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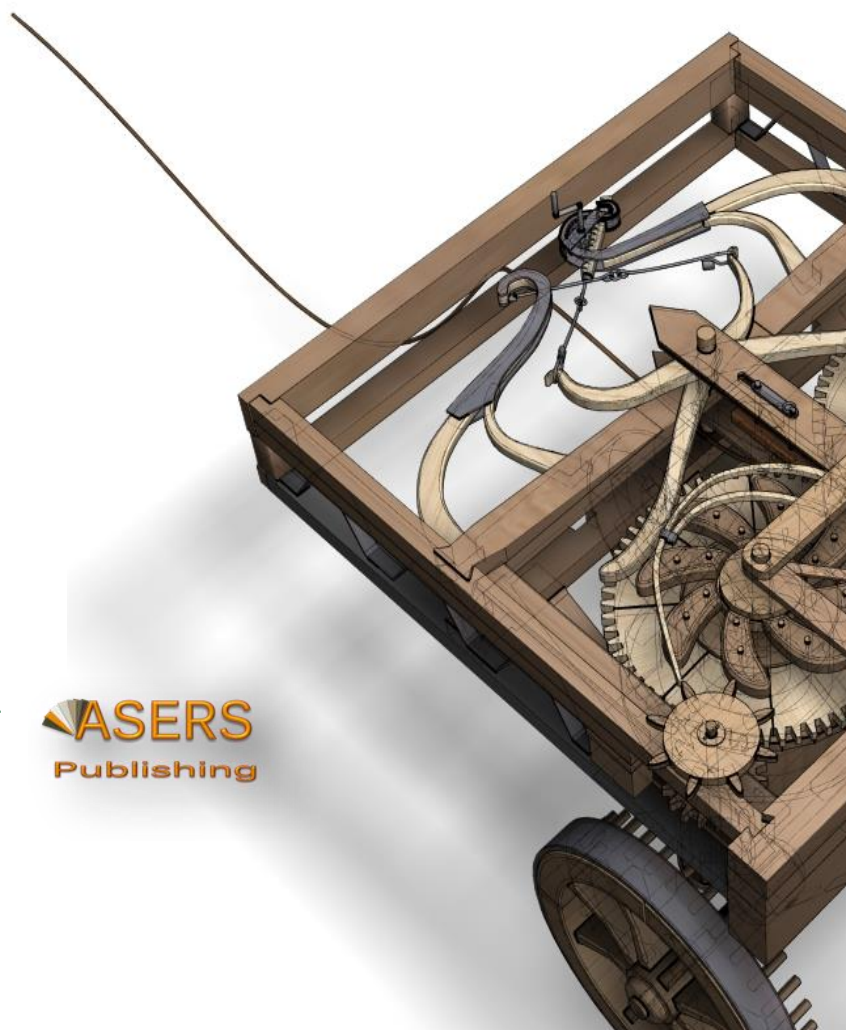
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Climate Change Impacts and Environmental and Water use Behaviors, Beliefs and Perceptions

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Abstract:

This paper presents research conducted on urban home water use behavior as a response demand mitigation strategy to reduce domestic water consumption in SA. The paper presents results of urban home residents' attitudes, behavior and perceptions towards their water consumption in a search for ways in which domestic demand for water may be substantially reduced. The analysis reflects the water use behavior and perceptions of urban dwellers in a period where water use rationing and restrictions are in place in parts of SA, therefore water scarcity is an important public crisis issue.

The research has brought to the fore the complexity of the forces shaping water demand and use in the context of the socio-demographic composition of homes residing in different types of dwellings, as well as the cultural, behavioral and attitudinal aspects of water consumption in city of Durban. The essential questions driving the research was what extent the two key dimensions of urban structure do, *i.e.* built form and the socio-behavioral characteristics of home water use, influence the pattern of water consumption. Additionally, the study ascertained the extent to which urban water users understood water-saving practices and the need to conserve this precious natural resource whilst also investigating the extent that the public believed were the most effective water-saving habits, interventions and communication methods to support reduced water consumption at a home level. In so doing, the study findings have aimed to inform public policy on ways to reduce consumption and identify alternative and complimentary ways to address the urban water conservation and demand management planning.

Keywords: urban; development; water resource; management; planning; resource; development.

JEL Classification: O18; O21; Q25.

