International Journal of Scientific Engineering and Research (IJSER)
ISSN (Online): 2347-3878
Impact Factor (2020): 6.733

The Economic Feasibility of Using Grey Water as an Alternative Source of Water Supply in Kohima City of Nagaland

Athungbemo R Lotha[1], Dr Adaina K. C[2]

[1]Masters Scholar, Reg No.1830001, Department Of Economics, Christ (Deemed To Be University) Bengalaru, Karnataka, India India
[2]Supervisor, Associate Professor, Department Of Economics, Christ (Deemed To Be University) Bengalaru, Karnataka, India India

Abstract: ***Water is one of the basic requirements vital for the healthy functioning of the world's ecological - system however, because of the increase in population, growth in industrialization and urbanization it has led to an increase in the demand of fresh water therefore leading to a decrease in the availability and supply of fresh water. Water like any other natural resource is very important for a nation's economic growth especially in terms of agriculture goods and manufactured products. Less supply and availability of water can affect the production level and harm the entire economy. Now, there is a universal recognition that grey water can be used as an alternative source for purposes like irrigation, toilet flushing and others. This paper seeks to understand the several major economic causes and problems of water scarcity. It also examines the level of social awareness on water scarcity and grey water, what are the various purposes of using Grey water. The main objective of this study is to explore the impact of information nudge on the willingness to reduce daily water requirement and opt for the use of grey water for the better management of water resource and also make a comparative nudge study on the average number of families on their maximum and minimum daily water requirement. Primary data has been collected through structured questionnaires. An experimental design has been used in this study. Responses before and after provision of information nudge has been studied. The results revealed that there is a significant association of overall social awareness and reusing of grey water as an alternative source for various other purposes.***

Keywords: Information nudge, Comparative nudge, Water scarcity, Grey water

1. Introduction

Water comes from the Proto - German word 'watar' Dutch 'water' German 'wasser'. Water is a wet, odorless, colorless, and tasteless, near colorless substance it is one of the basic requirements for human vital and very important for the healthy functioning of the worlds ecosystem including forest, lake and wetlands.71% of world's population is covered with water and it is one of the needed requirements in life. Water is a renewable resource however only 3% of the world's water is fresh. The total volume of freshwater on Earth far outweighs the human demands. Over the years increasing population, Rapid growth in Industrialization, improving living standards, change in consumption pattern has increased the demand for fresh water that has led to a situation where the consumption of water is increasing the demand of water however the availability of water is diminishing. Now, Humanity is facing huge water crisis, scarcity of water can also be caused due to droughts, lack of rainfall or pollution. This was listed by the World Economic Forum as one of the largest Global risk in terms of potential impact in the next 1 - 2 decade. Around 4 billion of the Human population lives under severe water scarcity at least one month a year and out of them half billion lives under severe water scarcity condition all through the year. Currently it has been estimated that about 800 million people live under a threshold of water stress and it is expected to reach 3 billion by 2025. When it comes to human experience of water scarcity it is categorized in two terms physical and economic water scarcity physical water scarcity refers to the lack of availability of fresh water to meet its demand and Economic water scarcity refers to the poor management of the sufficient available water resource. Afghanistan, Kazakhstan, Morocco, Pakistan, Israel, Singapore, Libya, Jordan, Saudi Arabia. These are some of the top countries suffering from water scarcity. India compared with the rest of the country is not a poor country but because due to the growing population negligence and over exploitation of water resource water has become a scarce commodity. Further negligence can lead to more scarcity for the next 1 - 2 decades. India is facing a huge water crisis and within no time it is estimated that India will be suffering from severe water scarcity. India occupies a small geographical area but with increasing population and development there is a need to critically look at alternative approaches to ensure water availability. Over the years supply of water resource is worsening globally. According to a report from the United Nations water shortages will affect 2.7 Billion people by 2025 which means 1 of every 3 people will be affected. Re - using of waste water has become a very good way to tackle water scarcity and solving this problem. Alternative availability of water includes rain water and buckets of water used in household which emerges as grey water. Grey water is a mixture of waste water from kitchen sinks, laundry, bathroom, showers, hand basins etc. There is a universal recognition that grey water can be used as an alternative water purposes such as irrigation, toilet flushing, car washing, floor mopping and others. It is considered high volume, low strength wastewater with high potential of reuse and application. Reuse of grey water has been an old practice and it is still been practiced by places suffering from water scarcity. People are now waking up to the benefits of Grey water and the term waste water has become a misnomer.

Benefits of using grey water:

1. It helps in reducing fresh water from rivers and aquifers.
2. Recycled grey water can be used for toilet flushing.
3. Reduced Energy use and chemical pollution from treatment.
4. Reduction in the demand of fresh water. If people reduce the use of fresh water then the cost of domestic water consumption is significantly reduced.
5. Demand on conventional water supplies and pressure on sewage treatment systems is reduced by the use of Grey water.

Socio - Economic benefits of using Grey water.

Grey water is relatively clean water although rendered undrinkable by the presence of cleaning products, food, grease and dirt grey water can be reused for a variety of other purposes. With the help of treatment systems facilities grey water has been found for utility purposes like toilet flushing. Because water is re - used, less water is needed for various functions that might otherwise consume water from potable sources more efficient treatment of grey water will proof more cost effective investment.

Re - use of Grey water can ultimately lead to a reduction in the usage of fresh water. Saving on the usage of fresh water can significantly reduce on household water bills, and also at the same time it can also benefit for the broader community in reducing demands on public water supply. Re - use of Grey water will lead to the reduction in the amount of wastewater entering the sewage disposal block.

Disadvantages and impediments of using grey water: There are some risks and concerns over adoption of wider use of grey water.

1. Public health concerns due to confusion about grey water and high quality recycled water.
2. A reduction in the capacity of carrying solids caused by reduced flow.
3. Reduced flow of raw materials into wastewater treatment facilities that can hinder in the efforts of recycling water in these facilities.
4. There is a potential impact on the environment. (e. g - impaired soil health,) from the outdoor use of grey water due to metals, salt present in the grey water.

1.1 Water scarcity, Water supply in Kohima city of Nagaland

Kohima is the capital city of Nagaland with the population of 2.86 lakhs (2011 census) the people of kohima faces acute water shortage every dry season of the year which starts from November to April (six months). Common suffer the most out of this problem. There is an increase in the population and expansion but there still has not been much improvement in the augmentation of water supply. The Government supply never meets the need of the public. Majority of the population in kohima don't have fixed pipeline connection as there is no provision for that. Selling of water in kohima city due to water scarcity increases day by day by the people and its demand keeps on increasing. However against the requirement of 14 million liters per day the Department can only provide 1.5 million liters per day in kohima town not only in kohima but acute water shortage is faced by the entire Nagaland state during the lean season. Even to purchase water an early booking is required to be done. The lowest cost of bucket is Rs20 per bucket even to which some of the public are not able to purchase it on a regular basis as it becomes expensive. Most of the people spent time waiting for hours to fetch and get water from the public hardly reaches their minimum requirement and sometimes the water is not even provided for a week or even more. The government is not able to do much in tackling the problem of water scarcity. In kohima water supplier is the best option for people looking for 'private water tanker near me' online for events, programs big function that require thousands of people to supply water. They have experts that handle in the transporting of water in sindex tank and transferring the drinking water in the events. To solve the problem of scarcity of potable drinking water the Public Health Engineering Department has initiated steps on drawing water from Dzukou river namely Dzupfu/Tepuiki river. Steps are being taken for permanent water supply solution problem in kohima and the scheme is initiated only for permanent solution. Water education is also provided to the residents of kohima to conserve water and to store water by adopting economical used and practice hygienic use of water. Every household needs to know how to conserve and store water.

1.2 Grey Water Management in India

By 2025 it is estimated that India will be suffering from acute water scarcity as demand for water excess water supply. During the summer of 2018 Shimla faced acute water shortage leading to a shutdown of schools in the city. Changes in climate changes, growth in population and increase in the demand of water has brought about the necessary look to restrict the use of fresh water in activities that do not require high levels of water quality and try to recycle and wastewater that is generated and non - commercial activities. For this scarce natural resource grey water recycling has emerged to be the best viable alternative use for irrigation and agriculture. Therefore, it is pertinent to examine what constitutes grey water. the method applied by the country to treat grey water in ways where the rest of the country across the world has adopted reuse and recycle of efficient management of water.

Grey water is specifically wash water, waste water that has been discharged out from showers, bathtubs, sinks, dishwashers, washing machines, and black water, which is heavily polluted by biological contaminants particles in grey water. Grey water contains a decreased load of pathogen and about a tenth of nitrogen. The organic content of grey water decomposition is more rapidly than black water and is much easier to treat. This makes it feasible to use in number of other activities like irrigation. The composition of grey water depends on the activity it has resulted from it also depends on living standards,

household area, cultural habits etc. not all grey water can be used in one particular purpose. Each of them has its own purpose of usage. For example kitchen sink water laden with food solids and laundry water has been used to wash diaper is more contaminated than grey water from showers and bathroom sinks. Out of all the grey water discharged bathtubs, showers and hand basins is considered to be the least polluted. Grey water available from kitchen sinks are about 10 percent of total grey water available from household, water from cloth washing contributes to about 25 - 35 percent of total grey water available from household. Water used on washroom, bathroom generates about 50 - 60 percent to total number of grey water discharged from household activities. water from kitchen use is rich and organic and inorganic waste and is conductive to the growth of pathogens. it is difficult to use kitchen used water for all kind of grey water systems. Grey water discharged from cloth washing depends on the quality of the water whether water has been rinsed only once or twice or more than that. Contaminants included in bathroom sinks grey water are soap, shampoo and tooth paste. About 60 percent of water can be recycled and reuse from household discharged grey water.

1.2.1 Policies on Grey Water - India

So far, India do not have any focused policy framework for management and usage grey water in rural or urban areas. However some guidelines for treatment of waste water do exist. The Central Public Health and Environmental Engineering Organization (CPHEEO) has specified permitted discharge standards for treated water, use of treated wastewater in agriculture and horticulture (MoHUA, 2012). The Central Ground Water Board (CGWS 2000) states that treated waste water can be used as a source of artificial ground water recharge once it meet its standards and is compatible with existing ground water. It is important to add that the policy coupled with technological interventions are adopted in India so that the existing usage and generation of grey water can be regulated, recycled and reuse. Furthermore India has been using treated sewage for farm forestry, horticulture, toilet flushing, industrial use and fish culture. Drainage systems in traditional villages lack a lateral line as a result to which only half of the population uses it efficiently. Till now, India has not made compulsory for the installation of grey water systems in buildings that are generating high amounts of grey water.

