 (4.00%)
<b>Private</b>	13 (41.94%)	16 (28.57%)	6 (85.71%)	0 (0.00%)	35 (35.00%)
<b>Aqua guard</b>	14 (45.16%)	40 (71.43%)	1 (14.29%)	6 (100%)	61 (61.00%)
<b>Others</b>	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

There was once a time when people used water from rivers and wells for drinking purposes. But now resulting from water pollution the water in rivers and wells have gone brackish. Nowadays the water supplied from the corporation are also not fit for drinking purposes. The trends in consumption pattern have transformed considerably. The table 4.6 represents the source of drinking water for the residents in the selected areas. In Tudiyalur 12.09 percent of the samples depend on corporation supply for drinking water. The majority of 45.16 percent depends on aqua guard for good quality drinking water. The remaining 41.94 percent purchase packaged water for drinking purpose. The majority of samples in Podanur use aqua guard (71.43 percent) and the remaining 28.57 percent depend on packaged water for drinking purpose. In Karumbakadai the majority uses packaged water (85.71 percent) and an undersized 14.29 percent use aqua guard for drinking purpose. In Ukkadam the entire selected sample use aqua guard for the drinking water.

#### **4.6.1 Aqua Guard Water System**

Aqua guard water system is a water filter instrument used to filter water. It uses a carbon to remove all the impurities and produce freshwater. It is available in different shapes and sizes and also at different prices. Aqua guard water system was designed keeping in view the current and rapid changes in the population, pollution, and scarcity of freshwater. It needs

to be maintained once in six months for proper and efficient functioning. In the city of Coimbatore a lot of households are consumed and used on and have invested in aqua guard water system for the purpose of drinking safe and pure water. Table 16 portrays the preference of selected household consumers in the usage of aqua guard for drinking purpose.

**TABLE - 16**

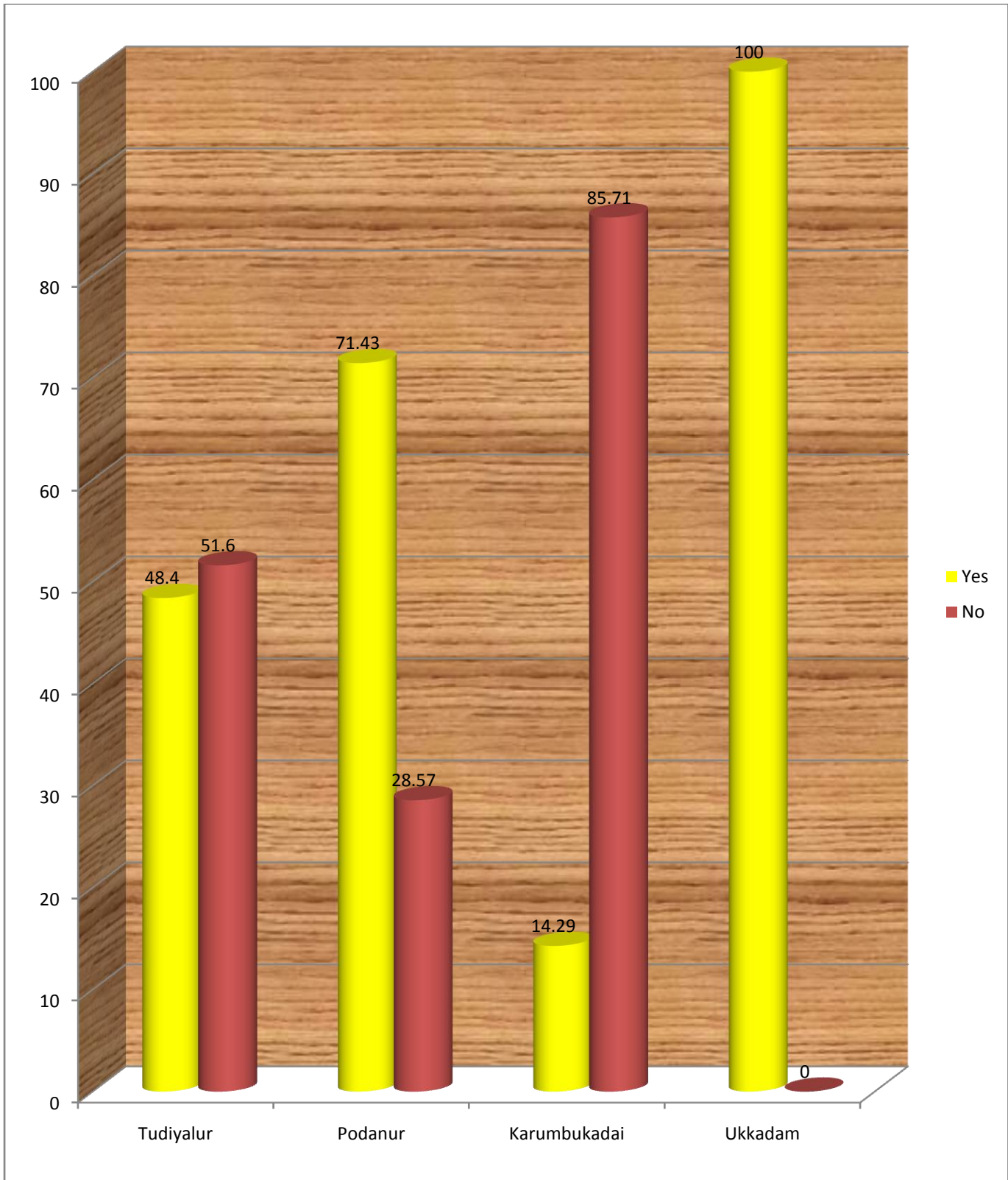
**DETAILS ON PREFERENCE OF AQUA GUARD WATER SYSTEM BY THE  
SELECTED HOUSEHOLD CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbukadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Yes</b>	15 (48.4%)	40 71.43%)	1 (14.29%)	6 (100)	62 (62.00%)
<b>No</b>	16 (51.6%)	16s (28.57%)	6 (85.71%)	0 (0.00%)	38 (38.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

Aqua guard water systems are used by many households for purifying water for the purpose of drinking. It is a machine that removes impurities from water. The study analysed the usage of aqua guards in the selected areas and the following results were obtained. In Tudiyalur the majority of 51.6 percent does not use aqua guard while the remaining 48.4 percent depends on aqua guard. In Podanur a majority of 71.43 percent have invested in aqua guards for access safe drinking water while the remaining find alternatives due to income constraint. In Karumbakadai the majority does not depend on aqua guards (i.e. only 14.29 percent use aqua guards). In Ukkadam all the selected samples make use of aqua guards.

