INTRODUCTION

"A generous person will be enriched, and who gives water will get water." – The Holy Bible

Water is special, strange, and conclusively, it is different with extraordinary properties. The role of water has been measured as extremely important to humans and all living organisms on the land. Man cannot live without water, and zilch would revolve around this world without its existence. It is an ubiquitous material that sprays from the sky and pours out from the taps. We drink water, wash and perform all our hygienic activities, and cannot imagine a World without water. Our Earth would resemble a moon without water. Within the biosphere, it exists as an alkahest and serves as a component that is necessary for all biochemical reactions. Water is an essential component of everything that lives. **No Water – No Life**. It is known that water is the origin of all root cause on planet Earth. The most significant raw material of Indian civilization is none other than ***'Water'*** for human existence and trade.

"The earth, the air, the land, and the water are not an inheritance from our forefathers but on loan from our children. So we have to handover to them at least as it was handed over to us."

- Mahatma Gandhiji
Ashcraft and Mayer, (2017)

Box: 1
Our Earth, Air, Land and Water on Loan

Singh *et al.* (2020) quoted that history said that Indian civilization was built on water. It has a legacy of more than 5,000 years, where water contributes a lot to its cultural development. Prehistoric documents clearly illustrate the effective water management practices that existed in India. Many civilizations like Indus Valley, Mesopotamian, Chinese and Egyptian have originated and prospered on the banks of water resources, i.e., lakes, rivers, seas, etc. Civilizations were incredibly advanced and technically equipped for social sustainability and benefited from the surrounding water. The importance of water was emphasized in the Mantras of the Puranas, Vedas, and The Upanishads, etc. Our ancestors observed the environment and developed numerous proverbs related to water.

Illustrious Phizog of Water - Water has been given a number of prestigious names, including *"**Gift of God**"*, "***Elixir of Life***", "***Ubiquitous Material***", "***Economic Good***"*,* *"**Unique**"*, "***Matrix of Life***"* among others. In the form of rain and drinkable water, it sustains plants, animals and human life; it nurtures, flourishes and relaxes our individual life; it is also responsible for our fecundity. It is accepted that water is a precious gift of nature to humanity. As it is the most scarce and precious natural resource, it is often called as ***'Liquid Gold'.*** It may also be delegated as one of the ***'Renewable Resources'*** as mentioned by Ganoulis and Fried (2018).

Water works magic inside the human body as it does not have any calorific value. It has superficial characteristics as ***'Universal Solvent'*** that can dissolve any substance up to some magnitude. Water has some chemical elements as essential nutrients that are useful. Natural water contains minerals, organic impurities and dissolved gases like air and carbonic acid gas as opined by Mosher and Kelter (2023).

Water is the fundamental ingredient of our ***India's economy,*** and it stands at the heart of economic and societal advancement. There exists an intimate association between water and the economic development of a country as it is required for domestic, agriculture and industrial purposes. Water plays a crucial role in human development and was accepted by all nations. If water is not paid attention to nor kept safe, it will make one's life miserable because it has a command sustaining as well as ruining life (UNESCO World Water Assessment Programme, 2021).

The quantity of water that is used during the manufacturing process of agricultural or industrial goods is referred to as ***Virtual Water.*** Virtually a country exports water, when it exports water-intensive products. Virtual Water has been proposed as a means of achieving ecological sustainability by balancing economic and population expansion. For example, one tonne of grain requires one thousand tonnes of water as commented by Shuval and Dweik (2007).

Life on the earth depends on many sources of water. For the satisfaction of our fundamental requirements and the provision of potable water, we are reliant on this liquid for our survival. There are several dimensions to how one defines the 'use' of water. There are jillion benefits of water as:

Direct Uses: (i) Utilization in agriculture, specifically for the irrigation of crops,

(ii) Industrial usage, and

(iii) Residential usage.

Indirect Uses:

(iv) Generation of hydro-electricity,

(v) Domestic conveyance, and

(vi) Amusement and aquatic activities (Chatterjee, 2008).