1.2.2 Ministry of Urban Development (MOUB)

The MOUD approved a project to centre to Environment and Development to set up a Centre of Excellence on 'Solid waste and Water Management' at Centre for Environment and Development. As part of this, Centre for Environment and Development (CED) has prepared a Strategy for Decentralized wastewater Management mainly focusing on Grey water. The main objective under COE Centre of Excellence and CED Centre of Development are;

1. To regulate strategy on strategy on methodology for wastewater Management including development of framework for wastewater recycling and re - use in urban areas.
2. To lay capacity building and training strategies for urban bodies.
3. To work and function as knowledge Hub in the area of Wastewater Management.

The Chennai Metro water supply and sewage board is advocating and endorsing the use of treated grey water f or supply to industries, thereby reducing the pressure on freshwater demand. Thermal power plants and industries like Chennai Petro chemical Ltd, Madras Fertilizers Ltd and Madras petrochemicals Ltd. are already using treated sewage for industrial purposes. Residential apartments have started using reclaimed water for flushing, land scaping applications due to a statutory compulsion. Indian urban areas generate 61, 948 million liters (MLD) of sewage a day which about 35 percent is collected and treated in sewage treatment plants.

1.3 Chapter Scheme

Chapter 1: This chapter includes brief relevant information on the water as a natural resource. How it is a required resource on a day to day life and how much people are facing water as a scarce commodity. It provides a picture on how the usage of grey water is one of the best alternative sources to tackle water scarcity, the benefits, socio - economic benefits and the various impediments of using grey water. The Government schemes and initiatives to tackle water scarcity, policies and management of grey water in India and addressing the people with the required knowledge on reusing of grey water. This chapter includes the main aspects of the study and also provides with brief information on the objectives of the study.

Chapter 2: This chapter includes the literature of the past studies and describes the methodology adopted for the present study. The chapter presents the research designs such as the type of study, theoretical framework, sampling technique, data collection methods and techniques and the significance of the study.

Chapter 3: The third chapter investigates the different major causes of water scarcity. It helps us to understand the different causes and the problems leading because of water scarcity. This chapter deals with the management of water resource and the Eco - feasibility of using Grey water as an alternative source. The chapter presents the analysis on the association of social level of Awareness of the sample population and grey water and the different purposes of using grey water. The association of relationship between the socio - demographic characteristics and steps for better management of water resource was also examined. The chapter also presents the effect of information nudge of the respondents by understanding their willingness to reduce daily water requirement and also present the effectiveness of comparative nudge by comparing the respondent's number of average daily requirement of water post information nudge.

Chapter 4: The fifth chapter gives detailed summary on Findings, conclusions, recommendations and suggestions based on findings of the study.

2. Review of Literature

Ensuring fresh water is one of the most essential and basic need for humanity and now, water scarcity has become widespread all over the world (Komal Mehta, 2015). According to studies done Wastewater is an immense resource that could find significant application in regions of water scarcity. Grey water has particular advantages in that as it is a large source with a low organic content as seen in the study carried out by 'M. Pidou and P. Jeffrey (2015) ' Grey water reuse has been considered as a very reliable method of ensuring scarcity of water in comparison to other methods like rain water harvesting. Grey water is a mixture of waste water from kitchen sinks, laundry, bathroom, showers, hand basins etc. There is a universal recognition that grey water can be used as an alternative water purposes such as irrigation, toilet flushing, car washing, floor mopping and others (Barbara Imhof and Joelle Muhlemen 2005). Historical studies have shown that grey water comprised approximately 50% of residential wastewater (Mayer, 1999) the generation of grey water depends mostly on lifestyle. The generation rates are usually predictable, however vary slightly between person to person (Erikson, 2002) The amount of grey water that discharges from the household activities vary differently from the living condition according to a study done by 'Michael - oteng Peprah, Mike Agbesi Acheampang and Nanne k Devries, (2018) ' it can start from 15 liters per person per day from a poor family to about several hundred per person per day. The study undertaken by 'Jillian Vandegrift, (2014) ' shows the characteristics of grey water where it contains a high variable organic concentration ranging from that equivalent to a medium strength influent municipal sewage to a tertiary effluent, a micro and macro nutrient imbalance equally split between nitrogen and phosphorus. A Study on Implementation of Grey water reuse system has been carried out by 'Jeslin Kaduvinal, (2007) where it shows that implementation of such a system has a significant effect on the cost. Implementation of economic benefits of grey water in general is more economically feasible in large buildings with multiple stories, but is not economically feasible in single - family homes. There may be some initial cost and infrastructure barriers until cities countries or the state adopts grey water systems as a required policy for buildings. Grey water systems could save a great deal of water if installed in residents and business (Natalie J. Munoz, 2016) public perception of using recycled water has also been carried out by many scholars as can be seen in the study done by Dolnicar and Schafer, (2006) that recycled water is more environmental friendly, Marks, (2007) shows that the most and the highest acceptability of re - using grey water are for non - potable uses (non drinking purposes). Grey water quality varies from location to location depending upon the sources personal uses and season (Eriksson, 2002) Grey water is classified into low - load and high - load. Low load is less polluted and less considerate excludes kitchen and laundry grey water high load is more considerate includes kitchen and laundry grey water. It contains physical, chemical and Biological contaminants. Physical contaminants include appearance of suspended solids, temperature and electrical conductivity. Normal temperature of grey water ranges between 18 to 35 degree Celcius, suspended solids in grey water may be due to washing clothes, shoes, vegetables, fruits and many others. Chemical contaminants in grey water are from cleaning and cooking purposes. The main chemical contaminants found majorly in grey water which is generated as a result of cleaning or washing activities are surfactant. Biological contaminant contained in grey water includes micro organisms such as bacteria, protozoa and helmith. (Michael - oteng Peprah, Mike Agbesi Acheampang and Nanne k Devries, 2018). In a study carried out by 'Fangue Li Knut and Raff Otterpoll (2009) Technologies applied for treating grey water includes physical, chemical and biological treatment systems. Soil filtration, coarse sand and filtration of membrane are a part of physical treatments; soil filtration removes organic pollutants and total phosphorus partially. The filtration of membrane helps in the removal of the suspended solids, turbidity and pathogens. The chemical process for the treatment of grey water include coagulation, photo - catalytic oxidation, biological treatment include the process of Rotation Biological Contactor (RBC) Sequencing Batch Reactor (SBR), Anaerobic sludge blanket (UASB) Constricted wetland (CW) and Membrane Bioreactor (MBR). There are several risks into using of Grey water specifically with public health issues. According to study undertaken by 'Juliane D. Kaercher and Blair E. (2003) ' the potential lethally of pathogens in Grey water and then impact of chemicals can affect human health. The occurrence of health issue will be one in a million whereby it raises the difference between the public and the Experts. For example according to the experts health risk occurred to one in a million can be acceptable but according to the public it might not be acceptable because that one in a million can occur to one of their family. Global effect on heath by using grey water has been examined but the studies are inconclusive. Advantages and disadvantages of using grey water in irrigation includes Development of soil Hydrophobicity (Chen et al, 2003), reduction of soil hydraulic conductivity by the surfactants or food based oils (Travis et al, 2008), Increase of pH in soils and reduced availability of some micronutrients for plants (Cristova - Boalet al, 1996), Enhanced contamination transport (Grabber et al, 2001). A study has shown that laundry grey water has a potential for reuse as irrigation water to grow tomato (Misra, 2010). Laundry detergents are essential and beneficial to plants particularly nutrients (Misra, 2010). In a study undertaken by Andre Martin Dixon, (2000) shows that small scale local domestic water reuse has the potential to make a significant contribution to water conservation. In a study undertaken by Josh Byrne, Steward Dallas and Goen Ho (2020) have demonstrated the impact that increased water efficiency can have on reducing grey water volumes requiring other sources to fill the demand. Conversely, it has been shown that poor water use behavior by householders can lead to determine impact on soil and local ground water.

2.1 Research Gap

According bh the Existing literature available majority of the studies undertaken on grey water focuses on the various reuse purposes, the socio - e conomic benefits, the treatment systems of grey water. The studies recognizes the gap of the utilization purposes of grey water but very few in depth studies have been conducted on the public perception of grey water and the different factors that lead to the influence and intercede peoples making decision. Furthermore, impact of information nudge on grey water preference is understudied.

2.2 Statement of the Problem

Water is a basic necessity of life however several problems facing from the less availability of water has led to various alternative approaches in the usage of water. Grey water is one of the important alternative sources which could be used for variety of application to areas suffering from water scarcity. Although there are various treatments and techniques implemented for grey water, the various purposes of using grey water, the environmental benefits the study will be focused on the causes of water scarcity the problems because of water scarcity and the potential to see the Eco - feasibility of using grey water as an alternative source of water and test if nudges work to encourage the generation of grey water.

2.3 Objectives of the Study

1. To analyze the major causes and problems of water scarcity in Kohima
2. To study the feasibility of grey water generation and usage for better management of water resource in Kohima.

2.4 Research Questions

1. What are the major causes of water scarcity and the leading problems of water scarcity in kohima?
2. What is the level of social awareness of water scarcity and grey water?
3. Could information nudge about water scarcity and grey water shift the behavioral preference of water requirement for better management of water resource?
4. Is comparative nudge more effective than information nudge in altering the behavioral preference of the respondents?

2.5 Hypothesis

In this section the hypothesis for this study has been stated. Both the null and alternate hypothesis is related to the second objective.

Null Hypothesis (H0): Consumption of water does not change after Information nudge

Alternate Hypothesis (H1): Consumption of water do change after Information nudge.

Null Hypothesis (H0): Comparative nudge is not effective than information nudge.

Alternate Hypothesis (H1): Comparative nudge is more effective than information nudge.

2.6 Research Design

2.6.1 Type of study

The current study is descriptive and experimental in nature. The first part of the study deals with a description on the various causes of water scarcity, the problems faced by the people due to water scarcity and the different usages of grey water in kohima city of Nagaland. It also seeks to associate the environmental consciousness and the awareness on water scarcity and the choices leading to the use of grey water. The second part of the study deals with the comparison on the feasibility of generating grey water by examining the maximum and minimum requirement of water per bucket per day. We also examine the role of socio - demographic play on the choices of water requirement per day by running a co - relation test and furthermore, the effectiveness of information nudges about water scarcity and grey water. We do this by comparing the respondent's willingness to change on their requirement of water per bucket per day before information nudge and after information nudge.

2.6.2 Theoretical Framework

The paper was carried out on the neoclassical model of behavioral economic theory that questions the assumption of rational decision making. Rational behavior refers to a decision making process that is based on making choices that result in optimal level of benefit or utility for an individual. The assumption of rational behavior implies that people would rather take actions that will benefit them rather than bringing harm on them. Behavior economics acknowledges the psychological insight to explain human behavior that people are emotional and easily distracted, and therefore their behavior does not always follow the prediction of economic model. Nudge theory is a concept of behavior science that proposes positive reinforcement and indirect suggestions as ways to influence the behavior and decision making. A nudge is as any aspect of the choice architecture that alters people's behavior in a predictable way without forbidding any options or significantly changing their economic incentives. Nudge is more generally applied to influence behavior.