**PREFERENCE OF AQUA GUARD WATER SYSTEM BY THE SELECTED  
HOUSEHOLD CONSUMERS**



**FIGURE: 8**

#### 4.6.2 Packaged Drinking Water System

Water today is been sold in cans, different capacity of water bottles and packages. Nowadays demand of fresh water is on the increase leaving supply far behind. India is the second most populous country in the world which makes the water resources even scarcer. Areas with high population and less affordability for the purchase of aqua guards go in for packaged drinking water. Income plays an important role in determining the choice made by a consumer. A large number of Indians are middle class families who cannot afford to invest large amounts in purchase of aqua guard's; hence they go for the substitute good, packaged drinking water.

**TABLE - 17**

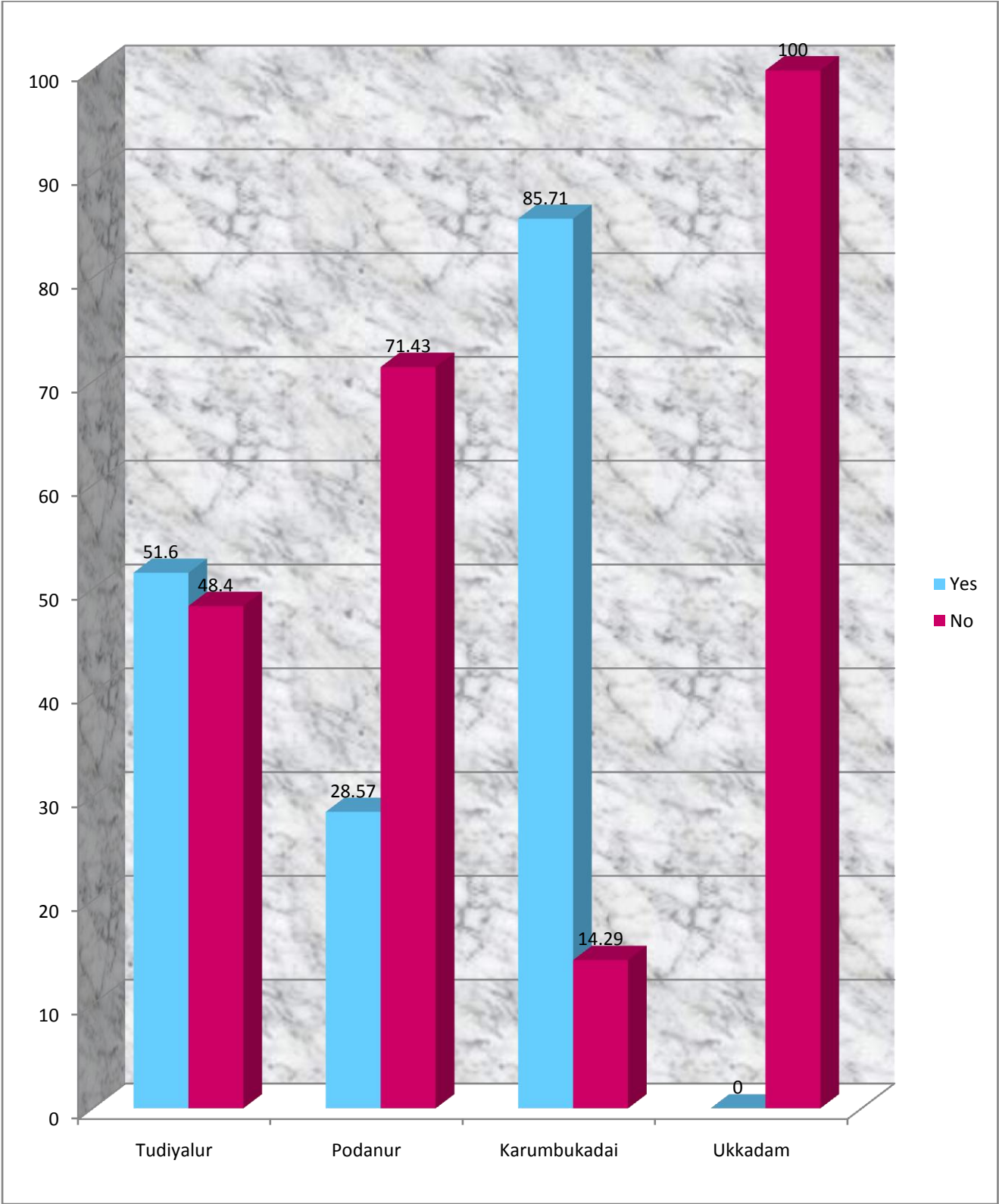
**DETAILS ON THE PREFERENCE OF PACKAGED DRINKING WATER SYSTEM  
BY THE SELECTED HOUSEHOLD CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbukadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Yes</b>	16 (51.6%)	16 (28.57%)	6 (85.71%)	0 (0.00%)	38 (38.00%)
<b>No</b>	15 (48.4%)	40 (71.43%)	1 (14.29)	6 (100)	62 (62.00%)
<b>All</b>	<b>31</b> <b>(31.00%)</b>	<b>56</b> <b>(56.00%)</b>	<b>7</b> <b>(7.00%)</b>	<b>6</b> <b>(6.00%)</b>	<b>100</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

Packaged water is used by many households for drinking purpose. Many private companies supply water in packaged containers as the demand of water is never ending. Table 17 explains the usage of packaged water in the selected study areas. In Tudiyalur the majority of 51.6 percent uses packaged water for drinking purpose. In Podanur only 28.57 percent use packaged water while the remaining use aqua guards. In Karumbakadai the majority of 85.71 percent uses packaged water for drinking purpose whereas 14.29 percent have alternatives for drinking water. All the samples of Ukkadam depend on other sources for drinking water.

**PREFERENCE OF PACKAGED DRINKING WATER SYSTEM BY THE  
SELECTED HOUSEHOLD CONSUMERS**



**FIGURE: 9**

## **4.7 Cost of Purified Water Systems**

Cost is defined as the money cost of production. It is the aggregate money expenditure incurred by a firm on the various items entering into the production of a commodity. Cost of purified water system differs from place to place. Willingness to pay and willingness to accept play a significant role here in determining the cost of purified water.

Fixed Cost does not vary with every change in output. In the current study the cost of aqua guard is referred to fixed cost. Variable Cost varies with every change in output. In the current study the cost of maintenance of the aqua guard is referred to variable cost.

### **4.7.1 Aqua Guard Water System**

Today consumers are more welfare oriented and are ready to pay the price for pure and clean water. The consumers are willing to pay for their welfare in order to purchase aqua guard water systems and packaged water systems. They attain their maximum satisfaction in the consumption of purified water. The cost of aqua guard has a wide range depending upon its size and features. Once a consumer purchases and fits the aqua guard he will have to change its carbon once in six months which accounts for variable cost.

