HYDRATING THE PLANET THROUGH BUSINESS INNOVATION: A STUDY OF ISRAEL'S WATER INDUSTRY

By

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Bachelor in Business and Society, York University, 2006

PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF BUSINESS ADMINISTRATION

In the
Faculty
of
Business Administration

SIMON FRASER UNIVERSITY

Summer 2009

Approval

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Abstract

The goal of this paper is to analyse Israel's water industry and explore global export opportunities. The first section outlines the development of Israel's water industry through a historical, ideological and political scan of the country. The Key Success Factors that made Israel's water management successful are identified at the end of the section.

The second part of the paper conducts an industry analysis using Porter's 5-force analysis plus government. The analysis identifies the threats and opportunities of the global water industry and offers a strategy for Israel to capitalise on its position. Israel's current water initiatives and global demand for water preservation are applied to the strategic suggestions stemming from the 5 force analysis. Ultimately, Israel has the technology, resources and management experience to be a major player in the global water industry.

Keywords: Israeli Water Industry; Israel; Water Demand Management; Water Reclamation; Desalination; Drip Irrigation; Water Technology; Water Infrastructure; Water Resources, Water Exports; Water Security;

Dedication

I would like to dedicate this paper to my mother for encouraging me in all my endeavours and being my unconditional foundation. I also want to dedicate this paper to my sister Daniella, who has the power to illuminate a room with her smile and kind words. I love you both more than can be expressed in this dedication.

Acknowledgements

Thank you to Professor Andrew von Nordenflycht and Professor Michael Parent for guiding me through my most challenging and rewarding academic assignment. I also want to thank my family and friends who were patient and understanding during this process, making it more manageable.

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1: Introduction

Water is the most abundant natural resource in the world; however, it is paradoxically scarce. With less than 1% of the world's water supply being able to be consumed, there is an increasing need for water technologies in order to sustain current water uses. According to an article published by BBC News titled *Water scarcity: A looming crisis?:*"Global water consumption rose six fold between 1900 and 1995 - more than double the rate of population growth - and goes on growing as farming, industry and domestic demand all increase….. Seventy percent of the water used worldwide is used for agriculture [and] much more will be needed if we are to feed the world's growing population - predicted to rise from about six billion today to 8.9 billion by 2050" (Kirby, 2004).

The pressing need to collect, preserve, desalinate and reclaim water is at the forefront in the discussion of human and ecological subsistence. Beyond the 2 billion impoverished people that do not have access to the minimum 50 Litres of water needed for daily use estimated by the UN, developed countries such as the U.S. are facing water depletion due to overexploitation and contamination. The Colorado River, which provides water to desert-like cities San Diego, Los Angeles and Las Vegas, is experiencing a significant depletion in its water. Many countries face the threat of diminishing water supplies however, developing countries, notably in Africa, have the resources but lack the infrastructure. Inadequate water systems affect 1.6 billion people

worldwide. With adequate investment into water management programs, the developing world's lack of accessible water would be addressed and have the potential to be a transformational force in the global economy (Yaron, 2002). The water industry is comprised of all actors and processes that indirectly or directly provide wastewater and drinking water to households and industrial users. The industry includes every actor from governments, to Non-governmental Organizations (NGOs), to private businesses.

The Israeli water industry has five major sectors that interact intimately with each other and their various structures: Desalination, Treatment, Management, Desertification and Irrigation. These effectively form the water industry and give insight into the growth and development of the emerging water economy. The need for global water technologies in order to sustain current water use and plan for a growing world population has created a lucrative market valued at $450 Billion and growing at 7% a year (Water The Israel Experience, 2009).

Israel has been at the forefront of water technology in order to help preserve this resource while satisfying the demand of its 7 million citizens. Since its inception in 1948, Israel has been confronted with the challenge of satisfying the water needs of her citizens. The arid land that Israel inhabits, the political dynamics of the region and the growing population has made it necessary for the country to be efficient and innovative with its water supply. Furthermore, with recent increases in urbanization and extended periods of drought affecting the region there is even more need to pay attention to the water situation. Israeli technology was responsible for drip irrigation in the 1950s and Israel is now a leader in water reclamation and reuse by recycling 75% of its water, whereas the country with the next best record, Spain, is only recycling 12% of its water

(Reclamation and Purification Boost Israel's Water Resources, 2009). Through government regulations, groundbreaking research in its Universities and an entrepreneurial culture, Israel is a major contender in the global water economy

Israel has been able to supply water to its citizens for the last 61 years despite the challenges it faces. Its population has gone up more than tenfold from 600 000 at its inception to currently 6.9 million citizens (Nativ, 2008). Despite the increase, water consumption per capita has stayed roughly the same. Furthermore, water levels devoted to agriculture have gone down drastically while agricultural products produced per capita have gone up 150% or three times historic amounts, reflecting a significant increase in water productivity.