Water scarcity has an impact on forty per cent of the global population. Since 1960, the worldwide per capita availability of potable water has decreased by 55 per cent. By 2030, the water demand is anticipated to be increased by fifty per cent. It is projected that by 2050, an additional 2.3 billion individuals will be confronted with acute water scarcity, particularly in South and Central Asia and North and South Africa. The continued expansion in population, economic development, and social progress contribute to an increased demand on the global water resources (Yadav and Malik, 2023).

1.2 Global Water Schema

Govind (2018), (https.//hdl.handle.net/10603/273555) opined that the urban population in developing countries is growing dramatically, generating demand beyond the already inadequate water supply capacity. As per UN World Water Development Report, at least one in four people would live in a country afflicted by never-ending shortages of fresh water by the year 2050. Millennium Development Goals Report (2012) has identified that 783 million people were struggling without access to pure potable water. The United Nations foresaw a global water catastrophe caused by inadequate water availability to meet basic human needs, agricultural and commercial needs decades ago. The main problems that may arise in the next

Figure 1:
Niger 2020, 15 kilometres from their house in Tchadi village, children go early in the morning to the closest water source to get water.
Source: https://www.unicef.org/wash/water-scarcity

A significant contributor to water insecurity, which in turn has significant repercussions for both society and the economy, is poor water quality. Information and data on water use are necessary for gaining a holistic view of water resources.
Data are unavailable and, when obtained, are insufficient and sparse, lacking the temporal and geographical precision necessary to comprehend trends, lifestyle, frequency, timing of shortages, and peak usage – World Bank

World Water Council, (2018)

Box: 2
Water Quality – Perspective of World Bank

century are going to be pollution and a lack of available water supplies. Unquestionably, the future of the world's water supply may be one of rising stress.

According to studies conducted by Damania *et al.*(2017), greater than 60 per cent of the global population already lives in regions that are water-scarce where available supplies cannot sustainably meet the demand for consumption and domestic use.

Kumar (2018) quoted that the supply of potable water for human consumption has become a constant source of concern throughout the world. A sobering fact is that the deterioration of drinking water is a source of concern for more than half of the global population, putting them at risk. Yearly, more than three million people around the world, including 1.2 million children, die as a result of water-related diseases caused by contaminated water. Figure: 1 showcased the status of children to get water early in the morning in Niger.

Shaw (2021) revealed that, in many countries, fresh water consumption has already approached or even beyond natural limitations. Unfortunately, many nations are in conflict with one another when it comes to sharing water. ***Kofi Annan, Secretary-General of the United Nations, on World Water Day (2002), stated that more than a billion members of the human family suffer tremendously as a result of a lack of access to water for drinking, cleanliness and food security. If current trends continue, water is expected to become an increasing source of friction and harsh rivalry between states, but it also has the potential to serve as a catalyst for international cooperation.***

1.3 An Overview of Indian Water Sector

According to Kumar *et al.* (2020), the country's average annual precipitation varies from 100 mm in Jaisalmer, which is located in Western Rajasthan, to 11,700 mm in Cherrapunji, Meghalaya. As informed by Joy and Janakarajan (2019), we are in

a situation that we have on one hand floods, and on the other hand droughts. We need to learn to live coping with two aforesaid antipode conditions. Composite Water Management Index (2019) estimates that six hundred million people of India's population are experiencing severe water shortages, with 70 per cent of accessible water being polluted, according to the organisation. It is possible that by the year 2030, up to forty per cent of India's population may not have access to water that is fit for human consumption. UNICEF assessed Indian water as, there would be continual struggle for water between rural families and urban residents, environmental conservationists and industrialists, who reckon on natural resources, and enterprises seeking to exploit the resource base for commercial gain.

* At least one month out of every year, a severe lack of available water affects around two-thirds of the world's population, or four billion people.
* More than two billion people are estimated to be living in countries with insufficient water supply.
* It is likely that by the year 2025, half of the world's population would be living in locations where there is inadequate access to water.
* By 2030, severe water shortages might force almost 700 million people to relocate.
* By 2040, approximately one-quarter of the world's children will reside in regions with extreme water stress.