The table 18 deals with the details regarding the willingness to pay for aqua guard by the residents in the selected areas. The concept of cost is divided into two- fixed cost and variable cost. In Tudiyalur 33.33 percent of the people spend 5 to 10 thousand for the purchase of aqua guard, 66.67 percent of the selected samples paid 10 to 15 thousand for aqua guard. The total numbers of aqua guard users are 15 that account for 24.19 percent of the sum total users. In Podanur 7.5 percent of the selected samples paid up to 5 thousand, 30 percent of the samples invested 5 to 10 thousand, 60 percent paid 10 to 15 thousand for the purchase of aqua guards and 1.25 percent spend up to 20 thousand. In Karumbukadai 33.33percent of the selected samples paid up to five thousand, 16.67 percent paid 5 to 10 thousand, 33.33 percent readily paid 10 to 15 thousand and the remaining was comfortable in paying up to 20 thousand for fitting the aqua guard.

**TABLE - 18**

**DETAILS OF COST OF AQUA GUARD WATER SYSTEM FOR THE SELECTED  
HOUSEHOLD CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbukadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Fixed Cost (in Rupees)</b>					
<b>0-5000</b>	0 (0.00%)	3 (7.5%)	0 (0.00%)	2 (33.33%)	5 (8.06%)
<b>5000-10000</b>	5 (33.33%)	12 (30%)	0 (0.00%)	1 (16.67%)	18 (29.03%)
<b>10000-15000</b>	10 (66.67%)	24 (60%)	1 (100%)	2 (33.33%)	37 (59.68%)
<b>15000-20000</b>	0 (0.00%)	1 (2.5%)	0 (0.00%)	1 (16.67%)	2 (3.23%)
<b>All</b>	<b>15</b> <b>(24.19%)</b>	<b>40</b> <b>(64.52%)</b>	<b>1</b> <b>(1.61%)</b>	<b>6</b> <b>(9.68%)</b>	<b>62</b> <b>(100.00%)</b>
<b>Variable Cost (in Rupees)</b>					
<b>0-1000</b>	1 (6.67%)	5 (12.5%)	0 (0.00%)	2 (33.33%)	8 (12.90%)
<b>1000-2000</b>	2 (13.33%)	11 (27.5%)	0 (0.00%)	1 (16.67%)	14 (22.58%)
<b>2000-3000</b>	8 (53.33%)	15 (37.5%)	0 (0.00%)	1 (16.67%)	24 (38.71%)
<b>3000-4000</b>	4 (26.67%)	9 (22.5%)	1 (100%)	2 (33.33%)	16 (25.81%)
<b>All</b>	<b>15</b> <b>(24.19%)</b>	<b>40</b> <b>(64.52%)</b>	<b>1</b> <b>(1.61%)</b>	<b>6</b> <b>(9.68%)</b>	<b>62</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

Under the variable cost maintenance cost was taken. A yearly estimate was made to simplify the analysis. In Tudiyalur 6.67 percent of the samples paid up to 1 thousand, 13.33 percent of the people paid up to two thousand, a majority of 53.33 percent paid 2 to 3 thousand and the remaining 26.67 percent paid 3 to 4 thousand on an yearly basis for the maintenance of the machine. In Podanur 12.5 percent of the people paid up to 1 thousand, 27.5 percent paid 1 to 2 thousand, a mainstream population of 37.5 percent spent 2 to 3 thousand whereas another 22.5 percent paid 3 to 4 thousand yearly. Of the total aqua guard users Podanur constitutes of 64.54 percent. In Karumbukadai there is only one aqua guard user who pays 3 to 4 thousand for maintaining it. In Ukkadam 33.33 percent of the users pay up to thousand, 16.67 percent pay 1 to 2 thousand, another 16.67 percent of the users pay 2 to 3 thousand and 33.33 percent of the selected samples readily paid 3 to 4 thousand for the maintenance of the appliance.

Of the total users for fixed cost, 8.06 percent fell in the category up to 5 thousand, 29.03 percent of the samples paid 5 to 10 thousand, the majority (59.68%) invested about 10 to 15 thousand and a bare minimum of 3.23 percent invested 15 to 20 thousand for the usage of aqua guard. Talking about the variable cost the estimates the total maintenance cost 12.90 percent spent up to 1 thousand, 22.58 percent paid 1 to 2 thousand for the maintenance, 38.71 percent spent up to 3 thousand and 25.81 percent paid up to 4 thousand as the variable cost. In the case of aqua guard users 24.19 percent belonged to Tudiyalur, the majority (64.53%) of the samples resided in Podanur, 9.68 percent of them lived in Ukkadam whereas on 1.61 percent of the selected samples were natives of Karumbukadai.

#### **4.7.2 Packaged Drinking Water System**

Packaged water system is easy available and can be afforded by most of the people irrespective of their economic background. The consumers of packaged drinking water are willing to accept the packaged water as they have income constraint in investing for aqua guard water systems. There are packages of different sizes based on which the frequency of purchase is decided.

The cost of packaged water is explained in the table 19. The cost purely depends on the fact that how often an individual purchases it. Here two things are taken into account, the frequency of buying (number of packaged water purchased per month) and its total cost. In Tudiyalur 31.25 percent of the selected samples purchased up to 5 packages a month, 18.75 percent bought 5 to 10 packages and the majority (50%) purchased up to 15 packages. In the current study Tudiyalur packaged water drinkers accounted for 42.11 percent of the total packaged water drinkers. In Podanur 25 percent of the samples purchased up to 5 packages, 12.5 percent procured 5 to 10 packages monthly, a majority of 37.5 percent obtained up to 15 packages while another 12.5 percent were satisfied with 15 to 20 packages a month. The remaining 12.5 percent of the selected samples acquired more than 20 packages in a month. Podanur accounted for 42.11 percent among the total packaged water. In the city of Karumbukadai 50 percent of the samples purchased 5 to 10 packages a month, while 16.67 percent of the samples bought up to 15 packages. The residual one third of the selected samples purchased above 20 packages a month. Karumbukadai contributed 15.78 percent to the total packaged water drinkers. In Ukkadam there were no packaged water drinkers.