Israel has already been able to export $1.5 Billion in water technology in 2008 and that number is expected to go up to $2.5 Billion by 2011 with analysts expecting the Industry to be Israel's main growth engine in the future (Israel to export $2.5B in water technologies by 2011, 2009).

This paper will explore the history and progression of the water economy in Israel identifying the opportunities to be a global leader by capitalizing on its innovations in clean technology. This paper will analyze Israel's primary water sectors to illustrate where it has a competitive advantage and where it has an opportunity to lead. The emergence of Israel's water economy can only be measured when juxtaposed with the global economy and demand for water. Finally, there will be an Industry Analysis, which will suggest ways for Israel to improve its water economy, which will ultimately lead to the opportunity Israel has to thrive in the global marketplace.

The paper will begin by reviewing Israel's history pertaining to water management. The early water history is shaped through government regulations and proxy powers like the Water Authority in order to give control to the state. Through the centralization of water control, the government is able to collect comprehensive information regarding water use, allowing water to be allocated for optimal use. The development of Mekorot, The national water company, developed by the government and partnerships with businesses gives insight into the dynamics of the Israeli water industry.

The historical foundation of the paper seg-ways into the political landscape of the region. Briefly exploring Israel's political landscape will help explain why the country has been successful in developing specific water technologies and how the entire economy is affected by the regional volatility.

The history and politics will give a necessary foundation leading into the body of the paper. Each sector of the water industry will be explored focusing on the need, genesis and subsequent application and success of the sector. The primary sectors that comprise Israel's water industry are Desalination, Water Treatment, Water Demand Management, Water Security and Drip Irrigation. Inevitably there will be overlap between each sector but the intention is to first view them separately and than illustrate how they interact in the entire water industry and why they are important.

Israel's Water Industry has been facilitated through government water programs and access to investors with extensive capital. Joint government programs such as Watec and Newtech act as a hub where scientists, engineers, entrepreneurs and governments officials can share informational and capital resources. These programs along with Joint Ventures through major Israeli Institutions promote Research and Development for new

technologies while also providing the tools needed to make innovative ideas into marketable products.

Venture Capitalists and Investment help fuel the Industry. Without proper funding, many innovations remain patents for extended periods or become obsolete because of the lack of funding. Israel has one of the most active Venture Capitalist industries in the world. Investors coupled with government funding gives priority to technology, which improves domestic access to water and becomes a potential export.

Funding projects bring them to fruition however, without demand there is no successful industry. The global demand for water sets the stage for Israel's opportunity to capitalize on its already developed industry. This section will deal with different issues raising the demand for global water supplies. Inadequate infrastructure, inefficient farming techniques and a growing population are some of the issues, which inhibit Israel's water supply.

Finally, the paper will identify Israel's opportunity to become a major actor in the global water industry. Through extensive knowledge and already applied technologies, Israel's potential to come out a leader in the Global Water market is both compelling and attainable. A 5-force analysis of the global water industry will lend some recommendations and opportunities for Israel's success in the industry. By addressing the strengths and current gaps in the water industry this paper will explore Israel's opportunity to expand its knowledge and technologies in the global water market.

1.1 Water Measurement Benchmarks

Average per capita daily use of water in Israel is 250 litres (which is equivalent to 0.25 cubic meters per day and 91.25 cubic meters per year). Annual total usage of water in Israel is about 2.5 Billion cubic meters.

2: History of Israel's Water Industry

The water history of Israel is one that was developed under strained circumstances highlighted by political issues of the country and desert make-up of the land.