- UNICEF (2021)

Box: 3
Water Shortage – Reality

Joy and Janakarajan (2019) observed that recent years have seen an increase in water-related and inter-state disputes in India. There have been numerous instances of inter-state water sharing disputes, including those between Karnataka and Tamil Nadu over the Cauvery river; Andhra Pradesh and Telangana over the Krishna and Godavari rivers; Punjab, Haryana and Delhi over the Sutlej, Ravi and Beas rivers; Karnataka and Goa over the Mahadayi river; Odisha and Chhattisgarh over Mahanadi river.

Due to increasing rivalry across sectors due to population expansion, urbanisation and greater industrialisation, India's water quality was deteriorated. A major source of concern in the region is unsustainable water withdrawals. Some nations are extracting substantial portions of their freshwater supply – more than half of total water availability. Asia and the Pacific are home to 7 of the top 15 groundwater abstraction enterprises in the whole globe.

In India, water contamination has come to the top of the list of important issues. Ineffective water use, the death of rivers as a result of pollution loads as well as damming and diversions, depleting ground water conditions and a lack of ground

water regulation, the absence of protected drinking water and sanitation facilities for the vast majority, as well as agriculture that is not sustainable does not yield much profit, are all additional issues.

Hence Kumar (2018) opined that there appears to be a rapid deterioration in the water situation in India. Apart from the fact that water is becoming increasingly scarce, states such as Punjab, Haryana, Tamil Nadu and Rajasthan are considered to be some of the most agriculturally significant states in the nation, and they are experiencing a drop in agricultural production because of decline in the levels of groundwater. More than one lakh deaths are reported as a result of water-borne diseases in India. Water contamination is responsible for millions of deaths every year due to pathogenic bacteria, viruses and parasites that cause various water-borne diseases. We are all aware that water is polluted by a variety of sources, including pollutants in the atmosphere, industries, transportation, rainwater, discharge of used wastewater, fertilizers, insect killer and the improper disposal of human waste, among others. Even the purified drinking water does not guarantee a lack of pollutants in the water.

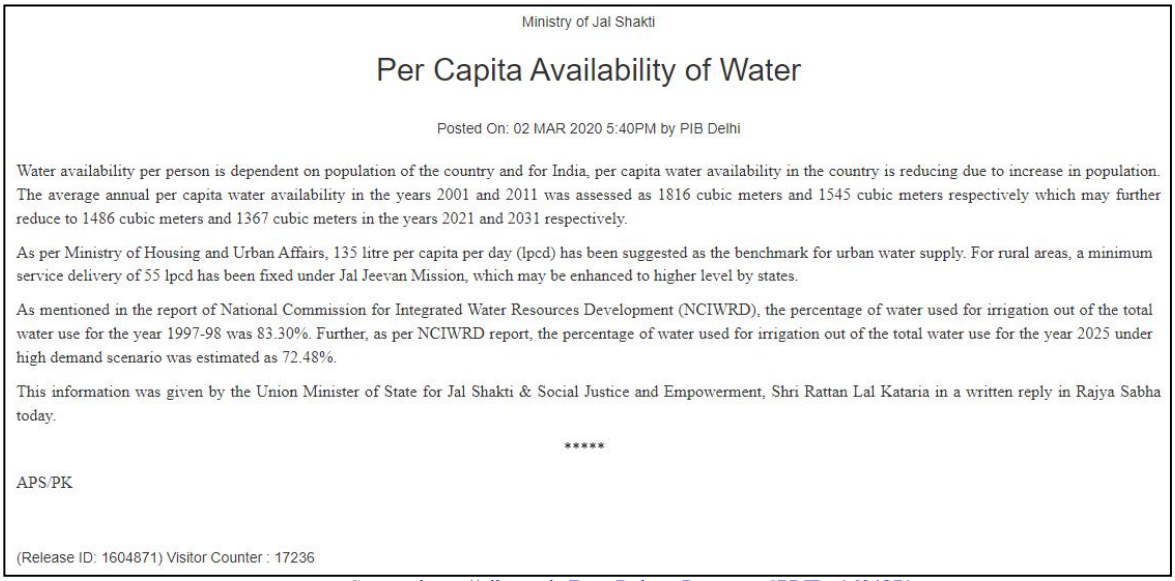
Water management practices are essential not only at the national level, but also at the regional and municipal levels. It is exceedingly complicated as a result of factors such as inequitable precipitation distribution, complex river system flow, farming methods, the expansion of human settlements and the exploitation of groundwater. These factors combine to make water management practices extremely difficult to implement. A national water policy that aims to promote resourceful, equitable and harmonious use of water should refrain from attempting to prescribe what type of water management action should be taken in a given scenario. The framework for making decisions pertaining to the management of water should be led by policy principles, rather than being governed by rigorous regulations and dogmatic standards, as is the case with other environmental challenges.