**TABLE - 19**

**DETAILS ON THE COST OF PACKAGED WATER SYSTEM FOR THE  
SELECTED HOUSEHOLD CONSUMERS**

<b>Particulars</b>	<b>Tudiyalur</b>	<b>Podanur</b>	<b>Karumbukadai</b>	<b>Ukkadam</b>	<b>All</b>
<b>Monthly wise frequency of buying (in numbers)</b>					
<b>0-5</b>	5 (31.25%)	4 (25.00%)	0 (0.00%)	0 (0.00%)	9 (23.68%)
<b>5-10</b>	3 (18.75%)	2 (12.5%)	3 (50.00%)	0 (0.00%)	8 (21.05%)
<b>10-15</b>	8 (50.00%)	6 (37.5%)	1 (16.67%)	0 (0.00%)	15 (39.47%)
<b>15-20</b>	0 (0.00%)	2 (12.5%)	0 (0.00%)	0 (0.00%)	2 (5.27%)
<b>Above 20</b>	0 (0.00%)	2 (12.5%)	2 (33.33%)	0 (0.00%)	4 (10.53%)
<b>All</b>	<b>16</b> <b>(42.11%)</b>	<b>16</b> <b>(42.11%)</b>	<b>6</b> <b>(15.78%)</b>	<b>0</b> <b>(0.00%)</b>	<b>38</b> <b>(100.00%)</b>
<b>Cost per month (in Rupees)</b>					
<b>0-200</b>	4 (25.00%)	5 (31.25%)	0 (0.00%)	0 (0.00%)	9 (23.68%)
<b>200-400</b>	3 (18.75%)	3 (18.75%)	0 (0.00%)	0 (0.00%)	6 (15.79%)
<b>400-600</b>	8 (50.00%)	6 (37.5%)	2 (33.33%)	0 (0.00%)	16 (42.11%)
<b>600-800</b>	1 (6.25%)	2 (12.5%)	1 (16.67%)	0 (0.00%)	4 (10.53%)
<b>800-1000</b>	0 (0.00%)	0 (0.00%)	1 (16.67%)	0 (0.00%)	1 (2.63%)
<b>Above 1000</b>	0 (0.00%)	0 (0.00%)	2 (33.33%)	0 (0.00%)	2 (5.26%)
<b>All</b>	<b>16</b> <b>(42.11%)</b>	<b>16</b> <b>(42.11%)</b>	<b>6</b> <b>(15.78%)</b>	<b>0</b> <b>(0.00%)</b>	<b>38</b> <b>(100.00%)</b>

Source: Field Survey, (2013).

The next part of the table deals with the total amount of money spent on packaged drinking water in a month by the selected samples. In Tudiyalur one fourth of the people spend up to Rs 200 on packaged drinking water, 18.75 percent of them spend Rs 200 to Rs 400, while a the majority of the selected samples expend Rs 400 to Rs 600 in a month for packaged water. The remaining 6.25 percent of the selected samples in Tudiyalur paid up to Rs 800 for drinking water. In Podanur 31.25 percent of the samples spend Rs 200 for water, while 18.75 percent paid up to 400. The majority of 37.5 percent of them fell in the category of Rs 400 to Rs 600. The reminiscent 12.5 percent put in up to Rs 800 per month. In Karumbukadai one third of the selected samples spend Rs 400 to Rs 600, while 16.67 percent of the samples devoted Rs 600 to Rs 800 and Rs 800 to Rs 1000 respectively. The remaining

one third of the selected samples readily invested more than Rs 1000 in a month for packaged drinking water. Taking the cost of packaged water, 23.68 percent of the total users paid up to Rs 200, and 15.79 percent of them put in Rs 200 to Rs 400 in a month. The majority (42.11%) invested Rs 400 to Rs 600 monthly, whereas minorities of 10.53 percent, 2.63 percent and 5.26 percent of the total selected samples devoted Rs 600 to Rs 800, Rs 800 to Rs 1000 and above thousand respectively for the acquirement of packaged water in a month. The total study constituted of 62 percent of aqua guard and the remaining 38 percent of the selected sample consumers were packaged water drinkers.

#### 4.8 Correlation between Cost and Income for Purified Water Systems

Income and willingness to pay for a commodity is directly related. When an individual's income increases he wishes to improve his standard of living irrespective of the cost he must pay. Therefore consumers with high income prefer to consume and are ready to pay for quality products irrespective of their prices.

**TABLE - 20**  
**CORRELATION BETWEEN COST AND INCOME FOR SELECTED HOUSEHOLD CONSUMERS**

Areas	Pearson's Correlation	Spearman's correlation
<b>Tudiyalur</b>	.464* *	.463 *
<b>Podanur</b>	.323*	.343* *
<b>Karumbakadai</b>	.412 NS	.793*
<b>Ukkadam</b>	-.439 NS	-.548 NS

Source: Field Survey, (2013).: \*- Significant at 5% level, \*\* -Significant at 1% level, NS- Not Significant

The degree of relationship between cost and income in the selected areas is analysed in the above table. In Tudiyalur both cost and income are positively related under both Pearson's and Spearman's correlation test. Pearson's test is significant at 1% level whereas Spearman's test is significant at 5% level. The same condition is repeated in Podanur also; both income and cost are positively related. In Karumbakadai Spearman's study shows a stronger relationship in comparison to the Pearson's test. However in the city of Ukkadam both the tests reveal that income and cost are indirectly related.

#### 4.9 Willingness to Pay and Willingness to Accept for Purified Water Systems

The consumption of a good depends on a lot of invisible factors. An individual is willing to pay only if he has the affordability and the knowledge of a given product. The remaining consumers are simply willing to accept. A consumer decides to consume a good or go for its substitute based on a various factors like income, education and so on.

**TABLE - 21**

#### **DETAILS ON THE WILLINGNESS TO PAY FOR PURIFIED WATER SYSTEMS**

<b>Regression analysis: cost = f (age, occupation, education, income)</b>				
<b>Particulars</b>	<b>Packaged water</b>		<b>Aqua guard</b>	
	<b>R<sup>2</sup></b>	<b>F</b>	<b>R<sup>2</sup></b>	<b>F</b>
<b>Tudiyalur</b>	.843	.817	.169	.117
<b>Podanur</b>	.192	.106	.683	3.21
<b>Karumbakadai</b>	-	-	.989	11.235
<b>Ukkadam</b>	.351	.385	.251	.586

Source: Field Survey, (2013).

Regression analysis was used to study the extent to which the selected variables affect the dependent variable cost. The variables selected as explanatory variables are age, occupation, education and income. Both packaged water and aqua guard were analysed separately. In Tudiyalur 84% changes in the cost of packaged water was caused by the selected variables whereas in the purchase of aqua guard the selected variables played a comparatively insignificant role. In Podanur the explanatory variables played a trivial role in determining the cost of the package water; in contrast the same variables played an important role in the cost of aqua guards by 68 percent. All the selected samples of Karumbakadai were aqua guard users as a result 99 percent of changes in the cost of aqua guard were determined by the selected explanatory variables. In the case of Ukkadam 35 percent of the changes in the cost of packaged water was caused due to the selected explanatory variables. In the case of aqua guards in Ukkadam the results were less satisfactory as only 25 percent of changes in the cost were caused due to the selected explanatory variables the remaining changes were due to the unaccounted factors. Satisfactory results were achieved in the cases of packaged

water in Tudiyalur ( $R^2 = .843$ ), aqua guard in Podanur ( $R^2 = .683$ ) and aqua guard in Karumbakadai ( $R^2 = .989$ )