2.1 Pre-State History

In 1897 Theodor Herzl, an Austrian Jewish Journalist developed Zionism, which was the movement to push for a Jewish homeland. Zionist ideology was created in response to the pogroms of Eastern Europe and the prevalence of anti-semitism throughout the region. Eventually through mass migration of European Jewish settlers, and political influence with the British, who formerly controlled the land, Israel was born in 1948. The country was founded in the biblical Jewish homeland but not without a war of independence in which it lost nearly 1% of its population protecting its borders from hostile neighbours. The region has remained volatile with Israel constantly faced with existential threats.

Prior to Israel's independence in 1948, Zionism was premised on the idea of having a strong working class where Jews returned to working the land. Agriculture based settlements called Kibbutzim were developed in Israel and were modelled as socialist communes providing food, jobs and foreign currency for the economy (Livney, 2009). Pursuit of this ideology, which called for the return to the cultivation of the land, focused on making the desert land arable using innovative farming technologies and drip

irrigation methods. This mentally permeates Israeli society today evidenced through an extensive agriculture industry and devotion to Research and Development, making the water industry a product of deeply ingrained Zionist ideology. The first independent entity responsible for supplying water to the Pre-Jewish state was Mekorot, the national water company, which was established in 1937 (Israel- More Water for More People, 2009). The company has emerged as one of the most advanced water companies with its investment in research, technology and experience in water resources management, desalination, wastewater treatment, effluent reuse, rain enhancement, water quality, water security and water project engineering. It now provides 80% of water in Israel for agricultural and household use and is a fundamental player in the regions water industry.

The development of Israel's water policy and national infrastructure can be broken down into two phases which help understand the issues within two general time frames (Rouyer, Turning Water Into Politics: The Water Issue in the Palestinian-Israeli Conflict, 2000). The first phase is pre-1965, which focuses on the accessibility of water supplies through a pipeline infrastructure and other means of allocation. The second is post-1965, which is based on strategies for coping with water shortages, which is an even greater issue today in Israel. See Figure 1 for an overview of the major legislative, infrastructure and technology developments related to water in Israel.

2.2 Israel's Water History Timeline

Infrastructure Development phase (until 1965)

- 1937 Establishment of Mekorot as Israel's national water company
- 1955 Completion of the first pipeline to the Negev
- 1955 Water Measuring Law/Water Drilling Law
- 1957 Drainage and Flood Control Law

- 1959 Water Law
- 1959 Kibbutz Hatzerim and Netafim developed modern drip irrigation system
- 1961 Establishment of the Rain Enhancement department of Mekorot, increasing rainfall by 13%-18%
- 1964 Completion of the National Water Carrier
- 1964/5 Building of the Brackish Water Pipeline, designed to divert brackish ground water from infiltrating the Sea of Galilee and transport it for agricultural use in the Negev region

Technological and Management era for reclaimed water (1965-1980s)

- Establishment of the Shafdan Water Treatment Plant in central Israel to treat approximately 130 million cubic meters of wastewater per year
- 1970s reuse and demand-side management national campaign
- 1984 Inauguration of the Kishon Wastewater Treatment Plant in Northern Israel that provides 20 million cubic meters of treated wastewater a year for agricultural use in the fertile Jezreel Valley, maximizing distribution potential during high-demand periods

2.3 Early Water Legislation

Set out by the British Mandate, which was the ruling proxy pre-1948, the *Mejelle* allowed the state of Israel to be free to establish water laws without compromising private water rights. The *Mejelle*—the Civil Code of the Ottoman Empire enacted in 1858—declared that water, like grass and fire, was a free good, jointly owned by the public. This law was the foundation of subsequent Israeli water laws because it recognized water as a public good that would be best controlled by the government in order to satisfy demand and preserve the supply. (Livney, 2009).

Israel adapted the Mejelle's civil code on the governance of water. Subsequent laws legislated by the government were in accordance with the Mejelle and early statehood was premised on its principles. Agriculture was at the helm of Israel's development and progress, supported by Zionist Ideology. The government's unfettered control over the water resources through the Ministry of Agriculture helped preserve and maintain Israel's socialist values. In order for the economy to succeed, there was significant emphasis on

establishing and building an agriculture industry whose success would be determined by the supply of water. Between 1955 and 1959, four water laws were enacted in order to control and preserve water resources. The water industry today remains governed by these four laws (Livney, 2009).