Introduction

The focus of this article provides an exploration of public levels of knowledge, awareness, and perceptions of water demand and water use behavior in the city of Durban which is facing increasing water demands to meet the needs of a rapidly growing and urbanizing population (Yong, Bairong, Manfei 2022). Concurrently, climate change

is driving the country towards a warmer and drier climate, with predicted longer and more extreme droughts in the future. Increasing water demand and the impacts of climate change therefore equate to lesser water being available to meet future water demands (SA, National Water Master Plan 2018). Changing socio-economic conditions also increases the uncertainty of water supply systems in major metropolitan cities in South Africa. Currently within hydro-informatics research. Most research methods have moved from classical computational tools to modern computational tools, which are gradually becoming a way to model the reasoning and decision-making processes of various stakeholders. However, social science can address current uncertainties in water security from a psychological and anthropological perspective by studying the difficulty of predicting decision-making processes linking environmental, social and technological change to water meanings (Gerakopoulou and Macropoulos 2013). Several authors have also observed and indicated that the increase in the overall water demand from urbanized homes, agriculture, industry; climate change; increasing pollution patterns are serious threats to home water security globally, in particular within sub-Saharan Africa and more specifically in South Africa (Sershen *et al.* 2016, Dos Santos *et al.* 2017, Wutich *et al.* 2017, Long and Pijanowski 2017, Fan *et al.* 2017, Mata *et al.* 2018).

This is important for South Africa as it is relatively unknown whether attitudes and goals for water saving or the installation of water-saving devices lead to sustainable water conservation and protection (Mata *et al.* 2018). It is generally accepted that the demand for water in the home/cities consists of different uses and users of water. These applications can be divided into two different categories: water consumption for basic daily needs (or non-discretionary) and for discrete applications (Willis *et al.* 2013). Basic needs include drinking water, sanitation (flushing toilet), bathing (access to sink, shower, toilet, washing machine) and kitchen activities (sink and dishwasher). It is important to consider unnecessary use of water such as irrigation and outdoor activities (swimming pools). However, the shift toward non-materialistic needs (Inglehart 2008) has led to the fact that many basic waters need now have large discretionary components, such as bathing or showering for convenience and non-hygienic purposes (Willis *et al.* 2008). The demand for water in the home is itself related to water demand behavior, and therefore questionnaires can provide important information about water consumption. In addition, it is also possible to analyze information about perceptions and habits when using water. However, it should be recognized that the answers to such questions may be biased (driven by the psychology of water use) and may not be limited even by the widespread use of water. Several authors have also identified that a home's perception of water use is quite inconsistent (Bill *et al.* 2011, 2013). However, a potential solution could lie in smart water metering, where new technologies such as smart meters collect information on the frequency, quantity and timing of all water consumption using specialized home technology. Several studies of the end-use of domestic water have also identified that the demand for domestic water is influenced by a number of sociological, cultural, psychological and social factors, including environmental awareness, perception of water consumption, water availability, consumption, contains knowledge and values, water and trust in the authorities or governments.

Jorgensen's (2009) research reviewed a number of social models and concluded that water consumption, climate and seasonal factors, population statistics, habitat characteristics, family structure, past water consumption and regulatory sensitivities influence behavior. In addition to user habits, programming factors and values, beliefs, interests, and perceptions of the risk of water scarcity (Jorgensen *et al.* 2009, and Monzer *et al.* 2011), it was found that environmental awareness, increased attitude towards the environment led to reduced water consumption, and that lifestyles and environmental attitudes were negatively related, indicating higher income levels and higher income levels. This was education. It does not improve attitudes towards the environment. Therefore, pro-environmental behaviors seem to be related to age, income level, education level, and other sociodemographic characteristics (Gregory and De Leo 2003, Gillig and Barr 2006). In particular, hardened "environmentalists" have grown up. The smaller the size of the family, the higher the level of education, the more money. On the other hand, non-environmentalists tend to be younger, have larger families, mainly live in rent, and have lower incomes and education (Gilagh and Barr 2006). In addition, (Willis *et al.* 2013) conducted a survey and questionnaire on water intake in Australian homes. Both measure water consumption and determine the general demographic characteristics of animal populations. There is no evidence of statistical significance. The impact of water demand, awareness of water consumption and investment in modern water technology are also important (Domenech and Sauria 2010, Dolnikar *et al.* 2011).

Social psychology researchers have identified discrepancies between attitudes and actual behavior (Hogg and Vaughan 2011). Research into behavioral patterns can benefit from the use of quantitative and qualitative research methods in social psychology and their combination to capture everyday practices (Brown *et al.* 2014). Qualitative tools, such as semi-structured interviews and methods, such as interpretive phenomenological

analysis, discourse analysis, biographical approaches, ethnography and others (Smith 2008), will allow an in-depth study of the factors that influence attitudes, perceptions, cognitions, etc. We do, etc. Traits and their relationship to behavior and decision-making. In addition, quantitative methods, such as questionnaires, will make it possible to collect sample data to describe water consumption habits (Wiper 2007). Therefore, the key question in this study was to understand to what extent urban structure, architectural form and socio-behavioral characteristics were the main drivers of water consumption patterns in the city of Durban. In addition, the study evaluated the degree of understanding on the part of users about the concept of saving water and the need to preserve this scarce natural resource. In addition, the research also envisioned identifying what urban water users consider to be the most effective water-saving habits, interventions, and communication methods about water demand and use. The results of the two social research methods were combined to gain a deeper understanding of the quantitative research results by exploring the qualitative results in depth.