1.4 Per-Capita Water Availability in India

According to International standards, if a nation has availability of less than 1700 cubic metres of water per person, it is projected to be water-stressed and water scarcity if less than 1000 m3 (Gangwar, 2013). In 1951, India's per capita surface availability was 3,450 m^3, 2309 m^3 in 1991 and 1902 m^3 in 2001, but this is destined

to drop to 1401 m^3 in 2025 and 1191 m^3 in 2050, reported Ministry of Water Resources.

Union Minister of State for Jal Shakti and Social Justice and Empowerment released an official circular on March 2, 2020, defining the estimated availability of water on a per capita basis in India (Figure: 2). It stated as follows:



Ministry of Jal Shakti

Per Capita Availability of Water

Posted On: 02 MAR 2020 5:40PM by PIB Delhi

Water availability per person is dependent on population of the country and for India, per capita water availability in the country is reducing due to increase in population. The average annual per capita water availability in the years 2001 and 2011 was assessed as 1816 cubic meters and 1545 cubic meters respectively which may further reduce to 1486 cubic meters and 1367 cubic meters in the years 2021 and 2031 respectively.

As per Ministry of Housing and Urban Affairs, 135 litre per capita per day (lpcd) has been suggested as the benchmark for urban water supply. For rural areas, a minimum service delivery of 55 lpcd has been fixed under Jal Jeevan Mission, which may be enhanced to higher level by states.

As mentioned in the report of National Commission for Integrated Water Resources Development (NCIWRD), the percentage of water used for irrigation out of the total water use for the year 1997-98 was 83.30%. Further, as per NCIWRD report, the percentage of water used for irrigation out of the total water use for the year 2025 under high demand scenario was estimated as 72.48%.

This information was given by the Union Minister of State for Jal Shakti & Social Justice and Empowerment, Shri Rattan Lal Kataria in a written reply in Rajya Sabha today.

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APS/PK

(Release ID: 1604871) Visitor Counter : 17236

Source: https://pib.gov.in/PressReleasePage.aspx?PRID=1604871

Figure 2: Per Capita Availability of Water

Class I cities inside India have an average water supply of 145 litres per person per day, according to the available statistical data. WHO has established a minimum daily water consumption of 200 litres for the general population, which may be decreased to 135 litres for economically disadvantaged and low-income people. As per 2001 census, all of Tamil Nadu's Class I cities lacked adequate water supplies.

(https://www.researchgate.net/publication/314234870_Water_Distribution_Pattern_in_Coimbatore_City_Tamil_Nadu_using_Remote_Sensing_and_GIS)

1.5 Glimpse at Coimbatore's Water Status

The current water supply status in Coimbatore Corporation, which has a population of 10,50,721 inhabitants, is 72 LCPD, as determined by the TWAD on 01.04.2021 (https://www.twadboard.tn.gov.in/content/coimbatore). There is no doubt that the demand for water will continue to rise in a developing city like Coimbatore in the foreseeable future.

Coimbatore's drinking water comes from two primary sources:

- Siruvani and
- Pillur Schemes

Pillur provides 66 million litres per day (MLD), while Siruvani provides 87 MLD. Both sources supply the city with water. The Corporation is responsible for maintaining the distribution of water supply lines. Currently, 64.15 million litres and 65.49 million litres of water are being withdrawn daily from Siruvani and Pillur Phase-I, respectively, and provided to the city. The city receives approximately 30 MLD of water per day as a result of the Water Supply Scheme – Pillur Phase II.