2.4 Water Measuring Law of 1955

The Water Measuring Law established in 1955 declared that no water would be distributed without being measured. A regulation under this law requires abstractors to file monthly reports on water consumed or supplied with the Water Commission. This law gave the government access to records of water use allowing them to regulate and control how much water would be allocated for domestic use and agriculture. By establishing this law, the government would be able to track water use and help conserve water supplies.

2.5 Water Drilling Law of 1955

The Water Drilling Law of 1955 outlines the need for government water control by outlawing the drilling of wells and extraction of water without the government permits. The law empowers the Water Commissioner to deny a license if water supplies can potentially be contaminated thereby effecting household water supplies. A magistrate court judge has the authority to close any well if it is dug without the consent of the Water Commissioner. By giving the state further control over the water supply and its use, the government can regulate and conserve the water levels of Israel's arid land (Livney, 2009).

2.6 Drainage and Flood Control Law of 1957

In 1957 the Drainage and Flood Control Law was introduced creating a national drainage board to oversee Israel's entire water conservation as well as implementing regional drainage boards that would monitor water uses on a smaller level. "The former [the national drainage board] advises the Minister of Agriculture responsible for execution of the law and approving regional drainage plans" (Livney, 2009). The latter are independent bodies, which are local, and national government representatives whose responsibility is to prevent soil erosion and promote efficient and sustainable water drainage. Under this law the Water Commissioner (now called the Director of the Water Authority), the Minister of Agriculture and the regional drainage boards can declare protective zones around specified water sources (Dan Yaron, 2002).

2.7 The Water Law of 1959

The Water Law of 1959 is established and endorsed by the Supreme Court at an almost constitutional level. Three central bodies were created in order to help carry out the production and preservation of water with the passing of this law. The water council, the water commission and the court for water matters were a product of the water law and were responsible to implement and monitor water regulations set forth by the state. This law states that water supply is the sole property of the people and must be managed by the state in order to satisfy the needs of the people and the economic and agricultural development of the country. 'A person's rights in land do not provide him with rights in a water source which is on the land, flows past it, or its borders…' (Livney, 2009)**.** The law makes stipulations that work toward preserving Israel's water source. According to the law, no one has the right to a water supply if that supply reduces or contaminates a water

source. Everyone is entitled to water as long as they do not harm the quantity or quality of the water source, and as long their use falls under the legal restrictions. The laws state that the water must be used for household, agricultural, industrial, handicraft, commerce, and public services (in 2004 an amendment was added whereby protection and reclamation of nature and landscapes were included as approved purposes). The Water Law has a robust and extensive definition of water sources in order to protect its water supply. The law defines these water supplies as 'springs, streams, rivers, lakes and other currents and accumulations of water, whether above ground or underground, whether natural, controlled, or manmade, and whether water rises, flows or stands therein at all times or intermittently, and includes drainage water and sewage water' (Livney, 2009).

Israel's ideological upbringing and subsequent laws focusing on water and agriculture were fundamental in the development of the current water economy. Israel's social fabric today is guided by the need to preserve water in order to sustain the country economically which is why it develops innovative water technologies and highly knowledgeable in water resource management.

2.8 Early Infrastructure & Technology Developments

1955, the year of the first two water acts, was also the year that the first pipeline to the Negev was built called the Eastern Yarkon Negev project. The project was started in 1953 and laid 22,000 sections of concrete-lined steel pipe, each weighing ten tons. (BUSINESS ABROAD: Water for the Negev, 1955). This ambitious project was the first to bring water to the arid land of Southern Israel. At the time of the project, Israel was only 7 years old and needed a way to support its growing population. The project was one

of the first extensive infrastructures to transport water expecting roughly 2 trillion cubic meters of water to flow through the pipeline.

In 1959, the same year the water law was established, also saw the beginnings of what is now modern drip irrigation technology. Israeli engineer Simcha Blass collaborated with Kibbutz Hatzerim in 1959 to form Netafim, a drip irrigation company (Irrigation, 2009). The partnership led to the first practical surface drip irrigation emitter. Drip irrigation is an efficient way of providing water for agriculture. The system delivers water to the root of the plant at regular intervals, enabling it to use the appropriate amount of water thereby minimizing water waste, which can occur frequently in sprinkler irrigation. This revolutionary method has helped preserve water and limit the amount of fertilizer and chemicals used in plants, effectively helping farmers to control plant disease. The establishment of this water technology has given Israel a first mover advantage in drip irrigation. While the technology was first discovered in Israel, Netafim continues to develop this technology in order to improve the process and now controls half of the global drip irrigation market valued at $1.5 Billion.