**TABLE - 22**

**MULTIPLE- REGRESSION MODEL: t TEST-PACKAGED WATER SYSTEM USERS**

<b>Tudiyalur</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Income</b>	-41.765	-.572	.579
<b>Education</b>	33.904	.293	.775
<b>Occupation</b>	23.846	.549	.594
<b>Age</b>	1.050	.312	.761
<b>Podanur</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Income</b>	.908	.013	.990
<b>Education</b>	52.118	.443	.667
<b>Occupation</b>	-53.869	-.311	.762
<b>Age</b>	-3.114	-.616	.550
<b>Karumbukadai</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Income</b>	-145.426	-.586	.662
<b>Education</b>	203.879	.755	.588
<b>Age</b>	18.978	.978	.504

Source: Field Survey, (2013)., S.E: Standard Error

The above table 22 represents the t test and the beta values for the adopted models. According to the above table in Tudiyalur income and cost of packaged water are negatively related wherein for one unit change in cost the income decreases by 41.765 units. Education and cost of packaged water are positively related, here for a unit change in cost education increases by 33.904 units. Occupation and cost are also positively related which shows that for a unit change in occupation the cost increases by 23.846. Age and cost are positively related and for a unit change in age cost increases by 1.05 units. Here the t values of  $\beta$  are not significant as the calculated values are less than the table value. We accept the null hypothesis here.

In Podanur income and cost are positively related wherein for a unit change income the cost increases by .91 units. Education and cost are highly related, here for a unit change in education, cost increases by 52.12 percent. In Podanur occupation and cost move in opposite directions, for a unit change in occupation the cost decreases by 53.87 units. Age and cost are also negatively related, for a unit change in age the cost decreases by 3.11 units. Here the t

values of beta are not significant as the calculated values are less than the table value. We accept the null hypothesis here.

In Karumbukadai income and cost are negatively related, where for a unit change in income willingness to pay decreases by 145.43 units. Here education and willingness to pay are strongly related as for a unit change in education the willingness to pay increases by 203.88 units. Age and cost are also positively related as for a unit change in age the willingness to pay increases by 18.978. In Karumbukadai the t values of  $\beta$  are significant as the calculated value is greater than the table value. Null hypothesis is rejected here.

**TABLE - 23**

**MULTIPLE REGRESSION MODEL: t - TEST FOR AQUA GUARD WATER SYSTEM USERS**

<b>Tudiyalur</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Income</b>	1026.631	2.823	.017
<b>Occupation</b>	-472.515	-.472	.646
<b>Education</b>	-148.960	-.238	.817
<b>Podanur</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Income</b>	607.400	1.109	.275
<b>Education</b>	-673.867	-.920	.364
<b>Occupation</b>	-259.650	-.213	.832
<b>Age</b>	28.448	.698	.490
<b>Karumbakadai</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Education</b>	-40.288	-.575	.576
<b>Occupation</b>	15.642	.163	.873
<b>Income</b>	19.960	.498	.627
<b>Ukkadam</b>			
<b>Particulars</b>	<b>Beta Value</b>	<b>t Test</b>	<b>Sig (S.E)</b>
<b>Income</b>	-1871.329	-1.065	.480
<b>Occupation</b>	-8214.464	-2.840	.216
<b>Education</b>	8814.469	5.529	.114
<b>Age</b>	-15.483	-.209	.869

Source: Field Survey, (2013)

The t values of beta for the aqua guard users are explained in the above table. In Tudiyalur income and cost are positively related. For a unit change in income the willingness to pay increases by 1026.63 units. Occupation and cost are negatively related where for a unit change occupation the willingness to pay decreases by 472.52 units. Education and cost are also negatively related. Here for a unit change in education willingness to pay decreases by 148.96 units. In Tudiyalur only the t values of beta are significant while that of occupation and education are insignificant.

In Podanur income and cost are positively related, for a unit change in income the willingness to pay increases by 607 units. Education and cost are negatively related, here for a unit change in education willingness to pay decreases by 673.87 units. Age and cost are positively related wherein for a unit change in age the willingness to pay increases by 28.45 units. In Podanur all the t values of beta except that of education are significant as their calculated value is greater than that of the table value. Here in this case we reject the null hypothesis.

**TABLE - 24**  
**DETAILS ON THE SATISFACTION OF THE SELECTED AREA HOUSEHOLD**  
**CONSUMERS**

<b>Aqua guard</b>		<b>Packaged water</b>	
<b>Feature</b>	<b>Rating</b>	<b>Feature</b>	<b>Rating</b>
Cost	-0.4355	Cost	0.0263
Quantity	1.0806	Availability	0,3684
Quality	0.7258	Quality	0.2368
Purity	0.3871	Quantity	-0.1579
Odour	1.5968	Health	0.2105
Taste	1.1452	Colour	0.8684
Colour	1.3387	Odour	0.4474
Health	0.3710	Taste	0.4473
Maintenance cost	0.3709	Purity	0.4037
Electricity consumption	-0.6452	Adequacy	0.5324

Source: Field Survey, (2013)

Table 24 depicts the satisfaction level of the selected household consumers. The consumers of aqua guard purified water are highly satisfied with the odour and are satisfied with the quantity, taste and colour of the water they consume. They are neutral with purity, quality health and maintenance cost of the purifying instrument. The consumers are dissatisfied with the cost and the electricity consumption of the aqua guard. The consumers of packaged drinking water are neutral with the cost, availability, quality, health, colour, odour, taste, purity and adequacy of the packaged drinking water. Here the consumers are dissatisfied only with the capacity of the packaged drinking water.

## CHAPTER V

### SUMMARY AND CONCLUSION

Water was once upon a time a free a commodity. Slowly it became an economic resource, and now it is on the path of scarcity. All this is due to human activities. Urbanisation, industrialisation and population explosion are the main causes of water pollution. Water pollution is not merely a problem of India but is common around the globe. Another major factor that accelerates the severity of water problems is the climatic changes occurring all over the world.

According to Global Water Supply and Sanitation Assessment Report (2000), prepared by UNICEF – WHO – WSSCC, over one billion people across the world do not have access to adequate and safe drinking water facilities. Nearly 3.4 million people in the world, most of them children die every year from diseases associated with lack of safe drinking water, inadequate sanitation and poor hygiene. (Chandrakumar.G and Mukundan.N, 2006)

Fresh water resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. The main source of freshwater pollution can be attributed to discharge of untreated waste, dumping of industrial effluents, and run-off from agricultural fields. Water scenario is now fast changing as a result of increasing population, rising demand for irrigation to raise high yielding varieties of crops, rapid urbanisation and industrialisation, electricity generation, impact of global warming and erratic rainfall. (Gopal Kolkoti, 2013).