CCMC has made the announcement that the soft water supply in the city of Coimbatore is currently distributed once in every two days under the Siruvani scheme and once in every three or four days under the Pillur Scheme Phases I and II. Currently, drinking water is provided by the Tamil Nadu Water Supply and Drainage Board to the extended areas of 11 ULBs, which are now included in the Coimbatore Corporation, through the Siruvani, Pillur Phase-I, Aliyaru, and Bhavani schemes. An average of 35.71 MLD of water was drawn, resulting in a daily consumption of only 66 litres per capita on an average (https://payment.ccmc.gov.in/Water_Supply.asp).

1.6 Need for the Study

Water is a precious resource. Finding, collecting, transporting and storing it is a significant responsibility of everyone in the society. People must stand in line and wait for their turn, and they may have to walk long distances and sometimes pay exorbitant amounts of money in order to obtain drinking water. Many of their efforts have gone into bringing water to their home for drinking, cooking and sanitation as well as for a variety of other consumable activities. They devote a significant amount of time to this activity.

Everyone are aware of the importance of water resources and recognizes their importance. However, despite the fact that water is a fundamental human requirement, this valuable resource is being squandered, contaminated and depleted at an alarming rate. Damania *et al*. (2017) asserted that, if water is not handled prudently – from the source to the tap and back to the source – then it is possible that the crises that we are experiencing right now may evolve into catastrophes in the future.

As documented by Kumar (2018), the purity of the water also continues to deteriorate during transportation and storage at home. Water collected or stored must meet its quality requirements for the specified number of days until the next distribution cycle.

Blokker *et al.* (2020) also shared that the health of people depends critically on the quality of the water they drink. Drinking water standards are met by extracting water from surface and underground, and treating it at the community level. The water is pumped into the drinking water distribution system and distributed to customers. Microbiological growth, chemical reactions, interactions with deteriorating infrastructure and maintenance and repair activities can all contribute to water quality degradation within the drinking water supply network. Despite the reality that certain steps were made in the drinking water supply network which may help to improve water quality, they can also have a negative impact on it, leading to incidents of poor water quality or outbreaks of diseases. In spite of recent advancements, access to high-quality drinking water is still a major concern.

Kumar (2018) emphasized that **water quality** and **purity** are the two most important factors to consider, because, they have the potential to put our ecosystem at risk by affecting its overall health. Added to water quality and purity, water conservation also ensures the third dimension of efficient water management.

Exhibit 1: Drinking Water Contamination with Drainage Water

The quality of available water and excessive consumption were considered to be fields that belonged to a specific niche. Both of these legends of our current state must be addressed together in order to be fully understood. Exhibit 1 provides a glimpse into the plight of people who are suffering from severe affliction.

Sturman *et al.* (2004) defined **water conservation** from a global perspective as restricting or adjusting human use of water in such a manner as to avoid causing changes in water quantity and quality beyond those induced by natural occurrences throughout the time-scale of human history. In a local context, this often involves lowering the amount of water consumed for a specific purpose or a complicated system of operations. In order to accomplish this goal, it is required to raise the quality of the water while simultaneously lowering the volume of water that is used.

In recent years, a significant amount of research has been conducted on a variety of topics including water conservation, quality and distribution pattern (Kumari and Singh, 2016). It was discovered by Holland *et al.* (2019) that individuals learn from experiences that occur in their environment. It was also revealed that individuals shape future decisions as a result of these experiences. In the context of water conservation, this makes a lot of sense in general. In the event that a person has first-hand experience with water scarcity, such as not having enough water, that person will be more concerned about water scarcity in the future and more likely to conserve water. In order to bring a frame of mind and behaviour variation in managing of water, general public must be made aware of the problem and encouraged to participate in efforts to resolve the water crisis.

Singh *et al.* (2021) declared that innovation in technology, institutional and policy arrangements is required to address the growing scarcity of freshwater resources in the world. People can start saving and conserving water in home on a daily basis right now. With smart technologies and management processes, water savings are possible. These processes include a new system for monitoring the water flow, organising the available water, controlling water expenditure and finally evaluating the output, which allows us to predict our water consumption.