In a study of Jorgensen *et al.* (2009), which reviewed different social models, it concluded that water consumption is influenced by climatic and seasonal factors, population, habitat characteristics, home structure, water use behavior, etc. How is it affected? for the alleged conduct. Control and indirectly the user's security intent, which is also influenced by their attitude towards user security. In addition to habits, restrictions, and prices, water users have their own beliefs, interests, and perceptions about the risk of water scarcity (Jorgensen *et al.* 2009). Furthermore, Mondzer *et al.* (2011) identified that environmental awareness increases water conservation attitudes, resulting in reduced water consumption, while lifestyle is inversely related to water-preserving attitudes, resulting in reduced water consumption. As a result, the use of water is reduced. Due to which the use of water is reduced. Due to which the use of water is reduced. This means that increases in income and education levels do not necessarily increase attitudes towards water conservation. Furthermore, water-seeking behavior is related to the user's general attitude towards environmental protection (Gilagh and Barr 2006).

Therefore, environmental behavior seems to be related to age, income level, education level, and other sociodemographic characteristics (Gregory and De Leo 2003, Gillig and Barr 2006). Committed "environmentalists", in particular, tend to grow up with smaller families, higher levels of education, and ownership. On the other hand, non-environmentalists tend to be smaller with larger families who mainly rent their houses and have lower income and education levels (Gilagh and Barr 2006). In addition, Willis *et al.* (2013) conducted a study of Australian homes using questionnaires and measurements of water components and identified common demographic characteristics of water user groups. The lowest number of consumers are single and include more homes than couples, and income levels and housing size were not found to be statistically significant. The Willis study further concluded that environmental and water approaches play the most important role in conserving water and managing water demand. Moreover, as water demand is directly affected by water consumption technology, water users' awareness and their willingness to invest in modern water technology are also important (Domenech and Sauria 2010, Dolniker *et al.* 2010).

1. Materials and Methods

1.1. Quantitative Social Research. Setting, Structure, Sample, Questions, Brief Presentation of Results

The quantitative approach

The survey addressed the lack of quantitative data on people's attitudes and behavior towards water use and water technology. The survey was designed to collect as much information as possible about home water use, perceptions, attitudes, and behaviors toward water conservation and water conservation infrastructure. It was implemented as a home area survey in August-October 2019.

Sample Considerations

The survey was part of a co-funded project that focused on urban homes water use behavior across South Africa which also included the city of Durban. The majority of the sampled population was therefore residents from the Durban metropolitan area. Furthermore, homes were also sampled to be representative of the geographical spread of urban residents across the metro. In total, 200 questionnaires were administered across 5 areas and a total of 196 questionnaires were completed in full and formed part of the data set used for analysis. Focus group sessions were also conducted and these were used in the qualitative analysis. Data was analyzed by use of SPSS and NVivo software analytical tools.

Questionnaire structure and research questions

The research instrument consisted of 52 items, with levels of measurement at nominal and ordinal scales. The questionnaire was divided into 12 sections and 4 study objectives. These included an analysis of: socio-economic perceptions, attitudes and behavioral factors relating to water saving and consumption practices, key drivers of responsible urban home water use behavior in support of effective water conservation and demand management (WCWDM), effectiveness of water demand management awareness tools, instruments and public policy interventions targeted at changing water use behavior, developing water use strategies that inform public policy and effective decision making relating to urban home water use demand reduction. The analysis of the data was further conducted under sub-thematic areas and these included investigating: situational/socio/economic and demographic factors, water source/use/saving and consumption practices, water use attitudes, perceptions and behavior, drivers of water saving behavior, tools and instruments used for water saving, water demand policy and strategy, public education and awareness, alternative water sources and practices and learning and collaboration.

Socio economic profile of sampled population and water use behavior

Overall, the ratio of males to females was approximately 1:1 (50.3%: 49.7%) ($p = 0.568$). This reflected a fairly even distribution of males and females with the majority of the respondents in the count which fell within the age category of 20 to 29 years. In the age category 30 – 39 years, 60.4% were female and 39.6% were male. Amongst the females only, approximately a third each of the respondents were between 20 - 29 years (31.7%), and 30 - 39 years (35.4%). A little less than half of all the males only (45.7%) were between the ages of 20 - 29 years. More than two thirds of the sample (69.3%) was younger than 40 years.

The analyzed distributions were extremely useful as indicators of respondents that were in the prime years of their working careers and therefore, the nature of their responses had a direct bearing in terms of financial costs relating to everyday water usage within the homes. The main reason(s) for saving water cited by 48% of the male respondents across the study areas was “water saving was a historical ‘practice” and therefore was no immediate need for changing water use behavior. Female respondents (52%) on the other hand indicated that municipal water restrictions and increasing monthly water costs as the main reasons for implementing water savings in their homes. Overall, both male and female respondents did not save water for any environmental reasons but indicated that the cost of water and constantly increasing bills/tariffs were the main drivers for water saving within their homes. In further relation to the gender composition of sampled population, there were very few references towards long term water security being a key driver of their water usage. The ‘conservation’ of water seemed to have been excluded from their everyday life activities but rising water costs was the core reason for implementing water saving techniques which alludes to an increased awareness of the water scarcity challenges being faced in Durban and more widely in South Africa.