The decreasing fresh water availability is causing concern not only in India but all over the world. Protection and quality of fresh water resources has been identified as one of the main action for sustainable development in the World Summit on Sustainable Development in Rio in 1992. Realising this, the ministerial declaration at the second world water forum in Hague in March 2000 called upon the nations to work towards water security in the 21<sup>st</sup> century and make water as everybody's business. Further the Ministerial Declaration at Freshwater Meet in Bonn, 2001 placed greater commitment on agreed principles of water resources management and called upon for new partnership to create water wisdom, cleaning up watersheds, to reaching communities and innovative solutions for sustainable use, protection and management of fresh water resources.

Tamil Nadu is the eleventh largest state in India by area and the seventh most populous state. It is the fourth largest contributor (2010) to India's GDP and ranks tenth in Human Development Index. Tamil Nadu is one of the urbanised states in India. An average of 10.56 percent of business enterprises is located in Tamil Nadu and it provides employment to 9.97 percent of the population. However, water management skill is not fully utilised. It is very much lacking on account of being non-systematic. (Lakshiminarayanan.M.R, 2013). Due to ill maintenance, the waters have become brackish and hence unfit for drinking purposes. Till some years ago, many thousands of farmers were benefited by Noyyal river, particularly those living in Coimbatore, Tiruppur, Erode and Karur districts. Presently this river is being polluted by chemicals and effluent waters from factories.

Water is finite in nature. Water should be used properly and wastage of water must be stopped. Since Tamil Nadu is facing serious water scarcity there should be some alternative option chosen for non essential activities so that water scarcity can be reduced to some extent.

With this background in the Coimbatore district households were selected and an attempt was made to analyse the “**Changing Consumer Behaviour Through Water Pollution: A Case Study Analysis**”, with the following objectives:

1. To study the current scenario of water pollution in India
2. To study the socio-economic background for the selected households
3. To study the water supply in the selected households in the Coimbatore district
4. To analyse the water pollution and changing consumer behaviour of selected households in the Coimbatore district
5. To find out the problem of water usage

### **Hypotheses**

The following null hypotheses were tested in the course of the study

1. The usage of private water supply
2. An increase in willingness to pay and willingness to accept
3. The change in consumer behaviour
4. An increase in consumer's satisfaction
5. Change in the consumption pattern

### **Methodology**

The present study was carried out in Coimbatore district in Tamil Nadu. From the severely affected areas, households consuming aqua guard and packaged drinking water were

selected for the study. Four severely affected areas selected were Tudiyalur, Podanur, Karumbukadai and Ukkadam. From Tudiyalur 31 samples were selected. Fifty six samples were selected from Podanur, 7 from Karumbukadai and 6 from Ukkadam. A total of 100 samples were selected for the current study. Both primary and secondary data was used in the study. Multi stage sampling was used to select the samples. The sources for secondary data are:

- Coimbatore Corporation
- Tamil Nadu Water Supply and Drainage Board
- District Statistics Office Coimbatore
- Tamil Nadu Agriculture University
- Pollution Control Board Coimbatore

Primary data were collected through personal interview method from the selected household consumers. Interview schedule were used to collect details related to the study from the selected household consumers. A pilot study was conducted to understand the areas with severe water shortage. On the basis of observation during the pilot study, the interview schedule was modified (Appendix – 1) and the survey was conducted between November 2013 and January 2014.

## **Major Findings of the Study**

### **Socio – Economic characteristics of Selected Household Consumers**

- In Tudiyalur 29 percent of the samples were males and a majority of 71 percent were females. In the city of Podanur 26.79 percent are males and 73.21 percent of the samples are females. In Karumbakadai the males 71.43 percent and females are only 28.57 percent. Males in Ukkadam constitute 33.33 percent of the sample size. In Tudiyalur has 83.9 percent of Hindus and only 16.1 percent of Christians. The city of Podanur consists only of Muslims. Muslims in Karumbakadai constitute for 85.7 percent, while the Hindus are merely 14.3 percent. In Ukkadam the entire samples are Muslims.
- In Tudiyalur the 61.29 percent of the samples are employed in the private sector and only 38.71 percent are employed in the government sector. The private sector dominates even in Podanur constituting to 87.5 percent. There are 10.71 percent working in the government sector and a bare minimum of 1.79 percent works in MNC. The entire samples of Karumbakadai work in the private sector. The private sector dominates in Ukkadam also with a majority of 83.33 percent and 16.67 percent of the samples are government employees.

- In the city of Tudiyalur 6.45 percent of the samples earn an annual income 60 thousand and 2.5lakhs respectively. A minimal of 1.94 percent receives an annual income of 1.5lakhs. A majority 23.33 percent obtains an annual income of 2lakhs and above 3lakhs respectively. In the area of Tudiyalur 3.23 percent of the selected samples were educated till the primary level, 35.48 percent till the secondary level, 32.26 percent of them are graduates and the remaining 29.03 of the selected samples have done other studies. In Podanur, 3.57 percent of the samples are educated till the primary level, 46.43 are educated till secondary level, 35.71 are graduates and the remaining is educated in other areas such as diplomas. In Karumbukadai 14.29 percent of the selected samples are educated till the primary level, 57.14 of them are educated till the secondary level and the remaining are graduates. In Ukkadam the majority of the population, 66.67 percent are educated till the secondary level whereas 33.33 percent of them are graduates.

### **Source of Water**

The study revealed that the residents of Tudiyalur depend completely on the corporation supply for water. In Podanur 64.29 percent of the samples depend on corporation water supply. A smaller amount of 8.93 percent of the samples prefer private water supply. An average of 26.78 percent of the samples has their own supplies in form of tube wells and bore wells. The majority of 57.14 percent have their own supplies while 42.86 percent of the samples depend on private water supply. In Ukkadam all the samples have access to water in form of their own bore wells and tube wells.

### **Use of Water**

In Tudiyalur 51.61 percent of the samples use corporation water for drinking purpose whereas 48.39 percent uses the corporation water for domestic purpose. In Podanur the 71.43 percent uses corporation water for domestic use and 28.57 percent of the selected household consumers use the corporation water for drinking purpose after boiling it. In Karumbakadai the majority use the corporation water for drinking purpose after boiling it and only 14.29 percent use it for domestic purpose. In Ukkadam all the selected samples use the corporation water for domestic usage.

### **Frequency of Water Supply**

The residents of Tudiyalur revealed that water was supplied only once a week, this leads to a lot of distress among the residents. In Podanur 16.07 percent of the samples

responded to the fact that water was supplied twice a week while the remaining samples complained that water was supplied only once a week. In Karumbakadai the residents were unhappy as water was supplied only once a week. In Ukkadam 83.33 percent of the samples were of the opinion that water was supplied only twice a week while in some areas water was available only once a week.

