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Factors Influencing Adoption of Sustainable Consumptive Practices of Domestic Water in Beirut-Mount Lebanon Region

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FACTORS INFLUENCING ADOPTION OF SUSTAINABLE CONSUMPTIVE PRACTICES OF DOMESTIC WATER IN BEIRUT-MOUNT LEBANON REGION

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DECLARATION

I hereby declare that this Thesis is entirely my own work and that it has not been submitted as an exercise for a degree at any other University.

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ABSTRACT

Purpose – Transition to a green economy in the Lebanese water sector requires a paradigm shift from the current embedded practices in the society. The aim of this thesis is to provide valuable information to policy makers on the Lebanese consumer's awareness, current practices and they key factors that affect their willingness to engage in water conserving actions.

Design/methodology/approach – A survey was conducted to examine current water consumption practices, behaviors and key drivers of water conservation intentions of Beirut-Mount Lebanon residents.

Findings – The findings showed that subjective norms and gender have no influence on water conservation behavior. Data analysis showed that increased affirmative moral norms along with economic incentives have a great significance on boosting sustainable consumptive behavior.

Research limitations/implications – The study was performed using a snowball sampling technique to gather respondents who reside in Beirut-Mount Lebanon area which cannot be generalized to a large population.

Practical implications – This study could be expanded by stakeholders to include a larger sample size covering all Lebanese regions. Moreover, exploration of actual adoption of water-related behaviors (rather than behavioral intentions) can be considered in future research to have a better understanding on the relationship between intentions and actual water conservation behavior.

Originality/value – This research provides a better understanding of the factors that most influence Lebanese residents to use water sustainably. This knowledge can assist the government and policy-makers with critical instruments to tailor policies that best suits the community as a whole and to find ways to use the water more efficiently.

Keywords – Water conservation, Lebanon, behavioral intentions, Water demand management, scarcity, sustainability, policy-makers, Pro-environmental behavior.

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LIST OF ABBREVIATIONS

All the abbreviations used in this thesis are placed here in an alphabetical order

BML	Beirut Mount Lebanon
GCC	Gulf Cooperation Council
LBP	Lebanese Pound
LC	Local Committees
LRA	Litani River Authority
MCM	Million M3
MENA	Middle East and North Africa Region
MoEW	Ministry of Electricity and Water
O&M	Operation & Maintenance
RWA	Regional Water Authority
TPB	Theory of Planned Behavior
WRM	Water Resource Management
WDM	Water Demand Management

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Chapter 1. INTRODUCTION

1.1. General Overview

When the astronauts went for the first time into space, they looked back at the planet Earth and called it the 'Blue Planet' (Drinkwater, et al., 2009). It's assessed that about 70 percent of the Earth's surface is covered with water. The oceans hold about 96.5 percent of all Earth's water which is saline. And about 68 percent of the total freshwater is locked up in ice and glaciers. Another 30 percent of freshwater is in the ground. Rivers and lakes constitute only about 0.266 percent of total water which are the source of most of the fresh surface water that is needed, in large quantities, in almost all human activities (Gleick, 1996).

John Muir, a Scottish-born American naturalist and author, noticed in 1911 how "When we try to pick out anything by itself, we find it hitched to everything else in the Universe" (Muir, 1911). One hundred years later, many decision-makers attained the same declaration. Margaret Catley-Carlson, the Chair of World Economic Forum Global Agenda Council on Water Security, stated that many forthcoming threats to global stability such as hunger, health, political conflicts, economic growth and climate change are connected to one universal security risk: fresh water (World Economic Forum, 2011).

Water is an essential element of the economic, environmental, and social health of the nations. One of the major reasons that highlight water as agent of conflict is water scarcity which can present a clear danger to the internal stability of the countries (El Kharraz, et al., 2012). Water shortage can trigger international tensions and political conflict due to competition over it and may threaten the sustainability of societies (Howard, 2009). Plus, water scarcity has emerged as one of the major economic and environmental issues of this century (Kehl, 2010).

Many climate reports and other international assessments conclude that freshwater systems are amongst the first to be affected by the climate change (Kundzewicz, et al., 2007). It is broadly projected that the world will face a chronic scarcity of water by 2030 along with further degradation of the water resources quality due to serious water pollution problems caused by the large quantities of industrial, urban and rural waste that are produced and discharged untreated in the sea (2030 Water Resources Group, 2009).

In the recent times, the Earth Summit Document 'The Future We Want' has called for the implementation of green economy policies in the context of sustainable development and protection of the environment (Schaller, et al., 2008). The scarcity of water resources and the need for protecting the environment and natural resources urged the countries in the Middle East and North Africa to introduce new plans for water resource management in their national plans (Booz&Co, 2012). Consequently, policies have begun to focus on more efficient and sustainable use of existing water resources.

Based on water resources management approach, many actions can be used to overcome water-related challenges. These actions have two possible classification; either 'supply-side', meeting demand by developing additional new water resources (supply management) or 'demand-side', managing the consumption of water itself to properly use it to postpone or avoid the need to develop new resources (demand management).

The supply approach was the main idea behind the water policies that have been dominating for the past years. But nowadays, similar polices needs to be oriented differently to properly confront the different competitions for water resources arising from the various sectors as well as the rise of environmental problems. Internationally, there is a substantial pressure from the general public, supervisory agencies, and some governments implying that the weight should be shifted towards water demand management (WDM) (Butler & Fayyaz, 2006).

Quick review of some of the policies that can be used to diminish the impact of water shortages are presented in the Table 1 below.

Demand-Side Policies	Supply-Side Policies
Metering water consumption	Constructing Dams
Installation of water efficient appliances	Digging Wells and coordinate water extraction
Consumer awareness campaigns	Rain-water collection
Reducing leakage	Wastewater treatment

Table 1: Water Supply & Demand Side policies

1.2. Lebanon Overview

Following these encounters, the Lebanese government is faced with a big challenge to introduce new plans for water resource management in the national plan and to craft policies that provide incentives for users to increase efficiency of water use while meeting their basic needs. Especially since the pollution of clean waters sources and the sea, alongside with poor irrigation uses, have led the country to a threatening state where the natural environment for both human usage and preservation of biodiversity are in jeopardy (Karam, n.d.).

With all the trends and historical data indicating that efficient water management is simply not possible without water pricing, in 2012, legislative steps have been taken under the auspices of the Ministry of Environment by introducing a new water pricing policy that calls for consumption monitoring and for the installation of water metering charging on individual basis (Dockery, 2012).

In the view of the above, we note that, the Lebanese government focused its National Water policies on the demand side approach; restraining the excess usage of water by using it in an efficient way. As with regard to increase the supply of water, the government has plans to build dams. Yet due to the intense process of planning of a dam, the tight budget and the bureaucratic problems of all Ministries, these plans are on a behind schedule (Dockery, 2013).

1.3. Context of the Study

Policy-makers around the world are progressively putting the emphasis on non-structural approaches to water management, in view of all water-related issues emerging in the world. The non-structural approach incorporates demand management, scientific research, education and coordination on how humans use water. These demand-side policies seek to deal with the human causes of water problems. This emphasis on water-users aims to encourage environmentally friendly water planning, least-cost and takes into account both supply and demand options (FAO, 1993)

Recognition of water use behavior is decisive aspect of water demand management which highlights a need for a better understanding of the psychological processes that underlies water demand.

Different studies researched the psychological processes of household water usage in various locations; however, none of the studies encompasses the Lebanese households. Therefore, this thesis intends to cover this gap of knowledge by shedding light on the usage of water efficient appliances and their daily consumption of water.

1.4. Need for the Study (importance)

Water resources were often considered abundant and water for domestic uses was expected to be provided to all almost free of charge. Over the last few decades, progressive water scarcity has been acknowledged and preserving the Lebanese freshwater availability and protecting its quality has become vital in the light of the emergence of climate change. Serious efforts will have to be made in order to conserve these resources, in terms of quality and quantity, which are subject to misuse and bad management.

Transition to a green economy in the water sector requires a paradigm shift from the current practices by adopting innovative technologies that provide environmental as well economic benefits.

This thesis studies the link between existing beliefs that are deeply entrenched within the population and their water consumption practices. The results of this study might stimulate further research to aid the government to have wider scope on what provokes the nationals the most, in order to minimize the waste of the used water.

The contribution to knowledge is a better understanding of the factors that most influence Lebanese residents to use water sustainably. This knowledge can assist the government and policy-makers with critical instruments to tailor policies that best suits the community as a whole and to find ways to use the water more efficiently.

1.5. Objectives of the study

The objectives of this thesis are:

- To investigate on the driving forces that push residents to use water sustainably and influence the adoption of pro-environmental action
- To define existing practices on the daily use of water
- To investigate on the willingness to have new water appliances in their home
- To develop guidelines for a national water policy

The main purpose of this research is to determine the knowledge, attitudes, current behaviors, and behavioral intentions of water consumers with respect to water conservation.

1.6. Thesis Structure

The overall structure of the study takes the form of six chapters, including this introductory chapter. The latter emphasized on the importance of fresh water in sustaining the life as we know it. It began by exploring the problem in a general overview. Then the chapter introduced the context of the study, the importance of recognizing water use behavior followed by the statement of the problem, significance of the study and purpose of the study.

The second chapter begins by laying out the theoretical dimensions of the research that examined the models and theories related to water conservation behaviors from which the researched model was developed. The third chapter is the literature review which includes previous studies that investigate those theories and highlight specific variables that influence water conservation behavior.

The fourth chapter is concerned with the methodology used for this study. It starts by identifying the research questions and the hypothesis, then by formulating a research design for data collection. The fifth chapter is about the data analysis process and is supported by tables, charts and figures; and the final chapter discusses the findings and the limitations, concluding with suggestions and recommendations for further study.

Chapter 2. THEORETICAL FRAMEWORK

This chapter is about the theoretical framework that discusses the theories that will be the foundation of this thesis.

Most of the reviewed literature indicate that human-kind and the industrial activities are responsible for environmental problems (Miller, 2011), and consequently it has been argued that changes in human behavior are an essential part of the solution (Oskamp, 2000).

The basic ground of this study is to build an integrated research model to examine the factors that most influence efficient water use and conservation in the household. Few of the most widely used behavior change models and theories will be tackled in this chapter.

2.1. Stern's Values-Beliefs-Norms theory (VBN)

Paul Stern, Thomas Dietz, Troy Abel, Gregory A. Guagnano and Linda Kalof have proposed a Value-Belief-Norm theory (VBN) for the relationship between values, norms and behavior. In nature, values are abstract (Schwartz, 1992). This suggests that the effect of value priorities on evaluations and actions in the environmental and political domains may be indirect. It is assumed that the influence of values on behavior is observed through basic beliefs and personal norms. Individual choice to adopt environmental engagements can be driven by personal norms. These are stimulated when a person believes that violating them would have negative impact on things they value and by taking action, they will be held accountable for the consequences (Stern, 2000).

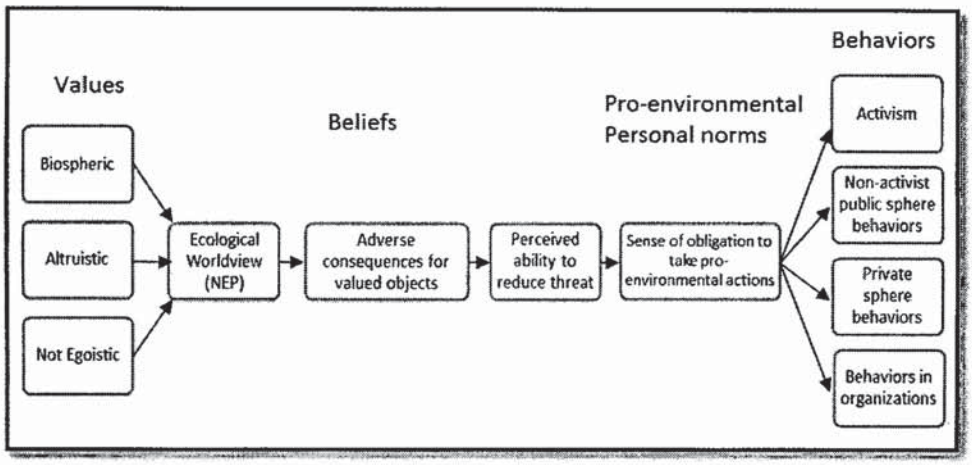

Figure 1: Stern's (2000) values-beliefs-norms Model
Source: (Stern, 2000)

Based on Stern's (2000) model illustrated in Figure 1 above, stimulation of water conservation behaviors can be grouped into five underlying causes: attitudinal factors, beliefs, habits, personal capabilities, and contextual forces.

2.1.1. Attitudinal Factors

There is a vast literature in the journals of psychology, sociology, education dealing with attitudes. With reference to the psychological literature, attitudes are defined as an evaluation of an entity such as an object or a behavior (Ajzen & Fishbein, 2000) (Eagly & Chaiken, 1993). Thinking in favor of water conservation or not reflects positive or negative attitudes respectively. It is about evaluating water-specific behaviors and whether considering it beneficial or not. One of the most widely used theories investigating the relationship between attitudes and action is the theory of planned behavior (TPB) which will be elaborated later on in section 2.2

2.1.2. Beliefs

In the article "Implicit connections with nature", Schultz et al (2004) consider that beliefs are the worldview of a person, which are reflected by the relationship of people with the natural world.

Many studies examined the relationship between the environmental beliefs of households and their water conservation behavior (Dunlap, et al., 2000). The results

revealed that having general environmental beliefs expected water conservation intentions and consequently lead to the actual practice of water conservation behavior (Corral-Verdugo, et al., 2008) (Clark & Finley, 2007).

On the other hand, Corral-Verdugo et al (2008) found that the general environmental beliefs aren't the immediate factors for stimulating water conservation behaviors but it is rather the specific beliefs about water. For instance, when people believe that water is an unlimited resource, the engagement in water conservation behaviors was less and vice versa. This deduction is also consistent with the attitude findings; just as precise attitudes about water conservation behaviors are key to predict the latter, particular beliefs and not broad ones are the significant drivers for water conservation behaviors (Ajzen & Fishbein, 1975).

2.1.3. Habits

As defined by Verplanken and Holland (2002), habits are the constant behavioral patterns acquired in the past which are executed automatically without cautious consideration. Thus, habitual behaviors are channeled by an automatic response, rather than intentional reasoning. Habits are measured by the frequency of past behavior; the more frequent a behavior is performed, the more likely a habitual pattern is formed which will eventually lead to automatic responses in prospect situations (Ouellette & Wood, 1998).

2.1.4. Personal capabilities

Some scholars argued that knowledge and skills can help shaping conservation behaviors while others also argues that socio-demographic elements can be considered as proxies of personal capabilities (i.e. age, education, and income) (Stern, 2000).

Clark and Finely tried to identify the relation between water conservation behavior and precise awareness of climate change effects. They found that persons that are conscious about the global warming consequences are willing to conserve water (Clark & Finley, 2007).

Nonetheless, there is a lack of clear literature that investigates the impact of personal capabilities on water conservation. More research is needed in that field.

2.1.5. Contextual Factors

Many intellectuals are interested in the study of factors that trigger political, economical, societal and environmental changes (Wischnevsky, 2004). Contextual factors are described by some intellectuals as the physical infrastructure and technical facilities in a society such as the ability to install water efficient devices, and possession of rainwater tanks (Steg & Vlek, 2009).

Water pricing is also an important contextual matter. Studies have shown that in order to further understand the relationship between water demand and water pricing, psychological variables must be considered (Randolph & Troy, 2008).

2.2. Theory of Planned Behavior

The theory of planned behavior, which is an extension of the theory of reasoned action (Fishbein & Ajzen, 1975), takes a rational approach to predicting behavior, assuming that decisions about behavior are driven by beliefs about the likely consequences of an action perceived as subjective norms and perceived behavioral control over the action. The stronger these factors are, the more likely someone is to form a behavioral intention to do the action and consequently, act (Ajzen, 1991).

The common ground between the theory of reasoned action and the theory of planned behavior is that both of them acknowledge that attitudes by themselves don't always act as significant predictors of behavior so they included subjective norms and attitudes in predicting intentions. The notion of perceived behavioral control is added by the TPB theory.

The theory of planned behavior has been used to understand decisions from a wide range of behaviors including water conservation (Clark & Finley, 2007). According to this theory, intentions are considered to be the most immediate predictor of behavior to engage in the behavior itself. They are in turn predicted by three main elements: attitudes, subjective norms and perceived behavioral control.

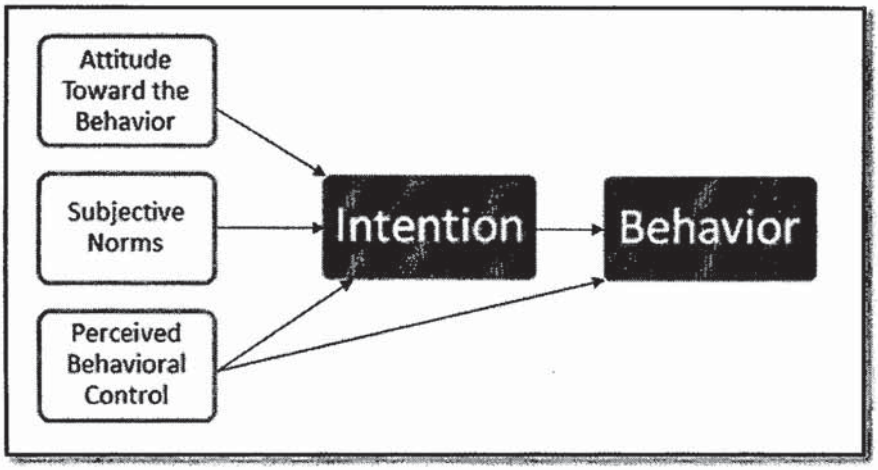

Figure 2: Theory of Planned Behavior (TPB)

2.2.1. Attitudes

Attitudes are defined as beliefs about the predicted outcomes of a behavior and the evaluations of each of the outcomes; whether positive or negative, favorable or unfavorable (Ajzen, 1991, p. 179).

2.2.2. Subjective norms

"Subjective norms are the beliefs about whether social support from the "others" and the community is important to engage in a behavior. It is weighted by the motivation to comply". Ibid.

2.2.3. Perceived behavioral control

Perceived behavioral control is an individual's perception of their ability to perform the behavior. It is also about the actual control over an action. Hence, it is related to the constraints they face in doing so; personal and environmental barriers. No matter how strong ones intentions, barriers are also able to affect behavior. For example, if someone lacks money and is not able to install water efficient devices, then he do not have actual control over the behavior and consequently it will impact the intention to install this efficient device (Cheung & Chan, 1999) (Fielding, et al., 2008).