The rain enhancement department of Mekorot was established in 1961 with the goal of increasing rainfall in the region. The program has been very successful increasing annual rainfall by 13-18% (Activities > Rain Enhancement , 2009). The success of the program has been founded on Israel's unique geographical location and atmospheric conditions as well as the technologies developed by EMS, a subsidiary of Mekorot. Rain enhancement is not a highly developed technology making it difficult to quantify the results. Determining whether the techniques actually increase rainfall or are merely coincidental is still debated among scientists with no substantive evidence supporting the

former. Israel is currently investing in R&D at leading academic institutions such as Hebrew University in Jerusalem and Tel Aviv University in order to determine the legitimacy of this science. Through the rain enhancement program Israel's culture of entrepreneurship has been further promoted through start-up companies that specialize in rain measurement and collection devices and satellite image photography. These new technologies have been catalyzed by similar government programs who fund and collaborate with Universities and leading scientists (Activities > Rain Enhancement , 2009).

2.9 National Water Carrier

The establishment of laws, government programs and the Water Commission assigned with the task of preserving and securing water supplies was the foundation for the National Water Carrier. The National Water Carrier is the largest water project in Israel. Built in 1964, the 130 Kilometre carrier was tasked with transferring water from the Sea of Galilee in the north of the country to the densely populated center and the arid lands of the south. Up to 72,000 cubic meters of water flow through the carrier each hour, amounting to 1.7 million cubic meters per day. The project was designed by Israeli engineering firm Tahal Group and was built by Mekorot, the state's national water company. The carrier consists of a system of giant pipes, open canals, tunnels, reservoirs and large scale pumping stations. Building the carrier required innovative technical analysis because of the complexity and diversity of the terrain and altitude through which it runs (Kantor, 2009).

The development of the water economy in Israel was first created through government laws that helped protect and preserve water supplies. The first phase of the water economy was centered on cultivating the Zionist ideology, which focused on farming the land and making the dessert bloom... The development of efficient pipelines that would transfer the water from the north to the south along with innovative technologies such as drip irrigation would help develop a viable water economy, which would provide the desired amount of water to households and farms. The realization that water was a finite source that would be essential to Israel's survival was a shift toward water reclamation and reuse starting in the late 1960s.

2.10 National Shift Toward Water Reclamation

The first major move toward the re-use and reclamation of water was in 1969 with the establishment of the Shafdan wastewater treatment plant. This is the largest wastewater plant in Israel and one of the largest in the world (Arlosoroff, 2004). It is located in the Central Israeli Dan Region, which encompasses Tel Aviv, and services 2 million people and treats 130 million cubic meters of water annually. This novel and complex system uses secondary effluents from the cities of Rishon Letzion and Yavne. These effluents are directed toward aquifers, which through a series of natural, biological and chemical processes are purified and subsequently used for irrigation (Israel- More Water for More People, 2009). A third pipeline was built that transfers this reclaimed water to the Negev so that it does not mix with the drinking water that is transferred through the other two pipelines. The quality of the water is high grade and is considered good enough for drinking however has yet to be approved by the government. The reclaimed water can be used for all types of irrigation and is commonly used for carrots,

lettuce, potatoes and different types of grains. Another major sewage reclamation project involves the Kishon River. Kishon River is known to be one of Israel's most important water sources however; it is also considered one of the dirtiest. In order to combat increasing levels of pollution, The Kishon Treatment Plant was established in 1984 and has successfully provided 20 million cubic meters of wastewater a year that is to be used for agriculture (Rouyer, Turning Water into Politics: The Water Issue in the Palestinian-Israeli Conflict, 2000). This was one of the first plans to get reused water back into agriculture allowing more freshwater sources to fulfil household demand.

Creating novel ways of reusing water will be fundamental in combating water shortages. Israel's 40 year national strategy on water reuse will act as an advantage given that many countries, especially China and India, have only recently began to deal with water shortages.