Basak *et al.* (2021) indicated that the current water crisis in big cities could be significantly alleviated by installing water-sensitive fixtures in households. Rasoulkhani *et al.* (2018) found that the adoption of water saving technologies by

households was affected more by income growth and the water pricing structure than any other demographic or building variables. Nasab *et al*. (2007) underlined that the most efficient strategies for water saving in residential settings is the use of low-flow fixtures and other devices that have been developed expressly for this objective.

In this context, the goal of this research is to evaluate the level of knowledge, attitude, and current practices that homemakers have about the management of household water supplies, as well as to provide a long-term solution for addressing household water challenges.

Being a zealous Research Scholar in Resource Management, as well as a responsible homemaker, and one of the sufferers has inspired the investigator to carry out this study on ***"Exploration of Domestic Water Management Practices and Paradigm Shift using IoT Enabled AI System for Devising Water Conservation in Ingenious Homes".***

1.7 Statement of the Problem

There is a water crisis in the world right now. However, the crisis does not stem from a lack of sufficient water to meet our desires. It is an emergency of water management that has got out of hand to the point where about 10 lakhs people – and the milieu – are suffering, said Cosgrove and Rijsberman (2014).

The current water management system is unsatisfactory due to the poor quality of the water, the irregular pattern of water supply, the unwillingness to control water consumption, a lack of public awareness and a low level of participation. According to Arellano *et al.* (2019) taking into account climate change, overall urbanisation troubles, and high-tech advancements, research on the demand for drinking water should continue to be conducted, particularly in developing nations where a large number of people still lack access to a sufficient supply of potable water to satisfy their fundamental requirements. They also claimed that excessive use of sanitary devices in residential buildings contributed to increased water consumption. Based on these considerations, the following research questions were devised for this research.

1. Are Coimbatore's homemakers committed to the general principles and practices of domestic water management?

2. How satisfied are the households with the existing quality and quantity of the water that was supplied, and storage practices as well?
3. Is it possible that the programme designed to disseminate information will have an effect on the homemakers of Coimbatore city in terms of their knowledge, attitudes, levels of behavioural change, and practices in relation to domestic water management?

1.8 Outlook of the Study

The conclusion of this research will contribute to the existing knowledge about residential water management practices in Coimbatore by providing new insights and amplify information on what is already known, concerning efficient water management know-how.

The problem would be addressed through the development of a model, and implementation of a smart water resource management system. This research could potentially serve as a starting point for future researchers who are looking to develop an alternative method of dealing with water conservation in the future.

According to Krishnan *et al.* (2022), Pasika and Gandla (2020) by formulating IoT based water management system, Government organizations may be provided with suitable solutions to mitigate water wastage and improvise the water quality. Efficient management of a water supply through the use of an IoT application to automate the operation of a motor (over head storage) in each house, utilizes a waterproof ultrasonic sensor that will reduce the domestic water wastage.

This study provides valuable information to homemakers about the concepts of water management at the household level, including how water consumption can be optimized and intentionally utilized to satisfy the requirements and expectations of an ever-expanding population. Homemakers would benefit from additional knowledge on tracking how much water is used by the family, unintentional water waste, failing to turn off water taps, and unattended water leakages in faucets and pipes, all of which result in a significant amount of water waste.

This study will draw the attention of the Coimbatore Corporation, government officials, and policymakers to understand the need to formulate new water policies in order to implement the proper strategies for managing the town's water-related issues and to ensure effective water management, as The New Water Policy

(NWP) considers water quality as the most serious unaddressed issue in India (https://www.nextias.com/current-affairs/29-10-2021/draft-national-water-policy-nwp).

The outcome of the study is anticipated as ***water crisis is to revolutionize, since we have the ability to transform the present water situation.***

1.9 Operational Definitions

"Exploration of Domestic Water Management Practices and Paradigm Shift using IoT Enabled AI System for Devising Water Conservation in Ingenious Homes."