The paper is focused on the role of information nudge in rational decision making. An economic factor uses both existing knowledge and additional information in assessing the options. Water is a renewable resource and due to its scarcity people are doing various steps to inculcate water in their daily uses an example can be recycling and reuse of grey water. Management of water has become a requirement on this day and age and to alter people's behavior on their daily intake and usage of water can be carried out with the behavioral economic concept of nudge theory.

2.6.3 Study Area, Sampling Design and Data Collection

The study was conducted across kohima city Nagaland through stratified random sampling. Primary data for the first part was collected via stratified random sampling method. The sample size of the study is 100 young adults falling in the age group 20 - 30. Primary data for the second part was collected via online survey method. The sample size of the current study is 40. The study ensured to capture the heterogeneity in the population in terms of gender, occupation and income among the respondents. The data was collected in the time duration of September 2020.

2.6.4 Data Analysis Tools

The first objective focused on the descriptive analysis on the various causes of water scarcity, the problems faced because of water scarcity, and the several purposes of grey water. For the second objective pear son's co - relation test was used to see the relation between the different amounts of water required on a daily basis and also to associate with the environmental consciousness on the feasibility for the generation of grey water. Pearson's co - relation test was also used to see the relation between the socio - demographic profiles. T - tailed paired sample test was applied to see the difference in the two sample mean and one tailed t - test was applied to test significance value.

2.6.5 Significance of the study

Water is a very required vital source for all living beings which has an environmental impact that cannot be ignored and now with the growing and increasing population, industrialization, urbanization water has become a scarce commodity and people all around the world has started using various recycling techniques to manage water scarcity. Grey water is one the best alternative source to tackle water scarcity and its practices has been going on in an around the parts of the world that are suffering from water scarcity. India is also among one of the country that suffers water scarcity and the use of waste water has been in practice for years. The Indian Government has also adopted policies and organizations to address the ongoing problems of water scarcity and adopt steps to save clean drinking water and implement the use of waste water. Nagaland is also among one of the states of India where water scarcity has taken its grip especially during dry season of the year and the residents from various districts has been following up with the practice of using Grey water to manage water scarcity. The Nagaland government has also initiated programmes and organizations to provide fresh water. However little attention has been paid to the steps to adopt and implement for the better management of water resource that can save clean drinking fresh water and opt for the alternatives use of grey water. The study attempts to fill the gap in our understanding of the various causes and problems of water scarcity and behavioral factors that can influence the willingness to reduce daily water requirement and opt more for the choice of using grey water to tackle water scarcity. The study also throws light on the social awareness of water scarcity and the steps leading to the use of grey water.

3. Major Causes and Problems of Water Scarcity

This chapter aims to give a description on the various major causes of water scarcity and also the several problems the people of kohima faces due to water scarcity. Water is a scarce resource and now, people are facing plenty of problems not only environmentally but also economically. This chapter examines the main major causes and problems of water scarcity across socio - demographic categories such as gender, Occupation and family income and provides a description on the economic problems of water scarcity. Frequency distribution tables and pie charts have been used for this purpose.

3.1 Socio - demographic characteristics of the Respondents

The table below helps us to understand the composition of the sample based on three socio - economic characteristics namely Gender, Occupation and Family Income per annum.

Socio –economic variables	Category	Frequencies/ percent	Total
Gender	Male Female	70% 30%	100
Occupation	Student Unemployed Government Employee Private Teacher	40% 38% 7% 15%	100
Family Income (per annum)	10, 000 - 50, 000 50, 000 - 1, 00, 000 1, 00, 000 and above Did not Respond	18% 54% 06% 22%	100

Source: Based on Primary data

The table shows the variables for the different socio - demographic profile categorized into Gender, Occupation and Family Income. The population is divided in their own socio - economic variable. The gender includes 70 percent male and 30 percent female. The occupation category is divided into four categories that include student 40 percent, Unemployed 38 percent, Government Employee 7 percent and private teacher consisting of 15 percent. The Family income divides the population into four class intervals under which 18 percent are from the

income group 10, 000 - 50, 000 per annum and 50, 000 - 1, 00, 000 per annum includes 54 percent.06 percent from the income group 1, 00, 000 and above. However 22 percent of the respondents did not disclose their family income.

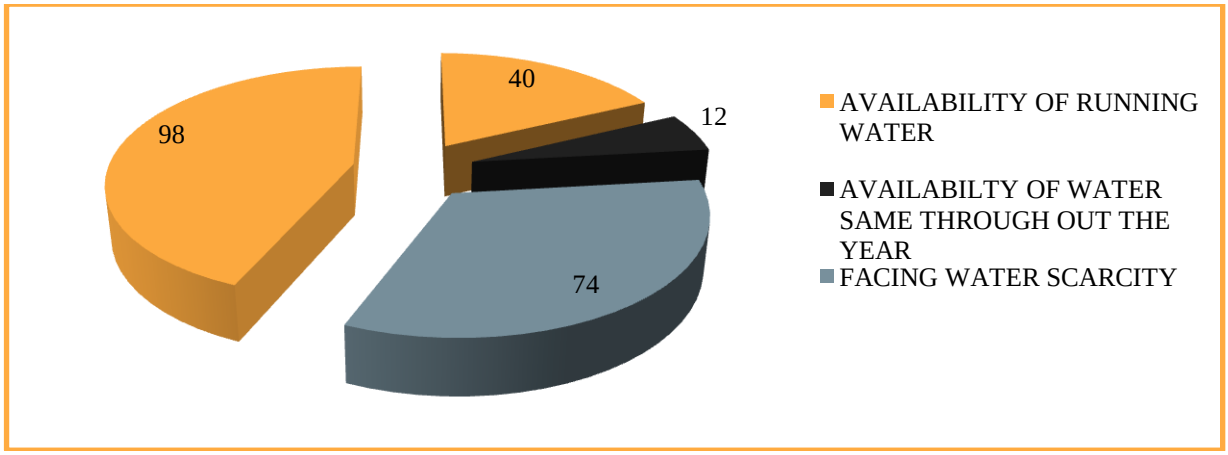

Figure 3.1: Extent of water scarcity

Source: Based on primary data

The figure above shows the different extent of water scarcity in kohima.40 percent of respondents have the availability of running water at their houses and out of the 40 percent respondents only 12 percent of respondents have the availability of running water throughout the year.74 percent of the respondents face acute water scarcity and 98 percent of the respondents face different problems because of water scarcity.

3.2 Main causes of water scarcity in kohima:

The Water Sources Are Desiccating

Structuring and evaluating the costs and benefits of changes to the economy and allocating the resources play an important role that determines the overall well being of the society, Government intervention to improve the welfare of the society. However less government intervention on providing sources and weak allocation of water resources has brought about significant decrease on the availability of water to the people hence becoming a hindrance in the welfare of the society. Water sources of kohima are Phesama, Jotsoma and Dzuna the PHED Public Health Of Engineering Development is the main organization looking after water supply in kohima. During the lean month from January to June the supplies of all the sources in kohima become uncertain, irregular erratic and meager in quantity. The government water supply never meets the need of the public. The water management programme carried out by the Government of Nagaland is as follows:

In Nagaland traditional ownership system organized by customary laws is directly related to the management of water resources. The main occupation in the state is agriculture with over 70% population in rural areas. According to the state census (2011). The state has a pre - dominant population in rural areas which stands at 71% living in villages. In Nagaland it has been a challenge to develop protect and manage water resources due to its topography. It still has not been able to connect many villages and even distant towns with proper drinking water supply facility. As a result many of the people in Nagaland still is dependent on their own streams and wells for their water needs, After the statehood in 1963 Government have started and implemented many programmes such as Public Word Department, Rural Development Department and Agriculture Department etc. it was the public work Department that provided piped water supply system in some of the Rural and urban areas in Nagaland. Around 3% area of Nagaland the supply water coverage is not provided. It is so because there is no water source with feasible distance or the feasibility is only pumping of water. pumping schemes might be feasible technically but not sustainable nor viable. The state Government presently works with this framework for the implementation of water sector plans and policies:

Public Health Engineering Department (PHED)

Public Health Engineering Department was separated from the former PWD and became a fully fledged Department in 1974. The PHED is responsible of providing safe and potable drinking water supply, safe disposal of solid and liquid waste and environmental hygiene. The Department is constantly striving to augment the existing water supply systems, regulate water supply, regulate proper water distribution, manage water sources, implement roof top water harvesting, Refresh traditional wells in water scarce areas and providing material and financial assistance to water and sanitation committees managing water supply systems to further the provision of providing safe, adequate and sustainable drinking water.

Soil and Water Conservation Programmes

The Department of soil and water conservation is an Agriculture and Allied Sector Department. It was separated from the Department of Agriculture and duly established as a full - fledged Department in 1968. Since its establishment the department has grown both in manpower and infrastructure as well as development activities. The policy of the Department is therefore to put

the land to optimum use and treating them as per their needs to develop, conserve and manage natural resources like land and water and by adopting appropriate soil and water conservation measures in an integrated manner on water - shed basis. The Department is to bring about sustainable development in harmony with nature through proper development and utilization of natural resources. The key objective "Scientific Development conservation and Management of land and water Resources for sustainable Economic Development and healthy Natural Environment the State" has been implementing schemes by taking up various oriented activities. i. e land development in the form of bench terracing, half moon terracing, contour etc.

Department of Irrigation and Flood Control

The Irrigation and flood control department in Nagaland was created in Agriculture Department in April 1988 as an Engineering Department to take up various works in irrigation sector, flood mitigation and erosion control in the state. The vision and the mission of the Department is;

1. To create irrigation potential through surface and ground water for sustainable development.
2. To alleviate flood erosion problem.
3. To have fare sustenance through all round water resources development.
4. To create infrastructure facilities for sustainable region.
5. To alleviate the flood and erosion problem of important assets and landed properties.

Nagaland Pollution Control Board

The Nagaland Pollution Control Board monitors the discharge of sewage and trade effluents in rivers or streams as per laid down standards. The department has taken Initiative under special campaigns to monitor water quality in three rivers in Nagaland, namely, Dhanasiri in Dimapur, Chathe in Medziphema and Dzu - u in Kohima. According to a report of the Central Pollution Control Board, it has 28 Water Quality Monitoring Stations in Nagaland, with 16 rivers; 2 Lakes, 10 Groundwater tested 18 times per year and another 10 half yearly monitoring through stations in States.333 The main source of funding of these activities is the National Water Quality Monitoring Programme (NWMP).