2.3. Conclusion

As stated above, the basis theories that will be used in this study are: Stern's Value Belief Norm theory (VBN), Theory of Planned Behavior (TPB). A quick summary of each theory in addition to its core constructs, definitions and limitations will be included in below Table 2 and Table 3.

Value Belief Norm Theory	
Paul Stern and his colleagues developed the VBN theory in 2000 for the relationship between values, norms and behavior. It assumes that the pro-environmental behavior is traced back to a chain of causes relating a chain of five variables.	
Core constructs	**Definitions**
Values	Simple principles guiding evaluations which influence on attitudes and behaviors. • Biospheric • Altruistic • Not Egoistic
Beliefs	Ecological beliefs about the relationship between human beings and the environment • Ecological Worldview (NEP) • Adverse consequences for valued objects • Perceived ability to reduce threat
Personal Norms	Activating or counteracting feelings of moral obligation, it is the main antecedent of ecological behavior. • Sense of obligation to take pro-environmental actions
Behaviors	• Activism • Non-activist public sphere behaviors • Private sphere behaviors • Behaviors in organization
Limitations	
This theory lack to mention the extent by which individuals have control over their behavior.	

Table 2: Summary of Value Belief Norm Theory

Theory of Planned Behavior (TPB)	
It is extension of the theory of reasoned action. It assumes that decisions about behavior are driven by beliefs about the likely consequences of an action perceived as subjective norms and perceived behavioral control over the action.	
Core Constructs	**Definitions**
Attitude Toward Behavior	Beliefs about the predicted outcomes of a behavior and the evaluations of each of the outcomes i.e. evaluation of installation of water efficient appliances.
Subjective Norm	Perception of social support to engage in the behavior i.e. extents to which people who are important to me think I should install water efficient appliances.
Perceived Behavioral Control	Extent to which a behavior is perceived as able to be done i.e. perceived ease or difficulty of installing water efficient appliances.
Limitations	
This theory neglects emotional variables such as fear, threat, mood and negative or positive feeling which could affect the behavioral intention	

Table 3: Summary of Theory of Planned Behavior (TPB)

This thesis will formulate a new model constituted from some of the variables extracted from the above theories in addition to other factors that are identified as relevant in the literature.

Chapter 3. LITERATURE REVIEW

More and more scientific literatures are increasingly reflecting unanimity that global climate change is a reality. The discrepancy in temperature and rainfalls, the melt-down of glaciers and ice caps, the increase of the severity and frequency of droughts and floods affects the freshwater availability required to sustain a healthy ecosystem on the planet earth.

Since the industrial revolution, human activities in coastal areas have evolved rapidly. The latter led to serious water pollution problems caused by the large quantities of industrial, urban and rural waste that are produced and discharged untreated in the sea (Oreskes, 2004).

With the existing climate change scenarios, these studies indicate that almost half the world's population will be living in areas of high water stress by 2030 and around 1.8 billion people will be living in counties or regions with absolute water scarcity (FAO, 2007). At the current consumption rate, it is forecasted that the supply of freshwater in 20 years, will close only a fraction of the demand for water which will be 40 percent higher than it is today as the world's population and economy are ever-increasing (2030 Water Resources Group, 2009).

Faced by the situation described above, policy-makers are faced with enormous challenges of effectively managing available scarce water resources to deliver water and sanitation services while minimizing the negative impacts on the environment. One way of responding to these global pressures on the water resources is application of Water Demand Management (WDM) concepts.

This chapter starts by defining Water Demand Management, then discusses its measures and policies, then moves to explain the measures that can be applied by the households in order to contribute to a sustainable supply of water in their community. Moreover, previous researches that are mostly relevant to this topic will be examined.

3.1. Water Demand Management

3.1.1. Definition

A general and simple definition of water demand management was given by UKWIR (UK Water Industry Research) and it states that "water demand management refers to the implementation of policies or measures which serve to control or influence the amount of water used" (UKWIR/EA, 1996).

According to the Department of Water Affairs and Forestry, South Africa (DWAF, 1999), water demand management is "the adaptation and execution of a strategy (policies) by a water institution to guide the water demand and usage of water in order to meet any of the following objectives: environmental protection, social equity, economic efficiency, social development, sustainability of water supply and services and political tolerability".

A more operational definition was suggested by David Brooks. According to him "water demand management is defined as any actions that reduce the amount of water used or enable water to be used more efficiently" (Brooks, 2006, p. 521). In that definition, five Items are proposed:

- Water requirement for a certain task are to be reduced qualitatively or quantitatively;
- Use less or lower quality water to accomplish a certain task;
- Losses to be reduced throughout the process from source to disposal;
- Shifting time of use to off-peak periods;
- Increasing the ability of water institutions to be more efficient during droughts.

This definition deduct the drivers of water saving and allows the gains to be tracked by the source of the saving. It also shows how more efficient water use goals are associated to equity, environmental protection and public involvement.

"The term water conservation is often used synonymously with water demand management" (Green, 2011). Water conservation can be described as "any beneficial reduction in water use or in water losses" (Baumann, et al., 1984). Ways to achieve water conservation include:

- Technical measure such as using water-saving fixtures, reduction of loss water in the system
- Use or process change, for example reuse of water
- Regulatory action
- Metering and pricing policies
- Public education to help people change behaviors to use less water without impacting life styles.

The conventional urban water management approach, in which the traditional response to the ever-increasing water demand is usually the development of new water sources, is no longer a feasible approach to follow. Such approach had financial and ecological implications. Furthermore the concept of sustainability was not broadly spread out in the past. People did not view resources as finite and that one day they will be exhausted. Consequently, the need for a new setup became apparent.

In the last 20 years a new approach has emerged. The demand side approach is based on the concept that, demand is not the quantity of the good sold but the service that will be provided to the end user (White & Fane, 2001). For example if we assume that a consumer has a 15 liter flush toilet, every time he flushes it he uses 15 liters of fresh water. But in reality he does not need those 15 liters, he needs less. If a dual flush toilet or a low flush toilet is installed, the demand for the consumer will be satisfied but with less water consumed. Also it is not necessary to flush the toilet with water of drinking quality. Water with a lower level of quality would flush the toilet as well as the fresh water.

The demand-side management (DSM) has emerged as a complementary approach to increasing water supply infrastructure. It is crucial for shifting the orientation of urban water policy towards a more sustainable direction. It involves decreasing the demand for water through a mixture of several components: education, technology, pricing reform, regulation and recycling (Brandles & Ferguson, 2003).

3.1.2. The Benefits of Water Demand Management

The benefits of WDM can be categorized in various ways. The most common method is by dividing them to financial benefits and ecological benefits. Another way is to divide the benefits depending on who is benefited. The benefits of WDM on various users are represented in Table 4 below.

Wringing more work from each drop of water sustains vital water supplies, lower water bills, reduces the need to wastewater treatment , protects the environment, and create wealth. Everybody wins:	**Consumers.** Installing water-efficient faucets, showerheads, toilets, and other devices can substantially reduce household water and sewage bills, and it can save even more money on energy for heating water. The use of these devices may also reduce or eliminate such problems as an overflowing septic tank. And don't overlook the comfort factor-an efficient showerhead lets twice as many people use the shower before the hot water runs out!
	Communities. Some communities are physically short of water, or at least uncontaminated water; some must pay expensive pumping cost; and many are seeking ways to avoid paying enormous capital costs to increase water storage or watewater treatment capacity. Local budgets can be stretched only so far. A community that avoids building a larger watr or wastewater facility will have services.
	Utilities. Increasing water efficiency can enable utilities to reduce baseload and peak demand, making it possible to postpone or avoid tapping new supplies, expanding storage, or expanding treatment facilities. Programs that promote efficiency can enable a utility to achieve more predictable patterns of demand and buy time for effective long-term planning. For these reasons, many utilities offer rebate programs that enable customers to install efficient fixtures at a reduced price or for free, thus saving consumers even more money.
	Companies. Using water more efficiently can reduce operating costs, often including fuel, chemicals, and labour.
	The environemnt. Water not consumed can save a river from a dam and a wetland from destruction. Water not heated with fossil fuel means oil or gas not depleted, coal not burned, carbon not released to cause global warming, and sulphur not deposited as acid rain.
	The economy. Money not spent on wasted water and energy is used more productively to create jobs and strengthen local businesses.

Table 4: Water Demand Management Benefits
(Source: Rocky Mountain Institute http://www.rmi.org)

3.2. Water Demand Management Measures

With reference to Tate (1990), Water Demand Management measures can be divided into three categories: sociopolitical, economic and structural-operational.

3.2.1. Socio-political Measures

Socio-political measures aim to influence a change in the users' behavior towards water usage and water wastage. It can be accomplished through spreading awareness to the public by education programs or media campaigns. Many users are not familiar with the great value of water and thus, if the appropriate tools are used to inform and enlighten them, they will likely changes their wasteful water behaviors, or discover new ways of using water wisely. Ibid.

3.2.2. Economic Measures

Water is considered, apart from a social good, an economic good. The Dublin principles put the notion of water as an economic good on the international agenda and it was widely accepted by the world's water professionals (Dublin International Conference on Water and the Environment, 1992). The four Dublin principles are stated in Figure 3 below. Thus, as per the latter, the water market obeys the laws of supply and demand. Therefore, an increase in water price would theoretically result in a lower consumption of water. Such measures apart from rise in the price of water include penalties for excessive water use or financial incentives for efficient use of water (Tate, 1990).

1	Water is a finite, vulnerable and essential resource which should be managed in an integrated manner.
2	Water resources development and management should be based on a participatory approach, involving all relevant stakeholders
3	Women play a central role in the provision, management and safe guarding of water.
4	Water has an economic value and should be recognized as an economic good, taking into account affordability and equity criteria.

Figure 3: The Four Dublin Principles
(Source: ICWE, 1992)

However, the prices for water are determined administratively through political mechanisms that rarely take water economic value into account. Therefore, water prices do not respond automatically to short-term and long-term changes in supply (Olmstead, 2010)

3.2.3. Structural-operational Measures

These processes include technological and engineering solutions that aim to reduce water consumption without lowering the level of service to the consumer. Such measures include water recycling, the promotion of water efficient devices, rainwater harvesting and adoption of plants that require less water for irrigation (Brandles & Ferguson, 2003).

3.3. Water Demand Management Policies

Water scarcity constitutes the major threat for the global community in the 21st century and the situation will get worse in the world's urban areas in the coming years (UN-HABITAT, 2009). The need to sustain water sources is nowadays obvious to scientists and governments. Thus, the latter are more and more placing regulations for the reduction of water consumption.

There are two types of WDM policies, price policies and non-price policies. The choice of non-price or price tools for water demand management has been at the center of a debate amongst economists and policy makers arguing about the effectiveness of those instruments in encouraging efficient water use of the residential users.

3.3.1. Price Policies

Water pricing was derived from the term "Water as an economic good" which was introduced in the Dublin principle. Two different schools of thoughts interpreted this expression. The first stipulates that it refer to the economic pricing of water, which would damage the interests of the poor society. Consequently, it has being added in the fourth Dublin principle that water is also a "social" good taking into consideration it should be affordable to the poor. Whereas the second school of thought construes that it is about making integrated choices for sustainable use of

water in a broad societal context while meeting all human basic needs (Gaffney, 1997). As a result, water pricing can be viewed as the pitfall of the concept "water as an economic good".

In view of that, the two concepts Water demand management and Water pricing can be considered compatible, within the framework of Water resource management. Water economics, as referred by some authors, is about making the right choices about the allocation, the conservation and the development of water resources. Water pricing is only considered as part of demand management and economic planning (Savenije & Van Der Zaag, 2002).

Using prices as an incentive for conservation was established in the economics of pollution control many decades ago. These policies allow households to respond to the increased water prices according to their freewill and judgment rather than installing a water efficient technology or reducing specified uses (Olmstead, 2009).

According to economic theory, volumetric prices are considered as the most efficient way to regulate water demand by obliging the users to pay a charge per amount of water consumed contrasting to water tariffs where users are charged a block rate depending on their consumption. During times of scarcity and drought, water price can be raised so users consumes less and thereby regulating demand. Ibid.

Metering and volumetric measurement of water supplies is at the center of most water demand management tools. When used with an effective tariff structure, metering has been found to be a powerful incentive to reduce water consumption. For instance, in 2001, Canadian residential water consumers whose house connections were not metered, and who paid a fixed or flat rate used an average of 474 liters/person/day, which was 74 per cent more water used compared to Canadians charged on volume-based water rates (Government of Canada, 2004).

3.3.2. Non-Price Policies

While many advocate that using prices to manage water demand is more cost effective than implementing non-price conservation programs, others argue that non-price approaches are the only viable tools to reduce residential water demand. These include constraints or subsidies for the use of water-saving devices such as dual flush toilets and low-flow shower heads, and promoting water conservation attitudes and awareness campaigns (Ward & White, 2012). Their key statement is that water is considered a basic need and since the demand for this natural resource is usually found to be price inelastic, then allocating it on the basis of price will place a burden on the poorer and larger households (Worthington & Hoffman, 2008).

In Fresno, California, the state legislature passed a law requiring the installation of meters by the year 2025 (U.R.S Corporation, 2002). Meters enable consumers to be responsible in their water use, or pay financial consequences. The absence of meters has significant effect on water use. In Fresno, a city without meters, per capita use is around 300 gallons per day; in neighboring Clovis, which has meters, use is approximately 200 gallons per day (Benjamin, 2003). Similarly, a case study by (Kayaga, 2008) shows how a combination of economic instruments has been used to effectively contribute to an integrated program for water demand management in Zaragoza, Spain. It is deliberated that the use of tariffs and other economic instruments for water demand management depends on the socio-economic status of the consumers. There are two key lessons to highlight from the Zaragoza case study. First lesson is that the economic instruments need to be implemented in combination with other measures in order to be effective on inducing water conservation. Second lesson consist of investigating more accurately the socio-economic status of the consumers enabling the effective design of the economic instruments.

In his article in the Texas Law Review, Robert Glennon (2005) advocated that the governments have a critical role to play in developing water conservation programs. One example of an effective program is to create financial incentives for homeowners to replace toilets and showerheads with low-flow fixtures (Gleick, et al., 2003).

3.4. Measures applied by Households to Conserve Water

3.4.1. Use of water efficient appliances

There are several appliances in a typical household residence that consumes water. "By installing more efficient water fixtures and regularly checking for leaks, households can reduce per capita water use from 74 to 52 gallons per day" (from 280L to 196L) (EPA, 2007).

3.4.1.1. White goods

The most common machines in a households which in order to function use water and can at the same time possibly save water are the washing machine and the dish washing machine. Apart from water, these machines use electricity and detergent. With efficient machine savings on water, electricity and detergent reduction could be achieved (EA, 2003).

3.4.1.2. WCs

The bathroom is the most demanding water component of indoor household use. The water used in WCs in mainly for toilet flushing, showering, bathing and washing. According to (Keating & Howarth, 2003), approximately 30% of house consumption is used for flushing the toilet. Traditionally, 12 liters of water were used per flush. Nowadays there are ultra-low flush toilets that can use only 4 liters. There are also dual flush systems that can flush with 6/3 liters per flush. The decision is in the user depending on the use of the toilet. Although these flushing systems might be technically impeccable, they are not always feasible because they are not always used correctly: some users usually double flush the toilet because they are not satisfied by the single low flush resulting in an increase of water consumption rather than its reduction.

3.4.2. Practice water saving behaviors

An operative way of reducing the consumption of water in the household is simply to practice certain behaviors that reduce the consumption of water without lowering the level of service. Individuals don't think about the implications of wasting the water while applying everyday tasks like washing the dishes and brushing their teeth. The water is flowing from the tap whenever they desire it and it seems infinite. Simple practices are neglected by the force of habits that are crucial action to save fresh water (EA, 2003).

3.4.3. Rainwater collection

In order to secure the enhancement of the supply of water, all the available options must be explored. Research has shown that demand on water catchments can be considerably reduced when a large proportion of households install rainwater tanks and/or reuse grey-water (Ryan, et al., 2009).

The harvest of rainwater is a technology used to collect and store rainwater from roofs, gutters, land surfaces or rock catchments using simple techniques such as jars and pots or more complex techniques such as underground check dams. It is one of the most promising alternatives for supplying freshwater in opposition to increasing water scarcity and escalating demand (Li, et al., 2010).

3.4.4. The reuse of Grey-Water

Grey-water is the untreated wastewater that is generated and can be collected from showers, kitchens, sinks and laundries. Consequently, it is the components of domestic wastewater which do not originate from the toilet (Lombardo, 1982). Grey-water comprises between 50 to 80% of residential fresh water total consumption, which can be reused for other purposes, especially landscape irrigation (Do Monte, 2007). Thus, recycled Water is the wastewater that is treated by eliminating solids and impurities, and used in sustainable landscaping irrigation or to restore groundwater aquifers.

The purpose of these recycling activities is to provide sustainability as well as water conservation, rather than discharging the treated water to surface waters such as

rivers and oceans and polluting the environment (Levine & Asano, 2004). The reuse and recycling of grey-water has been practiced in several countries because of the obvious benefits in terms of fresh water savings and management (Zaidi, 2007).

3.5. Previous Research

A study by Theodori and Fox (2009) for the Texas Water Development Board was conducted to have a clearer understanding on the knowledge, interest, perceptions, attitudes, behaviors and intentions of water consumers with respect to water conservation enabling the state of Texas to develop an effective policy to secure future water resources. The data used for this study was collected from a random sample of individuals living within the state of Texas. A survey questionnaire was sent by mail to a randomly selected sample of 8,768 from which 2,110 surveys were completed and returned. Logistic regression, Ordinary least squares (OLS) regression and the Chi-square ($\chi 2$) tests were used to analyze the findings of the survey.

It is found that although a good percentage of respondents recognized the importance of sustaining water through conservation, many do not understand the water challenges facing the State: there may not be enough water to meet the future needs without some effort to reduce utilization of water. These findings disclose that although there are a large number of citizens who are practicing water conservation in their routine lives, it appears there is room for more efforts. It also appears that if the population encounters incentives, the willingness to conserve water will increase. These incentives do not necessarily have to be economic in nature. Spreading awareness and education has proven to be easier to voluntary conserve water than to have more regulatory practices implement (Theodori & Fox, 2009).

In recent years, Australia has faced an extended drought in many regions across the nation which initiated the development of seawater desalination plants and wastewater recycling. A study by Dolnicar and Hurlimann (2010) examined Australians attitude and behaviors towards water conservation. They advocated that in addition to the measure used to increase the supply of water, water conservation

play a major role in reducing the water crisis of the country. A national online survey study of 1495 people was conducted in January 2009 using quota sampling to ensure that the survey was representative based on demographic characteristics. The survey included questions about: attitudes to water conservation; water conservation practices; water efficient appliances, and barriers to the purchase of water efficient appliances. The variables of the survey were retrieved from Ajzen theory of planned behavior.

Results indicate that Australians in general have affirmative attitudes towards water conservation and water saving appliances; however these positive attitudes are not regularly translated into actual behavior. The main barriers to adoption of water conservation behaviors identified in the study are: the perception of inconvenience and impracticality, as well as costs associated with purchasing water saving appliances (Dolnicar & Hurlimann, 2010).

Moreover, a research by Spinks, Fielding, Russell, Mankad and Price (2011) was carried out as part of the South East Queensland Urban Water Security Research Alliance which was formed to address Australia's South East Queensland (SEQ) region's emerging urban water issues. The aim of this research was to develop a comprehensive understanding of the social and behavioral aspects of household water use. The research used the Theory of Planned Behavior (TPB) as the primary theoretical framework (Ajzen, 1991) and developed a quantitative survey which identified socio-demographic and psycho-social drivers of domestic water use. Additional predictors were also added such as community and self-identity (as a water conserver), moral and descriptive norms, household culture, and habits.

The finding proposes that feeling a sense of personal moral obligation to conserve water is an important causal factor of water curtailment and efficiency intentions and intentions to install specific water efficiency devices.

Additionally, a recent study by Willis et al (2011) reports selected findings from the Gold Coast Residential End Use Study (Australia) (Willis, et al., 2009),

which purpose was to identify end use water consumption in Gold Coast homes and to evaluate the effectiveness of WDM strategies namely the application of water efficient devices and education as well as understanding water use differences between varying socio-demographic groups.

The study adopts a mixed method design through collecting, analyzing and mixing quantitative and qualitative research approaches and processes. Questionnaire surveys were developed to obtain socio-demographic information and were distributed to 151 houses and information were entered into SPSS (statistical analysis program). Analysis determined that a range of collected socio-demographic factors influenced end use water consumption levels, namely, location of household, lot size, Rain Water Tank (RWT) ownership, household income.

According to a recent U.S study, the potential water savings of more water efficient versions of the house appliances was well acknowledged, and householders were encouraged to upgrade their appliances by using rebates and exchange programs. The study deduct that such programs are publicly more adequate than other water management policies, such as water restrictions or price increases. It observed a 6 to 14% reduction in household water demand for the first two years after these efficiency programs were introduced by a water authority in Florida (Lee, et al., 2011).

3.6. Water Management in Lebanon: An Overview

"Lebanon is considered to be one of the most urbanized countries in the Middle East and the North African Region (MENA) compared to its small size. The country has a total population of about 4 million people and an average population growth rate of 1.8 percent per annum, noting that no population census was conducted in Lebanon since 1932 and therefore all population figures are an estimate" (World Bank, 2010, p. 1).

"About 78% of the Lebanese population is connected to the public water network. Excluding the GCC countries, water service coverage in Lebanon is in line

with the average in MENA countries as shown in Figure 4 below" (World Bank, 2010, p21).

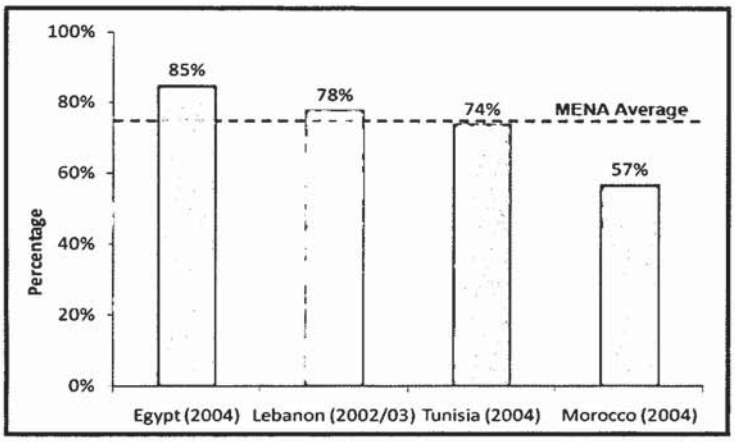

Figure 4: Lebanese Household Connection Rate

(Source: Lebanon: CDR 2002/03)

"The BML RWA is the largest public network that serves 1.8 million people, which is approximately 60 percent of the total connected households in the country" (Figure 5 & Figure 6).

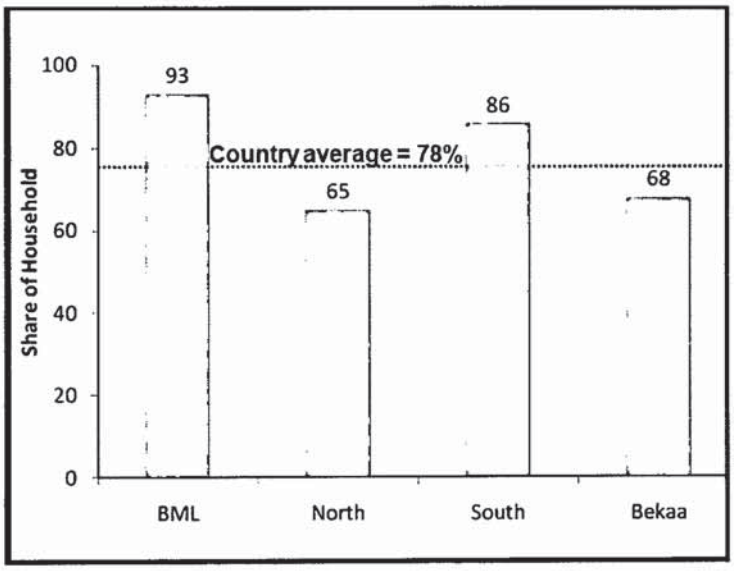

Figure 5: Lebanese Public Water Connection Rate

(Source: CDR 2002/03)

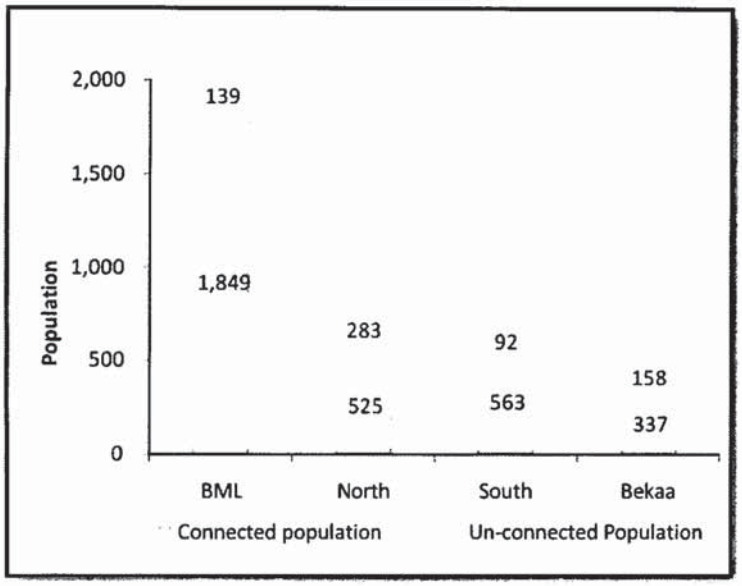

Figure 6: Number of connection in the four water authorities

(Source: 2008 population estimated based on CAS 2004 and WDI data; 2002/03 connection rate is based on CDR 2002/03 data)

Lebanon is well-known for its diversified water resources compared to its neighboring countries that contain more deserts and less rainy seasons. It is regarded to be one of the countries that have the highest total renewable water resources in the region, after Iraq and Iran (Figure 7) (World Bank, 2010).

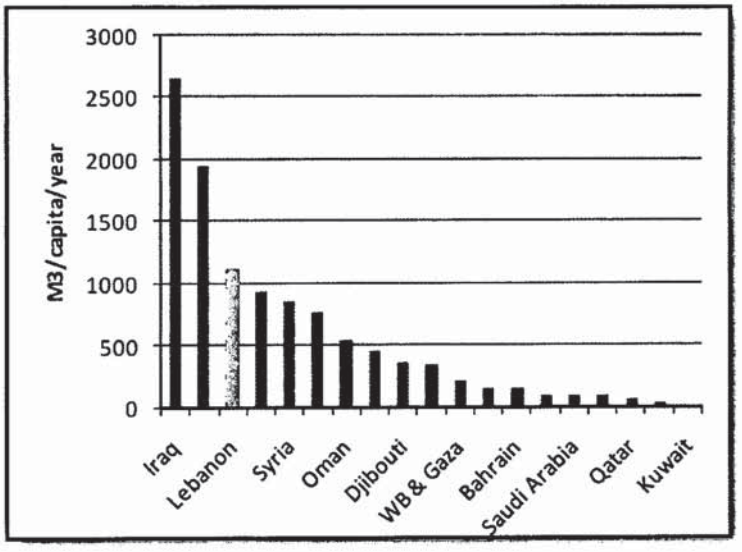

Figure 7: Total Renewable Water Resources per Capita, in some selected Countries

Source: (FAO AQUASTAT, 2003-2007)

Unless steps are taken to administer correctly the demand and supply by controlling the demand and increasing the storage capacities to increase the supply, it is estimated that Lebanon is poised to face chronic water shortages by 2025 (Figure 8) (World Bank, 2010).

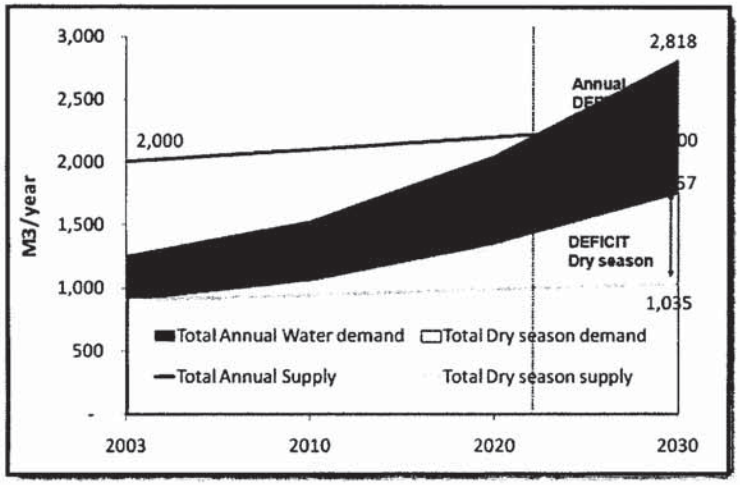

Figure 8: Projected Water Supply – Demand Balance, 2003-2030

Source: (World Bank, 2003)

Water demand for irrigation in Lebanon surpasses the storage capacities, making it a big issue. Compared to the rest of the MENA countries, Lebanon has a low level of water storage capacities, it accounts for only 5% of total renewable water resources in the country (Figure 9) (World Bank, 2010).

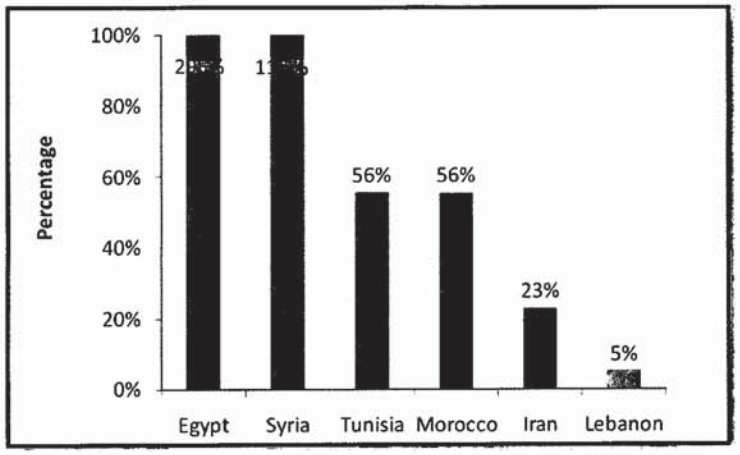

Figure 9: Dam Capacity in Lebanon and some selected MENA countries

Source: (FAO AQUASTAT, 2003-2007)

Despite the relatively high connection rate to the public water network, the continuity of water supply is low particularly in the Beirut Mount Lebanon (BML) region which receives only three hours of daily water supply during the summer season (Figure 10) (World Bank, 2010).

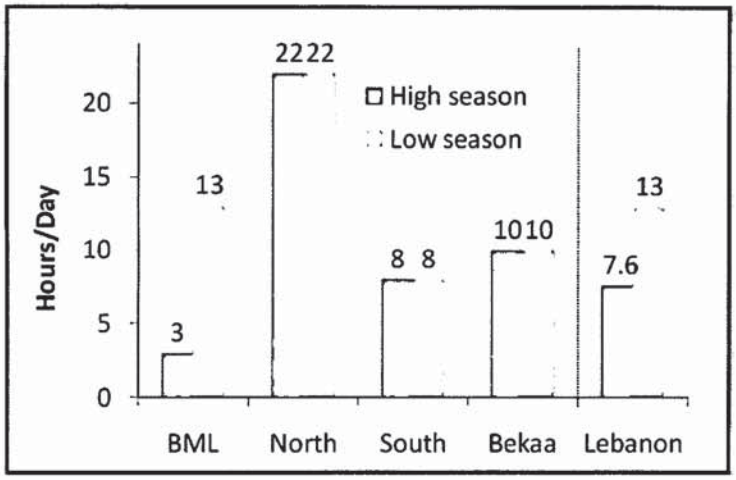

Figure 10: Continuity of Supply

Source: (World Bank, 2007)

As a summary, below a list of the main factors of the demand-supply instability in the country:

- The weak performance of the Regional Water Authorities
- The lack of storage capacity
- The growing uncontrolled demand
- The underdevelopment of wastewater sector
- The lack of measures to mitigate the environmental costs.

3.6.1. Reform of the water sector

In the past, service establishment was divided into 22 Water Boards and 209 Local Committees (LCs). "The legal reform initiated with Law 221/2000 delegated the responsibility for the delivery of drinkable water, wastewater and irrigation to four consolidated Regional Water Authorities (RWAs) and to Litani River Authority (LRA)" (World Bank, 2010, p. 7).

"Wastewater collection is de facto carried out by the municipalities and unregulated small scale private operators; however legally, it remained under the jurisdiction of the water authorities. As for the large waste water treatment plants and due to the limited capacities of the RWAs, the MoEW is responsible for their operation and maintenance. LCs and Old Irrigation Boards are responsible on the operation and maintenance of irrigation works" (World Bank, 2010, p. 7).

The institutional mapping of de facto responsibilities is presented in Table 5 below.

	Policy formulation	Donor financed	Budget financed	Cash-Flow	Service provision (O&M)
Water	MoEW	CDR	MoEW, Cos, CFD	RWA	RWA, MoEW
Wastewater	MoEW	CDR	MoEW	-	Municipalities, private operators
Irrigation/ WRM	MoEW	CDR	MoEW, LRA	-	Local committees, farmer groups

Table 5: Lebanese Institutional Mapping of Water Sector Responsibilities

Source: Bank staff analysis. CoS = Council of the South; CFD = Central Fund for the Displaced.

"The Council of Development of Reconstruction (CDR) is the principal agency in charge of planning and executing donor-funded water and wastewater investments. The MoEW takes responsibility for budget-financed investments. The CFD is responsible for providing access to basic services, including water supply, to displaced households. The CoS is responsible for the treatment of the water supply network in the South region. Both the CFD and the CoS raise their finance through the issuing of government bonds. The LRA is the agency responsible for the planning and execution of irrigation investment by which the CDR plays a minor role" (World Bank, 2010, p. 7).

3.6.2. Tariffs and pricing policy

Until today and for most of the Lebanese regions, the domestic tariff structure is based on a fixed annual fee for a contractual volume of water of 1 m3/day. Based on total billed revenues, a unit price per m3 of water sold is calculated taking into account the estimated level of water losses of 40 percent.

The effective cost of public water to the households is often much higher than the quoted tariff. The quoted average cost of 1m3 /day in Lebanon is US$ 0.37, which is equivalent to the average for MENA countries. Many households, who receive considerable less water than 1m3/day however, pay a higher actual, or effective. Furthermore, unreliability of supply imposes its own costs, because of storage, and purchase of backup or alternative water supply (World Bank, 2009).

"The analysis also suggests that the poor financial performance of the Water Authorities is due to the low billing collection. Collection efficiency in the water sector is on average 70%, slightly below the MENA average of 80%" (Figure 11) (World Bank, 2010, p. 21).

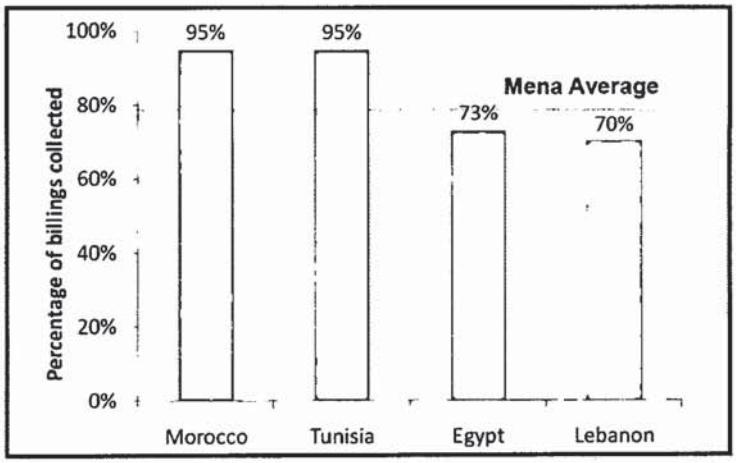

Figure 11: Bill Collection Efficiency in Lebanon and some selected Countries

Source: Lebanon: RWA submissions. Other countries: (World Bank, 2008).

"The Beirut-Mount Lebanon Water Authority is the most efficient between the four Authorities. Despite the high water losses and low stability of supply, the BML RWA has the best performance. Both connection rate and collection efficiency are in line with the average for MENA countries" (World Bank, 2010, p. 19).

3.6.3. Situation of water losses in Lebanon

Due to the lack of metering of the distributed water, no accurate estimation of the actual losses in Lebanon can be given. The middling level of water losses throughout the four RWAs is estimated at about 40% (Figure 12). These elevated percentages of water losses signify a low operation efficiency and insufficient maintenance, as well as technical inadequacies due to lack of metering (World Bank, 2010).

Metering is a long term goal in current circumstances. Lebanon is gradually moving toward a metered system, which would rationalize water usage and be a key improvement service. Presently, approximately 4 percent of households have a water meter but they still pay the same annual flat fee as households using the gauge system. The latter is designed to allow delivery of 1m3 per day. Yet, for any water consumed in excess of 1m3 per day, the consumers are charged an additional fee based on the additional volume used (World Bank, 2009).

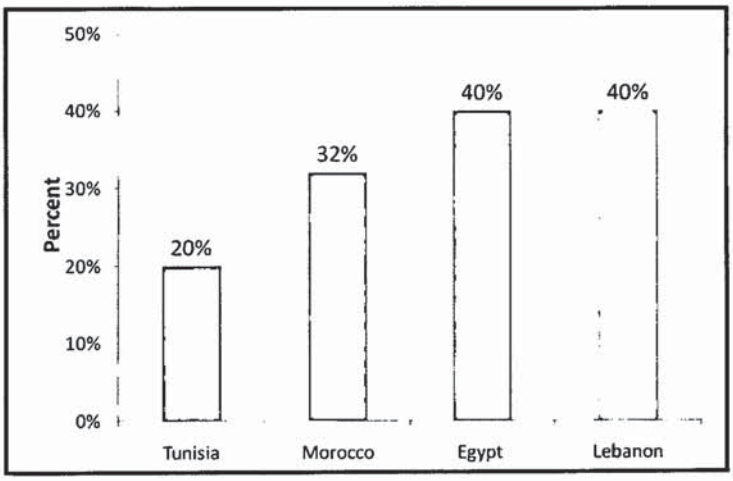

Figure 12: Water Losses

Source: Lebanon: estimate; Other countries: (World Bank, 2008).

The main restraint for end user welfare in the water sector is both the reliability of systems and availability of water, rather than affordability since the delivery of 1m3 per day is not always met. And it is a widespread concern across all household expenditure groups, regardless of their level of income. Due to the lack of metering, households in general and low-income households in particular, cannot evaluate their water consumption in comparison between demand and affordability level (World Bank, 2010).

Over the next 20 years, the composition of water demand in Lebanon is expected to change. Agricultural irrigation (64% of the water demand in Lebanon) is presently the largest user of water resource. This drift is expected to be reversed as industrial and domestic water demand are expected to grow at about 5% per year, whereas the irrigation water use is anticipated to grow at about 1% per year. Domestic water demand is mainly determined by increase in population and income. Domestic water demand (25% of total demand) is estimated to exceed irrigation demand reaching 45% of total water use (Figure 13 & Figure 14) (World Bank, 2010).

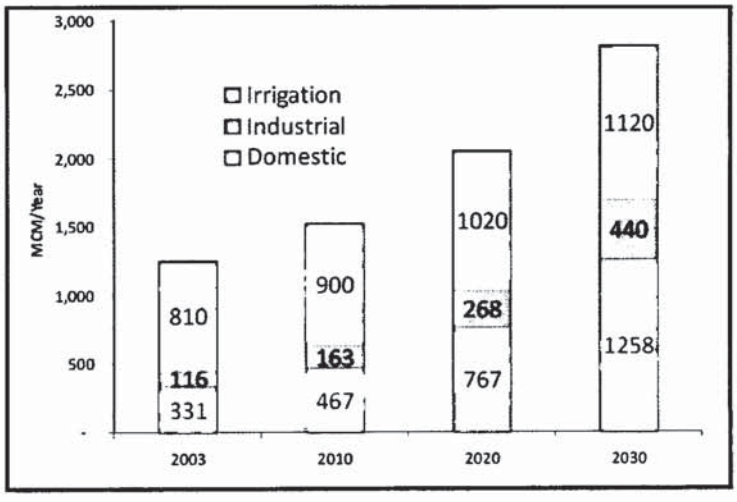

Figure 13: Projected Annual Water Demand by sector, 2003-2030

Source: (World Bank, 2003). MCM = million m3

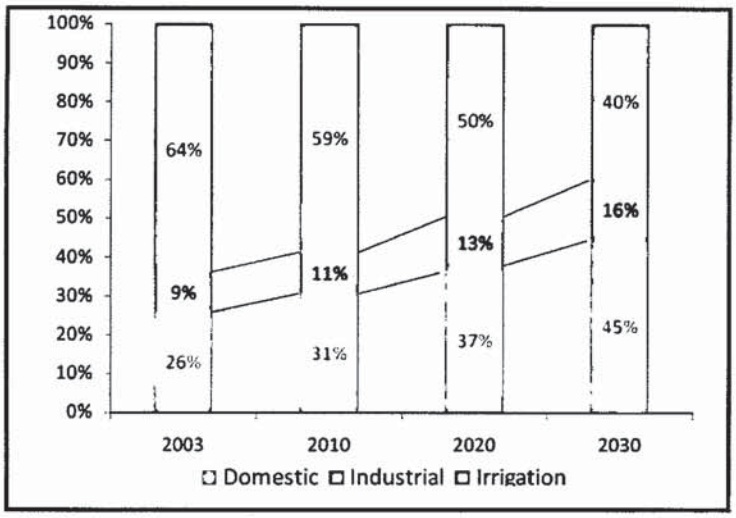

Figure 14: Projected Annual Water Demand by sector, 2003-2030 (Share of Total)

Source: (World Bank, 2003)

In order to maintain a stabilized public expenditure, Lebanon has to prioritize the improvement of efficiency in order to establish the necessary development of the public water sector. Improving sector efficiency requires a broad range of actions amongst them we mention the introduction of water metering that will encourage users to reduce water losses by providing them with control over their level of public water consumption (World Bank, 2010).

3.7. Conclusion

Despite the fact that Lebanon is amongst the countries that are well endowed with renewable water resources, it is predicted that it will soon face chronic water shortages. Climate change, pollution and mismanagement have a direct weight on the freshwater availability of the country. Moreover, the domestic and industrial water demand is anticipated to grow 5% per annum as opposed to a growth of 1% only for irrigation sector, which will put more pressure on the supply of water. Based on the above and considering the limited supply of water, the Lebanese government is urged to promote the approach of sustainable use of water in order to diminish the imbalance of water supply and demand in the country.

Although prior research in these areas has occurred, it is well established that there is a requirement for specific country and location based research due to a range

of reasons, including: (1) different community attitudes and behaviors; (2) water appliance stock efficiency profiles; (3) environmental conditions; and (4) water pricing structures; (5) government water restriction regime; and (6) conservation message intensity. All such contextual factors have an influence on the effectiveness of WDM strategies (Beal, et al., 2011) (Willis, et al., 2011).

Despite many national and international analyses and reports on the Lebanese fresh water, little is known about Lebanon' actual conservation behaviors, including their use of water efficient appliances.

This paper addresses this gap in knowledge by providing baseline data about Lebanese':

- Attitudes to water conservation
- Stated water conservation behavior
- Attitudes towards water efficient appliances
- Stated ownership and stated barriers to installing water efficient appliances
- Attitudes towards usage of grey water and rain water for non-potable use

In doing so, this study contributes to knowledge about Lebanese's attitudes and behaviors in relation to water conservation. Both attitudes and behaviors are included in this study in acknowledgement of the fact that, while it is ultimately behavior that matters, attitudes are known to influence behavioral intentions and behavior (Ajzen, 1991) and therefore represent a crucial antecedent construct which can be targeted with advertising, public education messages or policies.

In line with the above, the study seeks to answer the following research questions:

1) What are the factors that gravely influence residents of BML region to conserve water as established in the study?

2) What are the respondent attitudes towards the installation of new water-efficient appliances?

3) What variations are found based on the social-demographic variables (age, gender and educational level) towards efficient water use?

The chapter that follows will examine the methodology of the study as guided by the conceptual framework of the study.

Chapter 4. RESEARCH METHOD

4.1. Introduction

This chapter discusses the research method used in the thesis. Based on the literature review stated above, several researches were examined that investigated water conservation behaviors in US and Europe. Nevertheless, none of them studied the latter within the Lebanese context.

Therefore, the objective of this research design is to examine the key drivers of Lebanese residential water conservation intentions and behaviors. The purpose is the establish a model that can assist the government and policy-makers to tailor policies that best suits the community as a whole and to find efficient ways to sustain the usage of the water.

4.2. Research Problem

The need to secure water resources is inevitable. There is increasing concern that the predictions for the near future related to water availability in Lebanon will occur sooner than expected. According to meteorological figures at Beirut's international airport, rainfall rates until today had failed to reach the normal yearly average putting the Lebanese underground aquifers in an alert stage (Al-Samad & Al-Amin, 2014). With the increase in numerous threats: climate change, pollution and the demand-supply imbalance due to mismanagement of water resources, the Lebanese people will have to come together to start consuming efficiently this precious resource to secure their water future by making available resources a source of natural wealth for all.

However, what is not yet clear is the degree of awareness and the willingness of the Lebanese nationals to embrace new methods of water consumptions in their lives in the light of all these climatical changes. An understanding of the various water consumption patterns and behaviors of the Lebanese household that relate to water conservation can provide valuable information to policy makers and stakeholders seeking to promote these types of actions.

4.3. Selected variables

The main purpose of this study is to develop an understanding of the existing consumptive practices of domestic water and to research the psychological factors underlying to the adoption of the latter in a more sustainable manner. To be able to weight these aims, the following dependent variables are considered which are emanated from the theoretical framework and from the review of the literature on household water conservation: Efficient and curtailment moral norms, efficient and curtailment attitude, efficient and curtailment subjective norms, self-identity and households culture. The independent variables are age, gender and educational background.

It is important to highlight that there exist two different types of household water conservation behaviors; the first refers to the everyday saving actions whereas the second is about installing water efficient appliances which is referred with the term 'curtailment' (Gardner & Stern, 1996). This dissertation took into consideration the above as past studies have shown that these two measures may overlap.

4.4. Research questions

This study aimed to address the following research questions:

Research question 1:

What are the factors that gravely influence residents of BML region to conserve water as established in the study?

Research question 2:

What are the respondent attitudes towards the installation of new water-efficient appliances?

Research question 3:

What variations are found based on the social-demographic variables (age, gender and educational level) towards efficient water use?

4.5. Research Hypotheses

Individual behaviors that benefit the environment are potentially influenced by, personal values and attitude of environmental quality, social norms that encourage pro-environmental actions and economic incentives. Economic incentives often loom particularly large, including those that result from environmental policies. Less well understood are the respective roles of private values, attitude and social norms.

Accordingly, based on the above research questions, this thesis seeks to test the following hypotheses:

H_1: Respondents with positive efficient moral norms are more likely to consider using grey-water for non-potable uses.

H_2: Respondents with positive efficient subjective norms are more likely to consider using grey-water for non-potable uses.

H_3: Respondents with positive efficient attitude are more likely to consider using grey-water for non-potable uses.

H_4: Respondents with positive efficient moral norms are more likely to consider retrofitting their bathrooms.

H_5: Respondents with positive efficient subjective norms are more likely to consider retrofitting their bathrooms.

H_6: Respondents with positive efficient attitude are more likely to consider retrofitting their bathrooms.

H_7: Respondents with positive efficient moral norms are more likely willing to buy new appliances in order to save water.

H_8: Respondents with positive efficient subjective norms are more likely willing to buy new appliances in order to save water.

H_9: Respondents with positive efficient attitude are more likely willing to buy new appliances in order to save water.

H_{10}: Efficient moral norms vary with gender.

H_{11}: The willingness to buy new appliances in order to save water varies with the setup of governmental charges on waste water.

H_{12}: The willingness to buy new appliances in order to save water varies with subsidizing water efficient appliances.

4.6. Research Design

4.6.1. Methodology

As reflected above in the literature review chapter 3, many researchers investigated the key drivers of residential water conservation intentions and behaviors. The examination led to the suggestion of this thesis research questions. As the end use of water is influenced by many factors within a household and as resources are limited, often household surveys on water use behaviors is the only basis for reporting end uses (Sivakumaran & Aramaki, 2010). Therefore in this study, an online survey instrument was designed to gather quantitative data in order to examine current water consumption practices, behaviors and intentions of Beirut-Mount Lebanon residents.

4.6.2. Sampling process

The target population for this study was the residents of BML region since it is the largest public network serving 60% of total connected households. In addition it has the best performance and most efficient in bills collection of the four authorities despite the high water loss and low continuity of supply. The sampling frame was obtained using the snowballing sampling technique through an internet based methodology, using an online survey. The number of respondents was not predetermined for this research; the goal was to gather sufficient data that allow valid statistics to base this study on. A total of 200 respondents have completed the online questionnaire.

4.6.3. Instrumentation

A quantitative research method approach was used in this study. Primary data were collected through an online questionnaire using Google Docs and hosted over the internet by Google Drive; the survey link available through Google drive was shared online on two social networks Facebook and LinkedIn and respondents were asked to share the link amongst their acquaintances. The purpose of sharing the survey online is to target a wide range of pool of respondent to increase statistical accuracy.

4.6.4. Pilot test

The questionnaire was pilot tested in order to assess the instrument for validity and eliminate any potential error. After collecting some comments, pilot respondents opinions were taken into consideration to update ambiguous questions. Thus, several modifications were done to allow a better understanding of the questions. Data collected during the pilot test were not included in the research.

4.6.5. Questionnaire

The questionnaire as presented in Appendix A is comprised of five sections, labeled from I to V. Section I gathered information on the environmental awareness of the respondent. It is constituted by closed-end questions with single or numeric answers along with Likert type scale. Section II covered the respondents' current practice on efficient water conservation, i.e. without the support of households' appliances. Section III examined the perception of respondents on efficient water appliances, and investigates the possession of the latter in their house. Section IV tackled the level of personal compliance (e.g., Consider using grey water?; Willing to buy new appliances?). Finally Section V collected specific information about the respondents in order to round out the data and allow comparative analysis for the variance in behavior between age, gender and educational background as many studies have shown that environmental behavior differs between population groups (Ignatow, 2006).

To minimize response bias, item statements were mixed as much as possible to ensure that the respondents read each item before responding. Table 6 shows the interrelation of theories discussed in chapter 2, variables extracted and questionnaire items corresponding to them.

Variables	Origins	Questionnaire questions
Moral Norms	*VBN Theory*	Curtailment Moral norms Question# 6 - d)e)f) Efficient Moral norms Question # 8 - c)d)e)
Attitudes	*TPB Theory*	Curtailment attitude Question # 5 Efficient attitude Question # 7 Curtailment subjective norm Question # 6 - a)b)c) Efficient subjective norm Question # 8 - a)b)
Subjective Norms		
Habits	*Identified by the literature*	Question# 4- A)
Self-identity		Question 14 # a)b)
Household Culture		Question 14 # c) d)

Table 6: Variables Related To the Conceptual Framework

4.6.6. Sample

Many studies have shown that environmental behavior varies between population groups (Ignatow, 2006). For the purpose of this study, variance in behavior between gender, age and education will be analyzed, all of which have been shown to be relevant in scrutinizing environmental behavior.

The final number of respondents reached is 200 out of which 97 (48.5%) are males and 103 (51.5%) are females (see Figure 15).

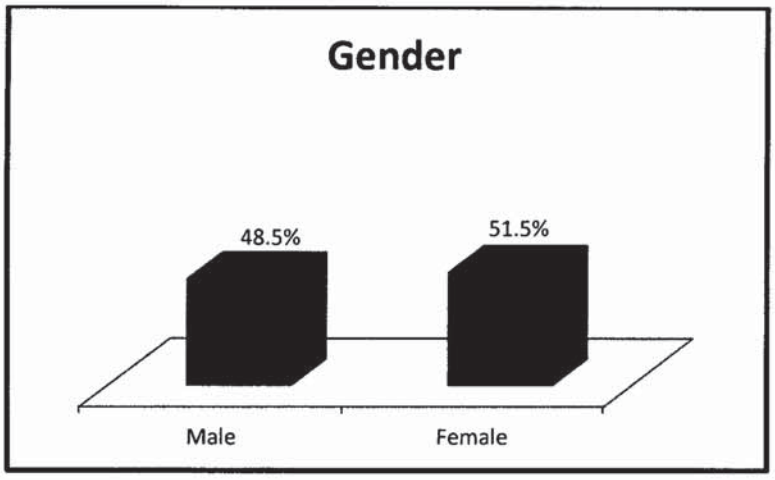

Figure 15: Gender

Table 7 displays that the mean age is 24 meaning that the sample is young. Since the online social networks are loaded by younger users of the new eager generation for the technology, the sample targeted, in a way, the young minds to be able to assess their intentions towards the daily usage of water. Besides, young people will have more flexibility in changing their daily routines and perception towards the natural endangered resource than the older ones.

	n	Minimum	Maximum	$\bar{X}$	Std.
Age	200	17	55	24.81	7.228

Table 7: Age

Subsequently, the young population stipulates high level of education (Figure 16). Indeed the sample revealed that 118 (59%) respondents hold a university (BA) and 58 (29%) hold a university degree (above BA).

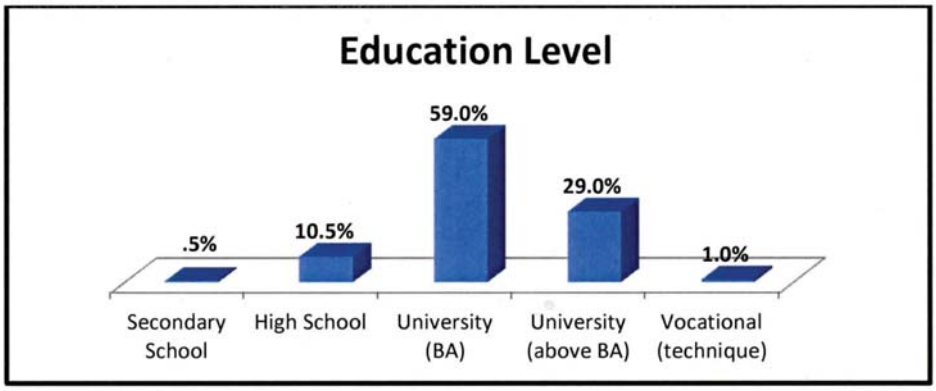

Figure 16: Education Level

The majority of the respondents' occupation 76 (38%) was students, followed by 37 (19%) in business. The lowest is for medicine for 1%. Check the pie chart below.

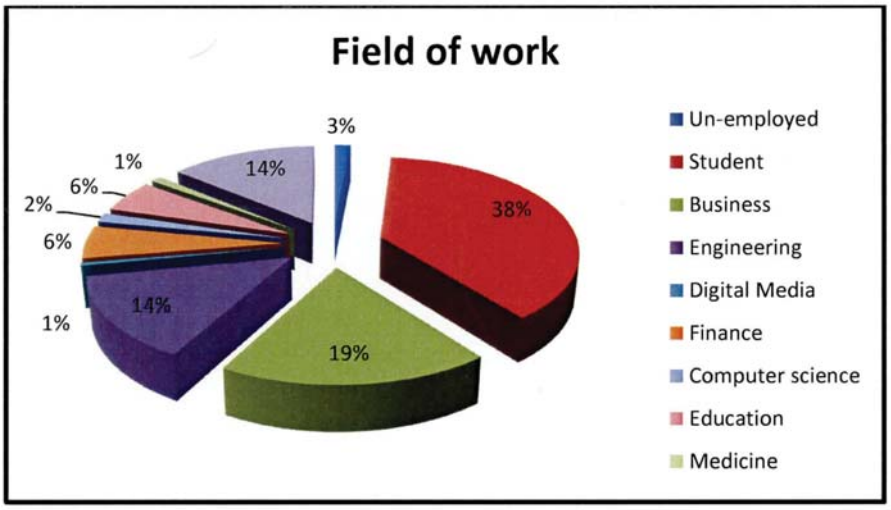

Figure 17: Field of work

4.6.7. Data Analysis

The statistics software package SPSS was used for data analysis. On the descriptive side, the data was summarized into tables and graphs. In addition, means, frequencies, percentages and standard deviations were calculated. This study constructed eight dependent variables: efficient subjective norms, efficient moral norms, curtailment moral norms, curtailment subjective norms, efficient attitude, curtailment attitude, self-identity and household culture, which might influence the adoption of a more sustainable consumptive practices of domestical water; and three independent variables: age, gender and educational background.

Non-parametric tests were considered for examining the hypotheses of the study. Logistic regression was used to analyze the relationship between dichotomous dependent variables and metric or dichotomous independent variables. Mann-Whitney U Test was used to compare differences between two independent groups when the dependent variable is either ordinal or continuous. And finally Binominal test was used for comparing the observed frequencies of the two categories of a dichotomous variable to the frequencies that are expected under a binomial distribution. For this study, all statistical tests are generated at a significance level of 95% (alpha=0.05).

4.6.8. Data Cleaning

Prior to the statistical analysis, all respondents were screened to check if they meet the following criteria:

- Resident of Beirut/Mount Lebanon
- Are connected to public water network

The data was also screened to eliminate any invalid data entered in SPSS. The purpose of data cleaning is to eliminate entries that are not eligible for this survey and prevent potential errors that could affect the results. Entries that are not valid to the research purpose; such as respondents living in North or south Lebanon or not connected to public water network were removed from the tested sample.

4.6.9. Validity and Reliability analysis techniques

A reliability analysis test is applied to test the reliability of the survey for each variable via Cronbach's coefficient alpha. The latter measures the correlations of each item scale, with a value that varies between 0 and 1 when all items measure a single construct; the higher level of reliability for Cronbach's alpha is reached. Generally, an alpha with a value of .70 is considered as an acceptable level of reliability; however, the greater the value of alpha the better it is. A lower level of reliability might designate a low level of internal consistency in the instrument or a missing data (Cronbach & Shavelson, 2004).

In this thesis, the Cronbach's alpha of the eight factors is equal to 0.853 which is considered good.

4.7. Conclusion

This study is based on primary data collected via a quantitative online survey designed to test the variables that are significant predictors for inducing efficient water use leading to a sustainable green environment. The survey targeted the residents of Beirut-Mount Lebanon Area. The next chapter discusses the findings of this research problematic.

Chapter 5. FINDINGS

This chapter dissertate the findings of the survey and examine the statistical tests performed that permit an elaborate discourse of the proposed hypothesis.

5.1. Introduction

The purpose of this research is to study the psychological processes of Beirut-Mount Lebanon households' water usage in addition to the factors that induces them to adopt a more sustainable consumptive practice of domestic water. The results have the potential to lay a foundation for further research in order to render the Lebanese government with the information necessary to base the reform of water policy in the aim of minimizing the waste of the used water.

5.2. Descriptive statistics

This section shows the descriptive statistics for each variable or concept tackled in the survey, all figures are listed below.

The first section which was composed by three questions, examined the general environmental perception of the respondents. In the first interrogation, the latter were asked to indicate what environmental problem the Lebanese government should tackle first in terms of their importance. It can be noticed that the respondents opinions varied between four environmental problems with 67 (33.50%) advocated water pollution, following by 48 (24%) for waste generation problem, 42 (21%) and 40 (20%) for air pollution and depletion of the forest respectively. Therefore, we can conclude that respondents do have some concerns regarding water issues facing the community but it seems that it is not considered as grave alerted environmental problem, at least for now.

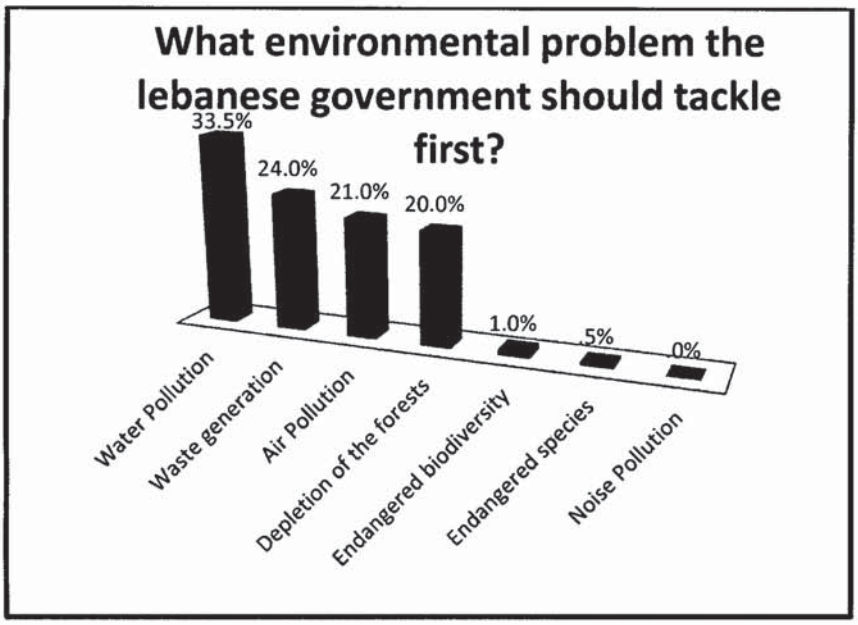

Figure 18: The environmental problem that should be tackled first

When asked about specific water conservation matters, 55% of the respondents mostly disagree on the statement that "Fresh/usable water is an "Unlimited source" as opposed to16.50% who do mostly agree. We can conclude that most of the respondents of this study are aware on the fact that consumable fresh water is a limited resource and having that awareness in mind would possibly tempt them to use efficiently the water running out from the tap of their houses.

Additionally, it was remarked that most of the respondent agree on the importance of water conservation for the environment and to limit the impact of water scarcity also that water conservation should attract more attention from the government and civil society. As well, most of the respondents do acknowledge the sense of responsibility they have toward water conservation. For numbers breakdown see Figure 19 below.

What was remarkable that there has been a debate on whether water conservation alone can solve Lebanese's water problem with 25% of the respondents mostly rejecting that proclamation and 26% of them mostly accept it.

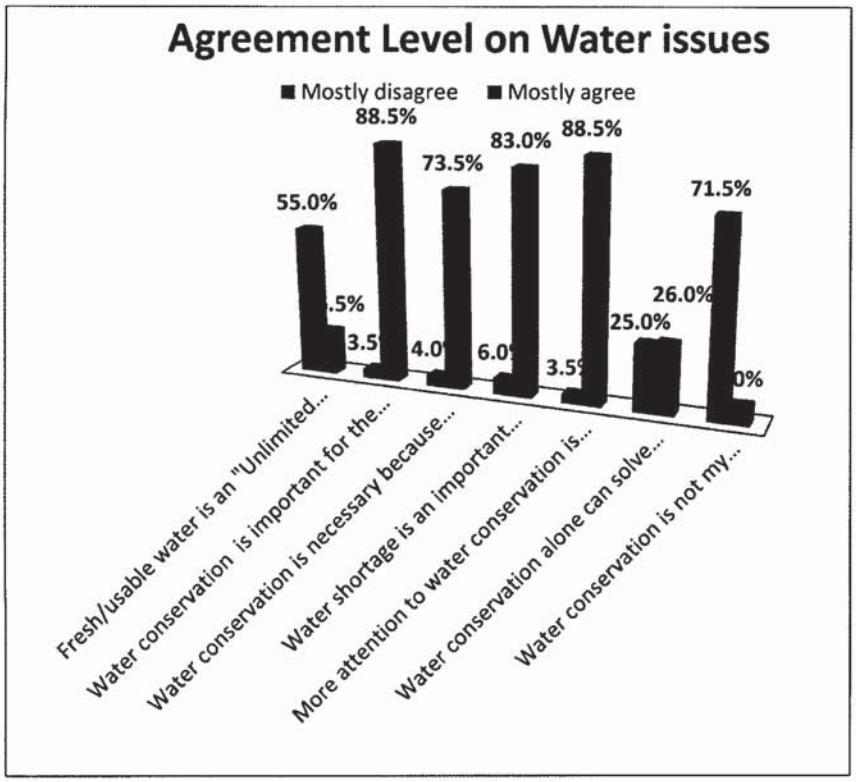

Figure 19: Agreement Level on Water issues

In the third and last question in this first section, respondents were asked to point out the major causes of wastage of water in their city. Most of the respondents (69.50%) believed that the major cause is that a huge quantity of water is being used where less is actually required by the consumers, while of course meeting their daily needs of water. It is then followed by another major origin of water wastage which is the leakage during distribution from the public water network pipes and drains.

These numbers, as seen in Figure 20 below, implies that most of the respondents admit that they are over-using this natural resource but also holding the Lebanese government responsible for the wastage of water due to leakage in the infrastructure. It can be deduced that if an effective mechanism is tailored to make the consumers use only the needed quantity of water to meet their needs, a tremendous amount of water might then, be conserved as the percentage of water lost in Lebanon is around 40% which is a high rate as indicated in chapter 3 above.

On a side note, it can be noticed in the below figure that the sustainable methods to increase the supply of water received a very low percentages, rain water not harvested with 5.50%, lack of water treatment for reuse with 1.50%.

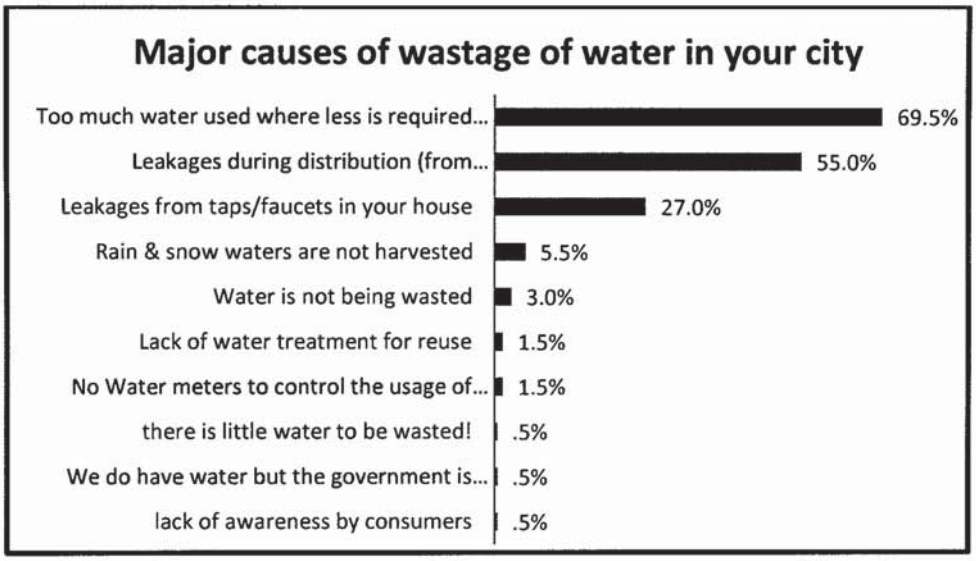

Figure 20: Major causes of wastage of water in your city

The second section was designed to define the existing practices on the daily use of water. As showed in Figure 21, the majority of the respondents implement these three following usage behavior: immediately fix any leakage in tap and pipes of their house with 72.5%, make sure that taps do not drip with 60% and only use the washing machine when it is full with 52%. On the other hand, over half of the respondents expressed that they rarely and even never carry out the following actions: collect water from shower/sink/bath (69%), hand wash clothes (56.5%), collect rainwater to use on garden (55%), take shorter showers (41.5%) and finally minimize toilet flushing where possible (49.5%). Likewise, it can be observed that the sustainable methods in conserving natural fresh water are not very well imbibed in the Lebanese community where only what it seem to be a fundamental conduct like fixing the taps and pipes of their house, is being implemented.

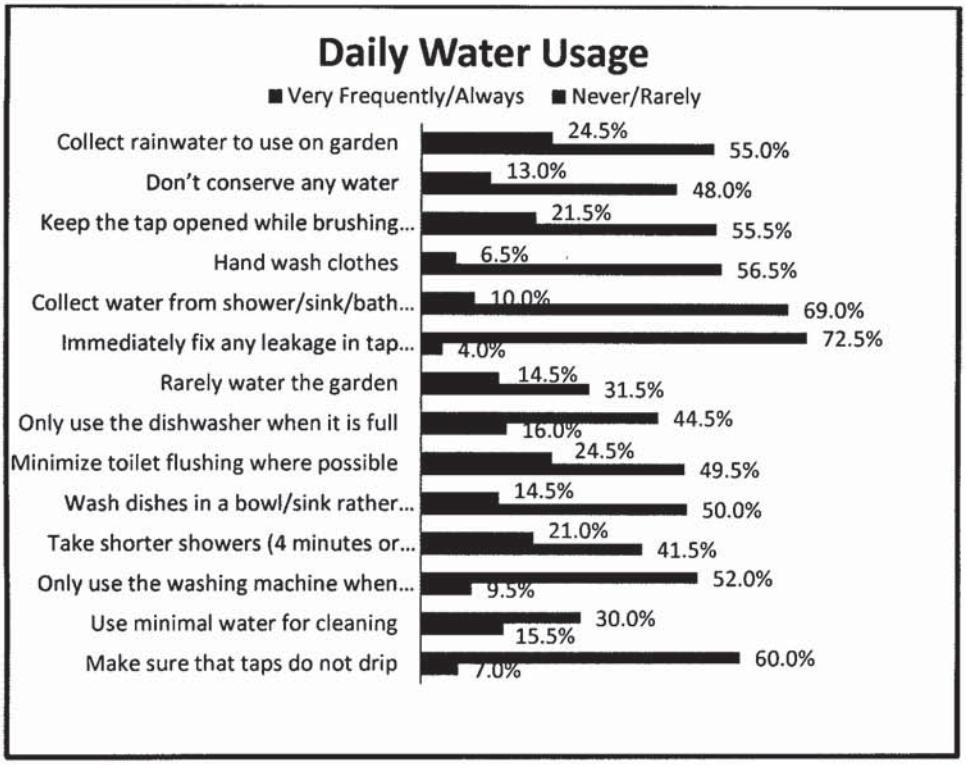

Figure 21: Daily Water Usage

Furthermore, respondents were asked to specify the reason behind the declaration that they never minimizing toilet flushing. The data in the pie chart below shows that, amongst the total 85 (49.5%) respondents who did state that they never carry such behavior, it is apparent that 33 (38.8%) respondents supposed that the reason is due to habit, 25 (29.4%) firmly confirmed that it is due to the hygiene and the personal cleanness and on the other hand 21 (24.7%) do not believe minimizing toilet flushing is necessary.

Thereby, this suggests that people are not mindful on the way they are using water to meet their end-use goal; every time they enter the bathroom they are accustomed to flush the toilet tanks entirely due to habit and due to relating using large amounts of water with hygiene and cleanness.

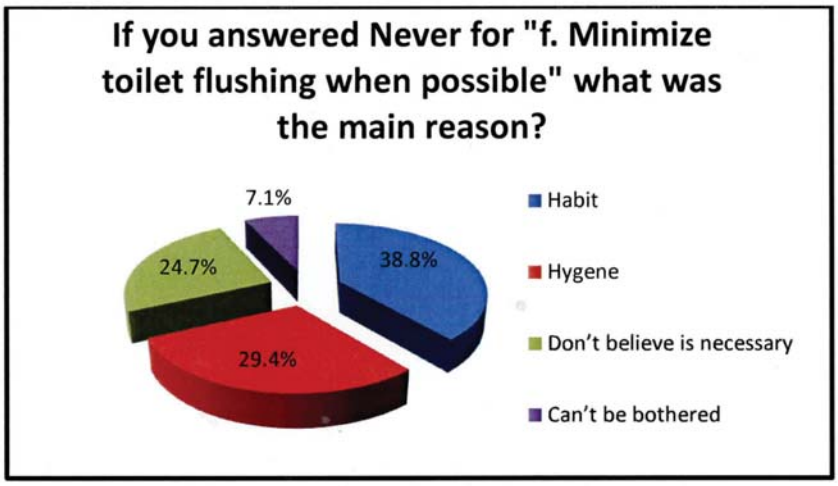

Figure 22: Main reason for never minimizing toilet flushing when possible

What is interesting is that no respondent has a negative attitude towards engaging in any of the everyday action to save water. Although nearly half of the respondents reported that they do not actually engage in most of these efficient actions toward water conservation. Figure 23 presents the breakdown of percentages, where 66% of the respondents think very positively about engaging in the everyday actions to save water without any evidence that these attitudes are transformed into actual behavior.

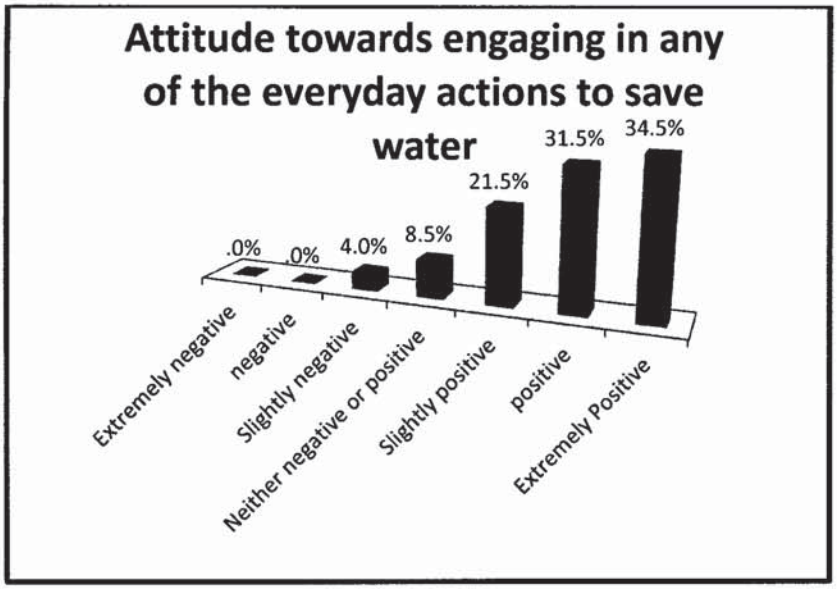

Figure 23: Attitude towards engaging in any of the everyday actions to save water

What's more is that, as indicated in the Figure 24 below, approximately half of respondents are willing to put extra efforts into saving water around the house and garden with 58% agreement level, followed by 50% agreement on the statement that if they feel that it is expected of them, by the community and by the people that are important to them, that they save water in the house and garden.

46.5% denoted that they feel personal obligation to conserve water and 36.5% would feel guilty about not engaging in conserving water in their daily usage of water in their house. Meanwhile, more than 70% of the respondents admitted that water conservation issues do affect them.

By contrast, 42% of respondents do not feel that there is any social pressure prompting them to save water in their daily repetitive tasks; this is an expected logical result, as the Lebanese government did not set up yet any effective mechanism that outset a positive harmless pressure to stimulate the society to use water more efficiently.

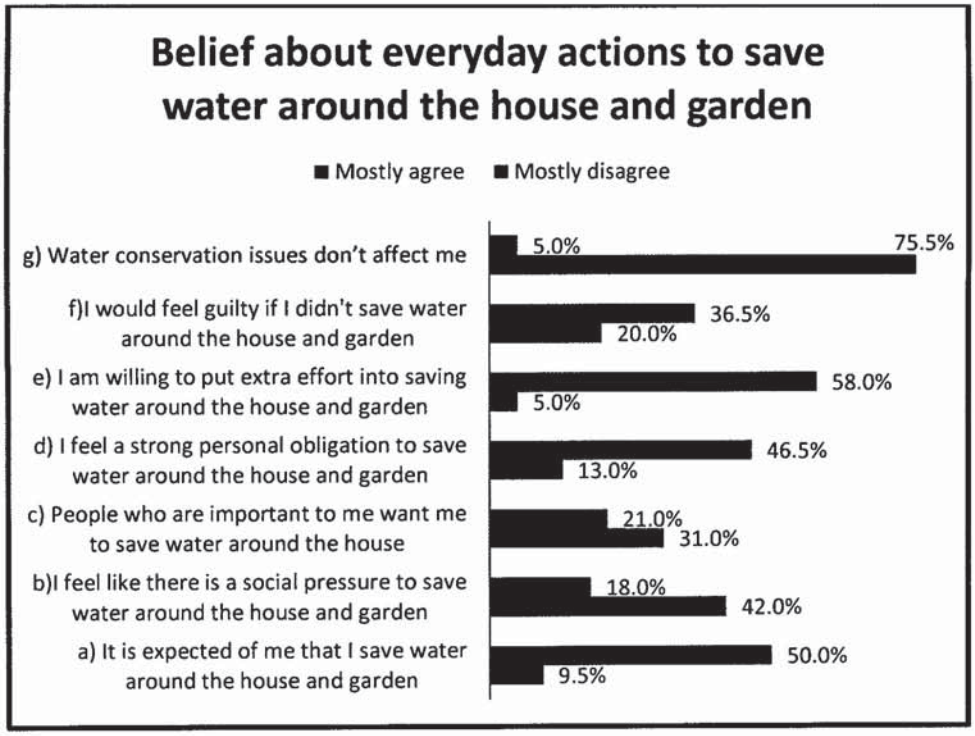

Figure 24: Belief about everyday actions to save water around the house and garden

With reference to the above chart, a debate on whether the respondents believe that people who are important to them want them to save water was registered. As shown in Figure 25, respondents who were neutral recorded 19% which is the highest rate followed by 16% of respondents who disagree and only 10.5% who agree. The results indicated that respondents do not have sufficient understanding on the views of their surroundings.

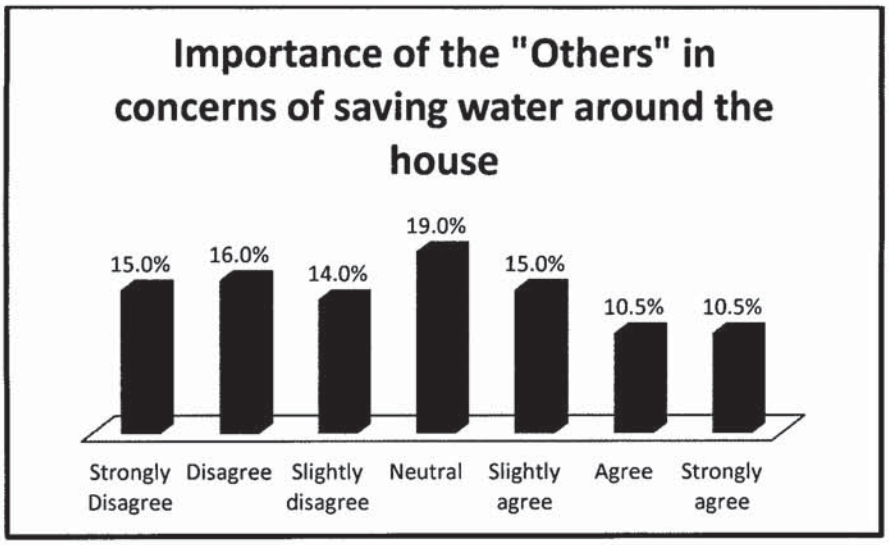

Figure 25: Importance of the "Others" in concerns of saving water around the house

The third section of the survey reviewed the attitude of the respondents towards water appliances and surveyed if they have any of these appliances with efficient standards. The majority of respondents encouraged installing water efficient appliances in the house and garden expressing positive attitude towards this engagement with only 11 (5.5%) of the respondents expressing neutrality.

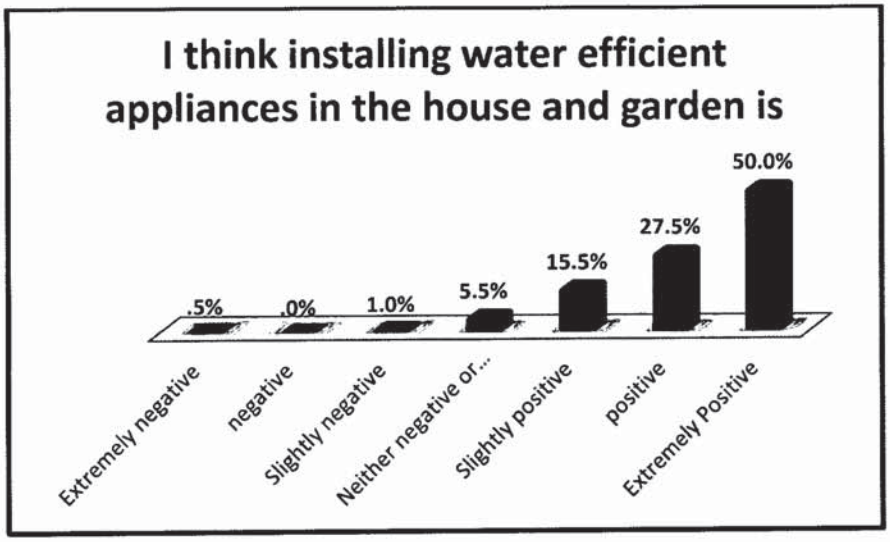

Figure 26: Attitude towards installing water efficient appliances

Nearly less than half of the respondents stated that they are willing to put extra effort into installing efficient water appliances in their house with 46%. As well 45% of the respondents pointed out that, water efficient appliances should be mandatory.

In compliant with the above findings of Figure 24, about 51% of the respondents mostly do not feel that they are under social pressure to install water efficient appliances in their house followed by 38.5% who also belief that they mostly disagree on the proclamation that people who are important to them want them to install these efficient appliances. Respondents mostly agree (37%) that water efficient appliances cost too much in their opinion. Only 18.5% of respondents slightly agree that they feel strong personal obligation to install these appliances. Without a doubt that respondents are still not certain about their personal feeling of guilt vis-à-vis not installing water efficient appliances, but overall most of them (31%) agree that they would feel the guiltiness.

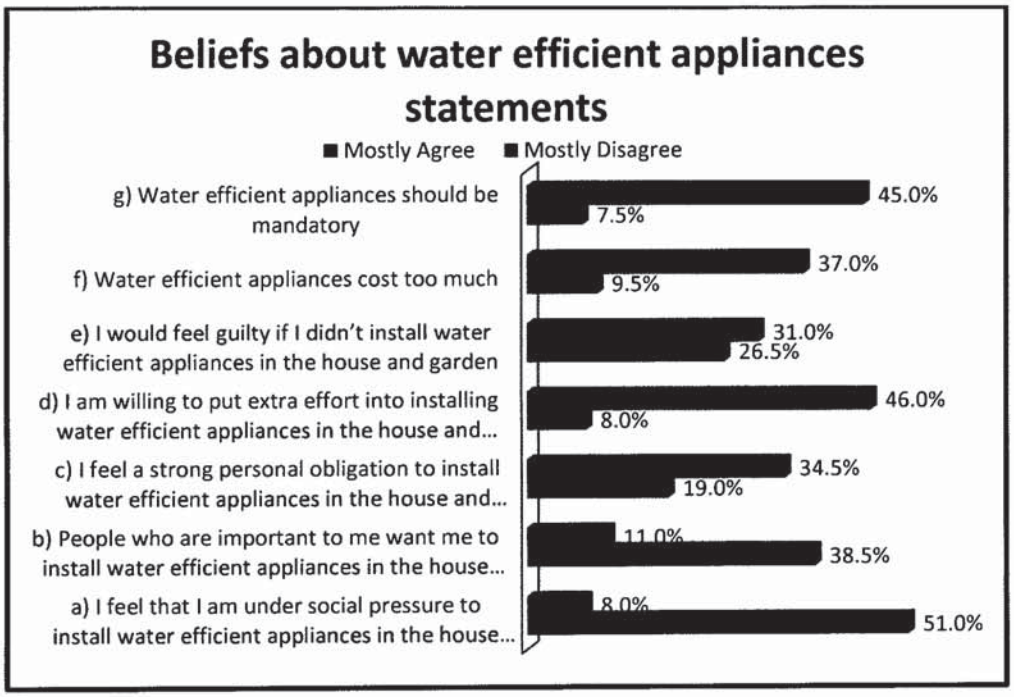

Figure 27: Beliefs about water efficient appliances statements

The percentage of those who have washing machine with water efficiency standards in their house was registered the highest with 41% as opposed to 34% for

shower head with water efficient standards and 11.5% for rain-water collection system and only 2.5% for grey-water recycling system (see Figure 28).

Nonetheless still less than 50% of respondents meaning less than half of the Lebanese population has water efficient appliances in their house.

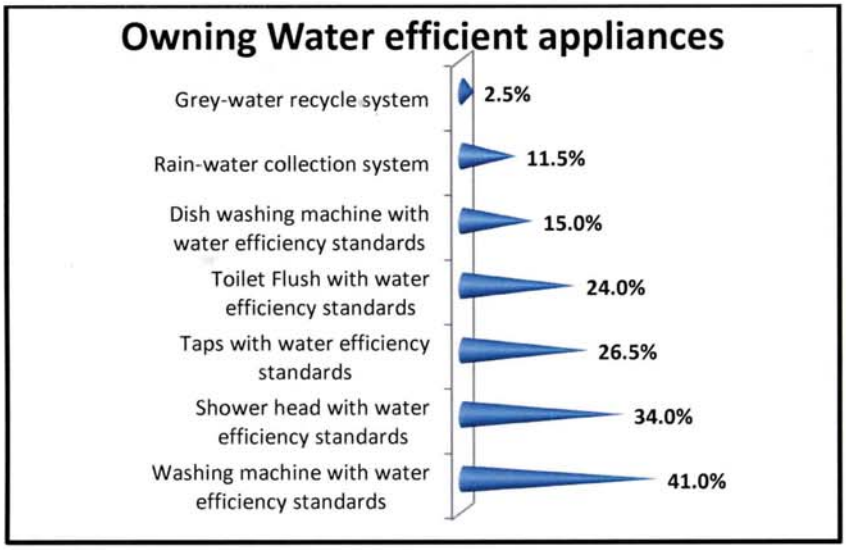

Figure 28: Owning Water efficient appliances

Out of the 200 respondents, 125 (62.5%) has at least one water efficient appliances as opposed to 75 (37.5%) who does not have any.

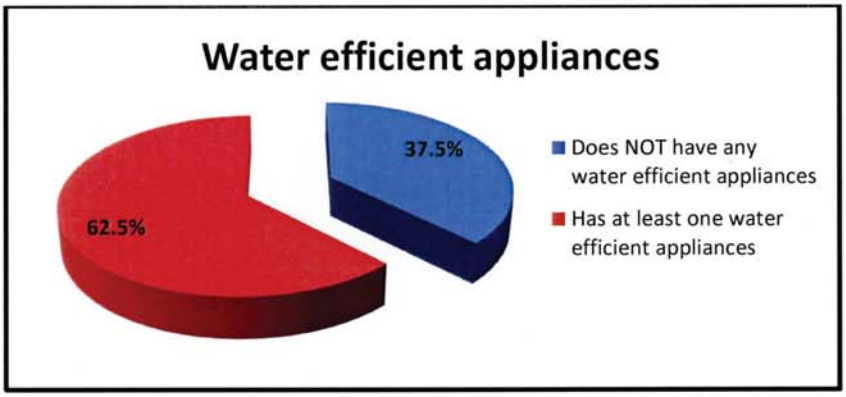

Figure 29: Water efficient appliances dispersion

From the 125 respondents who claim owning at least one water efficient appliance, 44 (35.2%) stated that the reason for purchase was economy. The second popular reason was for ecology with 42 (33.6%) followed by 28 (22.4%) for performance reason. The economic reasons may vary from one appliance to another; some of them do use less electricity while being efficient; thus it render economic benefits for its user by lowering the electric bill, for example.

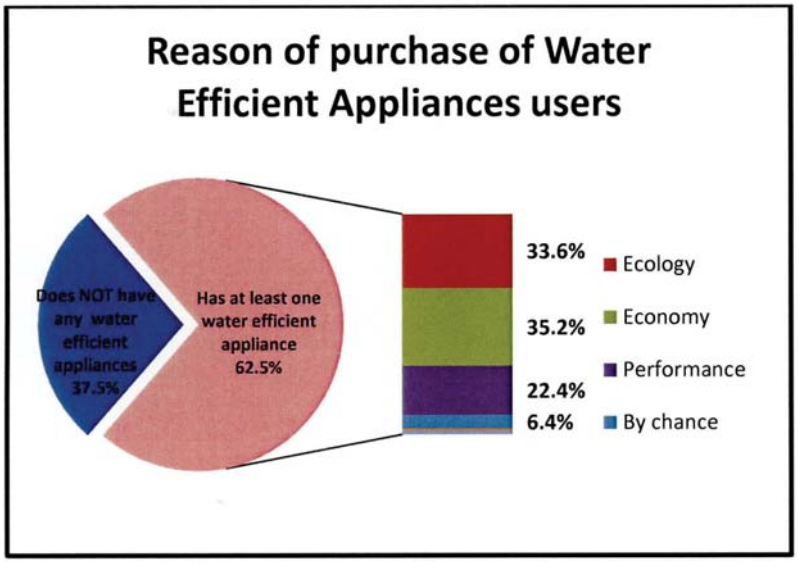

Figure 30: Reason of purchase of Water Efficient Appliances users

It can be seen from the data in Figure 31 that the majority of respondents 140 (70%) are willing to take more steps towards water conservation. This high rate indicates that there is room for more efforts if the right motivators were presented. Another interesting observation is that respondents' acceptance to use rainwater and use recycled grey-water for non-potable uses varies between 135 (67.5%) for considering rainwater and 93 (46.5%) for considering recycled grey-water. This finding may be caused by so many factors and hygiene might be one of them. Also, only 32.5% of respondents are willing to retrofit their bathroom to save water.

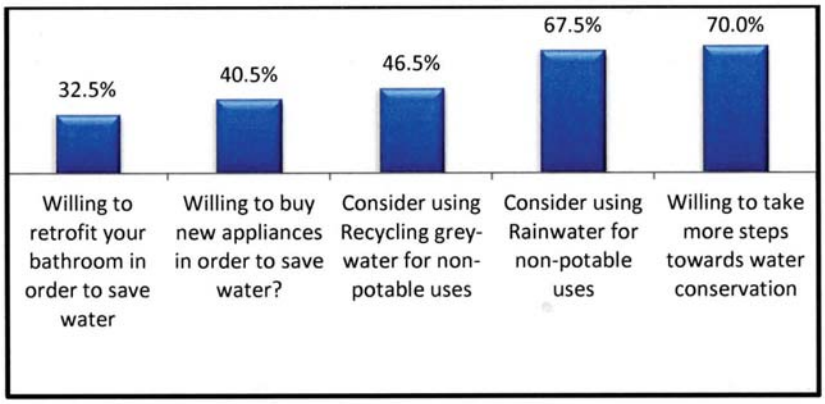

Figure 31: Percentage of respondents who are willing to take further steps towards sustainability of water usage

Furthermore, the majority of respondents, about 60% stated that they are not willing to buy new appliances in order to save water. It is highlighted in the study that the majority of those who weren't willing to buy new appliances to save water, would change their mind for the two reasons stated here after in the below two pie charts.

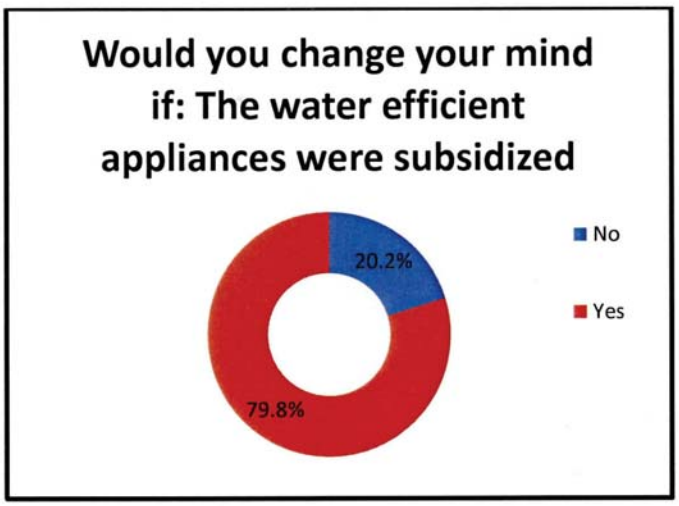

Figure 32: Change your mind if water efficient appliances are subsidized

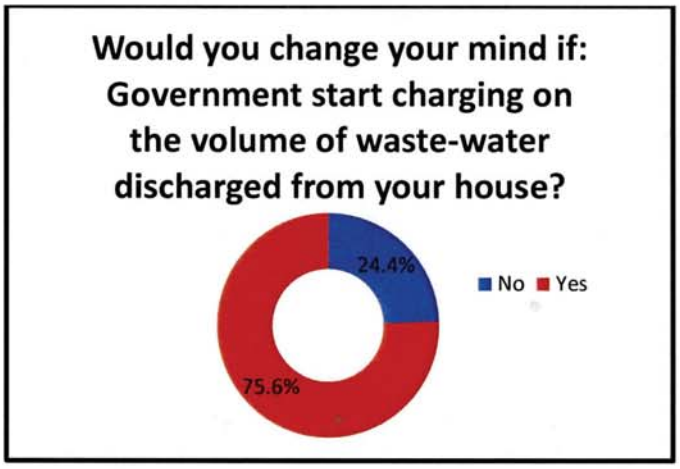

Figure 33: Change your mind if charged on the volume of waste-water discharged from your house

5.3. Discussion of the hypotheses

In this section the hypotheses are discussed and their analysis is detailed towards the results that will lead to the acceptance or rejection of the hypothesis.

There were eight factors: efficient subjective norms, efficient moral norms, curtailment moral norms, curtailment subjective norms, efficient attitude, curtailment attitude, self-identity and household culture; that affect the decision of adopting sustainable use of water. In order to answer the different questions related to each of the eight factors, the mean score of each dimension was obtained separately to derive only eight single variables.

The recoding of each element allowed the running of the statistical tests needed to examine the below hypotheses.

5.3.1. First equation: Hypothesis 1, 2, 3,4,5,6,7,8 and 9

H1: Respondents with positive efficient moral norms are more likely to consider using grey-water for non-potable uses.

H2: Respondents with positive efficient subjective norms are more likely to consider using grey-water for non-potable uses.

H3: Respondents with positive efficient attitude are more likely to consider using grey-water for non-potable uses.

H4: Respondents with positive efficient moral norms are more likely to consider retrofitting their bathrooms.

H5: Respondents with positive efficient subjective norms are more likely to consider retrofitting their bathrooms.

H6: Respondents with positive efficient attitude are more likely to consider retrofitting their bathrooms.

H7: Respondents with positive efficient moral norms are more likely willing to buy new appliances in order to save water.

H8: Respondents with positive efficient subjective norms are more likely willing to buy new appliances in order to save water.

H9: Respondents with positive efficient attitude are more likely willing to buy new appliances in order to save water.

To check all the above nine hypothesis, Logistic regression was used to analyze the relationship between the independent variables efficient moral norms, efficient subjective norms and efficient attitude and each of the dependents variables, using grey-water, retrofitting their bathroom and buying new appliances.

Logistic regression is applied "to analyze relationships between a dichotomous dependent variable and metric or dichotomous independent variables. It combines the independent variables to estimate the probability that a particular event will occur and it does not make any assumptions of normality, linearity, and homogeneity of variance for the independent variables"[1].

"The minimum ratio of valid cases to independent variables for logistic regression is 10 to 1, with a preferred ratio of 20 to 1". In this analysis, there are 200 valid cases and 3 independent variables. The ratio of cases to independent variables is 66.7 to 1, which satisfied the minimum requirement (see Table 8).

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[1] http://dx.doi.org/10.1002/9781118548387.ch1

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	200	100.0
	Missing Cases	0	.0
	Total	200	100.0
Unselected Cases		0	.0
Total		200	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table 8: Logistic Regression for Hypothesis 1,2 & 3 - Sample Size requirements

SPSS logistic regression "models the relationship by computing the changes in the likelihood of falling in the category of the dependent variable which had the highest numerical code" (SPSS Inc, 2005). The responses to "Strategies" were coded: 0= negative and 1 = Positive. The SPSS output modeled the changes in the likelihood of being code 1 (positive) because 1 corresponds to Positive attitude.

The independents variables were all included at the same time in the regression equation (simultaneous method). "The contribution to the model is measured by model chi-square which is a statistical measure of the fit between the dependent and independent variables. The presence of a relationship between the dependent variable and combination of independent variables is based on the statistical significance of the model chi-square" (SPSS Inc, 2005).

Hypothesis 1, 2 and 3

In $H_{1,2\&3}$ analysis, the probability of the model chi-square (7.847) was <0.049, less than or equal to the level of significance of 0.05. Thus, the existence of a relationship between the independent variables and the dependent variable was supported.

Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	7.847	3	.049
	Block	7.847	3	.049
	Model	7.847	3	.049

Table 9: Logistic Regression for Hypothesis 1, 2, 3 - Model Chi-square

The probability of the Wald statistic for the variable "Efficient moral norms" was <0.05. The null hypothesis that the b coefficient for this variable was equal to zero was rejected. This means its coefficient is significantly different than 0. This supports the relationship that the more respondents have positive efficient moral norms, the more they are likely to consider using grey-water for non-potable uses. The relationship between the two other independent variables and the dependent variable has not been found significant.

Furthermore, the value of Exp(B) was 1.329 (>1 and B>0) which implies that one unit increase in "Efficient moral norms" increased the odds by approximately one and a quarter times that survey respondents are more likely considering using grey-water for non-potable uses.

Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	Efficient Subjective norms	-.037	.105	.122	1	.727	.964
	Efficient moral norms	.285	.114	6.244	1	.012	1.329
	Efficient attitude	-.059	.153	.148	1	.700	.943
	Constant	-.969	.902	1.154	1	.283	.380

a. Variable(s) entered on step 1: Q8ab, Q8cde, AVQ7.

Table 10: Relationship of independent variables to dependent variable in hypothesis 1, 2, 3

Based on the above, statistically significant relationship only exists between efficient moral norms and usage of grey-water for non-potable uses.

Hypothesis 4, 5 and 6

In the analysis of $H_{4, 5, 6}$, the probability of the model chi-square (14.187) was <0.003, less than or equal to the level of significance of 0.05. Thus, the existence of a relationship between the independent variables and the dependent variable was also supported.

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	14.187	3	.003
	Block	14.187	3	.003
	Model	14.187	3	.003

Table 11: Logistic Regression for Hypothesis 4, 5, 6 - Model Chi-square

The probability of the Wald statistic for the variable "Efficient moral norms" was <0.05 which implies that there is a relationship between efficient moral norms and the dependent variable. No significant relationship was found based on the two other independent variables. The value of Exp(B) was 1.383 (>1 and B>0) which implies that one unit increase in "Efficient moral norms" increased the odds by approximately one and a quarter times that survey respondents are more likely to consider retrofitting their bathrooms for the purpose of conserving water.

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Efficient Subjective norms	.132	.110	1.437	1	.231	1.141
	Efficient moral norms	.324	.126	6.665	1	.010	1.383
	Efficient attitude	-.088	.165	.286	1	.593	.915
	Constant	-2.124	.994	4.564	1	.033	.120

a. Variable(s) entered on step 1: Q8ab, Q8cde, AVQ7.

Table 12: Relationship of independent variables to dependent variable in hypothesis 4, 5, 6

Also based on the above it is found that statistically significant relationship exists between efficient moral norms and the willingness of respondents to retrofit their bathroom to conserve water.

Hypothesis 7, 8 and 9

The probability of the model chi-square (25.324) was <0.001, less than or equal to the level of significance of 0.05. Thus, the existence of a relationship between the independent variables and the dependent variable was confirmed.

Omnibus Tests of Model Coefficients

		Chi-square	Df	Sig.
Step 1	Step	25.324	3	.000
	Block	25.324	3	.000
	Model	25.324	3	.000

Table 13: Logistic Regression for Hypothesis 7, 8, 9 - Model Chi-square

The probability of the Wald statistic for the variable "Efficient moral norms" was <0.05 which implies the existing of a relationship between efficient moral norms and the dependent variable. Likewise of the findings of $H_{1, 2, 3}$ and $H_{4, 5, 6}$, no significant relationship was found based on the two other independent variables. The value of Exp(B) was 1.666 (>1 and B>0) which implies that one unit increase in "Efficient moral norms" increased the odds by approximately one and three quarter times that survey respondents are more likely willing to purchase new devices with water efficient standards in order to save water.

Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	Efficient Subjective norms	-.046	.110	.174	1	.677	.955
	Efficient moral norms	.511	.126	16.508	1	.000	1.666
	Efficient attitude	.031	.164	.035	1	.852	1.031
	Constant	-2.813	1.004	7.845	1	.005	.060

a. Variable(s) entered on step 1: Q8ab, Q8cde, AVQ7.

Table 14: Relationship of independent variables to dependent variable in hypothesis 7, 8, 9

Further to above, statistically significant relationship exists between efficient moral norms and willingness to buy new appliances with water efficient standards.

In view of the above results, statistically significant relationship was found only between the efficient moral norms and the 3 dependents variables. Thus cross tabulation for the three variables was conducted only for the respondents who agree on using grey-water, retrofitting their bathrooms and purchase new appliances in order to save water. From the graphs below, results showed that there is an increasing trend line; the more the efficient moral norms are positive the more the person is considering using grey-water for non-potable uses, retrofit their bathrooms and buy new appliances in order to save water.

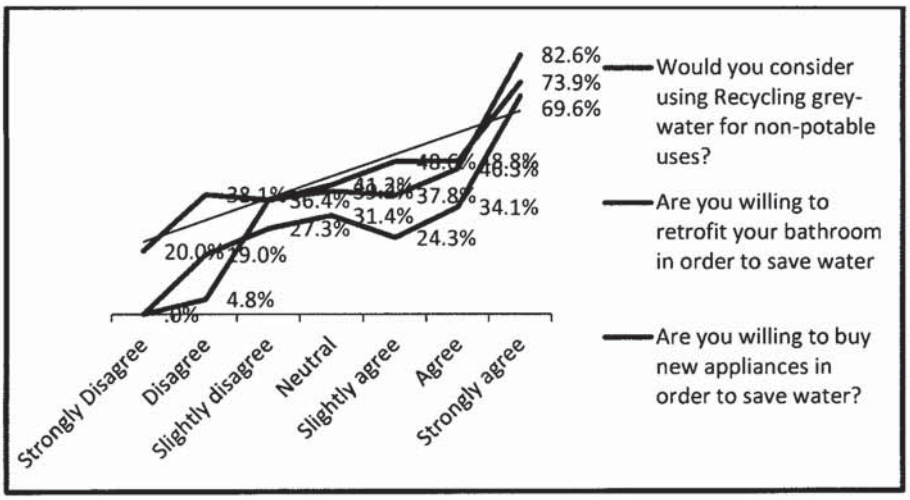


Figure 34: Contingency table analysis of efficient moral norms

5.3.2. Hypothesis 10

H_{10}: Efficient moral norms vary with gender.

To measure if variations do exist based on respondent gender, Mann-Whitney U Test was used. "The Mann-Whitney U test is used to compare differences between two independent groups when the dependent variable is either ordinal or continuous, but not normally distributed" [2].

The dependent variable, efficient moral norms, was used as an ordinal variable and the independent variable was gender.

[2] https://statistics.laerd.com/spss-tutorials/mann-whitney-u-test-using-spss-statistics.php

The Ranks table is the first table that provides information regarding the output of Mann-Whitney U test. It indicates mean rank and sum of ranks for the two groups tested.

Ranks

	Gender	N	Mean Rank	Sum of Ranks
Efficient moral norms	Male	97	96.90	9399.50
	Female	103	103.89	10700.50
	Total	200		

Table 15: Mann-Whitney U - Ranks table

The Table 15 above indicates which group can be considered as having the higher positive efficient moral norms, overall; namely, the group with the highest Mean Rank. In this case, females had the highest efficient moral norms. However this do not show if the difference is significant or not.

The test statistics table indicates the actual significance of Mann-Whitney test. It provides the test statistic, U statistic, as well as the p-value. The test yielded a p-value=0.385>0.05, thus it cannot be confirmed that Efficient moral norms differ significantly between women and men. Consequently, no relationship exists between gender and efficient moral norms.

Test Statistics[a]

	Efficient moral norms
Mann-Whitney U	4646.500
Wilcoxon W	9399.500
Z	-.869
Asymp. Sig. (2-tailed)	.385

a. Grouping Variable: Gender

Table 16: Mann-Whitney U - Test statistics

5.3.3. Second Equation: Hypothesis 11 and 12

H_{11}: The willingness to buy new appliances in order to save water varies with the setup of governmental charges on waste water.

H_{12}: The willingness to buy new appliances in order to save water varies with subsidizing water efficient appliances.

Following the recoding of the closed ended-question "Are you willing to buy new appliances in order to save water", variables "Maybe" and "No" are combined into another new single variable; to be able to generate the frequencies of the willing and un-willing respondents to purchase new appliances in order to save water.

		N	%
Are you willing to buy new appliances in order to save water?	No	23	11.5%
	Yes	81	40.5%
	Maybe	96	48.0%
Would you change your mind if: The water efficient appliances were subsidized	No	24	20.2%
	Yes	95	79.8%
Would you change your mind if: Government start charging on the volume of waste-water discharged from your house?	No	29	24.4%
	Yes	90	75.6%

Table 17: Frequency of the willing and un-willing respondents to purshase new water efficient appliances

The results of this study showed that the majority were not willing to buy new appliances in order to save water, scoring a negative attitude. However, when asked the two other alternatives; if water efficient appliances were subsidized and if the government starts charging on the volume of waste-water discharged from your house, the majority of those who weren't willing to buy new appliances to save water and hesitated, changed positively their attitude.

To analyze respondents' tendency to change their mind on their decision of not willingly purchase new appliances to save water, binomial test was used. "The Binomial Test procedure compares the observed frequencies of the two categories of a dichotomous variable to the frequencies that are expected under a binomial

distribution with a specified probability parameter. By default, the probability parameter for both groups is 0.5" (SPSS Inc, 2005, p. 502).

Results showed that the p-value <0.05 for both variables which means for both variables the percentage of those who were willing to change their mind and buy new appliances is significantly greater than those who said they won't.

		Category	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Would you change your mind if: The water efficient appliances were subsidized	Group 1	Yes	95	.80	.50	.000
	Group 2	No	24	.20		
	Total		119	1.00		
Would you change your mind if: Government start charging on the volume of waste-water discharged from your house?	Group 1	Yes	90	.76	.50	.000
	Group 2	No	29	.24		
	Total		119	1.00		

Table 18: Binominal Test

5.4. Answering the research questions

This section that follows will answer the research questions of the study.

Research question 1:

As already stated in section 4.4 of Chapter 4; the research question #1 that this research paper is aiming to answer is:

"What are the factors that gravely influence residents of BML region to conserve water as established in the study?"

The results of the survey pointed that most of the people declared that water pollution should be treated as priority by the Lebanese government and that attention to water conservation is more needed. It also highlight that the over-usage of water by the end-users is the main reason for water wastage. Hence this implies that they are partially aware that the solution necessitates changes in their personal consumption behavior. However, their possible awareness and statements are not

always reflected in reality by their actions. The respondents' routines and habits to save water around the house were mainly fundamental to the well-being of the house such as fixing the taps and leakages of the pipes of the house, use washing machine when its full…etc. but also it is noted that only minority of respondents were practicing the sustainable routines of conserving water i.e. collecting rain water, re-using grey-water for garden…etc. It is deduced that there is a deficiency in the encouragement on sustainable methods to increase water supply.

What is noticeable is that while many respondents agreed on the fact that water efficient appliances cost too much, the majority indicated that these should be mandatory.

The majority of the respondents, who were not willing to purchase new appliances for the purpose of saving water, would change their minds if the government subsidized them and if it began to charge on the waste-water discharge. In addition, as shown in section 5.3.1, respondents with affirmative moral norms are more likely induced to conserve water and put the extra effort; retrofitting the bathrooms and buying new efficient machines, than others.

Thus, it can be deduced that people are mostly affected by the economic incentives and by their inner moral norms, whether negative or positive.

Research question 2:

As already stated in section 4.4 of Chapter 4; the research question #2 that this research paper is aiming to answer is:

> "What are the respondent attitudes towards the installation of new water-efficient appliances?"

The results of the survey showed that most of the respondents had affirmative attitudes towards installing new water-efficient with a mean of 5.75 and a standard deviation of 1.11. On the other hands, many feel that there is no collective interest in installing these efficient machines with a mean score of 4.11 and standard deviation of 1.39. Plus, respondents rarely marked strong personal obligation into installing

efficient machines to help conserve water and use this valuable resource responsibly with a mean of 4.96 and standard deviation of 1.5.

These results could be due to the lack of an essential mechanism of spreading awareness throughout the Lebanese community and the lack of incentives that could help residents to have affirmative sense of personal obligation tempting them to install new efficient machinery.

The table below summarizes the mean score and standard deviations of BML respondents' attitudes on the eight factors of water usage.

Factors	N	Mean	SD
Efficient Subjective norms	200	3.01	1.54
Efficient moral norms	200	4.54	1.58
Curtailement moral norms	200	4.96	1.5
Curtailement subjective norms	200	4.11	1.39
Efficient attitude	200	6.1	1.04
Curtailement attitude	200	5.75	1.11
Self-Identity	200	4.68	1.58
Household culture	200	4.22	1.52

Table 19: Mean of eight factors representing residents of BML responses

Research question 3:

As already stated in section 4.4 of Chapter 4; the research question #3 that this research paper is aiming to answer is:

"What variations are found based on the social-demographic variables (age, gender and educational level) towards efficient water use?"

- Age

As the majority of the sample was composed by a younger people, aged between 15 and 25, it was found to have affirmative efficient moral norms; high

sense of personal obligation and willingness to try to engage into saving water in their daily usage routines.

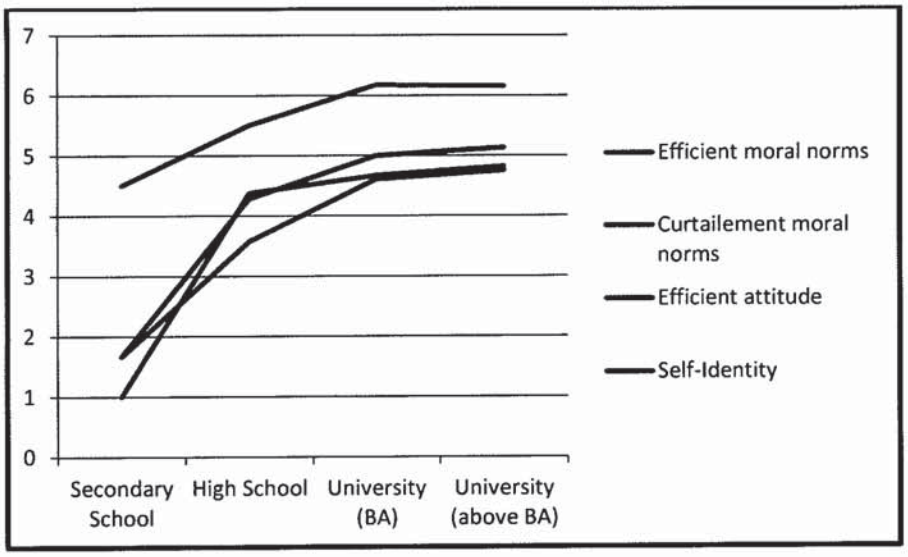
- Gender

Based on the survey and as discussed in Hypothesis 10, no significant variation was found between females and males in connection with efficient water use. This result could be generated from the fact that the survey was launched online and the sample was composed mostly of students and working force. In order to have a clearer understanding on the daily efficient water usage around the house, households needs to be targeted.

- Educational level

Chi-Square tests have been conducted between the eight factors and the educational level to test independence between them. According to the test, relationship has been found between education level attained and the following four factors: efficient moral norms, curtailment moral norms efficient attitude and self-Identity.

The mean of agreement for University students on efficient moral norms is significantly greater than the mean of High school and secondary students.



5.5. Conclusions

In summary, we can conclude that in general most of BML residents admit that water scarcity is inevitable and that serious behavioral paradigm shifts needs to be made to reduce the wastage of freshwater, which is a significant side of water demand management.

Furthermore, it has been found that personal moral norms play a very important role in efficiency usage of water and intentions to install devices with water efficiency standards alongside with economical sanctions imposed by the government.

Chapter 6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Introduction

This chapter discusses the findings and limitations of this study. The aim of this research was to study the psychological processes of Beirut-Mount Lebanon households' water usage in addition to the factors that induces them to adopt a more sustainable consumptive practice of domestic water.

6.2. Main findings

In line with the findings of all the previous dissertations discussed in section 3.5 of the Chapter 3, this study found that although some citizens are practicing water conservation in their daily routine, it has been noted that there is room for more efforts specially if given the right incentives; psychological and economical incentives.

It is highlighted that Lebanese, similarly to the Australians, have positive attitudes towards the ownership and usage of water-efficient appliances and water conservation in general. Yet, the latter are not always converted into concrete conserving behavior. Furthermore, Spinks, Fielding, Russell, Mankad and Price (2011, p. 22) synthesized that "feeling a sense of personal moral obligation to conserve water is an important determinant of overall water curtailment and efficiency intentions"; which is compatible with the findings of this thesis.

It is clear from this thesis analysis that behavioral models describing voluntary behavioral change are complex. There is no proven single efficient method to facilitate behavior change to reduce water consumption to the individuals. Thus, it is deducted that change in water consumption behavior is most likely to occur when as many as possible of these elements are present: Appropriate water policy and pricing, strong positive attitude towards saving water, possession of water efficient appliances, belief that advantages of conserving water and using it efficiently outweighs its disadvantages, existence of social pressure to conserve this valuable resource.

6.3. Limitation of the research

In this study, rigorous data limitations were presented and several inconsistencies on water sector performance were faced. Thus, the data limitation needs to be taken into account in rendering the quantitative outcome of the analysis while considering the fact that no reliable official census was conducted since 1932.

Due to the lack of important population elements, the survey of this research was performed using a snowball sampling technique rather than a clustered or stratified one to gather respondents who reside in Beirut-Mount Lebanon area. This kind of sampling is not generalizable to a large population.

The financial figures and statements for the four water authorities mentioned in the study are not audited. Hence, the study relies on the records presented by the RWAs and reports prepared by consultants to evaluate supply-side performance in the water sector.

A fourth limitation of this study is the reliance on individual data to envisage a collective outcome. It has failed to accredit that the conservation of water generally necessitates the actions of numerous members of the house and thus takes place in a group setting.

These limitations can be tackled in depth in future researches.

6.4. Recommendations

This research could be expanded to include various residents from different regions across Lebanon. This might demonstrate if the results of this study were consistent across multiple districts and thereby generalizable.

In addition, a larger sample size is needed to be able to complete a more complex analysis for more thorough results.

For future in depth analysis on the daily efficient water usage around the house and garden, households needs to be targeted.

Furthermore, the examination of actual adoption of water behavior rather than the self-reported water conservation behavior and intentions, which has been shown by Hamilton (1985) to be somewhat biased, is recommended for future work. It is also urged to broaden the extent of water behavior investigations to comprise new solutions from the consumer's side.

Plus, in order to accommodate water-users on sustainable methods to increase water supply, it is recommended that the government draft a law whereby it set charges on the wastewater discharged from user's residence or facility. Also, it is recommended that the government subsidies the appliances with efficiency standards.

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APPENDIX A

QUESTIONNAIRE

Since long ago, Lebanon is classified as a country rich in water resources. However, due to climate change, pollution and mismanagement of water resources, it is predicted that the demand for water will exceed the available supply. Unless precautious measures are taken immediately, Lebanon will face chronic scarcity of water by 2030.

The present survey is part of an academic study aiming at promoting better practices in sustainable water management in Lebanon.

You should be able to answer the questions in 10 to 15 minutes. Please be as open and honest as possible when answering each question. Your participation is completely voluntary. There are no correct or incorrect responses; we are merely interested in your personal point of view. Please be assured that your responses will be kept strictly confidential and will be used for statistical purposes related to this research.

In this survey, we will be asking you about two types of water conservation methods:

1- Engaging in everyday action to save water
2- Installing water efficient appliances around the house

Please refer to the below examples of the two different methods when you are answering specific questions related to each (boxes below)

Everyday actions **to save water around the house and garden: The following actions are things that you and members of your household may do to conserve water:**
• Check and fix leaking taps
• Collect rainwater to use in garden
• Only run dishwasher if it is full
• Have shorter showers (4 minutes or less)
• Use half flush
• Wash cars with minimal water
• Collect and use grey water on garden
Installing *water efficient appliances* around the house and garden: The following are examples of water efficient appliances that you or members of your household may install in order to conserve water:
• Low-flow taps and/or shower heads on all fittings
• Hose with trigger or a timed sprinkler
• Water-wise plants and/or gardens
• Dual-flush or composting toilet
• Shower timer
• Grey water system
• A Rainwater tank
• Efficient/low water consumption washing machine
• Water efficient dishwater

Section I - General Environmental Perception

1. **From the below list, what environmental problem the Lebanese Government must tackle first in terms of their importance.***
   Choose 1 answer

   a) Air Pollution
   b) Endangered Biodiversity
   c) Waste generation
   d) Water Pollution
   e) Noise Pollution
   f) Depletion of the forests
   g) Endangered species

2. **Please rate your agreement level with the below statements by choosing the appropriate response.***
   "1" being Strongly Disagree and "7" being Strongly Agree.

a) Fresh/usable water is an unlimited source	|1|2|3|4|5|6|7|
b) Water conservation is important for the environment	|1|2|3|4|5|6|7|
c) Water conservation is necessary because of water scarcity	|1|2|3|4|5|6|7|
d) Water shortage is an important environmental issue	|1|2|3|4|5|6|7|
e) More attention to water conservation is needed	|1|2|3|4|5|6|7|
f) Water conservation alone can solve Lebanese's water problem	|1|2|3|4|5|6|7|
g) Water conservation isn't my responsibility	|1|2|3|4|5|6|7|

3. **What are the major causes of wastage of water in your city?***
   Please choose all that apply

   ☐ Leakages from taps/faucets in your house
   ☐ Leakages during distribution (from municipalities, tankers, etc. to your house)
   ☐ Too much water used where less is required by us as consumers
   ☐ Water is not being wasted
   ☐ Other: _____

Section II – Water Usage

4. **A) Please indicate the frequency of implementing "Everyday actions to save water" from the below list.***
   "1" being Never and "7" being Always

   a) Make sure that taps do not drip |1|2|3|4|5|6|7|
   b) Use minimal water for cleaning |1|2|3|4|5|6|7|
   c) Only use the washing machine when it is full |1|2|3|4|5|6|7|
   d) Take shorter showers (4 minutes or less) |1|2|3|4|5|6|7|
   e) Wash dishes in a bowl/sink rather under tap |1|2|3|4|5|6|7|
   f) Minimize toilet flushing where possible |1|2|3|4|5|6|7|
   g) Only use the dishwasher when it is full |1|2|3|4|5|6|7|
   h) Rarely water the garden |1|2|3|4|5|6|7|
   i) Immediately fix any leakage in tap and pipes |1|2|3|4|5|6|7|
   j) Collect water from shower/sink/bath for use elsewhere |1|2|3|4|5|6|7|
   k) Hand wash clothes |1|2|3|4|5|6|7|
   l) Keep the tap opened while brushing my teeth |1|2|3|4|5|6|7|
   m) Don't conserve any water |1|2|3|4|5|6|7|
   n) Collect rainwater to use on garden |1|2|3|4|5|6|7|

   B) If you answered never for "f. Minimize toilet flushing when possible" what was the main reason?*

   ☐ Habit
   ☐ Don't believe is necessary
   ☐ Can't be bothered
   ☐ Others: _____

5. **I think engaging in any of the *everyday actions* to save water around the house and garden is:***
   Please choose one response on each line

Extremely Bad	|1|2|3|4|5|6|7|	Extremely Good
Extremely Harmful	|1|2|3|4|5|6|7|	Extremely Beneficial
Extremely Worthless	|1|2|3|4|5|6|7|	Extremely Valuable
Extremely unpleasant	|1|2|3|4|5|6|7|	Extremely pleasant

6. The following questions ask your belief about everyday actions to save water around the house and garden.*

"1" being Strongly Disagree and "7" being Strongly Agree.

a) It is expected of me that I save water around the house and garden |1|2|3|4|5|6|7|

b) I feel like there is a social pressure to save water around the house and garden |1|2|3|4|5|6|7|

c) People who are important to me want me to save water around the house |1|2|3|4|5|6|7|

d) I feel a strong personal obligation to save water around the house and garden |1|2|3|4|5|6|7|

e) I am willing to put extra effort into saving water around the house and garden |1|2|3|4|5|6|7|

f) I would feel guilty if I didn't save water around the house and garden |1|2|3|4|5|6|7|

g) Water conservation issues don't affect me |1|2|3|4|5|6|7|

Section III – Water Appliances

7. I think installing water efficient appliances in the house and garden is:*

Please choose one response on each line

Extremely Bad	|1|2|3|4|5|6|7|	Extremely Good
Extremely Harmful	|1|2|3|4|5|6|7|	Extremely Beneficial
Extremely Worthless	|1|2|3|4|5|6|7|	Extremely Valuable
Extremely unpleasant	|1|2|3|4|5|6|7|	Extremely pleasant

8. Please rate your agreement level with the below series of statements about water efficient appliances by circling the appropriate response.*

"1" being Strongly Disagree and "7" being Strongly Agree.

a) I feel that I am under social pressure to install water efficient appliances in the house and garden |1|2|3|4|5|6|7|

b) People who are important to me want me to install water efficient appliances in the house and garden |1|2|3|4|5|6|7|

c) I feel a strong personal obligation to install water efficient appliances in the house and garden |1|2|3|4|5|6|7|

d) I am willing to put extra effort into installing water efficient appliances in the house and garden |1|2|3|4|5|6|7|

e) I would feel guilty if I didn't install water efficient appliances in the house and garden |1|2|3|4|5|6|7|

f) Water efficient appliances cost too much |1|2|3|4|5|6|7|

g) Water efficient appliances should be mandatory |1|2|3|4|5|6|7|

9. A) Please indicate if you have some of the following appliances in your house:*
You may choose several if applicable

- ☐ Washing machine with water efficiency standards
- ☐ Dish washing machine with water efficiency standards
- ☐ Taps with water efficiency standards
- ☐ Shower head with water efficiency standards
- ☐ Toilet Flush with water efficiency standards
- ☐ Rain-water collection system
- ☐ Grey-water recycle system
- ☐ None
- ☐ Other: _____

B) If you have some water efficient appliances in your house what was the reason for this selection?

- ☐ Ecology
- ☐ Economy
- ☐ Performance
- ☐ Other:_____

Section IV – Level of Personal Compliance

10. Are you connected to the public water network?*

☐Yes ☐No ☐ Do not know

11. Are you willing to take more steps towards water conservation?*

☐Yes ☐No ☐ Maybe

12. Would you consider using:*

A) Rainwater for non-potable uses?

☐Yes ☐No ☐ Maybe

B) Recycling grey-water for non-potable uses?

☐Yes ☐No ☐ Maybe

13. A) Are you willing to retrofit your bathroom in order to save water?*

☐Yes ☐No ☐ Maybe

B) Are you willing to buy new appliances in order to save water?*

☐Yes ☐No ☐ Maybe

C) If you answered "No" or "Maybe" on any of the above questions, would you change your mind if:

- The water efficient appliances were subsidized
  - ☐ Yes
  - ☐ No
- Government start charging on the volume of wastewater discharged from your house?
  - ☐ Yes
  - ☐ No

14. Please rate your agreement level with the below statement*

"1" being Strongly Disagree and "7" being Strongly Agree

a) I personally describe myself as water conserver. |1|2|3|4|5|6|7|
b) Water conservation is important to me personally. |1|2|3|4|5|6|7|
c) Members of my household think that installing water efficient appliances in the house and garden is a good thing |1|2|3|4|5|6|7|
d) Most individuals in my households engage in everyday actions to save water in the house. |1|2|3|4|5|6|7|

Section V – Socio-Demographic

15. What is your age?* _____

16. What is your gender?*

☐ Female ☐ Male

17. Education level attained*

- ☐ Primary school
- ☐ Secondary school
- ☐ High school
- ☐ University (BA)
- ☐ University (Above BA)
- ☐ Vocational
- ☐ No formal education

18. Occupation: _____

19. Are you a member of a social/environmental NGO?

☐ Yes ☐ No

20. Residence Area*

- ☐ Beirut
- ☐ Mount Lebanon
- ☐ North Lebanon
- ☐ South Lebanon
- ☐ Beqaa
- ☐ Nabatieh

21. Income per Month

- ☐ > $1'000
- ☐ $1001 - $1500
- ☐ $1501 - $2000
- ☐ $2001 - $2500
- ☐ $2501 - $3000
- ☐ $3000 <

Thank you for taking the time to complete this questionnaire. Your input is a valuable and important contribution to the results of this research project.

APPENDIX B

FREQUENCY ANALYSIS OF THE EIGHT FACTORS

Table 20: Efficient Subjective Norm Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	40	20.0	20.0	20.0
	Disagree	33	16.5	16.5	36.5
	Slightly disagree	48	24.0	24.0	60.5
	Neutral	39	19.5	19.5	80.0
	Slightly agree	26	13.0	13.0	93.0
	Agree	7	3.5	3.5	96.5
	Strongly agree	7	3.5	3.5	100.0
	Total	200	100.0	100.0	

Table 21: Efficient Moral Norms Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	2.5	2.5	2.5
	Disagree	21	10.5	10.5	13.0
	Slightly disagree	22	11.0	11.0	24.0
	Neutral	51	25.5	25.5	49.5
	Slightly agree	37	18.5	18.5	68.0
	Agree	41	20.5	20.5	88.5
	Strongly agree	23	11.5	11.5	100.0
	Total	200	100.0	100.0	

Table 22: Curtailment moral norms Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	2	1.0	1.0	1.0
	Disagree	11	5.5	5.5	6.5
	Slightly disagree	28	14.0	14.0	20.5
	Neutral	34	17.0	17.0	37.5
	Slightly agree	42	21.0	21.0	58.5
	Agree	46	23.0	23.0	81.5
	Strongly agree	37	18.5	18.5	100.0
	Total	200	100.0	100.0	

Table 23: Curtailment Subjective Norms Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	6	3.0	3.0	3.0
	Disagree	19	9.5	9.5	12.5
	Slightly disagree	41	20.5	20.5	33.0
	Neutral	58	29.0	29.0	62.0
	Slightly agree	41	20.5	20.5	82.5
	Agree	26	13.0	13.0	95.5
	Strongly agree	9	4.5	4.5	100.0
	Total	200	100.0	100.0	

Table 24: Efficient attitude Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	1	.5	.5	.5
	Slightly disagree	2	1.0	1.0	1.5
	Neutral	11	5.5	5.5	7.0
	Slightly agree	31	15.5	15.5	22.5
	Agree	55	27.5	27.5	50.0
	Strongly agree	100	50.0	50.0	100.0
	Total	200	100.0	100.0	

Table 25: Curtailment attitude Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Slightly disagree	8	4.0	4.0	4.0
	Neutral	17	8.5	8.5	12.5
	Slightly agree	43	21.5	21.5	34.0
	Agree	63	31.5	31.5	65.5
	Strongly agree	69	34.5	34.5	100.0
	Total	200	100.0	100.0	

Table 26: Self-Identity Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	2.5	2.5	2.5
	Disagree	12	6.0	6.0	8.5
	Slightly disagree	22	11.0	11.0	19.5
	Neutral	41	20.5	20.5	40.0
	Slightly agree	41	20.5	20.5	60.5
	Agree	42	21.0	21.0	81.5
	Strongly agree	37	18.5	18.5	100.0
	Total	200	100.0	100.0	

Table 27: Household culture Frequency

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly Disagree	5	2.5	2.5	2.5
	Disagree	17	8.5	8.5	11.0
	Slightly disagree	32	16.0	16.0	27.0
	Neutral	51	25.5	25.5	52.5
	Slightly agree	46	23.0	23.0	75.5
	Agree	29	14.5	14.5	90.0
	Strongly agree	20	10.0	10.0	100.0
	Total	200	100.0	100.0	