Exploration

The urge to discover more about what is out there in the vast, wide world, engaging in the activity of exploration to examine or investigate something systematically(https://en.wikipedia.org/wiki/Exploration#:~:text=Exploration%20has%20been%20defined%20as,(seek)%20experience%20first%20hand).

Domestic water use

The total amount of water used in a residence is referred to as the **"Domestic water use"** including water used for toilets, showers, washing machines, taps, cleaning the outdoors, and other uses. By having an understanding of the final uses of water, water planners, water authorities, and homeowners will be able to establish where water is utilized or wasted, how much of it, and how often it happens, as revealed by (Trinidad *et al.,* 2011, P.37).

Paradigm shift

Distinct shift in the underlying principles and experimental techniques of a scientific subject is referred to as a ***paradigm shift***. It is a technique to explain how an individual perceive the same information in a completely different light.

A paradigm shift is a radical change in the fundamental worldview, ideas, and practices that govern the performance or accomplishment of something. There are many different contexts in which a paradigm shift is possible to take place, including scientific study and industry (https://en.wikipedia.org/wiki/Paradigm_shift). When new technologies are brought into an industry, they can bring about paradigm shifts because of the transformative effects that they have on the method of production or the manufacturing of a product or service (https://www.investopedia.com/terms/p/paradigm-shift.asp).

IoT

Kapoor (2019) mentioned that Internet of Things (IoT) refers to a broad variety of internet-connected devices, including sensors, actuators, smart phones, among others. IoT platforms are often used in order to handle information coming from layers of the network. Buildings that are equipped with Internet of Things technologies may not only assist in lowering the amount of resources that are used, but also in raising the level of contentment experienced by those who live or work in such environment. The buildings are equipped with intelligent sensors that not only monitor the usage of resources but also can proactively recognize the demands of the occupants. This data is then utilized to forecast actions, which may be automated according to occurrences. As a result, efficiency could be maximized, which saves time, resources and money.

AI – the Artificial Intelligence

According to Kaur *et al.* (2021) one of the most promising methods to make the acceptance of new ideas for the construction of a closely linked network is the use of Artificial Intelligence. These new principles include processes of learning, cognition and decision-making. One of the most promising techniques is Artificial Intelligence. The use of AI as a study subject in more advanced wireless communication systems is one of the most recent trends.

Artificial Intelligence emulates ***Intelligent Behaviour***. Humans are good at making machines to perform tasks. "AI is the new electricity." If AI is the new energy, then data should be considered the new coal, and the Internet of Things should be considered the new coal mine (Kapoor, 2019, P.7).

Water conservation

Policies, methods and actions, related to water conservation, cover anything from preserving the hydrosphere to ensuring that present and future human needs may be satisfied (thus avoiding water scarcity). How much water is consumed depends on factors including population, family size, growth and prosperity. Water conservation includes minimizing negative impacts on water quality, decreasing unneeded water consumption, and optimizing existing water resources using better water management methods (https://en.wikipedia.org/wiki/Water_conservation).

Ingenious homes/ smart homes

Obaidat and Nicopolitidis (2016) states that a recent trend is the creation of smart houses. Futuristic feet such as programmable and zone-based smart thermostat, wireless power, automated door locks, and improved security systems are some of the features that will be available in a smart home.

1.10 Intention of the Research

The primary objective of this study was to investigate the current domestic water usage practices of homemakers in the selected city of Coimbatore and to propose a high-tech tool for the administration of residential water management.

In order to conduct the investigation, the following objectives were set:

1. Recognize the socio-demographic profile of respondents as well as their degree of awareness, knowledge, attitude and lifestyle regarding domestic water consumption,
2. Identify the alternate water sources available, water conservation techniques used, water distribution, customs of storage and water consumption pattern among selected homemakers of Coimbatore city,
3. Evaluate the quality of water – physical, chemical and biological qualities - that has been stored for drinking purpose among the selected water samples,
4. Investigate individual water consumption analysis (micro-components), comparison using varied methodologies for different domestic activities in chosen houses,
5. Plan, implement and evaluate the impact of an intervention programme on the water-use behavioural attitude of selected homemakers and
6. Design a prototype model of IoT based effective water usage monitoring and control system using Transmission Control Protocol/ Internet Protocol (TCP/IP) that could be used for water conservation.