Lack of Investment in Rainwater Harvesting

The Economic benefits of rain water harvesting are in manifolds ranging from reduction in the usage of potable water to reduction in the purchasing cost of water thereby leading to savings, whole costs of communities reduced greatly. Structuring and evaluating cost and benefits plays an important role for the economy to function properly however due to the proper lack of investment in making cemented potholes, sintex tanks, inefficient water management, lack of adequate preservation, effort to harvest the free gift of nature and various other sources to harvest water. It has become one of the major causes of water scarcity in kohima failing to provide the environment and the economic benefits. Kohima is a place that is situated fairly at high altitude and the climatic conditions are pleasing. The summer is accompanied by fairly heavy rainfall (June to December). The Adaptation strategies implemented by the Government of Nagaland for storing excess water are noted down as follows:

The National water policy in consultation with the states aims to implement basin level management strategies to deal with variability in rainfall and river flows due to climate change Creation in the investment of storages for both above and ground water, rainwater harvesting with efficient management strategies. The main aim of this policy is to provide effective strategies and enhancing structures of water storage during heavy rainfall and increase in effect of precipitation. A comprehensive list of activities carried out in accordance is given below.

Increase in the storage capacity by building water reservoirs in rural and urban areas: Villages in the state is known for the strategies applied for rain water harvesting. There is perennial shortage of water in the villages and one of the strategies is to construct roof top rain water harvesting tanks. The PHED can extend its work on the effectiveness of water storage in rural households under various programmes like exploring the traditional water harvesting methods.

Zabo: Zabo meaning 'impounding run - off water' is a conservation system practiced in Phek district of Nagaland. The villages that are situated above the River water level practice this system for domestic and irrigation purposes. it is practiced during the monsoon season when rainwater is collected in pond like structures in hilltops whereby then it used to distribute and run - off to different purposes like growing paddy and fish farming.

Bamboo drip irrigation and Cheo - Ozihi - Bamboo drip irrigation and Cheo - ozihi both are similar conservation of water that rely on bamboos. It is a method adopted by the Angami tribe village in Nagaland. Tribal farmers of this region developed a system for irrigation in which water from the springs is diverted to the terrace fields using varying sizes and shapes of bamboo pipes. The cost for making the structure can be finance through loans and subsidies from the government at a lower rate of interest. More investment by the government in such kind of activities by providing certain structures and strategies to conserve water harvesting can enhance the economy. The government should act as a facilitator for this type of small project.

Increase irrigation potential of the state: The irrigation potential of the state can be enhanced by accelerating the implementation of medium and small irrigation projects that have been planned and by storing the excess water in structures along the streams. The department of Irrigation and flood control can make an assessment of the excess water that is likely to be received and construct reservoirs and make certain devices that can control the flow of water for irrigation from the water storage tanks.

Enhance water use efficiency in urban households: Limited urban areas are metered to regulate water use

efficiency in the state. Water tax is also levied on the consumers in accordance to Nagaland Consumer Rule 1998. A efficient charges on the tax levied on the consumers can definitely help in sustainable utilization of water by this category.

Increase in Population and Urbanization

Students and Govt. employees migrating from various districts of Nagaland and the rapid growth of urbanization is giving rise to the usage of fresh water whereby, leading to increase in the demand of fresh water hence putting pressure in the availability of the resource. The relationship between increasing population growth and economic development has always been a topic for debate for a long time. Now, economic development can be said and understood by the quality of life of the citizens and also the population being improved whereas population growth can be defined as a numerical increase in people. Malthus explains that an increase in population with limited land resource is likely to lead to a set in diminishing return. If one input in the commodity is increased while other inputs are fixed or constant it will at some point return lower output per incremental input yield. Which means with the increase in the population and the level of water provided being fixed; eventually the water level will start decreasing.

Changes in Lifestyle

Moving to a Sustainable economy does require lifestyle changes. Sustainable development would mean development that meets the need of the present without compromising the ability to meet the future needs. Lifestyle is a set of behaviors presented by people, families and societies and sustainable economy will mean a better production and useful services provided to those people, families and society however due to the unsustainable economy in keeping and maintaining of resources has brought about an effect in the water as an resource. Lifestyle changes from constructing more buildings and apartments, growing in the number of families. Consumerism has brought about society waste in money and energy. Consumerism is a factor to waste economic capital.

3.3 Problems faced due to water scarcity

The table below helps us to understand the problems faced by the respondents due to water scarcity. It gives a clear picture of the different problems caused because of water scarcity.

Variables	Category	Frequencies/percent	Total
Problems	Washing clothes and laundry	30%	100
	Cooking purposes	10%	100
	Personal hygiene use	36%	100
	Washing dishes and utensil	12%	100
	Purchase water	07%	100
	Greenery and Gardening use	05%	100

Source: Based on Primary data

The above table provides the different categories of problem faced by the respondents of kohima due to water scarcity.30 percent face problems in washing clothes and doing laundry.10 percent face problem on cooking purposes.36 percent face problem with their personal hygiene use.12 percent face problem with Washing dishes and utensils.07 percent have to purchase water and 05 percent face problem with greenery use.

Feasibility of Grey Water and Better Management of Water Resource

This chapter deals with the second objective of the study which aims to experiment the better management of water resource and also deals with the feasibility of using grey water as alternative source in kohima. Water is a scarce resource and now, people are facing plenty of problems not only environmentally but also economically which has led to several recycling techniques and treatment to tackle water scarcity of which re - using of grey water is the most convenient approach. This chapter examines the effectiveness of information nudge on the willingness to reduce daily water requirement pre and post information nudge and also make a comparison on the average number of family per household on their willingness to reduce water requirement. It also investigates the level of social awareness of water scarcity and grey water and how feasible it is to use grey water. Frequency tables bar charts, t - test paired sample data and one - tailed t test is used for this purpose.

3.4 Socio - demographic characteristics of the Respondents

The table below helps us to understand the composition of the sample based on three socio - economic characteristics namely Gender, Occupation and Family Income per month.

Socio - economic variables	Categories	Frequencies	Percent	Total
Gender	Male Female	15 25	37.5% 62.5%	40
Occupation	Student Teacher Government Employee Unemployed	21 9 05 05	52.5% 22.5% 12.5% 12.5%	40
Income (per month)	10, 000 and Below 10, 000 - 20, 000 20, 000 - 30, 000 30, 000 - 40, 000 40, 000 - 50, 000 50, 000 and above	18 07 08 03 02 02	45% 17.5% 20% 7.5% 5% 5%	40

Source: Based on Primary Data

The table shows the variables for the different socio - demographic profile categorized into Gender, Occupation and Family Income. The population is divided in their own socio - economic variable. The gender includes 37.5 percent male and 62.5 percent female. The occupation category is divided into four categories that include student 52.5 percent, Unemployed 12.5 percent, Government Employee 12.5 percent and private teacher consisting of 22.5 percent. The Family income divides the population into six class intervals under which 45% are from the income group 45 percent 17.5 percent are from the income group 10, 000 - 20, 000 per month and 20, 000 - 30, 000 per month includes 20 percent.7.5 percent from the income group 30, 000 - 40, 000, 5% from the income group 40, 000 - 50, 000 and 5 percent from the income group 50, 000 and above.

3.5 Management of water by socio demographic characteristics (Gender, Occupation and income)

The table below helps us to understand the relationship between the socio - economic variables and their management of water in terms of maximum and minimum requirement of water per bucket per day pre and post information nudge. Pearson's correlation is applied to examine the relationship.

Socio - economic variables	Categories	Frequencies	Percent	Correlation on the maximum number of water requirement per day pre and post information nudge	Correlation on the minimum number of water requirement per day pre and post information nudge
Gender	Male Female	15 25	37.5% 62.5%	0.87 0.94	0.82 0.95
Occupation	Student Teacher Government Employee Unemployed	21 9 05 05	52.5% 22.5% 12.5% 12.5%	0.97 0.54 0.66 0.66	0.96 0.89 0.87 0.86
Income (per month)	10, 000 and Below 10, 000 - 20, 000 20, 000 - 30, 000 30, 000 - 40, 000 40, 000 - 50, 000 50, 000 and above	18 07 08 03 02 02	45% 17.5% 20% 7.5% 5% 5%	0.95 0.89 0.53 0.5 0 0	0.94 0.90 0.86 1 0 0

Source: Based on Primary Data
Pearson's Correlation coefficient

$$\mathbf{r}= \frac{\sum(x-\bar{x})\,(y-\bar{y})}{\sqrt{\sum(x-\bar{x})^2\,(y-\bar{y})^2}}$$

The table above shows the co - relation between the socio - demographic variables and their maximum and minimum requirement of water pre and post Information nudge. Almost all the categories show strong positive co - relation. When two variables move in the same direction it is said to be positive co - relation conversely when two variables move in the opposite direction it is said to be negative correlation coefficient. If the maximum and minimum requirement of water per day changes in the same direction after information nudge than there is positive strong co - relation if they change in the opposite direction than there is negative or weak co - relation. Negative or weak co - relation means reduction in the variables post information nudge. In the gender variable the male category shows strong positive correlation with 0.87 in the maximum and 0.82 in the minimum water requirement. The female category also shows strong positive co - relation with 0.95 in the maximum and 0.94 in the minimum requirement of water. That means not all the respondents in the gender category will reduce their maximum and minimum usage of water per day after providing them with the suitable information on water scarcity (nudge theory applied). In the occupation variable all the categories show strong to moderate positive co - relation with the teacher category showing a moderate co -

relation of 0.54 in the maximum requirement of water which means not all the respondents from the teacher category will reduce their intake of water requirement per day even after providing them with the suitable information on water scarcity. In the income variable the correlation in the minimum requirement shows perfect positive correlation which means that none of the sample population is willing to reduce their requirement of water after nudge theory is applied. However, in the income category of 40, 000 - 50, 000 and 50, 000 and above the correlation is zero which means that there is no relationship. Meaning that all the respondents in the income category of 40, 000 - 50, 000 and above 50, 000 all the respondents are willing to reduce their maximum and minimum requirement of water per bucket per day after information nudge is applied. It shows that the higher the income is the more thee respondents are willing to reduce their water requirement as compared to respondents in the less income category.

3.6 Environmental Awareness

Water scarcity is a lack of sufficient water or not having access to safe water supply. The scarcity is spreading and people across the world have opted recycling of water to deal with water scarcity and grey water has been the cheapest and most convenient source to tackle water scarcity. This section deals on investigating the level of awareness on water scarcity and water recycling and the social awareness on grey water.

It also investigates the different purposes of grey water the sample population are making use of and provides an insight to the generation of grey water and how feasible it is to use as alternative source.

3.6.1 Level of Awareness of Water Scarcity

The section focuses on the level of awareness of the sample population about water scarcity.

Variables	Category	Frequencies	Percent	Total
Level of Awareness	Aware	34	85%	40
	Not Aware	06	15%	40

Source: Based on Primary Data.

The above table shows the level of awareness of water scarcity in a frequency table. In the sample size 85% revealed that they were aware of water scarcity and 15% revealed that they were not aware of water scarcity.