### **Preference of Consumers for Purified Water Systems**

A majority of 51.6 percent of the selected samples in Tudiyalur depend on packaged water for drinking needs. The remaining 48.4 percent use aqua guard. In Podanur the majority of 71.43 percent use aqua guard for purifying the water and 28.57 percent of the selected samples depend on packaged water for drinking purpose. In Karumbakadai a diminutive amount of 14.29 percent uses aqua guard while the remaining invests in packaged water. In Ukkadam all the selected samples depend on aqua guard for drinking water.

### **Source of Drinking Water**

In Tudiyalur 12.09 percent of the samples depend on corporation supply for drinking water. The majority of 45.16 percent depends on aqua guard for good quality drinking water, while 41.94 percent purchase packaged water for drinking purpose. The majority of samples in Podanur use aqua guard (71.43 percent) while 28.57 percent depend on packaged water for drinking purpose. In Karumbakadai the majority uses packaged water (85.71 percent) and an undersized 14.29 percent use aqua guard for drinking purpose. In Ukkadam the entire selected sample use aqua guard for the drinking water.

### **Aqua Guard Water System**

In Tudiyalur the majority of 51.6 percent does not use aqua guard while the remaining 48.4 percent depends on aqua guard. In Podanur a majority of 71.43 percent have invested in aqua guards for access safe drinking water while the remaining find alternatives due to income constraint. In Karumbakadai the majority does not depend on aqua guards (i.e. only 14.29 percent use aqua guards). In Ukkadam all the selected samples make use of aqua guards.

### **Packaged Drinking Water System**

In Tudiyalur the majority of 51.6 percent uses packaged water for drinking purpose. In Podanur only 28.57 percent use packaged water while the remaining use aqua guards. In Karumbakadai the majority of 85.71 percent uses packaged water for drinking purpose whereas 14.29 percent have alternatives for drinking water. All the samples of Ukkadam depend on other sources for drinking water.

## **Cost of Purified Water Systems**

### **➤ Aqua guard Water System**

In Tudiyalur 33.33 percent of the people spend 5 to 10 thousand for the purchase of aqua guard, 66.67 percent of the selected samples paid 10 to 15 thousand for aqua guard. The total numbers of aqua guard users are 15 that account for 24.19 percent of the sum total users. In Podanur 7.5 percent of the selected samples paid up to 5 thousand, 30 percent of the samples invested 5 to 10 thousand, 60 percent paid 10 to 15 thousand for the purchase of aqua guards and 1.25 percent spend up to 20 thousand. In Karumbukadai 33.33 percent of the selected samples paid up to five thousand, 16.67 percent paid 5 to 10 thousand, 33.33 percent readily paid 10 to 15 thousand and the remaining was comfortable in paying up to 20 thousand for fitting the aqua guard. Under the variable cost maintenance cost was taken. A yearly estimate was made to simplify the analysis. In Tudiyalur 6.67 percent of the samples paid up to 1 thousand, 13.33 percent of the people paid up to two thousand, a majority of 53.33 percent paid 2 to 3 thousand and the remaining 26.67 percent paid 3 to 4 thousand on an yearly basis for the maintenance of the machine. In Podanur 12.5 percent of the people paid up to 1 thousand, 27.5 percent paid 1 to 2 thousand, a mainstream population of 37.5 percent spent 2 to 3 thousand whereas another 22.5 percent paid 3 to 4 thousand yearly. Of the total aqua guard users Podanur constitutes of 64.54 percent. In Karumbukadai there is only one aqua guard user who pays 3 to 4 thousand for maintaining it. In Ukkadam 33.33 percent of the users pay up to thousand, 16.67 percent pay 1 to 2 thousand, another 16.67 percent of the users pay 2 to 3 thousand and 33.33 percent of the selected samples readily paid 3 to 4 thousand for the maintenance of the appliance.

### **➤ Packaged Drinking Water**

In Tudiyalur 31.25 percent of the selected samples purchased up to 5 packages a month, 18.75 percent bought 5 to 10 packages and the majority (50 percent) purchased up to 15 packages. In the current study Tudiyalur packaged water drinkers accounted for 42.11 percent of the total packaged water drinkers. In Podanur 25 percent of the samples purchased up to 5 packages, 12.5 percent procured 5 to 10 packages monthly, a majority of 37.5 percent obtained up to 15 packages while another 12.5 percent were satisfied with 15 to 20 packages a month. The remaining 12.5 percent of the selected samples acquired more than 20 packages in a month. Podanur accounted for 42.11 percent among the total packaged water. In the city of Karumbukadai 50 percent of the samples purchased 5 to 10 packages a month, while 16.67 percent of the samples bought up to 15 packages. The residual one third of the selected samples purchased above 20 packages a month. Karumbukadai contributed 15.78 percent to

the total packaged water drinkers. In Ukkadam there were no packaged water drinkers. In Tudiyalur one fourth of the people spend up to Rs.200 on packaged drinking water, 18.75 percent of them spend Rs.200 to Rs.400, while a the majority of the selected samples expend Rs.400 to Rs.600 in a month for packaged water. The remaining 6.25 percent of the selected samples in Tudiyalur paid up to Rs.800 for drinking water. In Podanur 31.25 percent of the samples spend Rs.200 for water, while 18.75 percent paid up to Rs.400. The majority of 37.5 percent of them fell in the category of Rs.400 to Rs.600. The reminiscent 12.5 percent put in up to Rs.800 per month. In Karumbukadai one third of the selected samples spend Rs.400 to Rs.600, while 16.67 percent of the samples devoted Rs.600 to Rs.800 and Rs.800 to Rs.1000 respectively. The remaining one third of the selected samples readily invested more than Rs.1000 in a month for packaged drinking water. Taking the cost of packaged water, 23.68 percent of the total users paid up to Rs.200 and 15.79 percent of them put in Rs.200 to Rs.400 in a month. The majority (42.11%) invested Rs.400 to Rs.600 monthly, whereas minorities of 10.53 percent, 2.63 percent and 5.26 percent of the total selected samples devoted Rs.600 to Rs.800, Rs.800 to Rs.1000 and above thousand respectively for the acquirement of packaged water in a month.

### **Correlation between Cost and Income for Purified Water System**

In Tudiyalur both cost and income are positively related under both Pearson's and Spearman's correlation test. Pearson's test is significant at 1% level whereas Spearman's test is significant at 5% level. The same condition is repeated in Podanur also; both income and cost are positively related. In Karumbakadai Spearman's study shows a stronger relationship in comparison to the Pearson's test. However in the city of Ukkadam both the tests reveal that income and cost are indirectly related.