2.11 Improvement of the Water Management Strategy

In the 1970's a national campaign for Water demand management (WDM) began to make its way into the water economy as a way to incorporate water reuse and efficient water use into the demand side of management. The advent of WDM pushed water issues forward and helped businesses as well as the government improve water management functions and processes. The focus on WDM was catalyzed by the influx of immigrants and increasing scarcity of water. Israel's WDM strategy concentrated on the two market forces: Supply and Demand.

Supply: The construction of extensive networks of water transport systems has facilitated the transfer of water from the relatively abundant water supply of the North to

the dry South. This gives the authorities' balanced water supply, which helps them, improve regulations, monitor, and allocate water supplies (Arlosoroff, 2004).

Demand: Demand for water was a more robust strategic target for WDM as there were comprehensive issues that needed to be addressed in order to project demand and how it would affect the population and the economy. Five major initiatives were implemented in order to control and monitor the demand side of water. (Arlosoroff, 2004).

1. Pricing and Economic Policy – By controlling the price and allocation of water through government policy and pricing it allows for more efficient water use thereby allocating water to best serve the country's needs.
2. Re-use of Sewage effluents – reclaiming sewage water through purification allows more water to be used for drinking. Improving and expanding these facilities allows for more reclaimed water to be used in irrigation.
3. Water Conservation/ Improved Water Efficiency – The implementation of large scale drip irrigation and automation of irrigation have helped preserve water supplies. By expanding, particularly, drip irrigation techniques and water technologies Israel has been more effective in managing its water supply. Through improved technology and proliferation of irrigation methods Israel has been able to better manage its water supply and decrease the need for agricultural water because of its more efficient use.
4. Residential Sector- Water metering, replacement of older pipes, electronic monitoring and retrofitting campaigns. These basic adjustments and changes in

both psyche on how water is consumed and the physical make-up of these systems have helped preserve water in Israel. Changes such as having the double volume toilet flushing basins and lowering water pressure on taps and showers have resulted in substantially less water waste. Improvements in the residential sector are illustrated in the fact that despite the 300% increase in GDP over the last 40 years, water consumption has remained the same when calculated per capita.

5. Virtual Water- The 1960's brought a difficult decision to light for Israel's Water Commission. Realizing that projected water supplies would not be able to meet national demands, Israel decided to import some of its staples saving the country plenty of "virtual water" which would have otherwise been used in order to cultivate and grow these crops. Today's figures estimate that nearly 3 billion cubic meters of water is saved annually, twice the annual supply, from imported products such as grains (Arlosoroff, 2004)

Some of the initiatives set forth by Israel surrounding WDM were available before the 1970s however, promotion for a consolidated approach, which implemented all of them, was new at the time. The need for proper management and interaction throughout the entire water economy was important in developing a viable water economy that would provide the essential supplies for irrigation and household use. The switch to a more measured and innovative way of managing the water supply has helped Israel save money and resources while also further promoting technological advances in areas such as water desalination and improvements in drip irrigation. Focusing on water

demand management has given Israel the requisite knowledge in order to be successful in the global water market. By developing new strategies in managing the water supplies, Israel has the opportunity to export this knowledge to other countries. Global warming, industrial pollution and depleted water sources are affecting water supplies. Learning how to manage available water sources will benefit the water industry while improving ecological sustainability.

2.12 Shift from Water Infrastructure to Water Preservation

The 1970's and 1980's was the beginning of the sea and brackish water desalination national strategy. The introduction of a national strategy to steer the country forward in desalination and water purification has helped Israel become a leader in water management and purification with achievements like the Eilat desalination plant and expected new plants to emerge in Ashdod and south of Rishon Letzion by 2012.

Through the course of the country's history, there have been changes in the way that water is viewed and the different approaches to help sustain water levels in the arid land. Major ideological changes about water were made in recent years with the primary focus being on how to increase and manage water supplies. Israel continues to work on infrastructure to deliver water to different regions however, the most pressing issues revolve around the need to reuse, manage and desalinate available water sources.

The recent history of Israel's water economy should not be limited to only the major breakthroughs but rather the shift toward the use of technology and R&D. Recent technological advances and government programs paired with businesses and University programs have helped Israel improve and enrich its water industry while preserving the country's economic and agricultural interests. This is important because the move

toward creating new water sources in desalination and reclamation has encouraged Israeli companies to become more innovative through necessity. When compared to countries whose survival is not contingent on developing new water sources such as Canada, one can infer that Israel's water industry is far more developed, especially when compared to countries in the west that have access to several large water resources. This therefore sets the stage for Israel to develop and extend its knowledge and technology to the world.