1.11 The Study's Hypotheses

The following research hypotheses are tested in this research. They are deduced based on the review of literature and the actual evidence.

$H_0$1. Selected socio-demographic variables does not influence the awareness on water conservation among the selected families.

$H_0$1.***(a)*** *Selected socio-demographic variable - home maker's educational qualification did not influence the awareness on water conservation among the selected families.*

$H_0$1.***(b)*** *Selected socio-demographic variable - family income did not influence the awareness on water conservation among the selected families.*

$H_0$1.***(c)*** *Selected socio-demographic variable – type of house did not influence the awareness on water conservation among the selected families.*

$H_0$1.***(d)*** *Selected socio-demographic variables – ownership status did not influence the awareness on water conservation among the selected families.*

$H_0$2. There was no association between the educational qualification of selected families and their usage of water conservation tools.

$H_0$3. Household's satisfaction about the quality and quantity of water distributed, irrespective of seasonal and non-seasonal variations, was not influenced by the distribution of water in their respective zones and the frequency of water supply.

$H_0$3.***(a)*** *Household's satisfaction about the quality of water distributed during seasonal variations was not influenced by the distribution of water in their zone.*

$H_0$3.***(b)*** *Household's satisfaction about the quality of water distributed during non-seasonal variations was not influenced by the distribution of water in their zone.*

$H_0$4. The properties (physical, chemical and biological) of water in different containers that has been stored during distribution cycle would not meet the quality standards set for its use.

$H_0$4.***(a)*** *The physical properties (i.e) colour and turbidity of water in different containers that has been stored during distribution cycle would not meet the quality standards set for its use.*

$H_0$4.***(b)*** *The physical properties (i.e.,) pH, electrical conductivity and total dissolved solids of water in different containers that has been stored during distribution cycle would not meet the quality standards set for its use.*

$H_0$4.***(c):*** *The chemical properties such as iron and chloride content of water in different containers that has been stored during distribution cycle would not meet the quality standards set for its use.*

$H_0$4.***(d):*** *The chemical properties such as hardness, alkalinity, calcium and sulphate content of water in different containers that has been stored during distribution cycle would not meet the quality standards set for its use.*

$H_0$4.***(e)*** *The biological properties of water in different containers that has been stored during distribution cycle would not meet the quality standards set for its use.*

H_a5. The amount of water consumption differed for selected activities using traditional (manual) methods and labor saving devices.

$H_0$6. There was no significant difference between the quantity of water used for household chores by homemakers and paid assistants.

$H_0$7. The knowledge dissemination session did not result in any noticeable changes in water-conscious behaviour among the sampled homemakers.

The above hypotheses were tested statistically and are discussed in Part IV – Results and Discussion.

1.12 Limitations of the Study

→ Only homemakers from Coimbatore city were chosen as the samples for the study.

→ The research focused only on the residential water management.

→ Except for Phase - I of the study all the selected samples were limited to West Zone of Coimbatore city based on results.

→ Selected samples were restricted to those who have Corporation water supply.

→ Significant portion of the population were exempted as they voiced their opposition to install the water measuring device in their sewerage system.

1.13 Map of the Research

The content in this research book was arranged into five major sections that were arranged sequentially.

Part I – Introduction incorporated the global water schema, an overview of Indian water sector, per-capita water availability, glimpse at Coimbatore's status, necessity and scope of the study, the problem description, the goals, proposed hypotheses and the study's limits.

Part II – The **Review of Literature** focused on the most current and most relevant works in the field of study.

Part III – The **Methodology** of a research shows the scientific order of the actions that were taken, as well as the instruments and procedures that were used in the course of carrying out the different stages of the investigation.

Part IV – In the section under **Results and Discussion**, the outcomes of the research are presented and discussed in detail.

Part V – Summary and Conclusion presents condensed version of the full piece of work, as well as ideas for more study and proposals for the strategy planner.