Synopsis of quantitative analysis

The respondents were questioned about eight water use behavior activities and four of them showed no significant statistical differences between the areas. However, some p-values indicated significant statistical differences between the areas in relation to following water consumptive behavior and practices. An inspection of the ANOVA tests adjusted for Kruskal Wallis, identifies the differences by areas where this occurred. For example, when it came to “consumption by persons and animals *i.e.*, for drinking and cooking food, it was found that there were significant differences between Durban North - Amanzimtoti ($p = 0.008$) and Pinetown-Umlazi ($p = 0.048$).

Furthermore, it was observed that in all areas, most respondents (34.4% on average) indicated that water was used mostly for consumption by persons and animals *i.e.*, for drinking and cooking food. The water consumptive practices in Durban are consistent with studies indicating that the largest increase in water demand by 2035 will come from the municipal sector in SA. Municipal water demand is predicted to increase from 5.5 km³ in 2014 to 7.2 km³ by 2035 (Hedden and Cilliers 2014). As a result, larger and far-reaching WDM initiatives in this sector are immediately required to narrow the expanding water supply-demand deficit in South Africa. Rising income levels and increased rural-urban migration, particularly in the provinces of Kwa-Zulu Natal, Gauteng, and the Western Cape, will significantly increase municipal water demand (Go *et al.* 2013). Therefore, it will be important that public policies on water conservation and water demand management interventions such as education campaigns must take cognizance of socio-economic aspects, as they relate to access and water use.

Environmental and water use behavior beliefs and perceptions

Respondents were questioned about their general environmental and water use behavior, beliefs and perceptions and in most instances the levels of agreement were higher than those of disagreement across the

areas. However, as indicated in Table 1, respondents indicated much higher levels of disagreement with, 'there is enough water in the city for us to use as much as we want to use', 'there is enough water in South Africa for each home to use as much as they want to use', 'nobody owns water so it should be free'.

The general disagreement with these statements indicates an environmental belief that water is common good and as such nobody owns water and therefore it should be free. This was a significant finding from this study as the higher disagreement levels with the statements relating water resource availability within the Durban metro was clearly indicative of a lack of knowledge and information (particularly at the home level) relating to SA's national water security challenges. In accordance with the data presented in the NWSMP (2018), which states that SA is expected to have a national water deficit of 17% by 2030, if current consumption continues to rise unabated and if no concurrent tangible water conservation and water demand management initiatives are undertaken immediately. In relation to statements relating to ownership of water in SA, the findings reflect that there is a general understanding within the city of Durban's residents, that water is a shared national natural resource and as such the custodians of water supply and reticulation (e.g., Municipality, Department of Water and Sanitation, Water Boards) are not regarded as the 'owners' of water in SA. Therefore, it will be imperative that any water conservation or water demand management initiatives that are undertaken by such public entities to conserve and sustainably utilize this resource, needs to be done in an equitable manner and with a great degree of transparency. Equally important will be the need to have citizen science inputs into co-developing such strategies.

Overall, the study found that there were no significant water saving practices or measures that residents deployed and that there was no significant difference between the areas, except for manual grey-water reuse ($p = 0.010$). More than twice the number of respondents in one suburb used grey water compared to the other areas. This finding reflected the vast socio-economic inequalities prevalent in the city of Durban in terms of access to water as residents who generally are low to middle income earners have inherently adopted grey water reuse as water saving measure, as compared to the more affluent and higher income earning residents in the city, who are economically advantaged and financially able to pay for their water use and therefore do not generally reuse their grey water. It is also noted that most residents did not invest or use readily available water saving technologies (e.g., low flow regulators, smart meters and dual flush toilets).

Adoption of such water saving practices will need to be driven by the authorities in the form policy, legislation (e.g., bylaws) and/or incentivizing the adoption of such technologies. Water saving practices should also linked to social norms and these are important factors when it comes to water conservation behavior as they symbolize the pressure of moral obligation. Such norms will encourage people to either conserve water or to continue using water wastefully. In order to promote positive water conservation behavior at the level of society or a community, it is important to develop a shared identity with a common interest to conserve water (Russell and Fielding 2010). However, social norms can also encourage undesirable water use behavior. For example, people can use the perceived excessive or wasteful use of water by others as an excuse to justify their own wasteful water use. Furthermore, social norms often make it difficult for positive environmental behavior to be adopted. The behavioral theories reviewed in this study have confirmed that individual behavior is shaped by the society in which it exists. The study by Troy and Randolph (2006) further states that wasteful home members are not socialized to conserve water when they were growing up. This certainly seems to be case in the city of Durban residents' water consumption attitudes, perceptions and behaviors as well.