3.6.2 Level of Awareness of Water Recycling

The section focuses on the level of awareness of the sample population about water recycling.

Variables	Category	Frequencies	Percent	Total
Level of Awareness	Aware	36	90%	40
	Not Aware	04	10%	40

Source: Based on Primary Data.

The table above shows the level of awareness of water recycling in a frequency table.90% revealed of the sample size showed positive awareness and 10% of the sample size did not.

3.6.3 Level of Awareness of Grey Water

The section focuses on the level of awareness of the sample population about Grey water.

Variables	Category	Frequencies	Percent	Total
Level of Awareness	Aware	14	35%	40
	Not Aware	26	65%	40

Source: Based on Primary Data.

The above table provides the level of awareness of grey water (note - even though the sample size was using grey water they were not aware of the term grey water).35% showed level positive awareness and 65% revealed that they were not aware.

3.6.4 Level of Awareness of Waste Water Benefits

The section focuses on the level of awareness of the sample population about Grey water benefits and whether the sample population is using grey water to tackle water scarcity.

Variables	Category	Frequencies	Percent	Total
Level of Awareness	Aware and using	30	75%	40
	Not Aware	10	25%	40

Source: Based on Primary Data.

The table above reveals the level of awareness of grey/waste water benefits in a frequency table.75% revealed that they are aware of the benefits and that they are using grey water.25% of the sample size was not aware of the benefits of using grey water.

3.7 Different purpose of grey water

By the result of the above table the table below reveals the different purposes of grey water used by the sample population.

Variables	Category	Frequencies	Percent	Total
Purposes	Toilet flush	12	40%	30
	Floor mopping	06	20%	30
	Washing clothes	04	13.33%	30
	Room cleaning	05	16.66%	30
	Gardening/Irrigation	03	10%	30

Source: Based on Primary Data.

The table above reveals the different purposes of using grey water by the sample size in a frequency table.40% revealed that they use it for toilet flush, 20% revealed that they are using if for washing clothes, 13.33% revealed that they are using for washing clothes, 16.66% revealed that they are using for room cleaning, 10% revealed that they are using for gardening. The frequency table reveals that the highest use purpose of grey water is for toilet flushing.

Existing literature review states that the generation of grey water depends mostly on lifestyle. The generation rates are usually predictable, however vary slightly between person to person, the amount of grey water that discharges from the household activities vary differently from a several hundred per person per day. The living condition of kohima varies differently, even though kohima is the capital city of Nagaland it is still a developing city let alone the state itself being a developing state it is still very underdeveloped. Facing the global challenge of water scarcity, many countries and organization have raised their awareness of water shortage and proposed effective policies to reduce water usage. Grey water has a high potential for recycle and reuse to provide sufficient quantity of water for human beings. Physical water is not enough for the people of kohima, Above all economic water scarcity is by far the most disturbing form of water scarcity because it is entirely a lack of compassion and good governance, lack of monetary means to provide necessary implementation of structures and storage has also been one of the main causes of water scarcity that has led the people of kohima to vouch for more use of grey water to tackle water scarcity. Grey water contains traces of dirt, food, grease, hair and certain household cleaning products. While grey water may look dirty it is still a safe and even beneficial source of irrigation water in a yard suitable for growing trees, and food crops. As can be seen in the table above that 10% of the sample population use for gardening/irrigation, using grey water for plantation is a very valuable fertilizer. Grey water utilization is also beneficial for saving water not only for saving water but is also beneficial in saving money for water bill. In the first objective a frequency table showed that 7% of the sample population face problem in purchasing water. More usage of grey water can help in the reduction of purchasing water. The most suitable use of grey water is the extraction of water from laundry that can be used to flush toilets as revealed in the table above 40% of the sample population use grey water for toilet flushing. Sources of grey water are applicable to all in their household activities. Water that comes from washing machines, kitchen basins, sinks, bathroom showers, etc are some of the most common grey water that most people encounter on a daily basis. Essentially, any water other than toilet wastes draining from a household is grey water. Studies has found out that approximately 50 - 70% of the water used in household activities result in grey water generation, Seen in the above table 75% of the sample population use grey water for different purposes. In the Indian context there also has been rising awareness on the usage of grey water as alternative source to reduce water scarcity. For e. g. - The Chennai metro water supply and Sewage board is championing the supply of treated grey water to industries to reduce the pressure on fresh water.

3.8 Better Management of Water Resource

This section deals with the main objective of the study which is to study the effectiveness of information nudge on the willingness to change and reduce water requirement per day. Willingness to change in economic terms is a shift in the consumer's desire to purchase a good or service regardless of variation in its price. Thus change could be triggered by a shift in the level of income, taste and preference. Information nudge about water scarcity was provided to the sample population to educate the respondents and helping them make more informed and make them more conscious of the choices and decisions to make. The information nudge was applied to see whether the respondent's behavior of choice can be altered without forbidding any options or significantly changing their economic incentives.

The study was conducted using online survey method a long written paragraph note and e - poster of water scarcity and using of grey water was provided and shown to the sample population. The different countries that are majorly suffering from water scarcity and also giving reference to Indian context with Nagaland as a sate suffering from water scarcity and the different provisions and organizations the government has formulated to tackle water scarcity. The effect of nudge is measured through the stated preference of the respondents with respect to their willingness to reduce their daily maximum and minimum requirement of water post information nudge.

3.8.1 Willingness to reduce the maximum requirement of water per day post Information nudge

Variables	Category	Frequencies	Percent	Total
Willingness to reduce	Willing to reduce	30	75%	40
	Not willing to reduce	10	25%	40

Source: Based on Primary Data

The above table provides the result on the willingness to reduce water requirement per bucket per day post information nudge in a frequency table.75% showed positive result post information nudge and that they are willing to reduce their daily maximum water requirement if provided with the suitable information of water scarcity and the different problems caused because of water scarcity. However even after providing the information post information nudge 25% of the sample population are not willing to reduce their water requirement.

3.8.2 T - Test: Paired Two Sample for Mean

T - test was tested to compare the means of the two samples. Maximum requirement of water pre and post information nudge.

	Maximum requirement of water pre information nudge	Maximum requirement of water post information nudge
Mean	**5.525**	**4.05**
Variance	19.07628205	9.433333333
Observations	40	40

Source: Based on Primary Data.

The above table shows the mean of the two paired sample maximum requirement of water pre and post information nudge. The mean of the maximum requirement of water pre information is 5.25 and the mean of the maximum water requirement post information nudge is 4.05. There is a strong decrease in the mean value post information nudge. That means the sample population is willing to reduce the maximum daily water requirement post information nudge.

3.8.3 Willingness to reduce the minimum requirement of water per day post Information nudge

Variables	Category	Frequencies	Percent	Total
Willingness to reduce	Willing to reduce	22	55%	40
	Not willing to reduce	18	45%	40

Source: Based on Primary Data.

The table above reveals the frequency result on the willingness to reduce the minimum requirement of water post information nudge.55% of the sample population are willing to reduce their minimum daily requirement post information nudge but 18% of the sample population are not willing to reduce their daily minimum requirement post information nudge.

3.8.4 T - Test: Paired Two Sample for Mean

T - test was tested to compare the means of the two samples. Minimum requirement of water pre and post information nudge.

	Minimum Water Requirement Post Information Nudge	Minimum Requirement Post Information Nudge
Mean	**2.775**	**2.05**
Variance	5.460897436	2.612820513
Observations	40	40

Source: Based on Primary Data.

The above table shows the mean of the two paired sample minimum requirement of water pre and post information nudge. The mean of the minimum requirement of water pre information is 2.775 and the mean of the maximum water requirement post information nudge is 2.05. There is a decrease in the mean value post information nudge. That means the sample population is willing to reduce the minimum daily water requirement post information nudge.

3.8.5 Co - relation of the sample population in the maximum and minimum requirement of water per bucket per day pre and post Information nudge.

This section deals with the co - relation of the sample population in the maximum and minimum requirement of water pre and post information nudge. Pearson co - relation is applied to examine the relationship.

Category	Total	Correlation on the maximum number of water requirement per day	Correlation on the minimum number of water requirement per day
Respondents	40	0.93	0.93

Source: Based on Primary Data.

The table above shows the Pearson co - relation in the maximum and minimum requirement of water per day. Both the co - relation shows strong positive co - relation of 0.93 in the maximum and 0.93 in the minimum requirement meaning the variables are moving in the same direction.

3.8.6 One Tailed t - test

One tailed t - test is applied to test the significance value.

H0: Consumption of water does not change after information nudge.

H1: Consumption of water does change after information nudge.

	P (T<=t) one - tail
Maximum requirement of water per bucket per day	**5.63927E - 06**
Minimum requirement of water per bucket per day	**1.8958E - 05**

Source: Based on Primary Data.

The above table reveals the p - value of the pre and post information nudge of the sample size through one tailed t - test. The p - value of the maximum requirement of water pre and post information nudge stands at 5.6397e - 06 which is very small than the significant value 0.05, that means it is statistically significant. Therefore, we reject the null hypothesis and accept the alternative hypothesis. The p - value for the minimum requirement of water pre and post information nudge stands at 1.8958e - 05 which is also very small than the significant value 0.05, that means it is statistically significant. Hence, we reject the null hypothesis and accept the alternative hypothesis.

3.9 Comparative Nudge

After analyzing the information nudge we carry the study forward by making a comparison in the better management of water resource in the average number of families per household of the sample population. The

average number of families per household in the sample population is 5. The comparison nudge is carried out to check the effectiveness of better management of water resource whether the information nudge is more effective in altering the respondents willingness to reduce water requirement or comparative nudge is more effective in altering the respondents willingness to reduce water requirement.

3.10 Socio - demographic characteristics of the Respondents

The table below helps us to understand the composition of the sample based on three socio - economic characteristics namely Gender, Occupation and Family Income per month.

Socio - economic variables	Categories	Frequencies	Percent	Total
Gender	Male Female	6 10	60% 40%	10
Occupation	Student Teacher Government employee	5 4 1	50% 40% 10%	10
Income (per month)	10.000 - 20, 000 20, 000 - 30, 000 30, 000 - 40, 000	5 4 1	50% 40% 10%	10

Source: Based on Primary Data.

The above table provides the socio - demographic profile of the sample population in a frequency table. In the gender category 60% are male and 40% are female. In the occupation category 50% are students, 40% are teacher and 10% are government employee. In the income category 50% are from the category 10, 000 - 20, 000, 40% are from the category 20, 000 - 30, 000 and 10% from the category 30, 000 - 40, 000.

3.11 Management of water in the average number of members in a household by socio demographic characteristics (Gender, Occupation and income)

The table below helps us to understand the comparison in the relationship between the socio - economic variables and their management of water in terms of maximum and minimum requirement of water per bucket per day pre and post information nudge. Pearson's correlation has been applied to examine the relationship.

Socio - economic variables	Categories	Frequencies	Percent	Correlation on the maximum number of water requirement per day	Correlation on the minimum number of water requirement per day
Gender	Male Female	6 10	60% 40%	0.29 0.33	0.5 1
Occupation	Student Teacher Government employee	5 4 1	50% 40% 10%	- 0.16 0.57 0	0.61 0.57 0
Income (per month)	10.000 - 20, 000 20, 000 - 30, 000 30, 000 - 40, 000	5 4 1	50% 40% 10%	- 0.16 0.57 0	0.61 0.57 0

Source: Based on Primary Data.

The table above shows the co - relation between the socio - demographic variables and their maximum and minimum requirement of water pre and post Information nudge. When two variables move in the same direction it is said to be positive co - relation conversely when two variables move in the opposite direction it is said to be negative correlation coefficient. If the maximum and minimum requirement of water per day changes in the same direction after information nudge than there is positive strong co - relation if they change in the opposite direction than there is negative or weak co - relation. Negative or weak co - relation means reduction in the variables post information nudge. In the gender category both male and female show co - relation of 0.29 and 0.33 in the maximum requirement of water post information which is not so strong and in the minimum category the co - relation is 0.5 for male and 1 for female, Which means that in the female category there is no willingness of reduction post information nudge. In the occupation category the student category showed - 0.16 and the government employee showed co - relation of 0 that means there is zero to no co - relation which means the student and the government employee category are more willing to reduce their water requirement as compared to the teacher category. In the income category the income category of 10, 000 - 20, 000 and 30, 000 - 40, 000 showed a co - relation of - 0.16 and 0 which means that they are more willing to reduce their daily water requirement as compared to the income category 20, 000 - 30, 000.

3.12 Management of Water Resource

This section deals with the main objective of the study which is to study the effectiveness of comparative nudge by making a comparison of the average number of

families on the willingness to change and reduce water requirement per day. Willingness to change in economic terms is a shift in the consumer's desire to purchase a good or service regardless of variation in its price. Thus change could be triggered by a shift in the level of income, taste and preference.

3.12.1 Willingness to reduce the maximum requirement of water per day post Information nudge

Variables	Category	Frequencies	Percent	Total
Willingness to reduce	Willing to reduce	6	60%	10
	Not willing to reduce	4	40%	10

Source: Based on Primary Data

The above table provides the comparison result on the willingness to reduce the maximum water requirement per day on the average number of families in the sample population.60% showed willingness to reduce and 40% showed not willing to reduce.

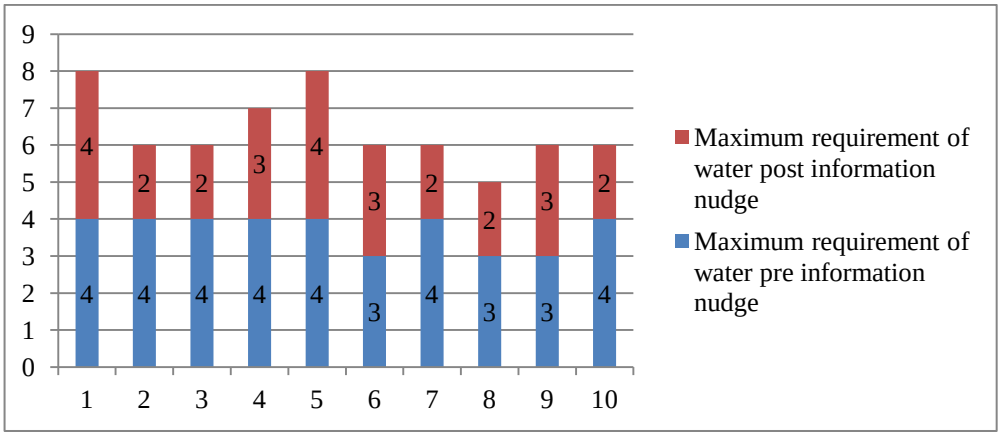

Figure 3.2

Source: Based on Primary Data.

The above bar chart provides the willingness to reduce maximum water requirement post information of the average number of families. The blue color chart shows the number of maximum bucket requirement pre information nudge and the red color chart shows the number of water requirement post information nudge. The efficient number of buckets water requirement post information nudge is 2.

variables	category	frequency	percentage
Ranking performance	Excellent	5	50 %
	Good	3	30 %
	Average	2	20 %
	Below average	0	0 %
	Poor	0	0 %

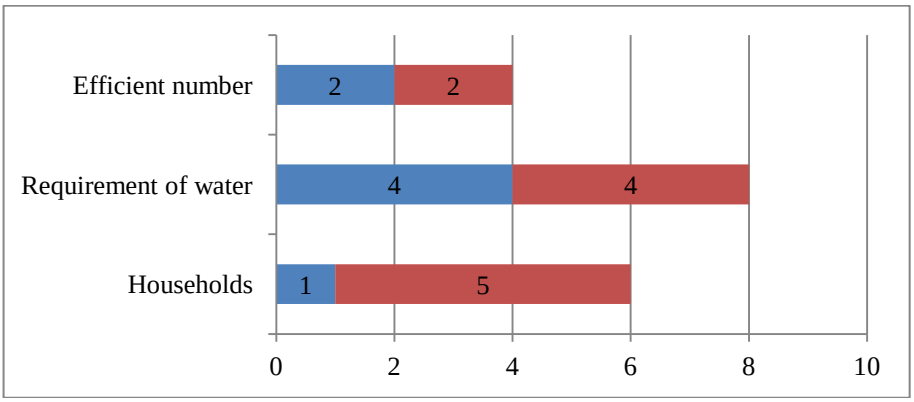

Figure 3.3: Level of maximum water requirement Comparison among the average number of households

Source: Based on Primary Data

The above bar chart reveals the comparison of average number of households in the maximum requirement of water. As can be seen in the above chart that households 1 and 5 requires extra 2 more buckets than the efficient number ranking them in the performance of average category.

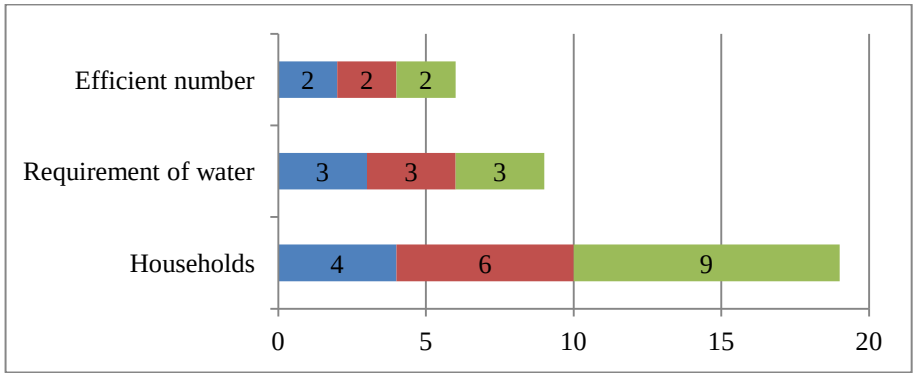

Fig.3.4: Level of maximum water requirement Comparison among the average number of households
Source: Based on Primary Data.

The above bar chart reveals the comparison of average number of households in the maximum requirement of water. As can be seen in the above chart that households 4, 6 and 9 requires extra 1 more bucket than the efficient number ranking them in the performance of good category.

3.12.2 T - Test: Paired Two Sample for Mean

T - test was tested to compare the means of the two samples. Maximum requirement of water pre and post information nudge.

	Maximum water requirement pre information nudge	Maximum water requirement post information nudge
Mean	**3.7**	**2.7**
Variance	0.233333333	0.677777778
Observations	10	10

Source: Based on Primary Data.

The above table shows the comparison value of the mean of the two paired sample maximum requirement of water pre and post information nudge in the average number of families of the sample population. The mean of the maximum requirement of water pre information is 3.7 and the mean of the maximum water requirement post information nudge is 2.7. There is a strong decrease in the mean value post information nudge. That means the comparison in the average number of families of the sample population is willing to reduce the maximum daily water requirement post information nudge.

3.12.3 Willingness to reduce the minimum requirement of water per day post Information nudge.

Variables	Category	Frequencies	Percent	Total
Willingness to reduce	Willing to reduce	2	20%	10
	Not willing to reduce	8	80%	10

Source: Based on Primary Data.

The above table provides the comparison result on the willingness to reduce the minimum water requirement per day on the average number of families in the sample population.20% showed willingness to reduce and 60% showed not willing to reduce. (Note - 50% of the sample population pre and post information in their minimum requirement of water per bucket per day is 1.)

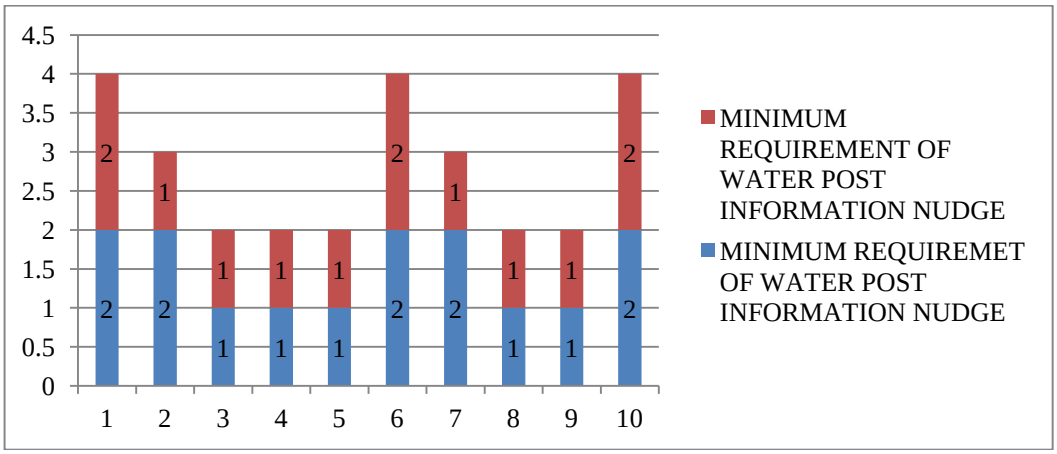

Figure 3.5

Source: Based on Primary Data.

The above bar chart provides the willingness to reduce minimum water requirement post information of the average number of families. The blue color reveals the minimum bucket of water requirement pre information nudge and the red color reveals the water requirement post

information nudge. The efficient number of buckets water requirement post information nudge is 1.

Variables	Category	Frequency	Percentage
Ranking performance	Excellent	7	70 %
	Good	3	30 %
	Average	0	0 %
	Below average	0	0 %
	Poor	0	0 %

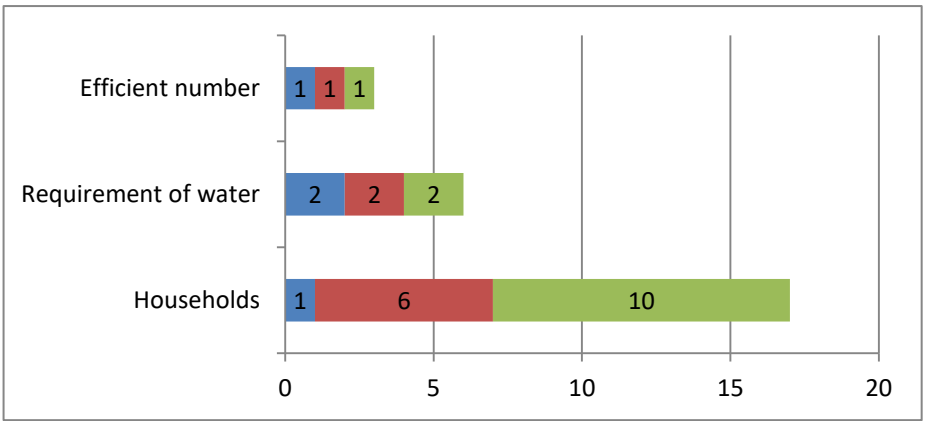

Figure 3.6: Level of minimum water requirement Comparison among the average number of households
Source: Based on Primary Data.

The above bar chart reveals the comparison of average number of households in the minimum requirement of water. As can be seen in the above chart those households 1, 6 and 10 require extra 1 more bucket than the efficient number ranking them in the performance of good category.

3.12.4 T - Test: Paired Two Sample for Mean

T - test was tested to compare the means of the two samples. Minimum requirement of water pre and post information nudge.

	Minimum water requirement pre information nudge	Minimum water requirement post information nudge
Mean	**1.5**	**1.3**
Variance	0.277777778	0.233333333
Observations	10	10

Source: Based on Primary Data.

The above table shows the comparison value of the mean of the two paired sample minimum requirement of water pre and post information nudge in the average number of families of the sample population. The mean of the minimum requirement of water pre information is 1.5 and the mean of the minimum water requirement post information nudge is 1.3. There is a decrease in the mean value post information nudge however the increase in the mean value is very less.

3.12.5 One Tailed t - test

One tailed t - test is applied to test the significance value.

H0: Comparative nudge is less effective than information nudge.

H1: Comparative nudge is equal to or more effective than information nudge.

	P (T<=t) one - tail
Maximum requirement of water per bucket per day	**0.004**
Minimum requirement of water per bucket per day	**0.8**

Source: Based on Primary Data.

The above table reveals the comparison in the p - value of the pre and post information nudge of the average number of families of the sample population through One Tailed t - test. The comparison p - value of the maximum requirement of water pre and post information nudge stands at 0.004 which is smaller than the significant value 0.05 that means it is statistically significant. Therefore, we reject the null hypothesis and accept the alternative hypothesis. The comparison p - value for the minimum requirement of water pre and post information nudge stands at 0.8 which is greater small than the significant value 0.05 that means it is not statistically significant. Hence, we accept the null hypothesis and reject the alternative hypothesis.

4. Discussion of Results, Recommendations and Conclusion

4.0 Discussion of results

Waste water also known as Grey water has environmental impacts which cannot be ignored given the increasing importance of water recycling due to water scarcity. It is a very good alternative of water resource especially for non - potable use however not all public is aware of that. The study throws light on the major causes of water scarcity, the problems of water scarcity leading to the various use of grey water, the feasibility of using grey water as an

alternative source of water and also the better management of water.

This chapter discusses the results and provides a summary of the present study and its implications.

The main objective of the study was to test the effectiveness of information nudge in influencing the respondents to reduce their requirement of water usage and opt for the use of grey water as an alternative source and also use comparative nudge to test the effectiveness on the willingness to reduce post information nudge. To achieve this objective it was important to understand the major causes of water scarcity, the problems face because of water scarcity and also the maximum and minimum requirement of water of the sample population. The study focused on the extend of water scarcity, how much the respondents are facing water scarcity that led us to understand the different problems the sample population is facing due to water scarcity. The study was also carried out to find out the environmental consciousness on water scarcity that led us to understand the awareness on grey water and whether it was feasible and benefitting them. Existing literature shows us that re - using of grey water is the most and highest acceptability for non - potable use. The main objective of this study was collected during COVID - 19 pandemic via online survey.

The first objective of the study focuses on the major causes of water scarcity and the problems faced because of water scarcity. Descriptive statistics of the socio - demographic data in the form of frequency revealed that 70% are male and 30% are female. In the occupation variables the categories was divided into student, teacher, government employee and unemployed where the highest respondents was from the student category at 40%. And in the family income category the highest respondents was from the income group of 20, 000 - 30, 000 per month at 54%. Pie chart data reveals that 74% of the respondents face water scarcity and 98% of the respondents face problems because of water scarcity. There are several major causes of water scarcity the sources of water in kohima drying up, lack of investment from the government and the public to invest in rain water harvesting, increase in population leading to increase in demand of fresh water and decrease in the supply of fresh water, lifestyle changes like more construction of story buildings, more usage of washing machines, more purchase of cars leading to more use of water in car washing etc. The government has also create various organization to tackle water scarcity like the organization PHED Public Health Engineering Organization that looks and deals with providing clean drinking water resource to the people of Nagaland. The study found out that government intervention in tackling water scarcity by providing them fresh water is not sufficient enough to fulfill their daily requirement hence several problems are faced by the sample population due to water scarcity - washing clothes, for cooking purposes, for personal hygiene use, for greenery gardening use, purchasing water. And frequency distribution table reveals that the highest number of respondents face problem with personal hygiene use which reveals at 36%.

The second and the main objective of the study focused on the better management of water resource and the feasibility of using grey water as an alternative source of water. It also carried out to understand the level of environmental awareness on grey water. The demographic data revealed that 37.5 percent are male and 62.5 percent are female. In the occupation category student was the highest at 52.5% and in the income category the highest respondents were from the income group below 10, 000 per month which revealed at 45%. The relationship association between the socio - demographic variables and the better management of water was done by running Pearson's co - relation test through the maximum and minimum requirement of water per day per bucket pre information and post information nudge of the sample population. The absolute value of both the sample and population Pearson correlation are on or between 0 and 1. A value greater than zero indicates positive relation while value less than 0 indicates negative relation and a value of zero indicates no relation In the gender variable both male and female showed strong positive co - relation but the female category showed more strong and positive co - relation with 0.94 on the maximum requirement of water and a co - relation of 0.95 on the minimum requirement of water in the gender category the study found pt that males are more willing to change their per day requirement of water as compared to female post information nudge. Under the occupation variable all the variables showed strong and moderate positive co - relation student category showed more strong co - relation with 0.95 on the maximum requirement of water and Co - relation of 0.94 on the minimum requirement of water. The study found out that the students are less willing to alter their requirement of water as compared to other occupation categories. The teacher category showed a co - relation of 0.54 in the maximum number which means around 7.5 percent of respondents from the teacher category will not change their maximum and minimum requirement of water post information nudge. The government employee and the unemployed also showed the same result for the maximum requirement of water which showed Co - relation of 0.66 and their minimum requirement showed a Co - relation of 0.87 and 0.86 respectively. In the income variable the strongest positive co - relation stood at below 10, 000 income category 0.95 at maximum and Co - relation of 0.94 at minimum income. The categories of 40, 000 - 50, 000 and 50, 000 and above did not show any relation and so found out that higher the income higher the willingness of reducing on their daily requirement of water and lower the income lower the chances of willing to reduce their daily water requirement post information nudge. Environmental awareness on grey water was also studied out of which showed that only 35 percent of the sample population were aware of grey water. The study found out that although the respondents were using grey water for different purposes they were not familiar with the term grey water.90 percent of the sample population showed awareness of water recycling, 85 percent of the population showed awareness on water scarcity and 75 percent of the sample population showed that using grey water was benefiting them. The study focusing on the better management of water resource was carried forward by running a test if information nudge could influence the

sample population in reducing the maximum and minimum requirement of water resource and found out that 77.5 percent showed positive change in willingness to reduce the maximum number of water requirement per bucket per day and 55 percent of the respondents showed positive change in the willingness to reduce minimum requirement of water per bucket per day. Positive change meaning that after providing the sample population with the correct knowledge and information on water scarcity the reasons, causes and also the various water recycling methods post information nudge the sample population will change and reduce their daily requirement on water resource. One tailed t - test test was done to test significant value of the difference in the daily maximum and minimum requirement of water per bucket per day where it showed the P value of the maximum requirement of water at 5.63927E - 06 which is very small than the significant value 0.5 and the P value for the minimum requirement of water showed 1.8958E - 05 which is also very small than the significant value 0.5. Therefore we accept the alternative hypothesis and reject the null hypothesis. Comparative nudge was carried forward in the study to compare the different values of reduction post information nudge among the average number of members per household of the sampling size. The demographic data revealed that in the gender category 60% are male and 40% are female, in the occupation category 50% are students, 40% are teachers and 10% government employee, the income category revealed that 50% are from 10, 000 - 20, 000 40% are from 20, 000 - 30, 000 and 10% are from the category 30, 000 - 40, 000. Pearson co - relation was tested to see the relation between the socio - demographic profile and management of water pre and post information nudge. In the gender category male showed a co - relation of 0.29 and female showed a co - relation of 0.33 in the maximum requirement of water which is quite low and in the minimum category male showed a co - relation of 0.5 which is also very low and female showed co - relation of 1 which is a strong positive co - relation. In the minimum category the study found out that females are not willing to reduce their water requirement post information nudge. In the occupation variables category of three - student, teacher and government employee the government employee showed co - relation of zero relationship of 0 in both the maximum and minimum requirement of water per day meaning all the respondents in the government category are willing to reduce their daily water requirement post information nudge. The student category showed a negative co - relation of - 0.16 in the maximum requirement of water and a strong co - relation in the minimum requirement at 0.61. And the teacher category showed both maximum and minimum daily requirement of water at 0.57 which is moderately positive meaning 50 percent of the respondents from the teacher category are willing to change and reduce their daily water requirement0 and 50 percent of them are not willing to reduce. In the occupation category the study found out that employed category are more willing to reduce their water requirement post information nudge. In the income category the study found out that the higher income are more willing to reduce their daily water requirement post information nudge. A paired sample t - test was run to test the mean difference on both the maximum and minimum water requirement pre and post information nudge. The mean difference in the maximum requirement revealed 3.7 pre information nudge and 2.7 post information nudge which means there is a reduction in the requirement of water post information nudge. The mean difference in the daily minimum requirement pre and post information revealed 1.5 pre information nudge and 1.3 post information nudge. Although there is reduction post information the mean difference in the pre and post information is very small. In the Comparative nudge the test found out that information nudge is more effective in the maximum requirement of water category as compared to minimum water requirement of water category. One tailed t - test was run to test the significance value of the difference in the daily maximum and minimum requirement of water per bucket per day where it revealed the P value of the maximum requirement of water at 0.004 which is smaller than the significant value 0.5 so, we accept the alternative hypothesis and reject the alternative hypothesis and the P value for the minimum requirement of water revealed at 0.8 which is greater than the significant value 0.5. Therefore in this case we accept the null hypothesis and reject the alternative hypothesis. The study found out that information nudge is effective in influencing the sample population in reducing their daily maximum and minimum water requirement and is also more effective than comparative nudge.

4.1 Recommendation and Scope for Further Research

The main objective of the study was to test if the sample population could be nudged to reduce their daily water requirement and opt for the use of grey water to tackle water scarcity. As seen in the responses from the study that 57.5 percent of the sample population is willing to reduce daily water requirement post information nudge. More suitable policy recommendation to improve the current situation is required, more abundant source and knowledge via articles, blogs, advertisement etc should be mandatorily available to the respondents in altering their choices and willingness to reduce water consumption in order to save clean drinking fresh water and choose grey water as an alternative source for different non - potable purposes. Further Research on a larger sample size will also give more definite and appropriate results.

Another objective of the study was to examine to the different major causes of water scarcity and the leading problems because of water scarcity. As seen in the study the major causes are mainly because of the lack of appropriate measures taken by the government as well as the public in tackling water scarcity. Although organization such as PHED Public Health Engineering Department is there to provide clean drinking water to the public it is not sufficient to meet the demand of public's requirement. Lack of investment to harvest rainwater is also another major cause of water scarcity. Appropriate measures should be taken to provide knowledge to the public in investing and building storages and structures to contain rain water. More organization and sources are required to be implemented by the government to tackle water scarcity.

Awareness is very important to understand the causes and measures to tackle water scarcity. . As seen in the study that 85 percent of the sample population is aware of water scarcity and 75% of the sample population is aware and is using grey water. Research about the relationship between water scarcity and environmental issues can be carried forward to understand the various problems and the steps required to minimize the environmental issues caused because of water scarcity. An extensive study on grey water and the benefits can also be carried forward to understand the various social and economic benefits and provide the required knowledge to increase and make better utilization of grey water.

The study in the comparative nudge of the average number of families per household has found out that the 40 percent of the average number of families in the sample population is willing to reduce their daily water requirement and 60 percent of the sample population is not willing to reduce their daily water requirement. Findings from the study has also found out that the average minimum daily requirement is 1 bucket pre and post information nudge and the average maximum daily requirement is 2 bucket post information nudge. Further Research on a larger sample size can give more definitive results.

4.2 Conclusion

Water scarcity is a natural phenomenon experienced by almost the entire world's population especially countries with increasing number of population and urbanization. Many population areas have chosen grey water as the best alternative source to manage water scarcity. Two research objectives have structured this research into the context of the major causes and problems of water scarcity, better management of water resource and the feasibility of generating and using grey water in kohima city of Nagaland.

The first objective revealed that the major causes of water scarcity even though it is due to natural factors where the water sources are desiccating due to increase in population and urbanization; majorly the cause of issue is because of the lack of understanding and investment by the governing authority and the public in storing water to meet the required needs due to which several problems are faced by the sample population. The second objective revealed a strong and significant association between overall social level of awareness of water scarcity and the feasibility of choosing and using grey water for multiple purposes to manage water scarcity. It also revealed a strong and significant association relationship between the socio demographic variables and the management of water. Information nudge revealed to be effective in altering the samples population in the willingness to reduce water requirement for better management of water where it received positively with 57.5 percent of the participants. Comparative Nudge revealed to be less effective as compared to information nudge in altering the sample population willingness to reduce daily water requirement. It received positively with only 40 percent of the participants. A more effective study can be undertaken to understand the rational choice of the participants with respect to using grey water as an alternative source to manage water scarcity. This can be done by examining the choice behavior in decision making of the participants self interest of using grey water as an alternative source to provide greatest benefit and satisfaction.

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Appendix

- **To analyze the major causes and problems of water scarcity in Kohima.**
- **QUESTIONNNAIRE**

Q. what is the extent of water scarcity?
Q. What are the different problems you face because of water scarcity?

Q. What do you do with the waste water?

A) Throw it
B) Use for other purpose,

Q. If used for other purpose, what are the other purposes?

- **To study the feasibility of grey water generation and usage for better management of water resource in Kohima.**
- **QUESTIONNNAIRE**
- SOCIO - DEMOGRAPHIC SURVEY QUESTIONNAIRE

My name is ……. this is a survey to explore the socio - demographic features of the project area and the aim to identify potential social impacts, your contribution will help us identify potential social impacts.

RESPONDENT CHARACTERISTICS

NAME OF THE LOCALITY…… . DATE - …….
VILLAGE - …….
RESPONDENT - ……
1. GENDER
MALE …… FEMALE …….
2. OCCUPATION ……. . .
3. INCOME GROUP
BELOW 10, 000……. .
10, 000 - 20, 000…….
20, 000 - 30, 000……
30, 000 - 40, 000…….
40, 000 - 50, 000……
ABOVE 50, 000……

Q. Are you aware of recycling of water?
a) Yes
b) No

Q: How much amount of water do you use per day?
a) Two buckets
b) Four buckets
c) More than four buckets.

Q: When you use water are you always conscious about the scarcity?
a) Yes
b) No.

Q: Have you ever heard the term Grey water?
a) Yes
b) No

Q. Do you use grey water?
a) Yes
b) No

Q. if yes, what are the different purpose of usages?

Q: Is the usage of grey water benefiting you as an individual?
a) Yes
b) No.

Q: If a limit has been imposed on you regarding the per day uses of water. What will be the maximum and minimum amount of using water in terms of buckets?
a) Maximum -
b) minimum -

Information nudge

Scarcity of Water

Water scarcity means the lack of sufficient amount of available water resources which were to meet the demands of water usage within a region, community, place etc. All in all water scarcity has been affecting every continent and around 2.8 billion people around the world are suffering from water scarcity at least one month out of every year. More than 1.2 billion people are suffering from adequate amount of clean drinking water Scarcity of water could be mainly because of two reasons

- Physical (absolute) water scarcity
- Economic water scarcity.

Physical water scarcity arises due to the result of insufficient natural water resources to supply a region's need.

Economic water scarcity arises due to the poor management of the sufficient available water resources.

Here is a list of some top countries suffering from water scarce:

1. Afghanistan
2. Kazakhstan
3. Morocco
4. Pakistan
5. Israel
6. Singapore
7. Libya
8. Jordan
9. Saudi Arabia

Around 308 districts in INDIA are facing shortage of water.

Among those districts 13 well known states are suffering from shortage of clean drinking water. States like Uttar Pradesh, Maharashtra, Madhya Pradesh and Karnataka are facing shortage of drinking water.

Method for Conservation Of Water

There are several simple methods to which we can apply to conserve Gray water. A rational process of using domestic home water can be a good Example of it, where control of usage water in the kitchen or bathroom applies to it. Turning off the tap while brushing or washing face, not taking unnecessary lengthy showers, water that has been rinsed from washing dishes be re - used again for other use purposes like mobbing the floor etc are some of the best examples of conserving water for re - using again. Here are some places around the world where water recycling took place.

Western corridor Recycled Water Project - Queensland, Australia - In 2009 the Queensland Government completed a 2.5$ billion water grid to treat and supply recycled water to South East Queensland. This water is used by the regions three main power stations, industrial and agricultural users, and also to supplement drinking water supplies through wivenhoe Dam. To date, this is the largest recycled water scheme in Australia. Source: Domestic and industrial wastewater.

NE Water - SingaporeSingapore's national water agency completed its first ever NE Water plant in May 2000. NE Water is highly treated recycled water that has been strongly endorsed as a safe and sustainable source of water because it exceeds the drinking water standards of the World Health Organization (WHO). Approximately 11 million liters of water a day is added to a reservoir then\ further treated as part of Singapore's normal drinking water treatment System. Currently there are four NE Water plants which meet the nations water needs.

Recycling of Water in India

An estimate 62, 000 million litres per day (MLD) sewage is generated in urban areas across India, according to the Environment Minister while there is treatment capacity for only 23, 277 MLD as of Dec 2015. A CPCB report further reveals that the actual amount of sewage treated stands at 18, 883 MLD as only 522 out of 816 sewage treatment plants were operational, as of March 2015 (even this claim of 81.1% capacity seems highly exaggerated. Thus at least 70% of sewage generated is being dumped in rivers, seas, lakes, and wells, polluting water bodies and contaminating fresh water sources. Partially treated or untreated sewage is responsible for large part of the pollution in streams and water bodies. Up to 80% of water bodies could be polluted. MUMBAI generates around 2, 700 MLD of sewage. Seven treatment plants together treat about 1, 384 MLD and the rest nearly 49% is discharged untreated into the sea. The CPCB had in October 2015 issued directives tightening norms on quality of water discharged into the sea. The Maharashtra Pollution Control Board (MPCB) and the Maharashtra Human Rights Commission had also objected to the pollution of coastal water by discharging untreated sewage into the sea. The BMC proposed an STP plant which would be the biggest of its kind in Mumbai capable of recycling and re using up to 847 MLD of sewage at a cost of Rs 4500 crore. DELHI generates 3, 800 MLD of waste and has a present installed treatment capacity of 2, 693.7 MLD of which t75.8 MLD. Thus, only 41% of wastewater is treated and the remaining 2, 225 MLD of untreated water is either seeping or being discharged into Yamuna. Many STPs are working 20 - 30% below their capacity and only 3 are working at their full capacity. The Delhi Jal Board (DJB) claims to supply around 700 MLD of treated water from sewage treatment plants for non - domestic use. The Delhi Government, in the Twelfth Plan, plans to use treated wastewater for non - potable purposes and collect, treat and dispose95% of the total sewage generation.
There is an universal recognition that grey water can be used as an alternative water purposes such as irrigation, toilet, flushing and others. For any living being water, air, are the essential needs, for which water has the best significance. However with the increase urbanization coming into picture there has been a significance decrease in the asset depletion like water. Waste water has been in view that enhances the weight of water environment. Grey water is one such sort of wastewater produced from household activities, for example, clothing, dishwashing, and showering which can be reused for reused for alternative utilization purposes.

Are you aware of recycling of water?
a) Yes
b) No

Q: How much amount of water do you use per day?
d) Two buckets
e) Four buckets
f) More than four buckets.

Q: When you use water are you always conscious about the scarcity?
a) Yes
b) No.

Q: Have you ever heard the term Grey water?
a) Yes

b) No

Q: Is the usage of grey water benefiting you as an individual?
a) Yes
b) No.

Q: If a limit has been imposed on you regarding the per day uses of water. What will be the maximum and minimum amount of using water in terms of buckets?
a) Maximum - b) minimum