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GRADUATION PROJECT (MAN 400)

MARKETING SOLUTIONS FOR WATER SHORTAGES

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ABSTRACT

It is agreed without doubt that the water shortages have become a growing problem worldwide. Short supplies of water at a deteriorating quality are a long faced annoyance for most countries. Many blame it on global warming and increased population (Terry et al, 1997).

Water shortages are a growing problem worldwide. But global warming and increased population are not the actual causes. Instead government subsidies have caused unbridled demand for cheap water, and restrictions on uses of water have limited the available supply. Government attempts to curb demand and increase supplies by building dams and desalination plants have only made matters worse (Anderson & Hill, 1997).

Northern Cyprus has been experiencing a drought for more than thirty years. The problem has now reached a serious stage not only in the supply of irrigation but for human consumption as well. Since the early 1980's, the government launched a massive water reclamation programme with projects designed to sustain agriculture, tourism and urban needs. These government reclamation projects were limited in success on many counts, and caused environmental problems. For example, the "Yayla Irrigation Project" that aimed at pumping of water over the safe yield has resulted in seawater intrusion from the nearby coastline that disrupted agriculture in the area (Gökçekuş, 2001).

In addition, the past Northern Cyprus governments have failed to promote or stimulate private action for modern irrigational methods. Some municipal authorities were observed limiting water transfers to other areas outside their jurisdiction. The result has been to hold water captive in old fashioned uses such as flood irrigation, while the demand for water to meet urban needs and protect environmental amenities, continues to grow (Ertugan & Gökçekuş, 2002).

Water is a commodity like any other; however, it is often perceived as unique (Anderson & Hill, 1997). This perception has led to political interference and has disrupted water trading. Policy makers need to realize that water crisis need not occur if individuals are allowed to respond to scarcity through market processes.

This study considers water as a marketable product and explores marketing solutions that may help both publicly and privately ran enterprises to find solutions into managing well-rationed, quality supplies both for the advancement of the economy and the conservation of the environment. It aims to observe that allowing a market to allocate the water supplies achieves the most efficient allocation of the water resources, in order to bring a successful solution to water shortages in TRNC.

Keywords: Water Shortage, Water Management, Privatization, Water Marketing, Water Trading, Northern Cyprus,

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To my family…

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CHAPTER I

THE BEGINNING

1.1. Introduction

This chapter introduces the statement of the topic, the problem situation, the problem statement, the purpose of the study, and the objectives set for the study.

1.2. Statement of the Topic

Water resources are used in various ways by society and scientists predict that water scarcity will be one of the most important issues of the 21st century. Currently, 2.4 billion people lack access to basic sanitation and 1.2 billion people lack access to safe water sources. Nearly 2 billion people live with water scarcity, and this number is expected to rise to 4 billion by 2025, unless radical reforms emerge (Medalye, 2007).

Reports from development agencies, governments, water commissions, and research institutes continually point to an impending water crisis. These agencies also point to the water crisis arising from mismanagement not an absolute scarcity problem. According to UN (2003) "The water crisis is essentially a crisis of governance." Thus, improving current water provisions and avoiding a crisis of availability -with the entire human suffering this would entail- is possible. The message highlighted by various international efforts is that sub-optimal management of water is not an option if sustainable development is to be achieved (Medalye, 2007).

Throughout the history of civilization governments have grappled with the issue of water system management. Historical governance structures range from fully privatized systems to public-private arrangements to public systems. In the last decade the global water sector has experienced rising involvement of private entities in the production, distribution, or management of water and water services. This 'privatization' has been one of the most important and controversial trends in the sector. The privatization of water encompasses a variety of water management arrangements. Full privatization is rare, and the most common form of 'privatization' is a partial privatization effort in the form of public-private partnerships. Forces driving these changes include degrading infrastructures, the inability of public water agencies to satisfy basic human water needs, and the financial strain on public entities. Controversy surrounding privatization arises from concerns regarding the 'commodification' of a basic human right, the multinational takeover or management of national water systems, and reports of privatization failures. Despite varying opinions, all positions agree that the global water situation requires new management of water (Medalye, 2007).

There is a crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people-and the environment-suffer badly. Historical development, finance, and operations of water supplies have resulted in countless conflicts over water allocation procedures, cost allocation, and physical solutions to water resource problems (Howitt et al. 1999).

One potential solution to this impending crisis is to allow free markets for water. Allowing a market to allocate the water supplies achieves the most efficient allocation of the water resources, in order to bring a successful solution to water shortages.

1.3. Problem Situation

Northern Cyprus has been experiencing a drought for more than thirty years. The problem has now reached a serious stage not only in the supply of irrigation but for human consumption as well. Since the early 1980's, the government launched a massive water reclamation programme with projects designed to sustain agriculture, tourism and urban needs. These government reclamation projects were limited in success on many counts, and caused environmental problems. For example, the "Yayla Irrigation Project" that aimed at pumping of water over the safe yield has resulted in seawater intrusion from the nearby coastline that disrupted agriculture in the area (Gökçekuş, 2001).

In addition, the past Northern Cyprus governments have failed to promote or stimulate private action for modern irrigational methods. Some municipal authorities were observed limiting water transfers to other areas outside their jurisdiction. The result has been to hold water captive in old fashioned uses such as flood irrigation, while the demand for water to meet urban needs and protect environmental amenities, continues to grow (Ertugan & Gökçekuş, 2002).

1.4. Problem Statement

"What solutions to water shortages in NC can be considered in a marketing context?"

1.5. Purpose of the Study

This study considers water as a marketable product and explores marketing solutions that may help both publicly and privately ran enterprises to find solutions into managing well-rationed, quality supplies both for the advancement of the economy and the conservation of the environment. It aims to observe that allowing a market to allocate the water supplies achieves the most efficient allocation of the water resources, in order to bring a successful solution to water shortages in TRNC.

1.6. Project Objectives

- What is a water shortage?
- How are water shortages managed around the world?
- What is the history of water shortages in NC?
- What are the concepts and principles of marketing that can be applied to the management of water shortages that
  - can provide safe, affordable water services in NC?
  - can better involve the community in decisions about water resources and water systems?

1.7. Conclusion

This chapter depicted the topic area, the current problem situation, the problem statement, purpose of the study and the objectives of the study. The next chapters discuss the topic more detailed.

CHAPTER II

GLOBAL SOURCES AND USES OF WATER

2.1. Introduction

This chapter aims to provide general information and commonly accepted facts and figures about some of the most important water-related themes: sources of fresh water and uses of fresh water.

2.2. Water at a Glance

Water is essential to human life and to the health of the environment. All living organisms are predominantly made of water: Human beings about 60 %, fish about 80%, plants between 80% and 90%. Water is necessary for all chemical reactions that occur in living cells and is also the medium through which information is exchanged between cells. The sustainability of human development depends on the hydrological cycle, since water is essential for food production and all living ecosystems (World Water Council, 2005). Water is vital for human being in order to survive. However, increase in population, contamination of the water resources, salinization of coastal aquifers and over-extraction of the water from the ground water resources due to poor management, reduced the quantity of water on the supply side and increased the water need at demand side.

This chapter aims to provide general information and commonly accepted facts and figures about some of the most important water-related themes:

- Sources of fresh water
- Uses of fresh water

2.3. Sources of Fresh Water

2.3.1. Surface Water

Surface water is water in a river, lake or fresh water wetland. Surface water is naturally replenished by precipitation and naturally lost through discharge to the oceans, evaporation and sub-surface seepage.

Although the only natural input to any surface water system is precipitation within its watershed, the total quantity of water in that system at any given time is also dependent on many other factors. These factors include storage capacity in lakes, wetlands and artificial reservoirs, the permeability of the soil beneath these storage bodies, the runoff characteristics of the land in the watershed, the timing of the precipitation and local evaporation rates. All of these factors also affect the proportions of water lost through discharge to the oceans, evaporation and sub-surface seepage.

Human activities can have a large impact on these factors. Humans often increase storage capacity by constructing reservoirs and decrease it by draining wetlands. Humans often increase runoff quantities and velocities by paving areas and channelizing stream flow.

The total quantity of water available at any given time is an important consideration. Some human water users have an intermittent need for water. For example, many farms require large quantities of water in the spring, and no water at all in the winter. To supply such a farm with water, a surface water system may require a large storage capacity to collect water throughout the year and release it in a short period of time. Other users have a continuous need for water, such as a power plant that requires water for cooling. To supply such a power plant with water, a surface water system only needs enough storage capacity to fill in when average stream flow is below the power plant's need.

Nevertheless, over the long term the average rate of precipitation within a watershed is the upper bound for average consumption of natural surface water from that watershed.

Natural surface water can be augmented by importing surface water from another watershed through a canal or pipeline. It can also be artificially augmented from any of the other sources listed here; however in practice the quantities are negligible. Humans can also cause surface water to be "lost" (i.e. become unusable) through pollution (Wikipedia).

2.3.2. Sub-surface Water

Sub-surface water, or groundwater, is fresh water located in the pore space of soil and rocks. It is also water that is flowing within aquifers. Sometimes it is useful to make a distinction between sub-surface water that is closely associated with surface water and deep sub-surface water in an aquifer (sometimes called "fossil water").

Sub-surface water can be thought of in the same terms as surface water: Inputs, outputs and storage. The critical difference is that for sub-surface water, storage is generally much larger compared to inputs than it is for surface water. This difference makes it easy for humans to use sub-surface water unsustainably for a long time without severe consequences. Nevertheless, over the long-term the average rate of seepage above a sub-surface water source is the upper bound for average consumption of water from that source.

The natural input to sub-surface water is seepage from surface water. The natural outputs from sub-surface water are springs and seepage to the oceans.

If the surface water source is also subject to substantial evaporation, a sub-surface water source may become saline. This situation can occur naturally under endorheic bodies of water, or artificially under irrigated farmland. In coastal areas, human use of a sub-surface water source may cause the direction of seepage to ocean to reverse which can also cause salinization. Humans can also cause sub-surface water to be "lost" (i.e. become unusable) through pollution. Humans can increase the input to a sub-surface water source by building reservoirs or detention ponds.

Water in the ground in sections called aquifers. Rain rolls down and comes into these. Normally an aquifer is near to the equilibrium in its water content. The water content of an aquifier normally depends on the grain sizes. This means that the rate of extraction may be limited by poor permeability (Wikipedia).

2.3.3. Desalination

Desalination is an artificial process by which saline water (generally ocean water) is converted to fresh water. The most common desalination processes are distillation and reverse osmosis. Desalination is currently very expensive compared to most alternative sources of water, and only a very small fraction of total human use is satisfied by desalination. It is only economically practical for high-valued uses (such as household and industrial uses) in arid areas. The most extensive use is in the Persian Gulf (Wikipedia).

2.3.4. Frozen Water

Several schemes have been proposed to make use of icebergs as a water source, however to date this has only been done for novelty purposes. Glacier runoff is considered to be surface water (Wikipedia).

2.4. Uses of Fresh Water

Uses of fresh water can be categorized as consumptive and non-consumptive (sometimes called "renewable"). A use of water is consumptive if that water is not immediately available for another use. Losses to sub-surface seepage and evaporation are considered consumptive, as is water incorporated into a product (such as farm produce). Water that can be treated and returned as surface water, such as sewage, is generally considered non-consumptive if that water can be put to additional use (Wikipedia).

2.4.1. Agricultural

It is estimated that 70% of world-wide water use is for irrigation. In some areas of the world irrigation is necessary to grow any crop at all, in other areas it permits more profitable crops to be grown or enhances crop yield. Various irrigation methods involve different trade-offs between crop yield, water consumption and capital cost of equipment and structures. Irrigation methods such as most furrow and overhead sprinkler irrigation are usually less expensive but also less efficient, because much of the water evaporates or runs off. More efficient irrigation methods include drip or trickle irrigation, surge irrigation, and some types of sprinkler systems where the sprinklers are operated near ground level. These types of systems, while more expensive, can minimize runoff and evaporation. Any system that is improperly managed can be wasteful. Another trade-off that is often insufficiently considered is salinization of sub-surface water.

Aquaculture is a small but growing agricultural use of water. Freshwater commercial fisheries may also be considered as agricultural uses of water, but have generally been assigned a lower priority than irrigation.

As global populations grow, and as demand for food increases in a world with a fixed water supply, there are efforts underway to learn how to produce more food with less water, through improvements in irrigation methods and technologies, agricultural water management, crop types, and water monitoring (Wikipedia).

2.4.2. Industrial

It is estimated that 15% of world-wide water use is industrial. Major industrial users include power plants, which use water for cooling or as a power source (i.e. hydroelectric plants), ore and oil refineries, which use water in chemical processes, and manufacturing plants, which use water as a solvent (Wikipedia).

The portion of industrial water usage that is consumptive varies widely, but as a whole is lower than agricultural use.

2.4.3. Household

It is estimated that 15% of world-wide water use is for household purposes. These include drinking water, bathing, cooking, sanitation, and gardening. Basic household water requirements have been estimated by Peter Gleick (1998) at around 50 liters per person per day, excluding water for gardens.

Most household water is treated and returned to surface water systems, with the exception of water used for landscapes. Household water use is therefore less consumptive than agricultural or industrial uses.

2.4.4. Recreation

Water has a lot of recreational value. Recreational water use is usually a very small but growing percentage of total water use. Recreational water use is mostly tied to reservoirs. If a reservoir is kept fuller than it would otherwise be for recreation, then the water retained could be categorized as recreational usage. Release of water from a few reservoirs is also timed to enhance whitewater boating, which also could be considered a recreational usage. Other examples are anglers, water skiers, nature enthusiasts and swimmers.

Recreational usage is usually non-consumptive. However, when water is used for golf courses it can become the greatest water usage in a region. It has been estimated that a single average mid-western US golf course is equivalent to a population of 50,000 residents in water usage. (Thus, in areas where there are 20 golf courses the load is that of one million residents, as found in tourist areas such as Phoenix and Tucson, Arizona, and the famed 100 courses of Palm Springs and Desert Hot Springs, California use the equivalent of 5,000,000 resident consumers' water.) Some governments have labeled golf course usage as agricultural in order to deflect environmentalists' charges of water waste.

Additionally, recreational usage may reduce the availability of water for other users at specific times and places. For example, water retained in a reservoir to allow boating in the late summer is not available to farmers during the spring planting season. Water released for whitewater rafting may not be available for hydroelectric generation during the time of peak electrical demand (Wikipedia).

2.4.5. Environmental

Explicit environmental water use is also a very small but growing percentage of total water use. Environmental water usage includes artificial wetlands, artificial lakes intended to create wildlife habitat, fish ladders around dams, and water releases from reservoirs timed to help fish spawn.

Like recreational usage, environmental usage is non-consumptive but may reduce the availability of water for other users at specific times and places. For example, water release from a reservoir to help fish spawn may not be available to farms upstream (Wikipedia).

2.5. Conclusion

This chapter has provided a review of literature on the sources of water and the uses of water in the world. The next chapter discusses a literature review on water crisis in the world.

CHAPTER III

WATER PROBLEMS IN THE WORLD

3.1. Introduction

This chapter aims to provide the literature review carried out on water problems and their causes in the world.

3.2. Water Crisis in the World

During the last twenty years, the depletion of water resources has been recognized as one of the most severe environmental problems in many parts of the world. It is estimated that two billion people in the world live in areas with extended water shortages (Duraiappah, 1998). Intensified droughts have led to conflicts in many situations, leading some to predict that this century will be marked by national and international disputes over access to water (Venema & van den Breemer, 1999). In addition to water scarcity, water pollution is a problem that has affected every continent of the world (Sampat, 2000).

In the past century, the world's population tripled while global demand for water has increased six-fold (UNFPA, 1999). Today, more than a billion people lack safe drinking water and almost two and a half billion live without access to sanitation systems (UNDP). An estimated 14 to 30 thousand to people, mostly young and elderly, die every day from avoidable water-related diseases (UN Press Release, 2003). If current trend persist, by 2025 two thirds of the world's population will be living with serious water shortages or almost no water at all (UNESCO Courier, 1999).

3.3. People Lack Drinking Water and Sanitation in the World

Already there is more waste water generated and dispersed today than at any other time in the history of our planet: More than one out of six people lack access to safe drinking water, namely 1.1 billion people, and more than two out of six lack adequate sanitation, namely 2.6 billion people (WHO/UNICEF JMP, 2004). Every day, diarrheal diseases from easily preventable causes claim the lives of approximately 5000 people, most of them young children. Sufficient and better quality drinking water and basic sanitation can cut this toll dramatically, and simple, low-cost household water treatment has the potential to save further lives (WHO/UNICEF, 2005). One must know that these figures represent only people with very poor conditions. In reality, these figures should be much higher.

3.4. Water Resources are Becoming Scarce in the World

3.4.1. Agricultural Crisis

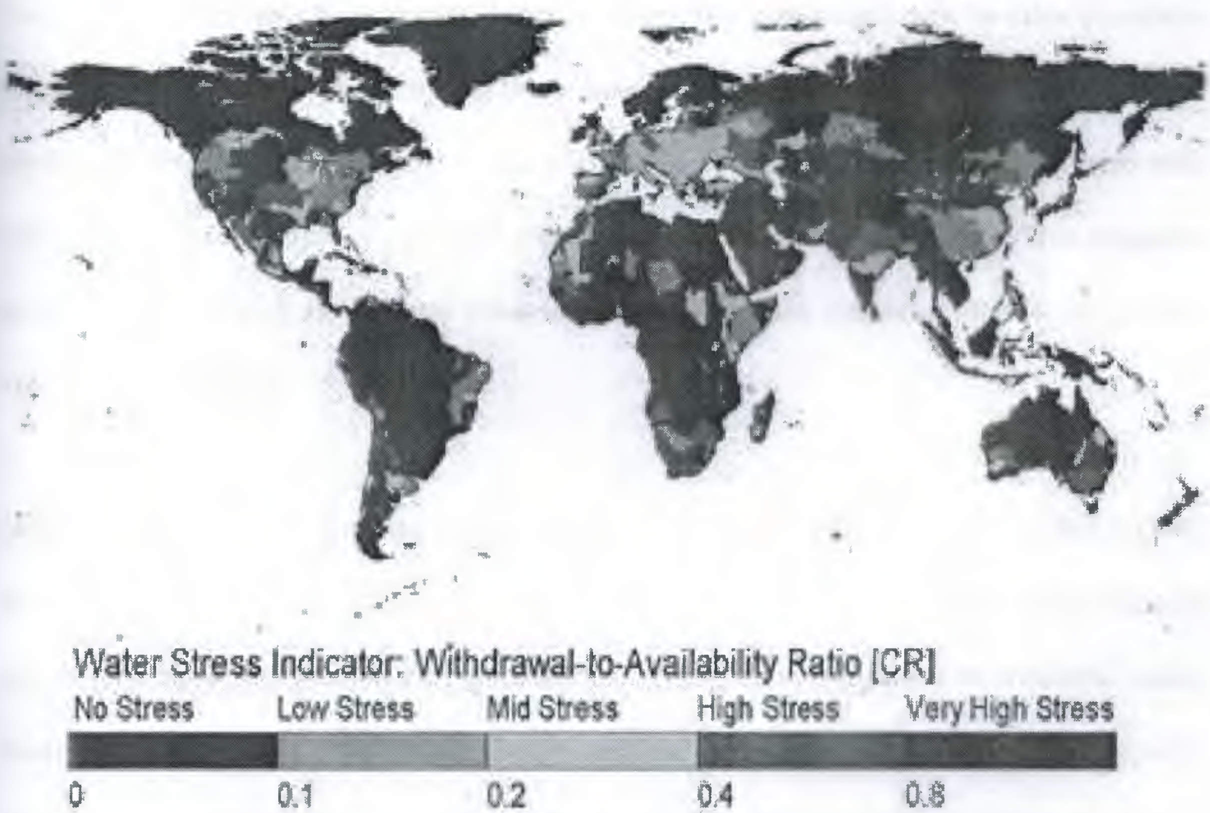
Although food security has been significantly increased in the past thirty years, water withdrawals for irrigation represent 66 % of the total withdrawals and up to 90 % in arid regions, the other 34 % being used by domestic households (10 %), industry (20 %), or evaporated from reservoirs (4 %). (Shiklomanov, 1999)

As the per capita use increases due to changes in lifestyle and as population increases as well, the proportion of water for human use is increasing. This, coupled with spatial and temporal variations in water availability, means that the water to produce food for human consumption, industrial processes and all the other uses is becoming scarce (World Water Council, 2005).

3.4.2. Environmental Crisis

It is all the more critical that increased water use by humans does not only reduce the amount of water available for industrial and agricultural development but has a profound effect on aquatic ecosystems and their dependent species. Environmental balances are disturbed and cannot play their regulating role anymore (World Water Council, 2005).

Figure 3.1. The Concept of Water Stress



Source: Water GAP 2.0 - December 1999

Water stress results from an imbalance between water use and water resources. The water stress indicator in this map measures the proportion of water withdrawal with respect to total renewable resources. It is a criticality ratio, which implies that water stress depends on the variability of resources. Water stress causes deterioration of fresh water resources in terms of quantity (aquifer over-exploitation, dry rivers, etc.) and quality (eutrophication, organic matter pollution, saline intrusion, etc.) The value of this criticality ratio that indicates high water stress is based on expert judgment and experience (Alcamo and others, 1999). It ranges between 20 % for basins with highly variable runoff and 60 % for temperature zone basins. In this map, we take an overall value of 40 % to indicate high water stress. We see that the situation is heterogeneous over the world.

3.5. World Water Supply and Distribution

Food and water are two basic human needs. In 2025, water shortages will be more prevalent among poorer countries where resources are limited and population growth is rapid, such as the Middle East, Africa, and parts of Asia. By 2025, large urban and peri-urban areas will require new infrastructure to provide safe water and adequate sanitation. This suggests growing conflicts with agricultural water users, who currently consume the majority of the water used by humans.

Generally speaking the more developed countries of North America, Europe and Russia will not see a serious threat to water supply by the year 2025, not only because of their relative wealth, but more importantly their populations will be better aligned with available water resources. North Africa, the Middle East, South Africa and northern China will face very severe water shortages due to physical scarcity and a condition of overpopulation relative to their carrying capacity with respect to water supply. Most of South America, Sub-Saharan Africa, Southern China and India will face water supply shortages by 2025; for these latter regions the causes of scarcity will be economic constraints to developing safe drinking water, as well as excessive population growth (Wikipedia).

3.6. Treats to Fresh Water in the World

The World Conservation Union (2004) lists some of the main factors adversely affecting water resources as in the following:

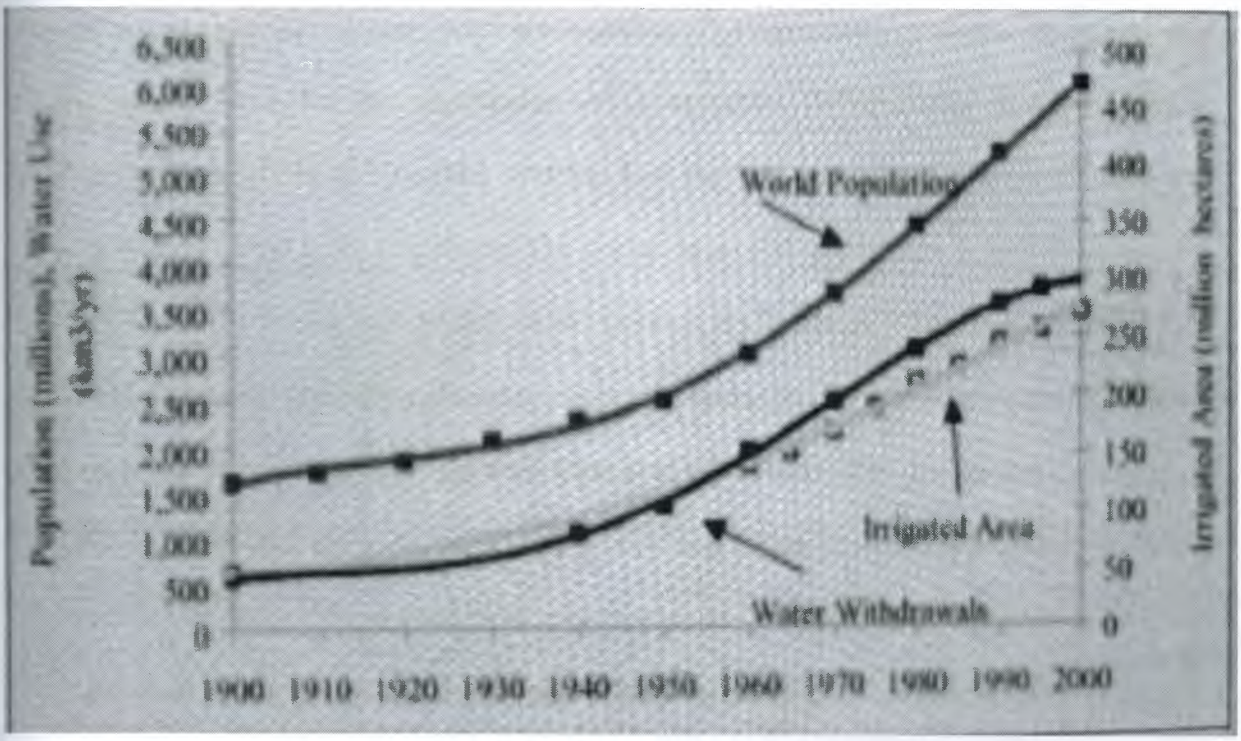
3.6.1. Increasing World Population

Population has grown at a significant rate, from 2.5 billion in 1950 to 6.1 billion today, yet the renewable water supply per person has fallen by 58% (Postel & Wolf, 2000). A study released by the UN Population Division states that the number of people in the world is likely to jump to 9.3 billion over the next 50 years, with Africa and Asia seeing the great growth (UN, 2001). As population rise, water supplies will become more and more stressed, and the issue of adequate supplies more critical.

3.6.2. Rising per Capita Consumption of Water

Irrigation has increased from around 50 million hectares at the turn of the century to over 267 million hectares today. These and other factors including industrialization have led to a nearly seven-fold increase in freshwater withdrawals (see Figure 3.2.). Global annual water use by industry is expected to rise due to the rapid industrial development of developing countries. If per capita consumption of water resources continues to rise at its current rate, humankind could be using over 90% off all available freshwater within 25 years, leaving just 10% for all other living beings (UNESCO). This alarming trend, in conjunction with overall rising world populations, foretells a potentially critical future situation.

Figure 3.2. World Population, Water Use, and Irrigated Area



Source: Peter Gleick, Island Press, Washington, DC, 1998

3.6.3. Global Climate Change

Recent estimates suggest that climate change will account for about 20% of the increase in global water scarcity (Gland, 2003). Though exact impacts of climate change are uncertain, precipitation is expected to increase at some latitudes, but decrease in tropical and subtropical regions (where the population growth is at its highest levels). More extreme weather conditions are foreseen which will highly affect water quantity and quality, particularly the impacts of flooding and resultant sanitation problems. One obvious signal is the drastic increase of the frequency and severity of disasters over the past decade. Between 1991 and 2000, the number of people affected by natural disasters rose from 147 million to 211 million per year, of which 90% were water-related (Gland, 2003). Floods and droughts have more than doubled since 1996, and 97% of all natural disaster deaths occurred in developing countries.

3.6.4. Infrastructure Development (Dams, dikes, levees, diversions, etc)

60% of the world's 227 largest rivers are significantly fragmented by dams, diversions and canals, which have led to degradation of ecosystems (UN, 2003). Consequentially, biodiversity is widely in decline. The Aral Sea had lost 75% of its total volume by 1998 due to the diversion of the inflowing rivers. The social impact of large dams is well documented: Adversely affected livelihoods, health, social systems, and cultures. "The direct benefits they provide to people are typically reduced to monetary figures for economic analysis and are not often recorded in human terms." *(Supra).* Case studies conducted by the World Commission on Dams indicates that the poor, vulnerable groups and future generations are likely to bear a disproportionate share of the social and environmental costs of large dam projects without gaining a commensurate share of the economic benefits *(Ibid).*

3.6.5. (Mis)management of Water

"The water crisis is essentially a crisis of governance." (UN, 2003). Lack of adequate water institutions, fragmented institutional structures, and excessive diversion of public resources for private gain; have impeded the effective management of water supplies. The effects of deforestation for example directly impact water supply by increasing runoff, and the lack of vegetative cover decreases water quality. Overgrazing also negatively impacts vegetation cover and contributes higher faecal quantities to water, which can dangerously affect its quality. Reclamation of wetlands deprives catchments of their natural flood mitigation system and filtration system adversely affecting quality. In many critical areas in Asia and Africa, these activities along with unsustainable agricultural practice, are rapidly accelerating desertification.

Riverine ecosystems are threatened worldwide by unsustainable development as well as the over-utilization of often limited freshwater resources. More than half of the world's major rivers are polluted and/or drying up in their lower reaches because of over-use, according to the World Commission on Water for the 21st century. Of the world's 500 major rivers, 250 are seriously polluted and depleted from over-use. Much of water pollution is the result of the two million tons of human waste disposed of in watercourses every day (Ibid). The human consequences of unsustainable water use are numerous, perhaps the most serious of these being displacement. Contamination and over-use of river basins displaced some 25 million environmental refugees in 1998/99 (Ibid).

Water resources are used in various ways by society and scientists predict that water scarcity will be one of the most important issues of the 21st century. Currently, 2.4 billion people lack access to basic sanitation and 1.2 billion people lack access to safe water sources. Nearly 2 billion people live with water scarcity, and this number is expected to rise to 4 billion by 2025, unless radical reforms emerge. Reports from development agencies, governments, water commissions, and research institutes continually point to an impending water crisis. These agencies also point to the water crisis arising from mismanagement not an absolute scarcity problem. Thus, improving current water provisions and avoiding a crisis of availability -with the entire human suffering this would entail- is possible. The message highlighted by various international efforts is that sub-optimal management of water is not an option if sustainable development is to be achieved (Medalye, 2007).

Throughout the history of civilization governments have grappled with the issue of water system management. Historical governance structures range from fully privatized systems to public-private arrangements to public systems. In the last decade the global water sector has experienced rising involvement of private entities in the production, distribution, or management of water and water services. This 'privatization' has been one of the most important and controversial trends in the sector. The privatization of water encompasses a variety of water management arrangements. Full privatization is rare, and the most common form of 'privatization' is a partial privatization effort in the form of public-private partnerships. Forces driving these changes include degrading infrastructures, the inability of public water agencies to satisfy basic human water needs, and the financial strain on public entities. Controversy surrounding privatization arises from concerns regarding the 'commodification' of a basic human right, the multinational takeover or management of national water systems, and reports of privatization failures. Despite varying opinions, all positions agree that the global water situation requires new management of water (Medalye, 2007).

3.7. Conclusion

This chapter has provided information about the water problem in the world and the threats: increasing world population, rising per capita consumption of water, global climate change, infrastructure development and (mis)management of water. The next chapter introduces the management types of water with an evaluation of advantages and disadvantages.

CHAPTER IV

WATER GOVERNANCE IN THE WORLD

4.1. Introduction

The water crisis is mainly a crisis of governance and the management forms under which water has been historically governed. This chapter discusses various forms of water governance with a focus on public-private partnerships and finds that evidence can build a case in favor of or against public-private partnerships.

4.2. Water Governance

The water sector worldwide is increasingly characterized in terms of a crisis situation. The unique and complex characteristics of the water resource entail complex social, political, and economic implications in its management. The water crisis is mainly a crisis of governance and the management forms under which water has been historically governed. At the crux of the water debate is governance and determining how to derive the most value from available water while not depriving people of their basic water needs (Medalye, 2007).

<u>Water governance</u> can be defined as the range of political, social, economic, and administrative systems that are in place to regulate the development and management of water resources and provision of water services at different levels of society (Medalye, 2007).

Counties face differing socio-economic, political, and historical contexts which will affect the way in which water resources and services are managed. However, according to Hall (2001), most countries face a similar set of challenges and objectives with respect to water. All countries face the challenge of ensuring water infrastructure exists. Infrastructure issues include challenges such as reducing leakage, replacing and extending networks, and improving technology. As well, countries must ensure that the various social and political objectives surrounding water are addressed. These objectives include public acceptance, improving coverage, effectiveness, affordability, raising standards, ensuring transparency and accountability, and resolving international water disputes. Also, environmental and health challenges must be addressed by countries. Countries must address public health needs, environmental management, and the conservation of water. In addition, countries must make financial and managerial decisions regarding water undertakings. Financial objectives such as sustainable and equitable tariffs, effective revenue collection, financing investment and fiscal impact are decisions which must be made. Managerial objectives such as improving efficiency and productivity, evaluating administrative feasibility, capacity building, and efficient procurement must also be implemented. There are multiple responsibilities which a water and wastewater service provider faces. These include infrastructure and asset ownership, capital investment, commercial risk, and operations and maintenance (Medalye, 2007).

Moreover, water is a large bulky good, which often requires large capital facilities that exhibit economies of scale. The collection, storage, treatment, and distribution of water are often best served by a large reservoir due to the low average cost associate with economies of scale in the sector. This structural requirement entails that water is best organized as a 'natural monopoly'. Thus, government regulation of the water sector is inevitable, regardless of which form of governance is chosen. There are various governance arrangements. The choice regarding which management structures can face the above challenges, objectives, decisions, and responsibilities of a country can vary from a complete public solution, to a quasi-public solution, to a fully private solution. Please see Table 4.1. below for a summary of governance structures in the water sector.

Table 4.1. Allocation Options of Responsibilities in Water and Wastewater Services

	Public	Public-Private Partnerships					Private
	All Public	*Service Contract*	*Management Contract*	*Lease/Affermage*	*Concessions*	*Build-Own-Transfer (BOT)*	*Divesture*
Asset Ownership	Public	Public	Public	Public	Public	Private/Public	Private
Capital Investment	Public	Public	Public	Public	Private	Private	Private
Commercial Risk	Public	Public	Public	Shared	Private	Private	Private
Operations and Maintenance	Public	Private/ Public	Private	Private	Private	Private	Private
Contract Duration	Indefinite	1-2 Years	3-5 Years	8-15 Years	25-30 Years	20-30 Years	Indefinite

Source: Budds, 2003

4.3. Forms of Water Governance

Today, various forms of governance exist in the water sector.

4.3.1. Public Governance

Public water provision is the most widely used governance structure under which the government takes on all of the responsibilities and challenges of water and wastewater services. The provision of water has long been considered an essential public good, and hence a core governmental responsibility. Worldwide, 85 percent of drinking water provision lies in public hands. In developed countries the public sector is the normal mode of management of water supply and sanitization services. The USA, Canada, Japan, Australia, New Zealand, and most European Union member states choose public sector management. Only the United Kingdom and France are the exceptions in which water and wastewater services are provided by the private sector or mixed management. Under a public governance structure decisions and management of infrastructure, capital investment, commercial risk, and operations and maintenance are taken on by a public entity for an indefinite period of time. Fully public management of water often takes place through national or municipal government agencies, districts, or departments dedicated to providing water services for a designated service area. Public managers make decisions, and public funds may be provided from general government revenues, loans, or charges. Governments are responsible for oversight, setting standards, and facilitating public communication and participation (Medalye, 2007).

Another form of public management involves cooperatives and user associations. These management arrangements tend to be decentralized and join local uses together to provide public management and oversight. Usually customers have decision-making power through elections for different water authorities. The system is often externally audited annually. A key element of most cooperatives is that a basic water requirement should be provided to all members at affordable rates. An example in Santa Cruz, Bolivia serves nearly one hundred thousand customers. In 1997, this cooperative compared well to other Bolivian utilities in terms of efficiency, equity, and effectiveness. The group uses a varying rate structure and incorporates conservation through increasing block rates, which are not applied to the very poor (Medalye, 2007).

4.3.2. Public-Private Governance

In the 1990s public-private partnerships became an advocated governance approach to resolving the twin problems of decaying infrastructure and financial constraints which both threatened public capacity for meeting water needs. A public-private partnership in the water sector involves transferring some of the assets or operations of a public water system into private hands. Rapid growth in water partnerships in the 1990s was met with a decline in 2001 after a series of financial crises. Though it is too early to tell, if this downward trend will persist, specialists suggest that rising water partnerships are likely to persist. This is partially attributed to the continued support international lending institutions have for public-private partnerships. Moreover, international support for partnerships continues. For example, at the second World Water Forum in the Hague in March 2000, the 'Framework for Action' called for 95 percent private sector involvement for supplying investment to meet water needs. There are a variety of arrangements of public-private participation including service contracts, management contracts, leases, concessions, and build-own-transfer programs (see Table 4.1.). Gleick et al. (2002) note eleven water system functions that can be privatized. These are:

- Capital improvement planning and budgeting (including water conservation and wastewater reclamation issues)
- Finance of capital improvements
- Design of capital improvements
- Construction of capital improvements
- Operation of facilities
- Maintenance of facilities
- Pricing decisions
- Management of billing and revenue collection
- Management of payments to employees or contractors
- Financial and risk management
- Establishment, monitoring, and enforcement of water quality and other service standards

Private-sector participation in public water companies has a long history. In this model, ownership of water systems can be split among private and public shareholders in a corporate utility. Majority ownership, however, is usually maintained within the public sector, while private ownership is often legally restricted, for example, to 20 percent or less of the total shares outstanding. Such organizations typically have a corporate structure, a managing director to guide operations, and a Board of Directors. This model is found in the Netherlands, Poland, Chile, and the Philippines.

Private companies are more attracted to partnership opportunities in water provision than sanitation. Occasionally, sanitation is undertaken by a private contractor but under conditions that it is subsidized or backed by the government with regulations for specified fees. In cases where public sewage systems are highly deficient, wastewater and sewage treatment services are contracted out by the public sector. However, it is common for water supply to be privatized separately from sanitation and for sanitation to remain the responsibility of the public sector.

The management and operation arrangements of different public-private partnerships vary. Service, management and lease/affermage contracts maintain public ownership and financing of water service management. Under these arrangements public water utilities give responsibility to the private sector for operation and maintenance activities. Such arrangements do not usually address financing issues associated with new facilities, or create better access to private capital markets. Rather, they provide managerial and operational expertise that may not be available locally. In a service contract a private firm takes responsibility for a specific task, such as installing meters, repairing pipes or collecting bills for a fee for a short period of time. Areas in which service contracts have proven effective include: maintenance and repair of equipment, water and sewerage networks, and pumping stations; meter installation and maintenance; collection of service payments; and data processing. Management contracts are arrangements under which the government transfers certain operation and maintenance activities to a private company. Management contracts are also short-term, and tend to be paid on a fixed or performance basis. Lease and affermage contracts are arrangements under which the private operator takes responsibility for all operations and maintenance functions. Here the term is longer, typically 10-15 years, and the private operator is responsible for billing and tariff revenue collection. Under an affermage, the contractor is paid an agreed-upon affermage fee for each unit of water produced and distributed, whereas under a lease, the operator pays a lease fee to the public sector and retains the remainder.

Under concession and Build-Operate-Transfer models, capital investment, commercial risk, and operations and management are undertaken by the private sector. The full-concession model transfers the entire utility and thus the operation and management responsibility for the entire water-supply system along with most of the risk and financing responsibility to the private sector. Specifications for risk allocation and investment requirements are set by the contract. Concessions are usually long-term to allow the private firm to recoup its investments. Technical and managerial expertise may be transferred to the local municipality and the community over time, as local employees gain experience. At the end of the contract assets are either transferred back to the government or another concession is granted. Build-Operate-Transfer (BOT) is a variation on the full-concession model. Here the role of government is predominately regulatory. These are partial concessions that give responsibilities to private companies, but only for a portion of the water-supply system. Another arrangement is for the private contractor to build the water supply system anew. BOT models are usually used for water purification and sewage treatment plants. The private partner manages the infrastructure and the government purchases the supply. Ownership of capital facilities may be transferred to the government at the end of the contract or remain private indefinitely. For full and partial concessions, governments and companies are finding that responsibilities and risks must be defined in great detail in the contract since such contracts are for a lengthy period. Cases of concession contracts have led to vastly different outcomes for similar physical and cultural settings.

Different regions exhibit varying preferences for different contract forms. Concessions were adopted by France over 200 years ago. Recently, in Latin America and Southeast Asia, concession contracts have become a popular approach. BOT models have been popular in India for water and wastewater treatment plants. Lease and management contracts are popular in South Africa, and a few parts of sub-Saharan Africa. BOT management contracts are used for rare cases where the public sector is highly deficient in wastewater and sewage treatment such as in the cases of Jakarta, Mozambique, and Malaysia. In developing countries concession contracts are the most popular form of public-private partnerships, accounting for 44 percent of all partnerships from 1990-2001.

One can simultaneously find evidence in support of or in opposition of public-private partnerships. Support for such partnerships is usually the result of improvements in financing, pricing, efficiency, risk distribution, environmental compliance, human resource management, and the services that public-private partnerships can provide. On the other hand, opposition typically arises from concerns over the economic implications of private participation, the power of corporate players, labor concerns, access inequality, environmental concerns, increased public risk, and inappropriate applications of private participation.

4.3.3. Private Governance

Private governance is the opposite of government agency provision. It is extremely rare and is often modeled under a divesture system whereby the government transfers the water business to the private sector. This model has only been adopted in a small number of cases such as England and Wales (full divestiture) and Chile (partial divestiture). In developing countries divesture accounted for only 8 percent of all worldwide private participation from 1990-2001, and accounted for a total of 16 projects during the same period. Usually, the transfer occurs through sale of the shares or water rights of the public entity. As such, infrastructure, capital investment, commercial risk, and operations and management become the responsibility of the private provider.

Fully private businesses and entrepreneurs are already found where the existing water utility has low coverage or poor service. They may obtain water directly from a water utility, indirectly from the utility through customers who have utility service, or from private water sources. In some instances, early settlers of an area privately develop water systems and later settlers become customers to the early ones. Private providers may also serve higher income groups or businesses when water is scarce or inconvenient to obtain. At the largest scale, private water companies build, own, and operate water systems around the world with annual revenues of approximately $300 billion. At the smallest scale, private water vendors and sales of water at kiosks and shops provide many individuals and families with basic water supplies. Taken all together, the growing roles and responsibilities of the private sector have grown, but not without controversy (Medalya, 2007).

This section has thus far provided an apolitical view of the water sector and the forms of governance available for managing water resources. However, the debate surrounding water governance is highly contentious and ideologically charged. To understand more about the water governance, let's look at the comparison of governance forms.

4.4. Public versus Private Debate

"Public versus private" is not the bright line that separates efficient from inefficient management. Like Alexander the Great, who "untied" the Gordian Knot with one slice from a sharp knife, we believe that the real solution to water problems worldwide has been overshadowed by the ideological debate between advocates and opponents of privatization.

The questions we need to answer are these: How can we provide safe, affordable water services for all people? How can we better involve the community in decisions about water resources and water systems? How can contracts be designed that effectively lay out the responsibilities of all parties? How can we ensure that the economic incentives for private or public entities are aligned with our social goals?

In the end, it doesn't matter to a resident of a settlement in Bombay or a suburb of Chicago whether a public or private company owns or manages the facilities that deliver clean and affordable water to their taps. What does matter is that people -wealthy and poor- have the water they need, that the environment gets a fair share, that profit levels and prices are reasonable, and that ambient water quality is protected for future generations.

Public water companies provide most water and wastewater services worldwide, nearly 95% by some estimates. But the number of people served by private companies has grown from 51 million people in 1990 to nearly 300 million in 2002. Six water companies alone expanded from 12 countries in 1990 to over 56 countries by 2002 (CPI, 2003). Signed concession contracts worldwide amounted to over $27 billion, based on data for late 1998 in Public Works Financing. At that time, over $38 billion of concession contracts were ‘‘in the pipeline’’ (Westerhoff, 2000). The data cover only long-term concessions; they do not cover short-term operation and maintenance contracts that are common in the United States. The signed contracts represented 147 projects, and the contracts under discussion at that time represented 192 additional projects.

Private involvement in water supply has a long history. In some places, including the U.S., private ownership and provision of water was the norm historically. In the latter half of the 19th century, private water systems in the U.S. began to be municipalized because private operators were not equitably providing access and service to all citizens or making necessary infrastructure investments. In the southern U.S. at the turn of the century, typhoid rates among African Americans, which were twice as high as for white Americans, dropped significantly after water systems became public (Troesken, 2001). On the other hand, recent water privatizations may have improved public health in some places. Galiani et al (2002) report that infant mortality declined 5–7% in parts of Argentina where water services were privatized.

Privatization has been proposed as the solution to every woe facing water utilities, including inadequate service coverage (over 1 billion people without safe drinking water and over 2.5 billion without safe sanitation), corruption, inefficiency, and large projected capital needs. The extent to which privatization will, in practice, improve water management is as yet unclear. It is clear, however, that private companies and investors are not the panacea some advocates of privatization claimed they would be, just five years ago. Prematurely terminated contracts in Manilla, the Phillipines, and Atlanta, after only 5 years and 3 years of operation under long-term concessions, demonstrate how hard it is to forge successful public-private partnerships, even in a regulated market economy such as the U.S. International currency risk and responsibility for an adverse change in currency valuation was at the heart of the Manila failure, while service quality problems seem to have been critical in Atlanta (Palaniappan, Gleick, Srinivasan, and Hunt, 2003).

4.4.1. Investment and Infrastructure

Water infrastructure is very capital-intensive (NRC, 2002). The ''Framework for Action'' of the Second World Water Forum estimated that water sector investments needed to increase from around $70 billion per year (2000) to about $180 billion a year. The Framework suggested that private funding would provide 95% of this increase (GWP, 2000).But this perspective is increasingly seen as unrealistic. In response to the Framework's suggestion, a senior water official at SUEZ, one of the largest water suppliers in the world, stated, ''... we question whether this level of private investment is a realistic solution to underinvestment in water systems'' (Moss et al. 2003). An official from Thames Water stated at the 3rd World Water Forum in Kyoto, Japan (March 2003) that industry business plan growth targets multiplied many times over cannot approach these levels of additional investment. Furthermore, private financing is often more, not less, expensive. In the U.S., for example, ''the tax exempt status of municipal debt...creates roughly a 20 to 40 percent interest cost gap'' (NRC 2002).

Finally, infrastructure and capital needs may be significantly less than projected. Centralized, capital-intensive infrastructure has provided water and wastewater services throughout history, but increasing scarcity is compelling water planners to consider other options. A ''soft path'' for water resources is emerging (Wolff and Gleick 2002). It continues to use ''hard'' infrastructure like dams and pipelines, but cost-effectively increases the services delivered by traditional infrastructure through water use efficiency, reuse, and decentralized infrastructure (e.g., improved appliances in millions of homes and businesses). The opportunities of the soft path transcend the debate over privatization but are often neglected when private versus public is the focus of discussion.

4.4.2. Management Quality and Skills

Better management and increased investment are interrelated. Ineffective management drives up the cost of providing services and will make it harder to make a case for obtaining needed investment. Private investors, politicians, and customers and taxpayers are reluctant to invest when they distrust management to deliver what they are paying for. This perverse value cycle -in which poor service quality undermines investment that in turn undermines service quality- is a significant problem in less developed countries (Moss et al. 2003).

Neither the public nor private sector has a monopoly on good management. Many public systems are reasonably well managed. Often-cited examples include various U.S. Municipal Utility Districts, the Dutch Water Companies, Australian State Water Authorities, and the Singapore Water Board. Some private water utilities are also reasonably well managed, including utilities in France and the United Kingdom and at least a few private utilities in Latin America and Asia. Proponents of privatization often cite LaPaz, Boliva; Macao, China; and many cities in Argentina as successes.

Whether public or private, the need for good management is critical and the demands on management are growing. Public participation in water decision-making is increasingly critical for success, both initially and over time. Managing input so that customers and citizens feel their concerns are being addressed, and so that technical staff can get their jobs done, is difficult whether the water company is private or public.

Finally, the skills required to directly deliver water services are different than those required to manage a contractor who delivers water services. As NRC (2002) points out, the role of the public sector is just as important if the utility operations are handed over to the private sector. For privatization to work, the public sector needs to provide effective oversight, monitoring, and regulation of the private operator. For example, the regulatory apparatus in the United Kingdom after privatization was underfunded and understaffed. Profit levels were excessively high and service was inadequate, at first. Effective regulatory systems, including those that regulate other public entities, require adequately trained and paid staff in economic, environmental, and water quality areas.

4.4.3. Market and Nonmarket Competition

Public economists have long known that water and wastewater systems are natural monopolies that cannot compete in the usual way. Customers served by enormously capital-intensive networks of underground pipes connected to facilities with large economies of scale (e.g., dams and reservoirs, water and wastewater treatment plants, etc.) cannot stop buying from an inefficient or low-quality service provider. Natural monopolies cannot compete for customers in the usual way because customers cannot usually switch suppliers.

Nonetheless, competition is possible. For example, the U.K. is currently testing a system of limited competition where large-volume water customers can bulk-purchase water from a variety of wholesale suppliers who sell their water through regulated monopoly distribution companies. Even if successful, this system is only partially competitive in that customers cannot individually specify the quality of water they purchase -they are limited to the quality of water delivered to their ''neighborhood'' in the common carrier pipelines

More generally, companies can compete ''for the market'' rather than ''in the market.'' Some people claim that profits can be kept reasonable by forcing companies to competitively bid for concessions or service contracts. Periodic rebidding or the threat of rebidding can help to keep companies on their toes. Reputation developed in one service area will affect a company's prospects of obtaining contracts in other service areas, and so forth. This model is fundamentally sound in theory, but may fail in practice. One important practical failure is when private competitors underbid in order to win a contract, and the contract is so poorly written that they can force increases in their compensation later. Another very common practical failure is to grant long-term contracts that preclude competition for many decades, based on the belief this is needed to induce long-term investments. But adequate inducement to invest can be created in 5–10 year contracts that make fair ''balloon'' payoffs upon transfer or renewal. Competition for the market is not limited to private companies. Public entities that don't ''reengineer'' themselves when in- efficiency exists are candidates for privatization. And failure to reengineer also exposes public managers to replacement by other public managers, an example of nonmarket competition. One successful reeengineering, by Phonex Water Services (PWS), saved an estimated $10 million between 1995 and 2000. In addition, the hiring of 72 additional staff was avoided by improvements in operational efficiency. According to PWS Director Michael Grit- zuk, ''Privatization doesn't even begin to address the scope of what are engineering Project can address.''

Similarly, Australian public water utilities were reconstituted in 1995 as state-owned companies. Companies pay ''dividends'' to their state governments in lieu of corporate income taxes, creating a financial incentive for politicians to support economically efficient management. The companies are also periodically audited on a variety of performance indicators, and the comparative results are published. Customers can see if their water quality or reliability of delivery or water prices are better or worse than industry benchmarks. They can and do exert political pressure if performance is poor. One tangible example of success due to this type of nonmarket competition is that Yarra Valley Water, one of three retailers in the Melbourne area, reduced unaccounted-for water (losses in distribution pipes) from 27% to 13% between 1995 and 2002 (personal communication, Tony Kelly, Managing Director, Yarra Valley Water, July 2003). Advocates of privatization mistakenly claim that competition between private companies ''for'' or ''in'' the market are the only ways to obtain these benefits.

4.5. Re-evaluating the Debate Surrounding Public-Private Partnership

The current heated debate surrounding public-private partnerships often seeks to prove or disprove the benefits and costs of such governance arrangements. The above arguments can all be validated in fact, and thus there is no conclusive evidence favoring one form over the other. Thus these debates have been infertile. The debaters have failed to direct their efforts to the root causes of the costs or benefits related with public-private partnerships. The debates also fail to acknowledge that public-private partnerships are limited, only 5 percent of the world's population receives its water services from private participation. As well, the debaters can find evidence in support of their ideologically-driven claims regardless of their position. The debaters have failed to recognize that many of the problems encountered with private participation can also arise with public utilities. Likewise, the debaters fail to recognize that the benefits encountered with private participation can arise with public utilities.

These debates have been unconstructive at achieving water provision goals. This was exemplified during the World Water Forum in March 2003, where discussions among the opponents and supporters of public-private partnerships led to no conclusive decisions or agreement between both sides. Dwelling on the public-private dichotomy has diverted attention from the roles each partner should play for constructive and effective partnerships to take place. The dichotomy also focuses on the broad political trends of neoliberalism rather then objectively looking at if, how, and when private participation is or is not appropriate. Discussions which are ideologically charged tend to overlook the misguided arguments of their own position. For example, many opponents resist private participation on the grounds that water is a human right. However, there is no inherent conceptual contradiction between private sector participation and the achievement of human rights. As well, the debates fail to recognize that neither public nor private utilities are well suited to serve the majority of low income or rural households who currently have inadequate water and sanitation and make up the appalling 1.1 billion and 2.4 billion figures offered in examples of the failure to provide water needs. Moreover, seeking universal dichotomous solutions to a complex and diverse issue such as water is a discussion which leads to no solution. Under the right circumstances, it may well be possible for private sector participation to improve efficiency and increase the financial resources available for improving water and sanitation services.

In light of the problems in the water sector, <u>public-private partnerships</u> have been increasingly advocated and adopted throughout the world. <u>Proponents</u> of partnerships have often appealed to the financial gains, cost reductions, efficiency gains, environmental compliance, human resource developments, and increased services which have followed private sector engagement. <u>Opponents</u> of partnerships have appealed to the price increases, imbalance of power, labor disputes, inequities, environmental damage, and increased risks associated with private sector participation in water services (Medalye, 2007).

However, much depends on the way private participation is developed and the local context. There is a great danger in the international promotion of public-private partnerships through conditional development assistance and finance. Partnerships do not apply to all circumstances, to all developing countries, nor to all regulatory and political frameworks. Failure to recognize these facts on behalf of international financial institutions has lead to an application of partnerships in contexts to which they do not apply and has further fuelled the debate surrounding private participation. What is required in discussions surrounding water governance is a focus on the principals and standards which can make private provision work for the public good when it is chosen.

4.6. Recommendations for Public-Private Partnerships

At the bottom of this governance debate lie two fundamental goals that all parties would agree must be reached: improving the water supply and protecting the public interest. Any form of water governance which does not achieve these two goals will not sufficiently resolve the water woes of today or the future. There are numerous cases of failures and successes from which lessons in governance can be learned, and principals and standards for effective governance can be derived.

Since public-private partnerships are unlikely to disappear and are more likely to increase due to the driving forces mentioned in this paper, attention to the principals and standards for effective public-private partnerships should be granted in discussions between interested parties. Historically, this attention has been diverted to dichotomous debates over private participation, and change is called for. Gleick et al. have devised a set of excellent principals and standards for public-private partnerships based on the lessons learned from successful and unsuccessful cases. These principles and standards are repeated here as a starting point for more constructive discussions among interested parties.

Principal 1: Continue to Manage Water as a Social Good

Ultimately, water is vital to life, and certain water systems are of national strategic importance. Contract agreements to provide water services in any region must ensure that unmet basic human water needs are met first, before more water is provided to existing customers. Basic water requirements should be clearly defined by the contract. All residents in a service area must be guaranteed a basic water quantity under any form of governance. Moreover, basic water supply protections for natural ecosystems must be put in place for every region. These protections should be written into the contract agreement and should be enforced by the government. Finally, the basic water requirement for users should be provided when necessary for reasons of poverty. These subsidies should not be implemented universally, but when specific groups of people or industries require these subsidies to maintain basic survival.

Principal 2: Use Sound Economics in Water Management

The provision of water and water services should not be free. Water and water services should be provided at fair and reasonable rates, which should be discussed with the public transparently. Rates should be designed to encourage efficient and effective use of water. Whenever possible, proposed rate increases should be linked with agreed-upon improvements in service. Experience has shown that water users are often willing to pay for improvements in service when such improvements are designed with their participation and when improvements are actually delivered. As well, subsidies, if necessary, should be economically and socially sound. Finally, private participation agreements should not permit new supply projects unless such projects can be proven to be less costly than improving the efficiency of existing water distribution and use. When considered seriously, water-efficiency investments can earn an equal or higher rate of return. Rate structures should permit companies to earn a return on efficiency and conservation investments.

Principal 3: Maintain Strong Government Regulation and Oversight

The "social good" dimensions of water cannot be fully protected if ownership of water sources is entirely private. Permanent and unequivocal public ownership of water sources gives the public the strongest single point of leverage in ensuring that an acceptable balance between social and economic concerns is achieved. Thus, governments should retain or establish public ownership or control of water sources. Moreover, governments and water-service providers should monitor water quality. Governments should define and enforce laws and regulations. Clearly defined roles, responsibilities, and risk-sharing frameworks among partners, written in the contract, should be the prerequisite of any form of private governance. Government agencies or independent agencies should monitor, and publish information on water quality. Where governments are weak, formal and explicit mechanisms to protect water quality must be even stronger. All contracts must explicitly lay out the responsibilities of each partner. The contracts must protect the public interest which requires provisions of ensuring the quality of service and a regulatory regime that is transparent, accessible, and accountable to the public. Good contracts will include explicit performance criteria and standards, with oversight by government regulatory agencies and non-governmental organizations. Moreover, contracts and regulatory institutions must have clear dispute resolution procedures in place prior to engaging a private partner. It is necessary to develop practical procedures that build upon local institutions and practices which are free of corruption. During the bidding process all competing firms should be treated equally. Contract reviews by an independent body should be a requirement of all partnerships, thus avoiding acceptance of weak and unfavorable contracts. Thus, ambiguous contract language or inappropriate reviews of contracts can be avoided, and only sound contracts will be put in place. Finally, negotiations over private participation should be open, transparent, and include all affected stakeholders. Numerous political and financial problems for water customers and private companies have resulted from arrangements that were perceived as corrupt or not in the best interests of the public. Stakeholder participation is widely recognized as the best way of avoiding these problems. Broad participation by affected parties ensures that diverse values and varying viewpoints are articulated and incorporated into the process. It also provides a sense of ownership and stewardship over the process and resulting decisions.

In addition, Hall suggests that governments should always consider the public sector option before engaging a private partner. He recommends that the public option should be contracted and capability for reforms should be evaluated. The private proposal can then be evaluated against the public sector option, in a public and transparent process. During this process secret agreements and secret contracts must be avoided and stopped. Considering and discussing these standards and principles is a starting point for constructive discussions among opposing parties in the public-private partnership debate.

The solution to the current and future water crisis will be found in changes to the way water is used and managed. Effective changes in water governance are the key to sustainable water management in the future. Physical, ideological, and international forces have encouraged public-private partnerships. Despite the promises of this form of governance, there have been gains and losses associated with its adoption. The current problems in governance structures cannot be ignored and a re-evaluation of the debate surrounding public-private partnerships is necessary.

4.7. Conclusion

This chapter has provided a review of literature on water governance types. The next chapter gives marketing as a solution to water problems.

CHAPTER V

MARKETING AS A SOLUTION

5.1. Introduction

There is a crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people-and the environment-suffer badly. This chapter aims to provide the literature review carried out on the marketing, water marketing as a solution the water problem, obstacles and opportunities of water marketing.

5.2. Marketing

Many people think of marketing only as selling and advertising. And no wonder-every day we are bombarded with television commercials, direct mail offers, sales calls, and Internet pitches. However, selling and advertising are only the tips of the marketing iceberg. Today, marketing must be understood not in the old sense of making a sale-"telling and selling"-but in the new sense of satisfying customer needs.

Broadly defined, marketing is a social and managerial process by which individuals and groups obtain what they need and want through creating and exchanging value with others (Kotler & Armstrong, 2006).

5.3. Marketing Concept

Marketing concept is the marketing management philosophy that holds achieving organizational goals depends on knowing the needs and wants of target markets and delivering the desired satisfactions better than competitors do (Kotler & Armstrong, 2006). Under the marketing concept, customer focus and value are the paths to sales and profits.

Instead of product-centered "make and sell" philosophy, the marketing concept is a customer-centered "sense and respond" philosophy. It views marketing not as "hunting", but to find the right products for your customers.

5.4. Marketing as a Solution to Water Problems in the World

There is a crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people-and the environment-suffer badly.Historical development, finance, and operations of water supplies have resulted in countless conflicts over water allocation procedures, cost allocation, and physical solutions to water resource problems (Howitt et al. 1999).

As fast-growing populations face shrinking water supplies, environmentalists and budget-conscious governments limit the number of new reservoirs, businesspeople and policymakers are searching for new solutions. One potential solution to this impending crisis is to allow free *markets for water. Water marketing would permit water-wealthy areas to sell water and water* rights to water-thirsty areas and allow low-valued users to sell to high-valued users (Phillips and Hernandez, 1998).

Interior Secretary Bruce Babbitt (1997) highlighted the importance of water marketing when he said, "Without water markets, we can't solve the problem of meeting the future water needs of the West."

5.5. Defining Water Marketing

Most of the goods and services we consume are delivered to us via a free-market exchange, in which willing participants enter into trade because each participant gains. Water, however, is often delivered to us by a local institution that typically draws from a local source such as a river, reservoir or aquifer. While we often hear about certain areas of the state facing a water shortage, products delivered through the free market rarely experience a prolonged shortage. In a market system, an increase in demand invokes an increase in price, which then stimulates a greater supply and a reduction in demand until the factors are equated and the shortage no longer exists. In a non-market system, an increase in demand might not be followed by an increase in price. Without the price rise, producers are not motivated to produce more and consumers are not motivated to consume less; thus, shortages arise (Phillips and Hernandez, 1998).

In theory, allowing a market to allocate supplies achieves the most efficient allocation of a resource, subject to several theoretical conditions. An ideal market is defined here as a market where buyers and sellers have perfect knowledge, there exists the ability to transfer rights inexpensively and reliably without any policy constraints other than environmental requirements, and all resource allocation is subject to the current projected infrastructure for the year 2020 (Newlin, 1998)

Water transfers are defined here as in MacDonnell (1990) and Lund et al. (1992): "the voluntary permanent or temporary change in existing purpose and/or place of use of water under an established legal right or entitlement". Water marketing is a transfer involving a financial transaction (Newlin, 1998).

Markets and prices play a role in allocation of resources among competing uses, and they provide incentives to conserve and invest in new supplies. In a competitive economy, price adjustments and market transfers keep supply and demand in balance. Prices rise when demand increases faster than supply. Higher prices provide incentives to use less, to produce more, and to develop and adopt technologies that conserve use and increase output. Markets enable resources to move from lower to higher-value uses as conditions change. For example, water traditionally used for irrigation may be more valuable as a municipal water source as the demands of a nearby urban center increase.

Tradable water rights potentially can encourage conservation and a more economically efficient allocation of scarce water resources. Currently, water is under-priced and often allocated based on institutions established when water was not considered to be a scarce resource. Users pay nothing for the water itself. Municipal and industrial users typically pay a fee reflecting the costs of storing, delivering, and treating water supplies. But even these costs are likely to be subsidized for irrigation, which commonly represents a region's largest water use. Without an opportunity to sell unused supplies, irrigators have little incentive to conserve water. With the introduction of tradable water rights, however, users value water in terms of its opportunity cost -the value they could get by selling water- rather than at the subsidized price they pay for it (Frederick, 2001).

In spite of their potential benefits and growing popularity, market forces have been slow to adapt to the reality of water scarcity. Efficient markets require well-defined, transferable property rights, and the full costs and benefits of a transfer must be borne by the buyers and sellers. Both the nature of the resource and the institutions that manage and allocate water can make it difficult to meet these conditions.

5.5.1. Drivers for Change to Marketing

- Increasing population growth
- Limited water supplies
- Water shortages by 2010
- Environmental Water Needs
- Groundwater supporting agriculture
- Drought Management
    - Negotiating for water
- Non-structural Approaches
    - Conservation—15% of needs
    - Using Sewage—5% of needs
    - Marketing—10 % of needs
- Declining Irrigation Use
- Economic Efficiency—highest/best use (Kaiser, 2001)

5.5.2. Benefits of Marketing

- Reallocation of lower valued water
- Drought Management Tool
- Provides Water to Growing Cities
- Alternative to reservoir construction
- Incentives to conserve—sell the water
- Revenue source for agriculture
- Minimizes water bureaucracy
- Requires negotiation with impact parties (Kaiser, 2001)

5.5.3. Factors Affecting Water Marketing

In order to be able to prepare a successful water marketing plan, one has to consider the following factors:

- First the researcher has to identify the economic factors. Economic factors include increasing demand, limited supply options, low valued uses, buyer and seller base, market database and transaction cost consideration.
- Second legal considerations have to be searched. Legal considerations are property rights, transfer authorizations, transfer barriers (that are third party impacts, interbasin/ aquifer transfers).
- Technical considerations are conveyance systems (pipelines and natural watercourses), state-wide plumping systems and lastly urban growth.

One has to identify institutional/ political support in order to understand if there is a support such as an agency promotion (planning support, regulatory approval), public agency ownership (river authorities) and clearing house for transactions (Kaiser, 2001).

5.6. Obstacles and Opportunities of Water Marketing with Examples from the World

5.6.1. Obstacles of Water Marketing

The variability of water supplies in time and space creates problems for establishing clear property rights. Driven by energy from the sun, water constantly evaporates from seas, lakes, and streams or transpires from plants, entering the atmosphere, then returning to earth through precipitation. Precipitation that is not quickly evaporated or transpired back to the atmosphere is the source of a region's renewable water supplies. This water flows into lakes, rivers, groundwater reservoirs, and eventually the ocean, unless it is first withdrawn for use. Three basic systems -riparian rights, prior appropriation rights, and public permits- have developed for establishing rights to this water (Frederick, 2001).

Riparian rights. The common law system of riparian rights gives owners of the lands bordering a water body use of the water in ways that do not unduly inconvenience other riparian owners. Riparian rights have origins in the earliest legal systems establishing private ownership of land. They continue to provide the basis of water law in many areas, including some arid Moslem and humid European countries and the eastern United States. These rights are poorly defined because shortages are shared by all riparian owners and use is subject to regulatory or judicial interpretation as to what is reasonable or might unduly inconvenience others. Moreover, riparian rights are not directly marketable because they are attached to the land and use is restricted to those lands.

Appropriative rights. Constraints on transferring water to non-riparian lands and uncertainties such as how much water a riparian owner can use are obstacles to applying riparian rights in areas where streams are fewer and flows are smaller and less reliable. Consequently, in the arid and semi-arid western United States, riparian rights were abandoned in favor of water rights based on prior appropriation. Prior appropriation rights, which have been adapted by all 17 western states, have three principal features:

- Water rights are established by withdrawing water from its natural source and putting it to a beneficial use, such as irrigation. Unlike the owner of riparian land-owner, and the water does not have to be used on riparian lands.
- During periods of shortage, water is allocated according to principle of "first in time, first in right." Thus, junior appropriators receive no water until senior ap- propriators—those with the old- est rights—have received their full allotment.

- Failure to use water for some period of time results in loss of the right. This provision creates a use- it-or-lose-it incentive, encouraging withdrawal even when the water contributes little if any value to the user.

Appropriative rights encourage the depletion of waters in a stream. Until recently, such instream flows lacked protection under state water laws. Unlike riparian rights, appropriative rights can be transferable, but sales are commonly restricted as to how and where water can be used.

Public permits. Riparian and appropriative water rights initially were acquired without state interference. But as supplies become scarcer, governments are assuming a more active role in controlling water use. Some form of a permit system now governs use of at least some water in virtually every country (Ludwik, 1972).

In principle, water permits can be auctioned by governments and bought and sold in private markets. In practice, however, permits are usually free, and transfers are limited by the nature of the right as well as by the infrastructure available to store and transport water. Transferring water from one place or use to another will commonly affect third parties—those other than the buyer and seller. When a farmer sells—in effect, transfers—water to a city, the economic base of the water-exporting community may decline. And when a transfer alters the quantity of water in a stream, other stream users are likely to be affected. Indeed, changes in flow affect theamenities and recreational opportunities that rivers and lakes provide, as well as the individuals who enjoy them. Generally, these water services are public goods that are not marketed, because the public cannot be excluded from freely enjoying them. Thus when marketing water, the private sector tends to ignore the impacts of water transfers on the public goods the waters produce. Similarly, polluters underinvest in waste reduction and treatment when the costs of using water bodies for waste disposal are borne by society rather than the individual polluter.

During the past three decades, water-related investments and legislation in the United States have been driven largely by a desire to protect the resource and the public benefits it provides. The resulting environmental legislation and regulations have contributed to uncertainties over water rights. On one side are the traditional users with rights established when water was treated as a free resource and environmental impacts were ignored. On the other side are the more-recently empowered stakeholders armed with legislation designed to protect and restore environmental and recreational uses. While domestic, industrial, and agricultural users may compete for the water diverted from streams and reservoirs, all three groups vie with environmentalists and recreationists over the amount that can be withdrawn. Conflicts also arise over the priority that dam operators give to flood control, water supplies, hydropower production, fish habitat, and recreational opportunities. Without markets and prices to guide allocation of water and guide dam and reservoir management, conflicts are often played out in the courts or administrative proceedings.

Groundwater initially was treated as a resource that land owners could capture at will. But groundwater is often a common property resource that flows from one property to another until captured for use. Pumping can adversely affect third parties. One party's pumping can reduce the water available to neighboring water users, forcing them to pump from greater depths and lowering their well yields. Third parties may also be harmed if groundwater use reduces surface flows, causes salt-water intrusion into an aquifer, or results in the collapse of lands above underground aquifers that have been at least partially drained. The emergence of such impacts, along with improved knowledge of the links between ground and surface water, have led to restrictions on groundwater use. In the western United States, for instance, most states have adopted some form of a permit system for groundwater. But even in states lacking a permit sys- tem—such as Texas, which continues to grant landowners unrestricted rights to pump ground- water without liability for damages inflicted on others—landowners overlying a defined aquifer may voluntarily form a conservation district to regulate wells.

5.6.2. Opportunities of Water Marketing

The absence of markets and market-based prices to allocate scarce supplies and guide water managers has resulted in large differences in the value of water among alternative uses. For example, most of the water rights in the western United States are held by farmers and irrigation districts, which pay only the modest cost of having water delivered to their farms. As a result, large quantities of water are applied liberally to relatively low-value crops. In some cases, simply leaving more water in the river to provide hydropower, recreation, and fish and wildlife habitat might increase the total value of the water to society. Similarly, selling water to urban areas that otherwise would invest in costly and often environmentally damaging water-supply projects might boost water values by an order of magnitude or more in some cases (Frederick et al, 1996).

Large differences in the value of water among alternative uses provide powerful incentives to overcome obstacles to transfers. As a result, water marketing is becoming common and increasingly innovative in several countries. A variety of market arrangements have emerged in the western United States to accommodate and respond to short-term fluctuations in supply and demand stemming from climate variability or other factors. These include leases, options to purchase water during dry periods, and water banking. The temporary nature of such transfers blunts a principal third-party concern that a transfer will undermine the economic and social viability of the water-exporting area.

Farmers with senior appropriative rights who grow annual crops might profit by selling an option to use some of their water during a drought and leaving some or all of their fields fallow. Growers threatened with the loss of long- term investments in orchards, or cities facing rationing, are able to more than compensate these farmers for losses incurred from temporarily leaving some of their lands fallow.

Such transfers among farmers within the same irrigation district are common and often relatively easy to arrange. But cities seeking to transfer water away from an irrigation district are likely to encounter greater institutional obstacles and financial costs.

Water Banks. Water banks represent one solution to these obstacles. Water banks are designed to facilitate water transfers in response to short-term changes in supply and demand conditions. They enable the owner of a permanent water right to sell all or part of one year's entitlement. Thus, the entitlement is, in effect, leased or rented but not permanently transferred. The primary water, and it sets the rental rules. The bank may also determine how much water can be transferred without injury to third parties. Once the rules are established, the bank operates like a broker, accepting valid water use entitlements for deposit and making them available to those hoping to obtain water at a lower cost than they would otherwise have to pay (MacDonnell, 1995).

California. A temporary federal water bank administered by the Bureau of Reclamation and endowed with federal funds was established in California during the 1976-77 droughts to provide for water transfers within the agricultural sector (Wahland & Ousterhoudt, 1985). Then, in 1991, California established an emergency water bank in the fifth year of a prolonged drought, after legislative attempts to promote private transfers produced few transactions. The bank, which reallocated water among willing buyers and sellers, operated in 1991, 1992, and 1994. Initially, the bank purchased water for $125 per acrefoot (about 10.1 cents per cubic meter) and sold it for $175 an acrefoot plus delivery charges. In some cases, the delivery charges exceeded the initial cost of the water (Sacramento, CA: Department of Water Resources, 1998).

Purchases by the bank proceeded slowly until the state guaranteed sellers that their price would be adjusted upward to reflect subsequent seasonal price increases. Farmers willing to idle land or shift from diverting surface water to pumping groundwater were the principal sellers. The bank purchased 800,000 acre-feet (nearly 1 billion cubic meters) of water, based on early estimates of critical need before the buyers made firm commitments.

California incurred a sizable financial loss when the bank was able to resell only about half of the water. Unsold water was used primarily for carryover storage and for reducing saltwater intrusion into the delta of the Sacramento and San Joaquin Rivers.

In subsequent years, the state required a signed contract with a buyer before committing to purchase water (MacDonnell1994). The third-party impacts associated with these transfers are unknown, but they were probably insignificant compared with the benefits of moving water to higher-value uses during a period of severe drought.

Idaho. Idaho established the nation's first permanent water-banking program in 1979, and several western states are considering similar actions. Idaho's bank allows temporary or permanent transfers of water rights, but rules governing where and how the water can be used are restrictive. For instance, out-of-state transfers are prohibited and irrigators receive preference over all other users in purchasing or renting banked water.

Australia. In Australia, the state of Victoria, which facilitates transfers, defines water rights as explicit shares of stored, rather than delivered, water. Under this system of capacity sharing, decisions regarding reservoir releases are made by individual owners of the rights rather than by a central authority. Reservoir operators serve like bankers, making releases on request. The operators also keep track of each owner's balance on a continuous basis by adding inflows and deducting releases and losses from evaporation and seepage. Water users control the timing of their deliveries, and transfers can be made simply by having the operator make the appropriate debit and credit (Patterson, 1989).

Banks can operate at any administrative level, ranging from multistate to water districts to ditch companies. They can be designed to manage different types of water-use entitlements. And they can facilitate temporary water transfers by developing clear, well-defined rules and procedures that reduce transaction costs.

Temporary water transfers, however, are not particularly effective for adapting to the longterm demand and supply shifts that result from population and income growth, urbanization, rising values for instream flows, groundwater depletion, and climate change. Indeed, at some point, as supply and demand conditions change, the historical allocation of water rights becomes inefficient enough to warrant a permanent transfer of rights.

Keeping Deserts Green. Transfers of permanent water rights are permitted, subject to review of third-party considerations, in all the western U.S. states. The process of resolving third-party impacts is often slow, costly, and contentious, however, and the outcome of a proposed transfer can be uncertain. Those orchestrating the proposed transfers face either the challenge of proving that a change will not harm others or the added cost of compensating the third parties who might be adversely affected by the transfer.

Ongoing efforts to meet the water demands of the rapidly growing coastal area of southern California illustrate the challenges of securing additional water in a region where supplies are already fully developed and allocated. The task is made more urgent and difficult because access to some of the region's traditional sources has been blocked.

As a result of environmental concerns, for instance, Los Angeles has been forced to reduce the water it takes from Mono Lake and Owens Valley. The region is also losing rights to the unused entitlements of other states to water from the Colorado River.

The Imperial Irrigation District (IID), in the southeastern corner of California, owns senior rights to much of California's share of the Colorado River. To help meet the growing demands of the state's southern coastal region, the Metropolitan Water District of Southern California (MWD) agreed in 1989 to invest approximately $115 million, plus about $3 million annually for operation and maintanance, to conserve water in the irrigation district through such measures as lining canals to prevent water loss through seepage. In exchange, the MWD acquired the rights to about 100000 acrefeet of conserved water per year (Metropolitan Water District of Southern California, 1991). Most recently, San Diego -which depends on, but has a low priority claim to, MWD water supplies- agreed to fund additional conservation investments in the IID in return for conserved water. These agreements illustrate the opportunities and obstacles associated with using market forces to reallocate water. In these cases, water was transferred from relatively inefficient, low-value agricultural uses to higher-value urban uses; IID's agricultural base was preserved through conservation investments; and the interests of neighboring U.S. irrigation districts were protected.

Yet concluding these apparent win-win arrangements required nearly five years of often contentious negotiations among the participants and interested third parties.

Moreover, agreement in this instance was facilitated because the participants were able to ignore the adverse third-party impacts in Mexico. Indeed, before the canals were lined, some of the water seeping out of them had helped recharge groundwater aquifers used by Mexican farmers just across the international border. These third-party impacts were ignored because the Mexicans had no recognized legal claim to the water.

Efforts to arrange interstate sales of Colorado River water have been less successful. The 1922 Colorado River Compact among seven western states divided the river equally between the upper basin states (Colorado, New Mexico, Utah, and Wyoming) and the lower basin states (Arizona, California, and Nevada). The upper basin states have never fully used their entitlements. The MWD therefore has been able to take the unused water for free. California, however, is being required to cut back on its use of these surplus flows, and the upper basin states are seeking opportunities to benefit from their full entitlements.

The potential for mutually profitable transfers from the underused upper to the overused lower basin has stimulated several proposed sales. In the 1980s, the Galloway Group, a Colorado corporation with claims to 1.3 million acre-feet of Colorado River water, proposed constructing reservoirs to produce hydropower and store water for leasing to Arizona and southern California. San Diego paid $10,000 for an option to lease 300,000 to 500,000 acre-feet per year for 40 years, but the project died under a flood of unresolved legal issues (Gross, 1985).

Las Vegas—which already uses most of Nevada's entitlement to the Colorado River—iscurrently seeking more water. Meanwhile, it lacks rights to surplus flows, and depletion of its groundwater is causing subsidence within the city. Unused upper-basin entitlements to the Colorado River are a logical source of additional supply, and Utah appears to be a willing seller. But consummating this or any other water transfer between the two basins could require renegotiation of the 1922 compact. Transfers among the lower basin states encounter fewer legal hurdles but, because of their similar hydrology, offer fewer economic benefits than do transfers between the upper and lower basins. In 1997, the U.S. Department of Interior issued a ruling designed to encourage and facilitate voluntary transactions among the three lower-basin states. Arizona has established a Water Banking Authority to purchase its own unused entitlements for storage in groundwater basins and possible sale to California and Nevada. But the opportunities for profitable water transfers among these three states—each of which is trying to meet the demands of rapidly growing metropolitan areas—pale in comparison to the potential benefits of transfers to the lower basin from the upper basin, with its large quantities of unused entitlements.

Colorado-Big Thompson. The U.S. Bureau of Reclamation's Colorado-Big Thompson project has been cited as a prime example of efficient water marketing. The project involves a series of reservoirs to capture part of the flow of the Colorado River and its tributaries. An average of 230,000 acre-feet of water annually is transferred through a tunnel from the western slopes of the Rocky Mountains to the Northern Colorado Water Conservancy District in northeastern Colorado. Rights to proportional shares of this water are freely traded, unencumbered by third-party concerns, within the district.

Under western law, downstream users generally own rights to the return flows of upstream users, and transfers must take account of downstream impacts. But since Colorado-Big Thompson water originates in another basin, the district has retained ownership of the return flow of the diverted water. This arrangement does not eliminate third-party impacts, but it does eliminate the need to consider them in transfer decisions.

In this case, the benefits of being able to transfer water readily among agricultural, municipal, and industrial users within the district are likely much greater than the costs of ignoring the third-party impacts.

But limiting sales to within the conservancy district precludes even more-profitable transactions that might take place with buyers outside the Northern Colorado Water Conservancy District. For example, the right to an acre-foot of water in perpetuity has sold for $3,500 more in the neighboring Denver suburbs than in the conservancy district (Howe, Schurmeier, and Shaw, 1986).

Chile Waters. Chile, which has embraced market economy principles for the last quarter century, has introduced measures to encourage water marketing. In 1981, the nation separated water rights from land ownership and made these rights freely transferable. Views differ as to the extent and benefits of the water markets that emerged in response to these changes. One view holds that Chile's water markets function effectively; water moves from lower to higher value uses, prices are responsive to temporary as well as longer-term scarcity, and trading is active (Briscoe, Salas, and Pena, 1998).

A less-optimistic view holds that transfers of water rights separate from land ownership are uncommon, involve only a small percentage of users, and result in little actual reallocation of supplies. In particular, several factors are cited as inhibiting sales of water rights separate from land ownership. These include the inflexibility of the existing canal systems for distributing water, uncertainty as to who actually owns the water rights, a rural culture that believes water should not be bought and sold separately from land, and slow and erratic administrative procedures designed to protect third- parties from injury (Bauer, 1976-95).

5.7. Sustainable Management

A consensus is growing that sustainable economic development depends on treating water as a scarce resource and using economic principles to guide its management and allocation. Water markets are a means of introducing these principles and allocating supplies in response to changing supply-and-demand conditions. But marketing water differs in important ways from the sales of most goods and services. The fugitive nature of the resource, the variety of services it provides, and interdependence among users limit the potential for efficient water marketing. Additional constraints result from the laws, regulations, and treaties that establish rights to water and limit how it can be used.

Water resources within a basin—precipitation, runoff, water in lakes and streams, and groundwater—are interrelated. Water users become increasingly interdependent as supplies become scarcer. Dams, reservoirs, canals, pumps, and levees make water availability less dependent on the vicissitudes of the hydrologic cycle and more dependent on human decisions. This infrastructure broadens the opportunities for allocating supplies and generates new demands on the resource.

Reservoir operations affect a variety of water uses, such as flood control, hydropower production, recreation, fish and wildlife habitat, navigation, water quality, and domestic, industrial, and agricultural water supplies. Allocating reservoir capacity for one use affects other users within the hydrologic system. Drawing down a reservoir for flood control, for example, may reduce available supplies when they are most valued for irrigation, hydropower production, navigation, or recreation. Managing these reservoirs in a way that best serves society is a daunting challenge. In smaller river valleys where water uses are limited, capacity sharing, as practiced in Victoria, Australia, is a way of defining marketable water rights. In a larger, more complex system, the interdependence among users is too great to ignore. Market allocation of water or reservoir capacity in such a system would be inefficient and chaotic.

While markets are not a panacea for achieving efficient and sustainable water use, they can play an important role in achieving these goals under some circumstances. Water markets, whether formal or informal, have a long history of facilitating transfers. Chile and the western United States, two areas where marketing is most advanced, illustrate both the opportunities and limitations of water markets. Water marketing in these countries has largely involved transfers from relatively low-value, inefficient irrigation use to higher-value domestic and industrial uses. Moreover, the sales often provide incentives and funds for water-conserving investments to protect the economic base of the water-exporting community.

Geography and institutional factors, however, have restricted development of water markets. Moving water outside of its natural channels is costly and subject to economies of scale. Chile's rivers flow from the Andes to the ocean in a series of small, steep-gradient rivers separated by hills. Consequently, it is expensive to move water from one watershed to another or from downstream to upstream areas within the same basin (Ibid). The frustrated efforts to sell water rights from the upper to the lower Colorado River basins illustrate how institutional factors can limit potentially profitable transfers even where the infrastructure is in place to move water at low cost. The successes and failures in transferring water emphasize that clearly defined, transferable rights are a necessary, but not sufficient, condition for market transactions.

Once transferable rights are established, the most important challenge for creating efficient water markets is developing procedures for expeditiously and fairly handling third-party impacts. Unfortunately, these impacts are not always obvious or quantifiable. Both Chile and the United States allow transfers subject to consideration of these impacts. But the judicial and administrative procedures used to assess these impacts and compensate third parties often impose a high hurdle for prospective buyers.

In spite of the obstacles, the potential gains of transferring water for new uses are encouraging the development of water marketing in many areas. The incentives for voluntary water transfers are strong and will continue to grow as the resource becomes scarcer and the costs of providing water for traditional uses increase.

Global warming would likely add to the potential benefits of water transfers. A warming world would alter the hydrologic system and increase the demand for water.

The magnitude, timing, and even direction of climate-induced changes in a region's water supplies are uncertain. The costs of building dams, reservoirs, and canals in anticipation of these uncertain changes are high. But reexamining reservoir operating rules, relaxing constraints on water use, and developing institutions to encourage voluntary exchanges of water through markets would create a system more efficient and able to adapt to whatever the future might bring (Frederick & Gleick, 1999).

5.8. Conclusion

This chapter has provided a review of water marketing in the world, obstacles and opportunities of water marketing with examples given from the world. The next chapter introduces water problem in Cyprus.

CHAPTER VI

WATER PROBLEM IN TRNC

6.1. Introduction

This chapter introduces water problems faced in Turkish Republic of Northern Cyprus (TRNC), water supply and water demand and water management in TRNC.

6.2. Water Crisis in TRNC

Water is the most basic element necessary for the livelihood of living creatures such as plants, animals and human beings. The existence of water is a measurement of development specifically of individuals and generally of communities. Water, apart from being so vital for the living, the amplitude and the quality of agricultural produce, and all types of industrial investments in one country depends upon the existence of both abundant and qualitative sources of water in that country. In short, water is not just life but indicates development.

Today, most Mediterranean countries are facing problems of water shortage. In the coming years, this situation will carry on with an increasing effect in many more Mediterranean countries. The problem is because of the imbalance that exists between demand and supply. Water used for different purposes (agricultural, domestic, industrial) in the Mediterranean countries indicates the degree of development in each country. In the developed countries of the Mediterranean water is used for 49% agricultural, 13% domestic, and 38% for industrial purposes. In contrast, in the developing countries these ratios appear as 79% agricultural, 13% domestic, and 8% for industrial purposes. The situation at the Turkish Republic of Northern Cyprus (TRNC) appears in parallel with those of the developing countries.

Cyprus with an area of 9251 km2 is the third largest island in the Mediterranean Sea after Sicily and Sardinia. Cyprus, with a typical Mediterranean climate, has experienced a drought for the last thirty years. In consequence, a serious problem of water shortage for the same number of years is also felt at the TRNC with a population of 200, 000 inhabitants living on an area of 3299 Km2.

The problem felt is not only a problem of quantity but also a problem of quality. In other words, apart from not having the enough amounts, the quality of the existing water supply is also unsatisfactory. The quality of drinking water in most areas is below world standards and there is no area with a regular supply of water. Despite the fact that of the total land area of 329890 Hectares (3299 Km2) of TRNC an 187069 Hectares (56.70%) is used for agriculture and only a 9482 Hectares (5.07%) of this is used for irrigation-based agriculture (Gökçekuş, 1999). While only less than the 1/10th of the agricultural area of the country is used for irrigation-based agriculture even this does not produce a quality yield in crops because of the low quality, insufficient and irregular supply of water. As seen, the problem of water shortage and quality is not only felt in drinking and other domestic use but also in agriculture.

The water problems faced in the last 30 years have now reached a serious stage in the TRNC. Water scarcity in Cyprus started in 1960s. Soon after, several studies and researches were performed to identify the level of water deficiency in the whole island (Konteatis, 1995). The backbone of the economy of the country is the agriculture and small farming. Citrus fruit plantation occupies the majority of the export of Turkish Republic of Northern Cyprus (TRNC) (ASP, 2003).

Uncontrolled irrigation of the fields, late adoption of old irrigation techniques and poor conveyance efficiency of pipelines and network systems, caused the over extraction of water from the available aquifers. That phenomenon resulted with the higher values of salt contamination due to the salt-water intrusion, where the coastal aquifers are invaded by the sea up to several hundred meters inland from the coast and also cause depletion of some of the small volume aquifers at the interior part of the island.

6.3. Causes of Water Problem in TRNC

Cyprus is an island where a typical Mediterranean climate is felt because of its geographical position. On this island semiarid-arid climatic conditions prevail. In contrast to the very hot, dry and long summer months the winter months are short and mild. Virtually two seasons exist instead of four.

The current surface and underground water sources of the country are fed by precipitation. In general, precipitation takes place in the form of rainfall rather than snow. While the annual average rainfall on the island is 500mm, it is 413mm at the TRNC. The reason for this uneven distribution of rainfall is because of the topographic features of the island. The area within the TRNC boundaries receives less precipitation because of its lower topographic elevation relative to the area under the South Greek Cypriot Administration.

Coupled with the 30 year old drought and the lack of the sufficient surface water sources with no unceasingly flowing springs the demand for the groundwater sources of the country is increased.

In addition to the drought, the growth of the agricultural areas since 1960 has increased the demand for the provision of water both for agricultural and other use on the underground water resources resulting in huge drops in their level.

While the drop in the level of the underground water sources is felt generally around the island, this was more effectively felt around the Güzelyurt Region where irrigation-based agriculture is more widely used.

The Güzelyurt aquifer covering a total area of 240 km2 where 150 km2 of which lies within the boundaries of the TRNC had no problems with its groundwater levels until the beginning of the 1960s, but the effects of the enlargement of the agricultural areas and the increase in the number of wells was felt within the next 8-10 years. In 1969, the ground water levels within a 20 km2 of the area declined below sea level and this was recorded as a maximum of –3m. By 1980, the area below the sea level was 75 km2 and the maximum descend was –32m. The situation recorded in 1988 was more severe as the decline at the water levels was now –55m affecting an area of 100 km2 (Gökçekuş and Doyuran, 1993).

Attention that needs to be drawn here is that these records were taken at the end of recharge seasons. In other words, these are the maximum water level values obtained at the end of the recharge seasons during the year. The situation during the summer months is worse when the pumpage from the irrigation wells is excessive.

Studies so far have shown that since 1961 there has been a decline in the water levels of the Güzelyurt aquifer at different rates. This has reached a maximum at the Southwest of Güzelyurt with amounts recorded more than 50m (Gökçekuş, 1998).

This threatening situation observed by various means is also reflected in the water budget carried out for the Güzelyurt region during the 1989-90 hydrologic years. Despite of limited recharge the discharge of the Güzelyurt aquifer has been twice the recharge amount and the shortage in the water budget was calculated as 28.4 million m3 (Gökçekuş and Doyuran, 1998). This is an indication of the fact that the shortage in the water budget has continued to increase until today.

Although no detailed studies were carried out around the country in general, adverse situations are believed to exist in all areas similar to that of the Güzelyurt region. The decline in the water levels due to excessive groundwater pumpage is clearly evident in the fact that the springs at the Kyrenia Mountains that used to flow during the winter months are no longer flowing.

The water shortage felt is affecting all parts of life in Cyprus. During the drought years, in parallel to the excessive pumpage of the ground water sources and the resultant sea water intrusion in Magosa (Famagusta) and Güzelyurt regions, there has been a decline in the fresh water quality consumed by the people living in these areas.

In contrast to the quality of the drinking water in the Kyrenia Mountains, the quality of the drinking water in Güzelyurt and Magosa, are well below most standards when compared with those of the World Health Organisation (WHO, 1963), Turkish Standards Institute (TSE, 1986), and the United States People Health Standards (USPHS,1962).

Especially during the summer months when the water shortage is felt most, the electrical conductivity value (EC) is observed to be more than 5000-6000 µS/cm at the wells that provide drinking water to Lefkoşa (Nicosia) and Magosa towns.

Water samples obtained from the irrigation wells situated within the Güzelyurt agricultural region show low levels of water quality due to salinity from seawater intrusion and contamination from geological formations when assessed according to Wilkox and USA Salinity Diagram (Gökçekuş and Doyuran 1995).

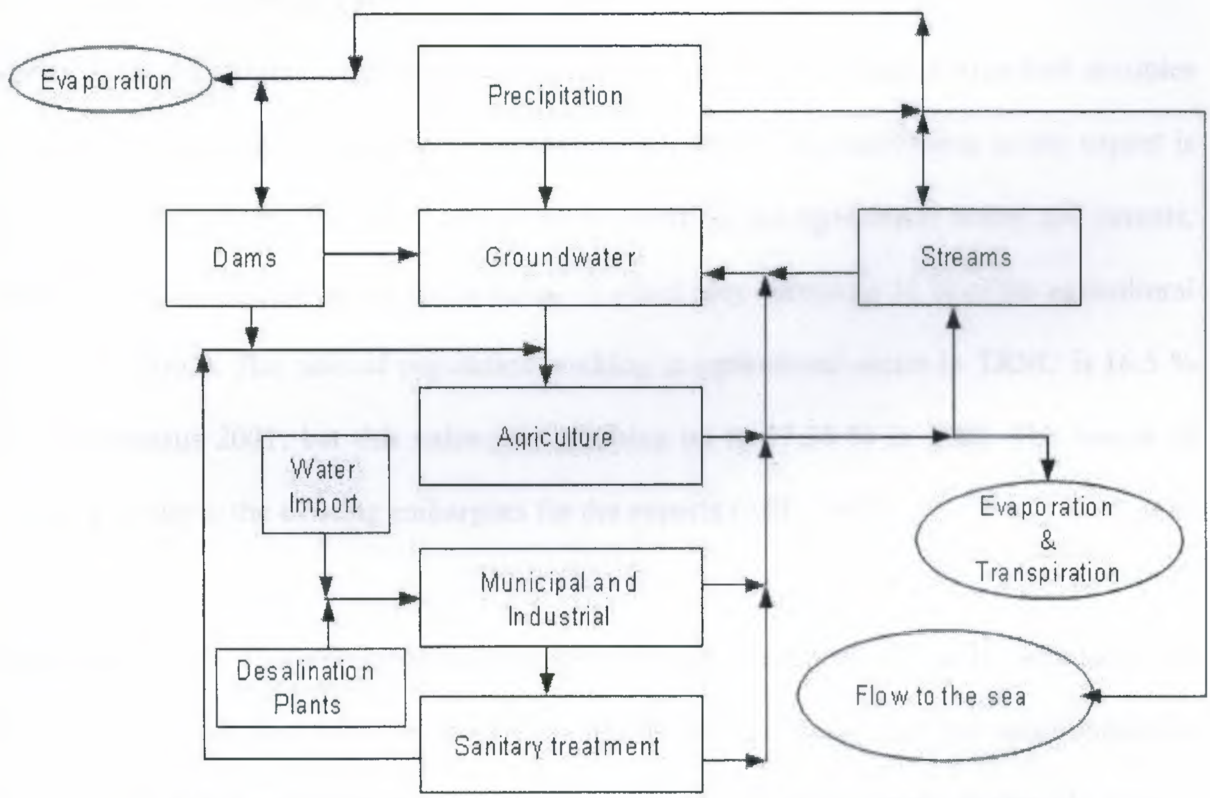
Apart from the seawater intrusion there are many other factors behind the degradation in the country's underground water quality; such as: (a) the CMC (Cyprus Copper Mines) and the contamination caused by the mining remnants (Gökçekuş and Gökçekuş, 1995); (b) contamination caused by the untreated waste of small industries; (c) fertilizers used in agriculture aimed at increasing productivity and pesticides used against pests; (d) contamination caused by domestic wastes (solid and liquid); (e) contamination caused by geological formations and their soluble ingredients (Gökçekuş and Doyuran, 1996). The contamination caused by seawater intrusion to underground water resources appears to be more significant than contamination from other causes.

6.4. Water Budget in TRNC

The only source replenishes the water resources of NC is the rainfall. Investigations of rainfall on Cyprus revealed that, only 20 % of the rainfall is in fact, contributing to the water budget. The remaining portion returns to the atmosphere through evapotranspiration (Kypris, 1995).

The rainfall degradation in NC is experienced more effectively. This can also be seen after application of the moving average technique to the annual average values, from 1974 to 2001 (Fig. 6.1). Unfortunately, it has been discovered that the rainfall trend is decreasing, 2.2 mm per annum. The same value is observed when alternative years of moving averages are used for the same data (Goymen, 2003).

Figure 6.1. Water Balance Scheme of TRNC



Since the water deficiency is realized in 1980s, to overcome this situation with the help of DSI of Turkey, 41 dams were constructed, of which, only 16 of them were aimed to store water for irrigation purposes. The remaining were constructed for preventing the direct flow to the sea and thus, contributing more efficiently to the aquifer recharge. Efficient reuse of effluent water for irrigation is out of the concept, due to traditional belief among the society.

Desalination plants are introduced by some of the institutions in year 2000, due to shortage of natural resources and availability of brackish water within the coastal regions (Ozturk, 1995).

Water outputs from the water budget are irrigation, municipal needs, industrial water consumption, stock farming, transmission line and the network system losses, unused effluent water and uncontrolled small seasonal spring flows that directly flows to the sea (Fig.6.1.).

6.5. Water Demand of TRNC

Agriculture. Agriculture, contributes a lot to the economy of the island. Citrus fruit occupies the greatest part of the production in agriculture and hence, its contribution to the export is also considerably high. The main crop patterns grown in the agricultural sector are, cereals, pulses, fodder crops, grapes and citrus fruits, of which they constitute 52 % of the agricultural land (ASP, 2003). The ratio of population working in agricultural sector in TRNC is 16.5 % based on census 2001, but this value was reaching up to 37.34 % in 1982. The reason of reduction is due to the existing embargoes for the exports (ASP, 2003).

Municipal Needs. The municipal water supply overcomes the needs of the householders, the farmers that are dealing with the stock farming, the tourism sector and the small industrial sector of NC. The amount of the water, that is supplied to the public needs, in drought seasons is controlled and restricted by applying a twice in a week type rotational water supply scheme. However, the tourism sector is highly affected by limitations and recently, they found a way to reuse the effluent water for irrigating their gardens (SID, 2002).

The rotational supply of water to the public caused the home gardens to be dried up. This scheme is also effectively experienced in the South reducing 33 % of the water consumption

(Georgiou, 2002). It is unfortunate to note that, in NC, the losses within the pipelines and network systems are in the range of 30-60 % due to late non-renewal of the rather old pipes (SID, 2002).

Consumptive Water Requirements. The consumptive water requirements (CWR) of different sectors in TRNC are given in Table 6.1.

Table 6.1. Consumptive Water Requirements of Different Sectors in TRNC.

Sectors	**CWR (l/day/capita)**
Householders	250
Cattle	50
Sheep	15
Universities	150
Tourism	200

6.6. Water Supply of TRNC

North Cyprus is a semi-arid country with a typical Mediterranean climate of hot and dry summers and mild winters. The average temperature falls below 0 C at the peaks in winters and rise above 40 C at the plains in summers (Elkiran, 2002). Rainfall distribution over the country varies considerably among these regions. The minimum average annual value is measured at Central Mesaoria region as 294.7 mm and the maximum annual average at Northern Coast and Besparmak Mountains are as 456.6 mm. The average rainfall value for the overall country is 373.3 mm/year. Based on 50 years data, the analysis reveals that, there is 1 mm/year reduction of the rainfall, whereas, 2.2 mm/year is reached when only the last 15 years values are used (Goymen, 2003).

Since 1998 till 2002, large water bags towed by ships of varying capacity from 10000 to 30000 m3 were used in order to overcome the municipal water needs of NC. These bags were filled at Anamur, Turkey and brought to Kumkoy coast near Guzelyurt. The first ship that was arrived in September 1998 until the end of that year unfortunately carried only 65374 m3 of water in five trips which was highly below the initial expectations. In fact the total quantity of water imported from Turkey during five years (1998-2002) by this way was only 4.1 MCM However, the expected amount per annum was about 5 MCM for the initial estimates (SID, 2002).

In North Cyprus, 3 central treatment plants were constructed to treat the sewerage waste water of the cities Girne, Lapta, and Lefkosa. The first two of these plants that are located in GMR have capacities only to treat black water up to 600 m3/ day, but this quantity reduces to 50 % during winter season since the utilization of the freshwater is reduced. Lefkosa Central Plant, treats about 10000 m3/day of the sewerage water where 6000 m3 of this black-water is collected from the North and the remaining is pumped from the Southern part of the city (SID, 2002).

Yearly an average of 3.6 MCM of effluent water is treated at Lefkosa Plant and diverted into the stream channel for evaporation, since the reuse of this treated water for the irrigation of alternative crop patterns are not accepted by the farmers psychologically. However, recently, farmers are using restricted quantity of this treated water for irrigation purposes, neither the amount of the water nor the types of the crop patterns grown are known officially (SID, 2002).

There is no perennial stream in North Cyprus. Ten of the streams that are originated from the South carry an average of 43 MCM of water. However, most of these streams are controlled at their upper reaches by the recently constructed dams at the South, hence, reducing the water potential of the North. The other 28 streams that are located at the North are approximately discharging 27 MCM of water annually (Ozturk, 1995).

In the period of 1974-1984, 20 dams have been constructed for water storage and recharge purposes. The approximate storage of the water within these dams is around 20 MCM per year. Furthermore, until 1990, 15 more dams were constructed of having an extra storage capacity of 15 MCM per year (Ozturk, 1995).

The amount of municipal drinking water that is supplied from 162 wells and boreholes is about 24.5 MCM and from the streams is nearly 0.34 MCM per year. It is believed that, 500 m3/day of water is pumped to the South from the North and nearly the same amount of water has been pumped back due to common piping systems within the cities (SID, 2002).

Irrigation water is supplied both from the available dams and the nearby wells. Variable values had been proposed for this utilized quantity of water in the literature due lack of measurements and control facilities. These values are within the range of 82.5 MCM (Bicak, 2000) and 144 MCM (Ozturk, 1999).

In Southern part of Cyprus, investigations revealed that, more than 80% of the rainfall over the land surface returns to the atmosphere through evapotranspiration (Socratous, 2000). Although there is no detailed study in the North, it is assumed that, nearly 90% of this precipitated water returns to the atmosphere. The total annual rainfall on TRNC is about 1250

MCM and the evaporation from the surface is hence, estimated to be 1000 MCM, indicating that, only 250 MCM of water is contributing to the water resources budget of TRNC.

Groundwater. Groundwater constitutes the major part of the water resources in the North. Available unconfined aquifers are used to supply potable water for the public needs and for the irrigation requirements. However, over extraction of water from these aquifers and due to poor recharge capacities resulted in the depletion of available freshwater within the aquifers. It is important to note that, due to this excess pumping, the contamination of the aquifers by sea water intrusion within the coastal regions reaches to an alarming stage and in some localized areas, the NaCl concentration is even reaching as high as 5000 ppm that is high beyond the world standards (Elkiran, 2002).

In NC, domestic and irrigation water are supplied mainly from the groundwater resources, dams and from the semi-perennial small springs. The aquifers in the island characterized into 13 groups within 8 hydrologic regions, which are having variable capacities (JMD, 2002). Based on 1970s estimates, the annual safe yield of these aquifers were nearly 74.1 MCM however, it is estimated that 28.9 MCM of water is over extracted from these aquifers (UNDP, 1970; DSI, 2002).

Guzelyurt aquifer, which is the biggest coastal aquifer in the North located at the westernmost of the island, supplies water, not only for irrigation requirements of the region but also for the municipal needs of Lefkosa and Gazi Magusa cities. Although the total storage capacity of the aquifer is 920 MCM, recent studies proves that, the aquifer is depleting and the average water table level is reaching 70 meters below the mean sea level in some local areas (Ergil, 1999).

The second important aquifer is the Girne Coastal Aquifer. The aquifer is elongated through the Northern coast of the island with a thin strip of 1.5 km in width. The aquifer area is about 40 km2 with an average annual replenishment of 10.5 MCM (Mollaoglu, 1985).

6.7. Current Water Management in TRNC

The form of water governance in TRNC is public governance in which the government takes on all of the responsibilities and challenges of water and wastewater services and in which the provision of water has long been considered an essential public good, and hence a core governmental responsibility.

In central places government manages the water, in villages and smaller places the citizens dig wells and manage their water with permission or without permission.

6.8. Projects carried out by Government to Solve the Water Problem

The experience of a 30 year long drought in the TRNC is the major cause of the water problem. Many projects have been carried out to correct the problem until this day. However, not much can be said regarding the success of these projects in finding a solution to the problem. This situation has arisen because of the deficiencies at the feasibility stages and the incompletion of the projects as a whole.

6.8.1. Yayla Irrigation Project

Yayla (Kumköy) Village is one of the leading citrus-growing and agricultural regions situated at the Northwest of the Güzelyurt plain. In the beginning water was pumped from 65 active wells in the area. As a result of the drought seawater intrusion occurred at the Güzelyurt Bay and at places close to the seashore. This further caused salt sieving from the shore to inside the plain and it continued as the years have gone by. In response to this situation, the Yayla Irrigation Project was brought about.

As a first step, the number of active wells was brought down to 18 by abandoning the other wells close to the shore. Later, 11 concrete pools were built in the area and the water pumped from the wells was gathered at these pools. The water from these pools was then pumped to the agricultural areas where the other wells were shut down.

At the second stage of the project, modern irrigation methods were planned for the irrigation of the agricultural areas in the region. Therefore, pumpage over the safe yield of the underground water would have been avoided.

The result of the project and its applications between the years of 1983-1985 did not bring the anticipated outcome. Problems related with construction: cracks developed at the concrete pools which caused excessive leakage. The 65 wells that were needed by the region were brought down to 18 and, therefore, the pumping rate of each well increased and in time this resulted in pumping sand and silt.

The most important factor contributing to the failure of the project was the fact that the modern irrigation methods planned for the Yayla region had not been materialized. Therefore, the water pumpage in the region continued to be over the safe yield and this resulted in seawater intrusion that was previously observed at places near the shore. In conclusion, the project planned to avoid the salinity at the wells near the shore did not reach its expected outcome as a result of wrong and deficient applications. In contrary, while the salinity at the already salt contaminated wells increased, the effects of salinity were also observed at the wells inside the plain. In other words, instead of decreasing, the project had increased the existing salinity levels.

6.8.2. Güzelyurt Derivation Channel Project

This project is a partial application of the "Tilliria-Morphou Project" within the part left within the Turkish boundaries which was originally aimed at easing off the water shortage in Cyprus before the 1974 Turkish Peace Keeping Operation (Electrowat Engineering Service, 1974 and DSİ, 1976). Apart from being poor in surface water sources, Cyprus has no regularly flowing streams and the flowing times of these streams are quite short.

On being a small island, surface waters forming during short precipitation periods rapidly reach the sea.

The aim of this project was to avoid the surface waters running to the sea during their short flowing periods and thus help to have a maximum use of them throughout the country. The project was realized in the year 1976. This project aimed at using the waters of the Çamlıköy Stream (Kariotis) and the Lefke Stream (Marathasa) within the inner parts of the Güzelyurt Plain by avoiding the running of these streams to the sea. Because of this, the waters of the two streams were gathered at the Güzelyurt Dam using a diversion channel. The first 5 km part of the Channel was concrete lined with water holding features while the rest of the 13 km part crossing the Güzelyurt plain was built in order to artificially recharge to the groundwater sources in the area (Gökçekuş and Doyuran, 1994).

It can not be claimed that the expected benefit from this project was attained. The main problem involves the pre-considered Güneşköy Reservoir not being constructed as a second reservoir for water storage to collect the excess water to be derived from the two streams and the Güzelyurt Reservoir. The precipitation during the years 1988 and 1994 was above the annual averages of the last 65 years and of the last 30 years of drought and it caused the flooding of the two streams over the limited-capacity Güzelyurt Reservoir into the sea. Before the drought and during the hydrologic years of 1968-1969 the amount of water flowing to the sea at the Çamlıköy Stream was 30 million m3 and for Lefke Stream it was 12 million m3 (Toufexis, 1970). In other words, while the total water capacity of the two streams sums up to 42 million m3 per annum, the capacity of the Güzelyurt Reservoir was only 1.875 million m3 during the years it was built. Not being able to carry out the Güneşköy Resorviour Project thus gave away to this result.

The maximum amount of debris of the two streams are recorded as 42 million m3 as against the average total recorded as 13.06 million m3 during the years 1967-1972. The total amount of water of the two streams during 1988 and 1994 had fallen far below the amounts recorded during the previously mentioned years.

6.8.3. Gemikonağı Reservoir Project

The Gemikonağı Reservoir Project is the largest project in the TRNC built on Maden Stream in 1995 using rock-earth type filling for purposes of irrigation. It was planned that the reservoir would be used to collect 4 - 4.5 million m3 of water during drought years and 7 million m3 of water during high precipitation years and thus would have contributed to the region's agriculture. However, problems started to occur after the Project's completion due to the wrong choice made on the axes location of the reservoir or due to the geological constraints. The fact that Cu-Fe Sulphite and mine spoils, because of the mining works existed within the recharge area of the reservoir, created a very adverse situation. As the water-tight lining built under the arch area prevented the underwater flow, after every precipitation the said toxic materials were carried into the reservoir increasing in concentration.

Along with the fall of rain, the oxygen in the atmosphere reacts with the minerals in the region (Pyrite, Calcopyrite, and Galena) resulting in the toxic materials (Cu, Fe, and Pb) sinking to the bottom of the Reservoir and in that medium an increase in $SO4^{-2}$ and the H^+ acidity occurs. With this outcome, the idea of using this water for irrigation purposes is abandoned for most type of vegetation (lettuce, spinach, parsley, etc.). Some of the remnants in the catchment area that create an adverse situation are made to flow outside the Reservoir through certain rearrangements. However, instead of providing a solution this could only help in carrying off the problem to other areas.

During the hydro chemical tests carried out at the municipal wells very close to the Reservoir and up the Stream no serious effects have been encountered. However, the close proximity of the Reservoir to the wells stands as a threat to human life that needs to be regularly monitored.

As seen the water obtained from the Reservoir and the nearby wells pose a threat both to plant and human life.

6.8.4. Transportation Project with Balloons from Turkey

This was a project that aimed at transferring in its first year 3.5, and in its second year 7 million m3 of drinking water from a fresh water source in Turkey's Southern coast using Norway made balloons (Normend) with capacities of 10000, 20000 and 80000 m3. The aim was to collect the water, first at the reserve where the water of the Lefkoşa's drinking water wells are gathered, and then to collect the water at the completed reserve with 10 000 m3 capacity so that drinking water should be provided to Lefkoşa (Nicosia) and to Magosa (Famagusta) where water shortage is severely felt during during the summer months. However, due to numerous technical problems (the balloon pulled by the motorboat could not be connected to the discharge point at 1 km from the shoreline in windy weathers, and sometimes the balloon itself was torn, etc.) the expected probability level could not be obtained.

Consequently, instead of the pre-planned 10.5 million m3 being transported, a mere 840000 m3 of water could be brought at the end of the 26 months period. It is also noteworthy to reconsider the transportation of water with such a high expense and effort before attempting to repair the leaks at water networks which are very high (%30 –%60).

The examples given clearly indicate the need to be careful in realizing any new projects. These government reclamation projects were limited in success on many counts, and caused environmental problems.

6.9. Conclusion

This chapter depicted current water problem in TRNC and unsuccessful applied projects in order to solve the problems. The next chapter gives the conclusions.

CHAPTER VII

CONCLUSIONS

7.1. Introduction

The following is the summary of the major findings of this study; which were discussed in above chapters in detail.

7.2. Major Findings

7.2.1. Global Water Problems

- It is estimated that two billion people in the world live in areas with extended water shortages (Duraiappah, 1998). Today, more than a billion people lack safe drinking water and almost two and a half billion live without access to sanitation systems (UNDP).
- Increased water use by humans reduces the amount of water available for industrial and agricultural development. It also has a profound effect on aquatic ecosystems and their dependent species.
- An estimated 14 to 30 thousand to people, mostly young and elderly, die every day from avoidable water-related diseases (UN Press Release, 2003). If current trend persist, by 2025 two thirds of the world's population will be living with serious water shortages or almost no water at all (UNESCO Courier, 1999).
- Threats to fresh water in the world
  - Increasing world population: Population has grown at a significant rate, from 2.5 billion in 1950 to 6.1 billion today, yet the renewable water supply per person has fallen by 58% (Postel & Wolf, 2000).

- Rising per capita consumption of the world : If per capita consumption of water resources continues to rise at its current rate, humankind could be using over 90% off all available freshwater within 25 years, leaving just 10% for all other living beings (UNESCO).
- Global climate change: Recent estimates suggest that climate change will account for about 20% of the increase in global water scarcity (Gland, 2003).
- Infrastructure development (Dams, dikes, levees, diversions, etc): 60% of the world's 227 largest rivers are significantly fragmented by dams, diversions and canals, which have led to degradation of ecosystems (UN, 2003).
- (Mis)management of water: The water crisis is essentially a crisis of governance. (UN, 2003). Lack of adequate water institutions, fragmented institutional structures, and excessive diversion of public resources for private gain; have impeded the effective management of water supplies.

7.2.2. Water Management Examples around the World as solution to Water Shortages

- The water crisis is mainly a crisis of governance and the management forms under which water has been historically governed. At the crux of the water debate is governance and determining how to derive the most value from available water while not depriving people of their basic water needs.
- Water governance can be defined as the range of political, social, economic, and administrative systems that are in place to regulate the development and management of water resources and provision of water services at different levels of society.
- Forms of governance

- Public governance: Public water provision is the most widely used governance structure under which the government takes on all of the responsibilities and challenges of water and wastewater services.
- Public-private governance: In the 1990s public-private partnerships became an advocated governance approach to resolving the twin problems of decaying infrastructure and financial constraints which both threatened public capacity for meeting water needs. A public-private partnership in the water sector involves transferring some of the assets or operations of a public water system into private hands.

  Specialists suggest that rising water partnerships are likely to persist. Support for such partnerships is usually the result of improvements in financing, pricing, efficiency, risk distribution, environmental compliance, human resource management, and the services that public-private partnerships can provide.
- Private governance: It is extremely rare and is often modeled under a divesture system whereby the government transfers the water business to the private sector.

7.2.3. Marketing Solutions to Water Shortages

- There is a crisis today. But the crisis is not about having too little water to satisfy our needs. It is a crisis of managing water so badly that billions of people-and the environment-suffer badly. Historical development, finance, and operations of water supplies have resulted in countless conflicts over water allocation procedures, cost allocation, and physical solutions to water resource problems (Howitt et al. 1999).

- As fast-growing populations face shrinking water supplies, environmentalists and budget-conscious governments limit the number of new reservoirs, businesspeople and policymakers are searching for new solutions. One potential solution to this impending crisis is to allow free markets for water. A consensus is growing that sustainable economic development depends on treating water as a scarce resource and using economic principles to guide its management and allocation. Water markets are a means of introducing these principles and allocating supplies in response to changing supply-and-demand conditions.
- Tradable water rights potentially can encourage conservation and a more economically efficient allocation of scarce water resources. Currently, water is under-priced and often allocated based on institutions established when water was not considered to be a scarce resource. Users pay nothing for the water itself. Municipal and industrial users typically pay a fee reflecting the costs of storing, delivering, and treating water supplies. But even these costs are likely to be subsidized for irrigation, which commonly represents a region's largest water use. Without an opportunity to sell unused supplies, irrigators have little incentive to conserve water. With the introduction of tradable water rights, however, users value water in terms of its opportunity cost -the value they could get by selling water- rather than at the subsidized price they pay for it.

7.2.4. Water Shortages in Northern Cyprus

- Cyprus, with a typical Mediterranean climate, has experienced a drought for the last thirty years. In consequence, a serious problem of water shortage for the same number of years is also felt at the TRNC with a population of 200000 inhabitants living on an area of 3299 Km2.

- The problem felt is not only a problem of quantity but also a problem of quality. In other words, apart from not having the enough amounts, the quality of the existing water supply is also unsatisfactory.
- The only source replenishes the water resources of NC is the rainfall. Investigations of rainfall on Cyprus revealed that, only 20 % of the rainfall is in fact, contributing to the water budget. The remaining portion returns to the atmosphere through evapotranspiration (Kypris, 1995).
- Uncontrolled irrigation of the fields, late adoption of old irrigation techniques and poor conveyance efficiency of pipelines and network systems, caused the over extraction of water from the available aquifers. That phenomenon resulted with the higher values of salt contamination due to the salt-water intrusion, where the coastal aquifers are invaded by the sea up to several hundred meters inland from the coast and also cause depletion of some of the small volume aquifers at the interior part of the island.

7.2.5. Water Governance and Projects in NC

- Current water management in TRNC: The form of water governance in TRNC is public governance in which the government takes on all of the responsibilities and challenges of water and wastewater services and in which the provision of water has long been considered an essential public good, and hence a core governmental responsibility. In central places government manages the water, in villages and smaller places the citizens dig wells and manage their water with permission or without permission.
- Unsuccessful results of projects carried out by government to solve the water problem

- Yayla irrigation project: While the salinity at the already salt contaminated wells increased, the effects of salinity were also observed at the wells inside the plain. In other words, instead of decreasing, the project had increased the existing salinity levels.
- Güzelyurt derivation channel project: The total amount of water of the two streams during 1988 and 1994 had fallen far below the amounts recorded during the previously mentioned years.
- Gemikonağı Reservoir Project: The water obtained from the Reservoir and the nearby wells pose a threat both to plant and human life.
- Transportation Project with Balloons from Turkey: Instead of the pre-planned 10.5 million m3 being transported, a mere 840000 m3 of water could be brought at the end of the 26 months period. It is also noteworthy to reconsider the transportation of water with such a high expense and effort before attempting to repair the leaks at water networks which are very high (%30 – %60).

7.3. Project Questions

7.3.1.

How can we provide safe, affordable water services for all people?

Water marketing, if properly designed, can encourage greater conservation and avoid the need to construct new reservoirs that can be costly and environmentally damaging. In a successful water market, voluntary transfers can create a market where prices reflect the scarcity of the resource. Then conservation would become a top priority because water that is saved could either be used or sold to someone else. This is very important in times of drought, or rising demand when the public benefits the most from stretching water supplies and minimizing inefficient use.

One method for alleviating the problem and providing safe, affordable water is water marketing under public-private partnership, where water would be transported from places with water surplus to those areas experiencing shortages (ex. Yeşilırmak may sell the water to other areas.).

The water companies can make contracts to manage the capital improvement planning and budgeting (including water conservation and wastewater reclamation issues), finance of capital improvements, design of capital improvements, construction of capital improvements, operation of facilities, maintenance of facilities, pricing decisions, management of billing and revenue collection, management of payments to employees or contractors, financial and risk management, establishment, monitoring, and enforcement of water quality and other service standards under the legislative regulations of government for a specified period of time.

7.3.2.

How can we better involve the community in decisions about water resources and water systems?
A water market is a reallocation of water in which the value of the water is considered independent of the value of land and improvements, buyers and sellers participate voluntarily, and terms of the sale, including the price, are decided by the buyer and seller. (Saliba 1987, pg. 3,4). It is obvious that the buyer and seller are voluntarily included in market place. So the water marketing would carry out the followings more easily: • providing information to the public on the quality of water • developing environmental education programs that help the community understand how their actions affect water quality • supporting total catchment management programs, as well as providing financial resources to communities through grants programs such as the Environmental Trusts • developing pollution reduction programs and regulating industrial activities, as well as controlling diffuse sources, to prevent water pollution • working with the community to tackle difficult water quality problems Under public-private partnership: • government agencies and water companies working together to develop and implement effective water quality management strategies.

7.4. Conclusion

This chapter provided the summary of major findings and answered the project questions.

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