3: Hydropolitics

This paper is premised on exploring Israel's opportunity in the global water market; however, in this volatile region, politics are intertwined in almost every facet of life while politics is often related to the economy, In Israel it is virtually impossible to separate the two. To obtain a comprehensive understanding of the water economy in the region it must be noted that water has become central to the politics of the region.

Israel is a country that was born into hostility and has been unable to stabilize its relations with its Arab neighbours. While the entire political volatility of the region is deep-rooted and outside the scope of this paper, water plays a significant role in the Middle East. The core of the political issue in Israel is how it relates to the Palestinian people, which in essence, also shape its relations with surrounding Arab countries.

While the central issue between Israel and the Palestinians is political, a more immediate conflict resides in water scarcity. Existing water supplies are in serious danger of being overused and depleted. The region has seen unparalleled levels of drought and has seen scarce water supplies over the last 5 years (Rouyer, Turning Water Into Politics: The Water Issue in the Palestinian-Israeli Conflict, 2000). The proportion of water used for agriculture in Israel was as high as 75 per cent until recently with "virtual water" being saved through an increase in imports of produce. Household water requirements are growing rapidly with the Palestinian population having one of the highest birth rates in the world with 7 children to each woman while Israel's population has ballooned with the

influx of nearly one million Soviet Jews (Rouyer, Turning Water Into Politics: The Water Issue in the Palestinian-Israeli Conflict, 2000).

The second dimension lies in the inequality of consumption between the Israelis and Palestinians. According to different estimates, Israelis are said to consume three to four times as much water as Palestinians. While data sources vary widely there is very little disputing that a gap exists in the availability of water for the two peoples (Rouyer, Turning Water Into Politics: The Water Issue in the Palestinian-Israeli Conflict, 2000). The water issue has been a recurring topic in peace talks between the regional neighbours. Israel defends its water policy by stating that its consumption is comparable to that of western states that indulge in longer showers and have large green lawns. This however does not absolve the Israeli government from its actions but remains a strategic bargaining tool in anchoring discussions. The issue has further extended to other Arab states, particularly in Jordan, where the Jordan River basin is used for water resources in Israel, Jordan and the Palestinian territories. All sides claim ownership to this water source but Israel controls a majority of it. The water politics of the region are not limited to allocation and shared resources but those issues are central in understanding the types of challenges that are brought forth. . The claim to water and rationing of it can merit a paper on its own. However, the intention is to shed light on the political and economic consequences that are tangled into Israel's water economy and how it has affected the industry. The political effects of Israel's water economy are important to understand because they give insight into Israel's extensive investment into water security (discussed in more detail below), essentially protecting the water supply and infrastructure from terrorist activities. With the increase in global terrorism such as attacks perpetrated

against the U.S. on September 11th there will be greater need to secure water supplies and protect them from contamination. Due to Israel's political instability, it has been dealing with potential threats to its water supply for decades. Beyond terrorism is the threat of accidental contamination, which can be caused by industrial waste and global warming. Software systems that automatically detect "real-time" water contamination are being developed and their success can be attributed to Israel's enduring need for security. Other countries, whether due to terrorism or natural threats, will be in need for securing their water supplies. The opportunity for Israel will be further explored in the chapter on water security.

4: PRIMARY WATER SECTORS

Beginning with water accessibility and transport and more recently transitioning to conservation, reclamation and security, Israel has been highly involved in developing ways of improving water resources. Israel's water industry exports products and services estimated to be worth around $1.4 Billion and this value is expected to go up to $2.5 billion by 2011 (Israel to export $2.5B in water technologies by 2011, 2009). The water industry is comprehensive and spans many businesses and economies. While there are many dimensions operating in Israel there are five main sectors that Israel is actively involved in: Water Desalination, Water Treatment, Water Demand Management, Water Security and Drip Irrigation. .