Table 1. Environmental and water use behaviors beliefs and perceptions

		Phoenix		Durban North		Umlazi		Amanzimtoti		Pinetown		Chi square p-value
		Count	Column N%	Count	Column N%	Count	Column N%	Count	Column N%	Count	Column N%	
We are approaching the limit of the number of people the earth can support	Strongly agree	8	23.5%	9	25.0%	5	15.6%	7	18.4%	6	18.2%	0.795
	Agree	15	44.1%	17	47.2%	18	56.3%	23	60.5%	16	48.5%	
	Neither agree nor disagree	7	20.6%	3	8.3%	3	9.4%	2	5.3%	4	12.1%	
	Disagree	1	2.9%	4	11.1%	6	18.8%	5	13.2%	5	15.2%	
	Strongly disagree	3	8.8%	3	8.3%	0	0.0%	1	2.6%	2	6.1%	
Humans are severely abusing the	Strongly agree	15	41.7%	14	38.9%	14	45.2%	21	53.8%	14	42.4%	0.467
	Agree	18	50.0%	14	38.9%	11	35.5%	11	28.2%	11	33.3%	
	Neither agree nor	1	2.8%	3	8.3%	1	3.2%	0	0.0%	5	15.2%	

		Phoenix		Durban North		Umlazi		Amanzimtoti		Pinetown		Chi square p-value
		Count	Column N%	Count	Column N%	Count	Column N%	Count	Column N%	Count	Column N%	
environment	disagree											
	Disagree	1	2.8%	2	5.6%	5	16.1%	5	12.8%	3	9.1%	
	Strongly disagree	1	2.8%	3	8.3%	0	0.0%	2	5.1%	0	0.0%	
The so-called "ecological crisis" facing humankind has been exaggerated	Strongly agree	0	0.0%	2	6.1%	3	10.0%	2	5.3%	2	6.9%	0.561
	Agree	6	16.2%	10	30.3%	10	33.3%	14	36.8%	6	20.7%	
	Neither agree nor disagree	9	24.3%	3	9.1%	3	10.0%	6	15.8%	8	27.6%	
	Disagree	14	37.8%	12	36.4%	13	43.3%	14	36.8%	12	41.4%	
	Strongly disagree	8	21.6%	6	18.2%	1	3.3%	2	5.3%	1	3.4%	
There is enough water in the city for us to use as much as we want to use	Strongly agree	0	0.0%	0	0.0%	1	3.2%	1	2.7%	0	0.0%	0.023
	Agree	1	2.7%	5	14.7%	13	41.9%	8	21.6%	5	16.7%	
	Neither agree nor disagree	7	18.9%	0	0.0%	3	9.7%	3	8.1%	3	10.0%	
	Disagree	16	43.2%	15	44.1%	11	35.5%	16	43.2%	17	56.7%	
	Strongly disagree	13	35.1%	14	41.2%	3	9.7%	9	24.3%	5	16.7%	
There is enough water in South Africa for each home to use as much as they want to use	Strongly agree	0	0.0%	1	3.0%	0	0.0%	2	5.4%	1	3.3%	0.040
	Agree	2	5.6%	3	9.1%	7	22.6%	6	16.2%	5	16.7%	
	Neither agree nor disagree	4	11.1%	1	3.0%	0	0.0%	1	2.7%	5	16.7%	
	Disagree	14	38.9%	12	36.4%	15	48.4%	18	48.6%	14	46.7%	
	Strongly disagree	16	44.4%	16	48.5%	9	29.0%	10	27.0%	5	16.7%	
Nobody owns water so it should be free	Strongly agree	5	14.3%	3	9.1%	10	33.3%	4	10.8%	5	17.2%	0.009
	Agree	4	11.4%	4	12.1%	6	20.0%	10	27.0%	11	37.9%	
	Neither agree nor disagree	11	31.4%	3	9.1%	1	3.3%	4	10.8%	6	20.7%	
	Disagree	8	22.9%	17	51.5%	11	36.7%	15	40.5%	7	24.1%	
	Strongly disagree	7	20.0%	6	18.2%	2	6.7%	4	10.8%	0	0.0%	
There is enough water in SA, the government just needs to plan better	Strongly agree	3	8.6%	4	12.1%	5	16.1%	5	13.5%	4	13.3%	0.371
	Agree	7	20.0%	8	24.2%	11	35.5%	14	37.8%	15	50.0%	
	Neither agree nor disagree	11	31.4%	7	21.2%	4	12.9%	6	16.2%	5	16.7%	
	Disagree	10	28.6%	8	24.2%	7	22.6%	9	24.3%	6	20.0%	
	Strongly disagree	4	11.4%	6	18.2%	4	12.9%	3	8.1%	0	0.0%	
Technologies are available to supply the water required	Strongly agree	3	8.6%	4	12.1%	5	16.7%	6	16.2%	6	20.0%	0.718
	Agree	13	37.1%	14	42.4%	13	43.3%	16	43.2%	12	40.0%	
	Neither agree nor disagree	9	25.7%	6	18.2%	3	10.0%	5	13.5%	5	16.7%	
	Disagree	8	22.9%	8	24.2%	6	20.0%	8	21.6%	7	23.3%	
	Strongly disagree	2	5.7%	1	3.0%	3	10.0%	2	5.4%	0	0.0%	

Source: by author 2022

1.2. Qualitative Social Research Setting, Structure, Sample, Questions, Brief Presentation of Results

From January to February 2020, a panel of government authorities and water users conducted qualitative sociological research. The method used was a biographical narrative (Elliot 2005) where participants were asked to describe water demand policies, strategies, water conservation, demand management, and water conservation

technology towards water technology. Water. Moment of the interview on water conservation using open questions based on semi-structured questions. Questions were asked.

The qualitative approach

Data analysis in the qualitative components of this study aimed to understand the complexity and significance of the content by examining the transcript of an interview in detail before examining others on a case-by-case basis. Follow a specific analysis method, start with a specific example, and then move on to a more general classification or grouping. As the analysis progressed, the previous printouts were revised in light of the new main theme, and examples of previous printouts were also included in the ongoing analysis. The qualitative data analysis was based on the identification of significant speech fragments and their evolution into conceptual categories.

Common categories were identified and compared to develop a more general universal theme. This process was deductive in the sense that it moved from the synthesis of smaller conceptual units to the construction of more general categories of meaning and experience that reflect the observations of individuals. Qualitative approaches aim to explore 'research questions' about personal experiences and perceptions, to get to the core of meaning and to understand how specific phenomena arise in specific sociocultural and environmental contexts. In the qualitative part of this study, the objective was to examine the perceptions, knowledge, attitudes, practices, elements and beliefs of the representatives of the water supply authorities and government institutions about domestic water consumption, use and value of water. Water. Thematic content analysis with explanatory phenomenological reasoning was chosen to examine in depth the effects of meaning, perception, knowledge, and public policy on domestic water consumption, water conservation, and water-saving technologies.

Sample considerations

A sample of 4 focus group sessions was selected for semi-structured in-depth interviews based on a maximum variance sampling strategy. When the maximum variance sampling method is used, the researcher selects some devices or cases that maximize the diversity relevant to the research question. The qualitative study was conducted by a single interviewer, each lasting about 120 minutes. Senior officials and staff from eThekweni Municipality and Umgeni Water (a water supply provider) were interviewed. Each focus group was explained the purpose of the study and the main areas to be addressed in the interviews. Participants were told that the interviews would be recorded and that all answers would be transcribed later. Instant transcription ensured that the most important issues raised during the interviews were caught as quickly as possible.

Interview structure and research questions

Specific research questions and extra probes were also included in the questionnaire which were integrated and utilized to lead the interview's main topics. The order of the questions was adjustable, and alterations were made during the interview. The survey asked about organizational water demand strategy, WDM policy, regulation, and systemic concerns, public/customer education and awareness, particular instruments and interventions for home water demand management, alternative water source utilization, and learning and collaboration. Officials were chosen based on their previous expertise or specialized knowledge of WCWDM. By interviewing multiple employees from the same organization with similar roles and responsibilities, the sample of respondents was carefully selected to avoid bias. This guaranteed that all insights into the water services authorities research, education, and awareness programs, as well as implementation of water-saving interventions/devices at the home level, were consistent and standardized.

Overall, the interviews yielded adequate qualitative data to provide a complete overview of the key WDM policies, strategies, challenges, and practices in the City of Durban as implemented by the various water services agencies. The findings, as well as some of the significant challenges identified during the interviews, were simply incorporated into the data analysis portion of this research project. A set of questions on the basis of an interview schedule was structured in advance after a literature review and pilot interviews. The aim was to enter the personal and social world of the respondents; the latter perceived as the experiential experts on the subject and therefore, allowed maximum opportunity to discuss their own views.

Data analysis method

The data collected were subjected to thematic context analysis. As the thematic analysis continued, previous printouts were revised in light of new children's themes, and examples of these earlier printouts were also included in the ongoing qualitative analysis. The analysis of the thematic context was based on the

identification of significant parts of the discourse and their evolution into conceptual categories. Common categories were identified and compared to develop a more general universal theme. This process was inspiring because it moved from a synthesis of smaller conceptual entities to the construction of more general categories of meaning and experience that reflected the perspectives of the participants. Qualitative analysis is not based on frequency, but on identifying common themes in the data. Sub-sample categories, key themes, were created using themes explaining specific knowledge, presentations, behaviors, and concerns related to water consumption, water conservation, smart metering, and e-learning services. Thematic analysis allows for the emergence of meaningful relationships and relationships between grouped themes. To help with the clustering process, participants had a folder of sentences supporting related themes where examples of symbolic references were reported, collected, and interpreted.

Synopsis of qualitative results

The precise thematic analysis showed a strong positive attitude towards water supply authorities' knowledge of water savings and demand management in general. In particular, qualitative analyses revealed several links between themes grouped together, leading to several focal points of interest. Overall, townhouses had a positive attitude toward changing and adopting policies and/or interventions that supported water conservation behavior. WSA indicates that cognitive behavioral patterns of water use are associated with specific personal values such as:

- water quality;
- water retention and economic practices;
- water/environmental awareness and sensitivity;
- understanding the 'business' of water consumption. In particular, qualitative analysis has also revealed links between themes and subthemes, and key points are summarized below.

Study participants suggested it has a strong and progressive policy framework, but NRW water depletion was the biggest challenge. "Townhouses may use less water in their daily lives than people who live in non-urban areas (but believe they don't need to conserve water). This statement is linked to social comparison theory, according to which people try to evaluate themselves correctly in order to compare themselves with similar others (Festinger 1954).

The participants communicated a series of positive tools related to promoting awareness and interest in water conservation in urban areas, and this was associated with projecting a positive social identity, which is mainly related to categorization as members of a group that is positively invested and perceived as environmentally and socially responsible. Such tools include the revival of household appliances through guided media campaigns and the installation of water-saving devices through local bylaws. Participants strongly expressed that it was not just advertising but dedicated citizen science campaigns and programs that were readily available on social media and other platforms for public engagement.

The participants' use of alternative water sources was identified as an important water management system. Several initiatives such as rainwater harvesting and low-cost smart water metering have been taken up at a rapid pace to save water and reduce demand.

Participants created a strong internal motivation to do more to promote water conservation by creating a need to do more civic science, self-achievement, and comparison with oneself, in the form of adaptive habits at a very young age, or in the form of meaningful memories of powerful 'do's and don'ts' related to water use and/or wastage in family references, at the history and family level.

2. Results and Discussions

The largest group gathered from the survey related to the dwelling type, being free standing houses with the second biggest group of respondents being homeowners instead of renters. Most of the respondents were well educated with more than half having a tertiary education and being in their Middle Ages from the calculated average mean for both the respondent and head of the home ages. A small percentage of homes had more females than males and the racial make-up of the homes were relatively similar between African, Colored, White and Indian respondents and in keeping with racial geographical distribution of the Durban metro. Additionally, more than 80% of the homes had 8 or less people permanently residing at the residence.

The study provides novel insights through the situational and socio demographic factor analysis, however, the study area was limited to 5 suburban areas within the Durban metropole and further investigations could be undertaken to expand the sampling area. The combinatorial conclusions of the two social research methodological approaches allow Durban residents to have a deeper understanding of water use attitudes,

perceptions, knowledge, and attributions. As a result of the quantitative research approach, a significant percentage of participants reported that they typically behave in a water-saving manner through simple water-saving behaviors, such as turning off taps while brushing their teeth, giving soap, and washing dishes, checking whether pipes and taps were being drained.

However, only a small portion of the sample surveyed has adopted quantitatively comprehensive water conservation methods, such as limiting daily rainfall or applying water storage technology to their homes. Based on research insights, there seems to be a conflict with a cognitive misunderstanding that has been characterized by a utilitarian representation of what water use and water storage should mean in the lives of everyday citizens of Durban. Participants' descriptions of water conservation were limited to fairly stereotypic descriptions with a basic and general understanding of water conservation practices. Some other conclusion observations suggest a moderate and low preference for interrelated investments needed to change water efficiency behavior and adopt water-saving technologies such as smart water meters. This seems to be related to certain characteristics such as age, socioeconomic diversity, doubts, interests, and the level of trust in the new technology proposed by the Water Service Authority. On the other hand, there are some positive drivers that seem to work well together to motivate individuals to adopt more water saving practices and invest in modern water efficiency technologies. Such behavioral drivers appeal to strong psychosocial needs and processes within the individual and include social comparisons in combination with social identity, positive self-image, social rewards, and some external (material) motivations (e.g., reducing billing costs for saving in water use). The data analysis also suggests that the strongest barriers to the adoption of water-saving behaviors are deeply distinct and have negative cultural and political influences on them, particularly in an occupied state and linked to widespread corruption in South Africa.

Generally, respondents exhibited a negative attitude towards water service providers and water utilities in providing basic water services. Such barriers have been strengthened in South Africa's current political environment which is characterized by widespread unemployment, low economic growth rates, mass poverty and social crises. Therefore, any attempt to adapt to more modern devices or to change water use behavior in order to adopt new water-saving technologies is immediately considered meaningless or meaningless for city dwellers, because of the perceived inefficiency and corruption of the government and government departments that are mandated to manage and supply basic water resources. Therefore, residents seem to have adopted the attitude that 'there is enough water for everyone in the SA, so conservation is not needed', an ideology that suggests that water conservation is completely unimportant and demand management is more related to economic and/or political gains or interests. Urban homes had many problems with water use behavior and distrust associated with water use, and this has morphed into serious cognitive confusion, bias, and conflicting behavior towards water storage technologies and water storage practices in general.

Conclusions

This paper presents the use of qualitative and quantitative social research method approaches, and combines their results to provide an exploratory insight into water users' meanings, perceptions, knowledge and social impacts on water use in their communities. House provides water conservation and water conservation behavior and technology. Sociological research focused on the general public with the aim of improving public policies. This is one of the few social research studies that has addressed water demand attitudes and behavior in South African homes. The main findings on water users in the city of Durban are:

- belief in conspiracy theories regarding political control of water (related to the current water crisis, for example, the zero-day situation in Cape Town) and prejudices; This is low level. Nelson Mandela Bay);
- identify other water users such as agriculture and industry as the main culprits of water scarcity in Durban and South Africa;
- and identify best practice-based water conservation practices to maintain water efficiency. Build a positive self-image.

Managing water demand requires an understanding of society's water demand behavior and how it is affected by political actions. This article acknowledges that an important component of familial cognitive error is a (illusory) perception of "lots of water". Water managers and policy makers need to reconnect with water users, restore their trust and create a conceptual link from home taps to water sources and citizen awareness that can ultimately lead to better performance in water conservation.

Acknowledgement

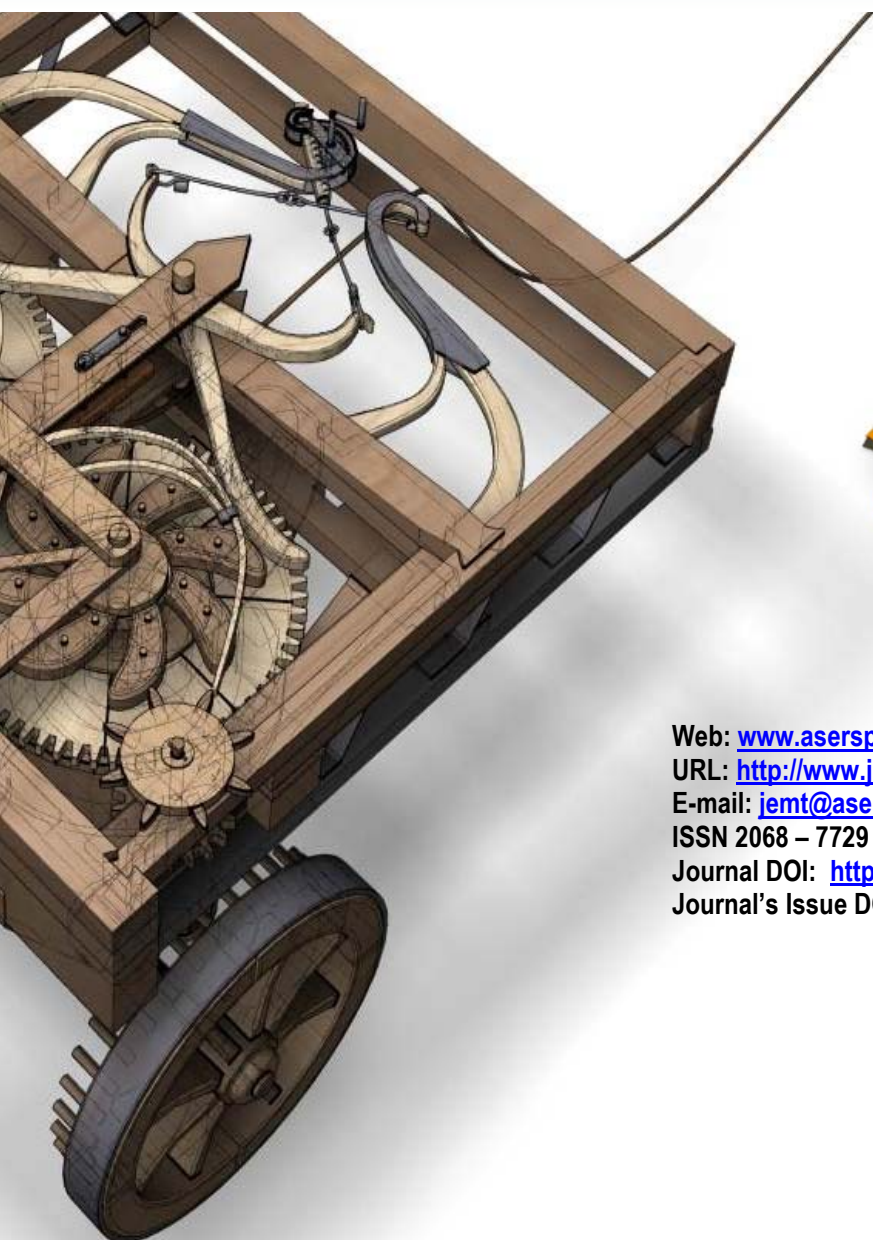
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