### **Willingness to Pay and Willingness to Accept for Purified Water Systems**

In Tudiyalur 84 percent changes in the cost of packaged water was caused by the selected variables whereas in the purchase of aqua guard the selected variables played a comparatively insignificant role. In Podanur the explanatory variables played a trivial role in determining the cost of the package water; in contrast the same variables played an important role in the cost of aqua guards by 68 percent. All the selected samples of Karumbakadai were aqua guard users as a result 99 percent of changes in the cost of aqua guard were determined by the selected explanatory variables. In the case of Ukkadam 35 percent of the changes in the cost of packaged water was caused due to the selected explanatory variables. In the case of aqua guards in Ukkadam the results were less satisfactory as only 25 percent of changes in the cost were caused due to the selected explanatory variables the remaining changes were

due to the unaccounted factors. Satisfactory results were achieved in the cases of packaged water in Tudiyalur ( $R^2 = .843$ ), aqua guard in Podanur ( $R^2 = .683$ ) and aqua guard in Karumbakadai ( $R^2 = .989$ )

### **Packaged Drinking Water System**

According to the study in Tudiyalur income and cost of packaged water are negatively related wherein for one unit change in cost the income decreases by 41.765 units. Education and cost of packaged water are positively related, here for a unit change in cost education increases by 33.904 units. Occupation and cost are also positively related which shows that for a unit change in occupation the cost increases by 23.846. Age and cost are positively related and for a unit change in age cost increases by 1.05 units. In Podanur income and cost are positively related wherein for a unit change income the cost increases by .91 units. Education and cost are highly related, here for a unit change in education, cost increases by 52.12 percent. In Podanur occupation and cost move in opposite directions, for a unit change in occupation the cost decreases by 53.87 units. Age and cost are also negatively related, for a unit change in age the cost decreases by 3.11 units.

### **Aqua Guard Water System**

In Tudiyalur income and cost are positively related. For a unit change in income the willingness to pay increases by 1026.63 units. Occupation and cost are negatively related where for a unit change occupation the willingness to pay decreases by 472.52 units. Education and cost are also negatively related. Here for a unit change in education willingness to pay decreases by 148.96 units. In Podanur income and cost are positively related, for a unit change in income the willingness to pay increases by 607 units. Education and cost are negatively related, here for a unit change in education willingness to pay decreases by 673.87 units. Age and cost are positively related wherein for a unit change in age the willingness to pay increases by 28.45 units. In Karumbukadai income and cost are negatively related, where for a unit change in income willingness to pay decreases by 145.43 units. Here education and willingness to pay are strongly related as for a unit change in education the willingness to pay increases by 203.88 units. Age and cost are also positively related as for a unit change in age the willingness to pay increases by 18.978.

### **Conclusion**

Water is basic to life and scarce too. But unfortunately we prefer to ignore this simple fact and use it wastefully. Our careless attitudes, lack of responsibility on the part of industrialist and lack of ethics on the part of powers that be, the precious resources of water

get polluted day by day and it has come to an almost irreversible in our country. Water is the essence of life, there is no life without water. Water was once upon a time a free a commodity. Slowly it became an economic resource, and now it is on the path of scarcity. The finding of the study reveals that there is a significant change in the consumer behaviour due to excess of water pollution. The selected household consumers are ready to pay the price for their welfare. Therefore “willingness to pay” plays a vital role in deciding the consumer behaviour of the selected household consumers. Consumers play a vital role in any economy. A consumer is defined as the end user of any commodity i.e. the one who gains utility from the commodity, consumers are welfare oriented. Generally consumer has a ‘utility maximising behaviour’. The current study reveals that the consumers are willing to pay for the purified water as their satisfaction level is higher with the consumption of purified water. The consumers in the selected areas are highly satisfied with the water colour, taste, quantity, quality and purity. Hence they attain maximum level of satisfaction from the usage of aqua guard purified water systems. The study also reveals that the selected sample area household consumers have gained high level satisfaction from the consumption of purified water. The study proved that consumer behaviour is determined by their taste and preferences irrespective of the cost. Hence the study satisfies the cardinal approach using the deductive method.

### **Suggestions**

- To provide purified regular water supply by the Corporation before supplying it
- Monitoring and supervising of cleaning of overhead tanks to be done regularly
- Ward wise awareness to be created about water saving
- Water association to be created using Public Private Partnership where youngsters must be made the volunteers

### **Recommendations**

- Ensuring pollution free water supply
- Removal of toxic materials from civic water bodies
- Ensuring adequate water supply by recycling water

**“Every drop of every size,  
Carries the precious gift of life,  
One more day we cannot wait,  
Value every drop before it’s too late,  
Save water, save life, save world!”**

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## APPENDIX – 1

### CHANGING CONSUMER BEHAVIOUR THROUGH WATER POLLUTION: A CASE STUDY ANALYSIS

#### GENERAL INFORMATION

- 1) Name :
- 2) Address :
- 3) Age :
- 4) Sex :  
Male/female
- 5) Religion  
 Hindu             Muslim  
 Christian
- 6) Community  
 OC                     BC  
 MBC                    SC/ST
- 7) Type of family : nuclear / joint family
- 8) Education :  
 Illiterate                     Primary level  
  
 Secondary level             Graduate  
  
 Others (specify)
- 9) Occupation (specify):  
 Primary sector    secondary sector    tertiary sector
- 10) Annual Income :  
  
 25,000-50,000                     51,000-1, 00,000  
 1, 00,001-1, 50,000             1, 51, 000-2, 00, 000  
 More than 2, 00,000(specify)

## SPECIFIC INFORMATION

11) Sources of drinking water :

- Corporation water                       well-water  
 Bore well-water                       Private water (specify)

12) Frequency of water supply :

- Weekly               monthly               quarterly

13) Use /purpose of water:

- Drinking water               domestic purpose  
 Agriculture               others (specify)

14) Sources of drinking water:

- Government water               Private water  
 Aqua guard               others (specify)

15) Use of aqua guard:  Yes    No

16) Cost of fitting aqua guard:

17) Frequency of maintenance:

- Monthly    Quarterly    Half yearly

18) Cost of maintenance :

19) Use of private water (packaged water):  Yes    No

20) Capacity of package :

21) Frequency of buying package:

22) Cost per package:

23) Cause of dependence on private sector for water

- Poor quality               Poor quantity               Colour  
 Odour               Irregularity in supply               Health issues  
 Bad taste

24) Cost of water per month:

25) Other water related problems:

26) Satisfaction level of consumers using aqua guard water systems:

Particulars	Highly satisfied	Satisfied	Neutral	Dissatisfied	Highly dissatisfied
Cost					
Quantity					
Quality					
Purity					
Taste					
Odour					
Colour					
Health					
Maintenance					
Electricity					

Kindly tick the option most suitable to you.

27) Satisfaction level of consumers using packaged water systems:

Particulars	Highly satisfied	Satisfied	Neutral	Dissatisfied	Highly dissatisfied
Cost					
Availability					
Quality					
Quantity					
Health					
Colour					
Odour					
Taste					
Purity					
Adequacy					

Kindly tick the option most suitable to you.

28) Suggestions, if any: