CHAPTER - 5

SUMMARY AND CONCLUSION

Water is a natural resource, Also it is a basic requirement for all living beings on the Earth. Water scarcity is the lack of freshwater resources to meet water demand. Half a billion people in the world face severe water scarcity all year round. Half of the world's largest cities experience water scarcity (World Economic Forum,2017) The increasing world population, Urbanization, improving living standards, changing consumption patterns, and expansion of irrigated agriculture are the main driving forces for the rising global demand for water (Hoekstra. A.Y,2014). Climate change, such as altered weather patterns (including droughts or floods), deforestation, increased pollution, greenhouse gases, and wasteful use of water can cause insufficient supply. (World Water Footprint,2013). India's finite and fragile water resources are stressed and depleting while the population had been growing rapidly. Population growth was the key to the whole equation of water availability and its use because India's population had grown four-fold over the past 70 years. The population of India which at the turn of the twentieth century was around 238.4 million increased to reach 1210 million at the dawn of the twenty-first century. The water per capita in India was over 6372m3 per annum in 1951; it now stands at about 1902m3 per capita. With every increase in population, there was a corresponding decline in per capita availability of water. (Central Ground Water Board, 2018)

Earlier Studies and Research Gap

Studies on impacts of urbanization like ***(Srinivasan et al. (2013), Arunpandiyan et al. (2015), Sitaram (2014), Pan et al. (2016), Miao et al. (2016), Karthiyayini et al. (2016))*** have discussed the impact on urbanization on water resources stated that rapid urbanization brings water at stress level and also they concluded that due to urbanization water quality was decreased and it may lead waterborne disease. Many studies ***like (Arisiso et al. (2017), Noiva et al. (2017), Mayurakshi et al. (2013), Singh G et al. (2017), Shah et al. (2015), Thangamayan et al. (2019), Jayaraj et al. (2016))*** are discussed that stress the problems associated with urbanization like a gap between demand for and supply of basic infrastructure facilities, inequality in the distribution of water and quality estimates of water resources. The studies like ***(Troy et al. (2004),***

Victor Istifanus et, al. (2019), Fan et al. (2013) Shaban (2008) Singh (2013)) are examined that urban domestic water consumption pattern and behavior, attitude, water supply quantity and its quality. They concluded that mostly lpcd was affected by family size and income level. ***(Chini et al. (2018), Naeem (2017), Venkatachalam (2014)***) they studied the management of urban domestic water demand and also discussed informal water markets and their necessity. Some Studies ***((Ali et al. (2012), S. Sethuram (2014))*** are discussed the role of climate change on water supply and demand patterns they concluded that climate change leads to high pressure in water resources. Studies on Willingness to Pay like that of ***Ifabiyi I.P (2011), Devota et al. (2012), Suprabha (2016))***, reveal that households are willing to pay more irrespective of their income and that the most important factor affecting willingness to pay is price. Studies on water conservation ***Koop et al. (2019) Economic Review (2012)),*** provide a framework that should be used in preparing, implementing, monitoring, and evaluating a Water Conservation Awareness program, or in reviewing the content and approach of ongoing programs. ***Marcos et al. (2021), Fielding et al. (2012) Kumar Chaudhary et. al, (2017), Russell et al, (2010)*** are discussing the theory of planned behavior in urban water conservation and promoting rainwater harvesting and water demand in urban areas***. Mahdavi, T. (2021), Zhong et al. (2019), Lam (1999), Warner et al. (2021), Kumar Chaudhary et. al. (2017), Russell et al. (2010)*** are discussing the planned behavior with rural areas irrigation water conservation.

Objectives

- To study the Socio-economic background of the selected households.
- To understand the economic aspects of the domestic water consumption of the selected households.
- To assess the environmental aspect related to domestic water consumption and health impact.
- To analyze income groups willingness to pay for improved urban water supply.
- To examine the domestic water conservation knowledge and practices of selected households.

- To analyze the reasons and problems faced by the households in the urban water supply.
- To analyze the water-saving behavior among the selected households.
- To suggest and recommend the policy implications for the selected sample area

Research Gap

There are various research works carried on urbanization and its impact on water resources and numerous works are available on domestic water consumption. Many research works are available on climate change and its impact on water resources and attempts are made to examine willingness to pay for better water sources but very limited studies are available on willingness to pay for improved urban water service and also very limited studies are available on the application of the theory of planned behavior especially in Coimbatore district there are no studies based on this theory. In this study, the researcher has tried to bridge this gap and have investigated willingness to pay for improved urban water supply based on income group classification and have implied theory of planned behavior to study the water-saving behavior.

Hypothesis

- There is no relationship between socioeconomic variables and LPCD
- Factors of problems of water supply do not influence respondents to go for the secondary water source.
- The water consumption pattern of the consumers belonging to different income groups is the same.
- There is no relationship between waterborne disease and the cost of treatment of waterborne disease
- Factors do not influence the respondents on water-saving behavior.
- There is no relationship between Willingness to Pay and other variables like LPCD, Income, and Family size, Source of water, Distance, and time of water collection.

Methodology

The present study was carried out in five zones in Coimbatore Corporation. Based on the highest number of Households the wards were selected. In North Zone ward no: 41 which holds 13066 households, in South zone ward no: 86 which holds 9999 households, in Central Zone ward no: 45 which had 7799 households, in East zone ward no: 59 was chosen it had 6999 households and in West Zone ward no: 24 was chosen which had 5887 respectively. Using Rao Sample Size Calculator the study employs 651 sample respondents, among this High-income group were 89 Households (above rs.1,05,001) Middle income group was 245 sample households (from rs.21,001 to 1,05,000) and the Low-income group was 317 sample households (Up to rs.21,000) were selected. The period of the study was from the year 2017-2020. The data for the study were collected from both primary and secondary sources. The information on Country, State, and district profile, Corporation details, Source of water supply, water distribution Pattern, Population details, ward details, and other information were collected from the following reports and Government Organizations. Primary data were collected through the personal interview method from the sample Household respondents. Interview schedules were used to collect details related to the study from the sample Household respondents. A pilot study was conducted to identify the gaps in the interview schedule. Based on observation, during the pilot study, the schedule was modified and the survey was conducted between September 2018 and May 2019. So the Household Survey revealed that the corporation water availability, access, and methods adopted for water-saving behavior.

Findings of the Study

- The socio-demographic characteristics taken for the study are gender, age, community, education, occupation, type of family, and the number of members in the family. The female population was dominant among the selected respondents among the category of low income(61.8 per cent) and middle income (57.2 per cent) whereas for high-income communities male population (59.6 per cent) was found to be high and most of them were found to be between the age group of 41 years to 60 years of age falling under married marital status and number of children’s in the family of selected respondents showed that for low-income group (48.6 per cent), middle income

(48.6) and high income (46.5) per cent were having 2 children in their family whereas rest had children from 0 to 4 in their family about Information on the number of family members of elders in the selected household showed that 86.8 per cent of low-income group, 78.0 per cent of middle-income group and 82.9 per cent of the high-income group had no elders in their family. and OBC community and have undergone at least minimum qualification of education with occupation as cooli`s and engaged in some kind of employment activity in the private and unorganized sector with the nuclear family system with 3 or more than 3 members in their households.

- Expense on food was an important item of expenditure as it was mentioned by 29.8 per cent of low-income respondents group, 19.2 per cent of middle-income respondents and 31.2 per cent of high-income respondents followed by the food it can be noted that the other dominating expenses were made on education, rent, and fuel. These expenses are considered to be mandatory as it occurs frequently among the selected group. The expense made on drinking water shows that only a small part of the income is been spent by the selected respondent's group on the particular as about 4.3 per cent of low income, 8.5 per cent of middle income and 13.8 per cent of high income is been spent on drinking water. It can be incurred from the study that most of the respondents are not spending much on their drinking water which is evident that the respondents are utilizing government water supply and only when there is a lack of water do they prefer buying drinking water outside.
- The living condition of the sample showed that the majority of the respondents live in Pucca houses and a small minority still live in other houses like Kutcha houses. Regarding the ownership of the house showed that the majority of low-income and middle-income respondents were living in a rented house and 98 per cent of high income were living in their own house whereas those who were living in rented paid approximately Rs.5000 to Rs.10,000 as housing rent.
- The housing pattern of the respondents showed that low-income category sample 75.08 per cent were having 2 rooms, for the middle-income category respondents 61.63 per cent were having 03 rooms and for high-income category respondents, 71.91 per cent were living in houses with 5 plus rooms.

For the low-income category, 97.16 per cent had a single bathroom, for middle-income category respondents 49.80 per cent were having a single bathroom. Whereas for high-income category respondents 71.91 per cent had more than 4 bathrooms.

- For low-income category respondents, 78.86 per cent had no taps for water, for the middle-income category 50.20 per cent had 4 taps in their houses and for the high-income category 85.39 per cent had 6 and above taps in their houses. Information on the number of washbasins showed for the low-income category 97.16 per cent had no washbasin, 76.33 per cent of middle-income category respondents had 1 washbasin and for high-income category respondents, 76 per cent had 3 and above the washbasin. The number of shower availability in the house of the respondents showed that for 98.42 per cent of low-income category there was no shower for middle-income category 62.86 per cent had 1 shower and for high-income category respondents, 85.39 per cent had 3 and above showers in the house. Whereas information on bathtubs for the respondents showed that for low income and middle-income groups no one had a bathtub in their house and for high income, 83.15 per cent had no bathtub in their house and only 16.85 per cent had 1 bathtub in their house.

- Among the selected respondents 95.6 per cent of the low-income category, 57.6 per cent of the middle-income category had no washing machine and dishwasher in their house whereas for the high-income category cent per cent had a washing machine and 16.9 per cent had a dishwasher. The water spent on the washing machine and dishwasher were analyzed by the researcher based on the type of machine used by the respondents. On average respondents spent 100-150 liters of water per washing through a washing machine and for dishwasher 20-60 liters of water was used per washing.

- The distance from the premises for getting water for the need of the respondent's details showed that for low-income category 45.1 per cent were traveling 2-3m for getting water, for middle-income category 51.4 per cent had water resources within 1-2m of their premises, and for the high-income category 42.7 per cent had water resources within 2-3m of the premises. The source of water availability for the respondents showed for the low-income

category 48.6 per cent used HSC service, a common street pipeline for their water consumption, in the case of the middle-income category 62.4 per cent used HSC connection and for the high-income category, 87.6 per cent used HSC connection for water resources.

- For low-income category respondents, 94.6 per cent reported that they have 1 pipeline connection, for the middle-income category 95.9 per cent had one pipeline connection, and for high-income communities, 53.9 per cent had 2 pipelines in their home. Information on the frequency of water supply for low-income category respondents 77.3 per cent received water 7-10 days once, whereas for middle-income category respondents 60.4 per cent received water between 7-10 days once, and for high-income category 55.1 per cent received water from 4-6 days once. Low-income category 88.3 per cent stored water in a container, whereas for middle-income category 60.4 per cent stored water in the sump and for high-income category cent per cent stored water in sump all the respondents were paying between 0 to 100Rs. Tariff for their water consumption and they were receiving moderate water supply.
- The number of bore wells available for the respondents was examined by the researcher for low-income category respondents no one had own bore wells in their household whereas for middle-income category 90.2 per cent were not applicable for the category and 9.8 per cent had one bore well and for high-income cent, per cent had borne well facility in their house. On average they were using the bore well 2-5 days once and were using a sump for storing the water and felt their water supply to be moderate.
- The number of pipelines available for the respondent is one of the important criteria in finding out the usage of water and identifying if water if being sufficient for the respondents. For the selected respondents among the low-income category 46.7 per cent were not applicable for this criteria, middle-income category respondents 46.5 per cent had one pipeline connection and for the high-income category cent per cent were not applicable for the particular analysis. On average the respondents received water daily and were storing water in containers and water availability was moderate.

- The frequency of buying of water by the respondents varies for various income groups and also it is subject to change based on the respondents living style, family style, and the place they are living in. In the current study for the majority of a low-income category (95.3 per cent), middle-income category (97.5 per cent) and high-income category (87.4 per cent) respondents were not preferring market water others were spending about Rs.300 to Rs.500 on average for the Market water source.

- The person who fetches water in the house detail showed that the majority of them was female member of the house. The time consumption for fetching water for the low-income category showed that 87.7 per cent of the respondents and 60.4 per cent of middle-income respondents spent 01-02 hours fetching water.

- The result showed that in the case of the low-income majority did not have overhead tanks but in the case of middle-income category majority had either one or two tanks but in the case of high-income category majority are found to have either 2 tanks or 3 and above tanks. For low income, 24.6 per cent of others said that they had over the tank with the capacity of 500-1500 liters for middle income 26.5 per cent tanks with the capacity of 1500-2000 liters and high-income category respondents 42.7 per cent had water tanks with the capacity of 2000 - 3000 liters. 32.2 per cent of the low-income category, 49.8 per cent of middle-income category used centrifugal pumps and for the high-income category, cent per cent used centrifugal pumps and submersible pumps for their water circulation to tanks and the respondents on average was spending Rs.1000-Rs.5000 for Origin and Management. It is also found from the study that with use of this kind of motors electricity bill has increased for the sample respondents.

- The Chi-square result of selected respondents regarding their association between LPCD and policy variables. For water details, the researcher has used variables person of water fetching, time, distance, family size, income, and source of water. It can be identified that variable family size and income are statistically significant at a 1 per cent level of significance indicating that there is a strong association between LPCD and these variables. As when the number of members in the family is high the family will need extra water to

meet their requirements and when the respondents are having adequate income they will be able to spend a good amount on their water consumption. So both the family size and income of the respondents are associated with the water details of the respondents.

- Multiple regression analysis is used to understand the relationship between LPCD and variables, education, age, total expenditure occupation, type of family, number of members, total distance for water collection, sources of water, and time spent for water collection. The result showed that variables such as education of the respondents, age of the respondents, type of family in which they were living, number of members in their family, total distance for water collection, total family expenditure sources of water, and time spent for water collection is statistically significant at 1 per cent level which indicates that these variables were found out to be influencing the respondents regarding their LPCD.

- For the high-income group majority of water, consumption is been made for cloth washing, bathing, and toilet and there is not much difference in their consumption pattern during changes in the season. For the middle-income group, there is no bigger difference in their water consumption pattern and season variations and for the low-income category, there are no changes in the water consumption made by the respondents and season variation. It can be found that for all income groups majority of water consumption is been made for cloth washing, bathing, and toilet and there is not much difference in their consumption pattern during changes in the season. Overall consumption of water for the selected households was highest in the summer season than average.

- Garret ranking result showed that for low-income group, middle-income group and high-income group the first preference of their domestic water supply if for Rank I have been assigned for “Drinking” purpose for all the three income group, without drinking of water human life cannot sustain so this item has been given higher preference by the respondents, as per the WHO survey a normal human must drink at least 3 liters of water per day so the respondents consider this item to be very important. “Cooking” purpose as all three groups has assigned “Rank I” for the preference. In everyday life, drinking has

become an essential household activity and the water used for the process is relatively high as it includes water for washing and rinsing cloth in the case using washing machines the consumption of water is high while compared to the traditional stone washing of cloth. Rank III has been given for the item "Cleaning of vessels", without washing of vessels we will not be able to reuse the vessels again and for this reason, there is again a higher need of water for cleaning it even with so much modern technology development we follow the same old tradition of reusing vessels everyday one-time use plates, a tumbler is not that much preferred by the people. Whereas, the least rank has been given for items like Cleaning of vehicles, bathing, and toilet. Even though these items are necessary for regular activities but a higher preference is given for washing, drinking, and cleaning of vessels.

- The researcher tried to find out the difference between the averages of a liter per capita demand for various income levels. The result for this is been drawn in the above figure. It can be identified that for the low-income group, the average LPCD is 45.236 per cent, for the middle-income group the average LPCD is 43.686 per cent and for a higher-income group, the LPCD is 40.837 per cent. From the study, it can be identified that the LPCD is found to be high for low-income groups than the other income groups
- In the case of low-income level, their water quality was either bad or moderate as it was reported by 59.94 per cent and 32.49 per cent respectively only 7.57 per cent stated that their water quality was good, the same is been reported by middle-income people about 90 per cent stated that their water quality was either bad or moderate and only 9.39 per cent enjoyed good quality of water. For the high-income level, 52.81 per cent had bad water quality, 29.21 per cent had moderate water quality and 17.98 per cent had a good quality of water. It can incur from the study that out of 651 respondents only 63 respondents enjoyed a good quality of water. In the case of taste and smell, 49.84 per cent and 17.98 per cent of low-income levels had the bad and moderate taste and smell respectively and 32.18 per cent had good taste and smell in their water. For middle income 58.37 per cent said their water was taste and smell bad, followed by 36.73 per cent whose taste and the smell was moderate and 4.90 per cent water was having good taste and smell. For the

high-income level, 74.16 per cent and 21.35 per cent stated that their water quality was either tasted and smelled bad or moderate only 4.49 per cent had good taste and smell in their water.

- Measures were adopted to purify the drinking water in selected households the finding showed that among the selected households only 22.71 per cent of the low-income level group, 43.67 per cent of the middle-income group were following some kind of Purification measures. Whereas for the high-income group cent per cent of the population were having Purification measures for their water utilization.

- Problems faced by respondence with their urban water supply: For low-income communities, the top three ranks have been assigned for the problem "Unpredictable supply of water". "Low Water Supply", "Dirty water supply" and Whereas for Middle-income group the first three ranks been given to the issues "Low water supply", "Unpredictable supply of waters" and "Dirty water supply" and for High-income group the higher ranks have been assigned for concerns "Unpredictable supply of water", "Low water supply" and "Dirty water supply". From this, it can be identified that for the selected households despite their income category they feel that the water they receive is low in quantity and quality and Unpredictable supply of water. The other ranks have been assigned for problems namely "Cleaning of containers" and "High cost of other sources of water".

- Factor analysis was carried by the researcher to identify factors influencing the respondents to go for a source of water. The KMO statistics was 0.797 signifying higher than acceptable adequacy of sampling. A value close to one indicates the patterns of correlation as relatively compact. Bartlett`s test of sphericity was also found to be significant at 1 per cent level providing evidence of the presence of a relationship between the variables to apply factor analysis. The eigenvalue for the first three factors alone was greater than one indicating that these factors alone were appropriate for inclusion in the analysis. These factors taken together accounted for 52.305 per cent of the variance. For the sample respondents, factor 1 has significant loading on 6 dimensions namely "Quality of Water", "Speed of water supply", "time spend for getting water", "To meet the daily requirement", "Inadequacy of

water supply" and "Unpredicted water supply of public water". Factor 2 has significant loadings on two dimensions namely "Quality of water" and "No one available for fetching of water" these variables explains about 16 per cent of the variance in the factors and Factor 3 has significant loading on 1 dimension which is "Distance for getting public water", this explains about 11 per cent of the variance in the factors.

- Multiple Regression Analysis was used to find out the cost of treatment for water-borne disease faced by the respondents for which the independent variables were medical expenditure, total expenditure, affected person, waterborne, and other water-related diseases. It can be identified that factors such as medical expenditure, total expenditure, affected person, waterborne disease, and other water-related diseases are statistically significant at one per cent level which indicates that these variables were found out to be influencing the respondents regarding their Cost of treatment for waterborne disease. The `R` squared value gives the goodness of fit of the model and the value being 0.512which indicated that 51 per cent of the variation was influenced by the combined effect of all the independent variables. Multiple correlation coefficient (0.728) between LPCD and the set of independent variables shows a good amount of correlation and is found to be significant at 1 per cent level ($p<0.01$) as tested by the 'F' ratio value being 35.54.
- Low-income group 45 per cent have stated that they need water and they are willing to pay for improved water supply followed by 35 per cent who stated that they need water but they are unable to pay for it and 20 per cent said that they no need extra water for their consumption. Middle-income group 50 per cent said that they need water and they are willing to pay for improved water supply, 32 per cent said that they need water but are unable to pay for it and 18 per cent said that they no need extra water. In the high-income group, 80 per cent said that they need water and they are willing to pay for it and 20 per cent said that they did not need extra water and only 02 per cent said that they need water but they are unable to pay for improved water supply.
- Probit model produced a good fit for the data because the chi-square value is statistically significant ($p<0.01$) and the pseudo adjusted co-efficient of determination reveals that the included variables explained 78.5 per cent of the

variations in the values of willingness to pay probability. The variables that show statistical significance are LPCD, Total distance for water collection, family size, and income. The significance and the positive relationship between the variables and willingness to pay by the respondent can be identified through the probit model.

- Inquiry on water conservation necessity in the district is been asked to the sample people. Where about 75 per cent of the respondents stated that water conservation in the district is a very important issue, 10 per cent mentioned that water conservation is an important issue, 3 per cent mentioned that water conservation in the district is not the very important issue, 2 per cent stated that water conservation in the district is not an important issue at all. Whereas 10 per cent of the respondents mentioned that they do not have any opinion about water conservation and its need in the district. Even though a large mass of the population mentioned that water conservation is needed in the district there are yet a group of people who do not have any opinion about water conservation or do not think that water conservation is a needed issue at the district.

Factor analysis was used in the current study to examine the underlying dimension among the various indicators of factors influencing the respondents regarding water-saving behavior of the respondence based on a theory of planned behavior. Factor 1 has a significant impact on the water-saving behavior of the respondents Water-saving behavior (WSB) is important for sustainable economic and social development in river basins and is promoted by improving water-saving awareness. Understanding the factors of WSB could facilitate water demand management and information campaigns. Using the theory of planned behavior, the researcher analyzes the influence of subjective attitude, perceived behavioral control, and subjective norms on behavioral intention and final behavior with WSB. Moreover, a comparative study of the high, middle, and lower-income groups is also carried out to examine the behavioral differences. Overall, it shows that,

1. Awareness of WSB is high in High and Middle-income groups but it is found to be low in the Low-income group

2. water-saving expectations and subjective norms and perceived behavioral control and have positive effects in all income groups;
3. The water-saving practice was highly adopted by High income and middle-income group's Low-income group is not much interested in investment in water-saving technology.

It can be understood from the study that even though the low-income respondents wish to adopt a saving pattern due to their income constraint they are not able to spend much on water saving. Thus, income influences the water-saving behavior of the respondents

Conclusion

The demand for water in India is expected to surpass supply in the near future. As a consequence of increased water consumption for personal cleanliness and use of water-consuming equipment as a result of rising standards of living, household water-using behaviours, and water demand is expanding. This increased demand will put further burden on outdated and failing water and wastewater infrastructure, perhaps reducing per capita mains water supply even more. Climate change and unpredictability will almost certainly test the water sector's resilience by causing havoc on the country's water supplies. Given the above-mentioned issues and the role that water efficiency can play in addressing some of them. Water resources are highly impacted due to urbanization across the globe. There is a vast gap between demand and supply of water in the study area. The socio-economic factors of the respondents impact their LPCD. There are numerous problems faced by the respondence regarding urban water supply in which the main problem is unpredictable urban water supply, quality of water for drinking due to which the respondents are tending towards other water sources and the decision is been influenced by the income group of the respondents. Where high-income group people are willing to pay extra for other water sources whereas middle and low-income groups are constrained due to their income level. Those respondents who are not willing to go for other water sources are limiting and conserving their regular water supply for future needs. Water conservation is the need of the hour whereas in the study area only limited respondents were found to be willing to water conservation. To find out the water-saving behavior among the selected respondence theory of planned behavior was used and the result showed that

high-income people ate found to spend money for water through government schemes and government intervention as they are limited by their income condition.

Suggestions

- To address the issue of insufficient water supply in the town, more water sources and pumping stations, as well as several independent water connection networks in all zones, including the town's boundary, are required. Furthermore, additional pipes should be installed in new residential areas.
- Due to regular climatic fluctuation, minor streams are becoming non-perennial; dams are shrinking in size, and rivers are drying up. As a result, sufficient consideration must be paid to these drinking water sources, with effective conservation and protection being conducted in order to improve the urban water supply.
- Any development or economic planning should take into consideration predicted population expansion and finite water supplies in order to regulate demand. Future population predictions should take dispersion into account for planning objectives. Growth plans in any industry must be weighed against the demand for enough clean water for residential consumption and to preserve healthy ecosystems
- The public should be involved in the development and execution of population-related water supply projects, as well as advocating for family planning and related health services. In addition, relevant technology and novel approach for water conservation, recycling, and water quality maintenance or restoration must be implemented.
- Before constructing any water infrastructure in the town, extensive studies based on the number of beneficiaries must be done to minimize unequal water distribution. Furthermore, the number of defunct dug wells, artificial springs, water taps, and public tabs must be located, thoroughly analyzed, and promptly restored, as well as safeguarded from harm.
- Appropriate surveying methods that take distances to water spots and their landscapes into account during the installation of water supply systems must be chosen/employed to lessen the problem of water scarcity, human efforts,

and water expenses. Water flow may be influenced by terrain, which is one of the limiting variables. As a result, during the survey, it must be artificially reduced or alternative acceptable techniques must be considered to make water flow and people movement easier during maintenance in case of damages.

- Given the town's adequate yearly rainfall, it's a good idea to apply practical rainwater gathering techniques; specialists should provide current rainwater harvesting equipment so that homes may readily use it.
- Water supply should be prioritized in newly built peripheral regions of the study area to guarantee equitable and efficient drinking water distributions.
- To ease the problem of uneven access to drinking water in the study region, surveyors, installers, and engineers must consider natural and manmade elements during water infrastructure development.
- The study strongly recommended that policymakers and relevant agencies should invest more in water infrastructure, giving a higher priority to the low income household areas so, as to improve their well-being and quality of life for sustainable socio-economic development.

Future Research

- Conducting a diary study on water use habits among the income groups
- To examine the impacts of climate change on water supply and demand and its socio-economic and health implications for achieving sustainable development.
- Rainwater harvesting systems should be evaluated for rainfall capture efficiency. Under verity of rainfall conditions and further investigations
- Upscaling the work to the regional level and constructing a WDM for each of the groups formed by the clustering algorithm
- Water integrated approaches, whereby handling water wisely forms an integral part of urban dynamics and urban design to understand the true water security of cities in the long run.