4.1 Water Desalination

One of the most recent and successful technologies used in Israel to combat water scarcity has been desalination. Desalination is the process of ridding water of salt and minerals. It allows saltwater and brackish water to be re-used and is becoming more pervasive as a means of supplying water demands. Desalination was first used in Israel with the invention of Vacuum Freezing Desalination, -which is a process of lowering the temperature and pressure of seawater eventually forming ice crystals which are then washed and melted back into freshwater-, in the 1960's (Water The Israel Experience, 2009). The move toward this technology has been based on the desire for a reliable and efficient source of water that has a relatively small impact on the environment and can be

adjusted to satisfy demand. The types of water, which are desalinated, include brackish water, seawater and secondary effluents. There are currently 30 plants, which service brackish water through reverse osmosis, a process of applied pressure, which separates the dissolved impurities from freshwater. The main objectives of the desalination program are to enhance depleted water resources and upgrade excessive secondary effluents.

The first desalination plant was a Multi Stage Flash (MSF), which is an evaporation method and it was constructed in the northern city of Eilat in 1965. In 1973 the plant was restructured in order to provide 4000 cubic meters of water per year, enough to provide 45 people water for a year using today's average of 250 Litres of water per day. Although this may sound as a relatively trivial feat the success of the plant is based on the technology used rather than the output of water provided. At the time this was a ground breaking project and was relatively new to the world (Activities > Desalination , 2009).

4.1.1 Ashkelon Desalination Plant: World's Largest

One of the most recent and groundbreaking developments for the country has been the reverse osmosis desalination plant located in Eilat which was opened in 1997. The plant itself is a global technological breakthrough as it is the world's first reverse osmosis plant that treats a mixture of sea water and reject brine from an adjacent brackish water desalination facility (Dan Yaron, 2002). While this plant has been a success in the country, exporting the technology at the time was a challenge because water demand was

not as pressing as it is today. A more recent success which will help Israel in the global water industry is the Ashkelon Plant. Ashkelon Plant: World's Largest

The improvement and advancement in desalination was, topped when in 2005 Israel opened the largest reverse osmosis desalination plant in the world. The $250 Million plan located in the central city of Ashkelon produces 100 million cubic meters of water per year, which amounts to 5-6% of Israel's total water use (Israel's Desalination Plants Make Up Water Shortages, 2009). According to the *European Jewish Press* "the estimated 1.5 billion Euro contract signed by Veolia [a leading French company that specializes in water services with revenues of $47US Billion] and its Israeli partners covers the finance, construction and operation of the plant and the overall revenue for the first 25 years. After this initial period, the plant will be transferred to the client, the government of Israel". Having international investors greatly improves Israel's credibility in green technology sector. By attracting foreign investors, Israel can further develop its economy and capitalize on the on its water advances. Part of Israel's future success will depend on attracting international investors. Partnering up with Veolia, one of the largest water services companies in the world will help Israel establish its reputation by gaining exposure. The resources of Veolia helped create the plant as well as added reputational capital to Israel's water industry. Because of Israel's small size, developing relationships and partnerships with larger companies will be fundamental to its success in the global water industry.

The Ashkelon plant was operational after 30 months of construction. The efficiency and technology involved in the production of the plant has allowed it to produce the cheapest desalinated drinking water in the world at $0.52 per cubic meter

where in the U.S. it costs roughly $0.80 to desalinate a cubic meter. Assuming that the U.S. could adapt a similar plant and produce the same 100 million cubic meters per year this would amount to a savings of $28 Million per year. The savings here is a modest estimate because in reality the U.S. has more access to capital so the actual savings could be 2-3 that amount. The plant is comprised of a complex infrastructure that includes the materials involved directly with the desalination process as well as a gas turbine engine station needed for energy and laboratory buildings used for ongoing R&D. (Israel's Desalination Plants Make Up Water Shortages, 2009). Over the course of its contract, which runs for 25 years, the plant is expected to earn $825 Million in revenue The Ashkelon plant was showcased around the world because of its size and water capacity. North Africa and the Middle East constitute 6% of the world population but only have access to 2% of the usable water. This is a very important statistic as birth rates in the region are amongst the highest in the world, which means the gap between water availability and water demand will continue to increase. Given Israel's geographic proximity and developed technologies there is a growing opportunity to export its technology throughout the region. In 2000, Israel decided to address this problem by launching a desalination project, which will build seawater treatment plants along the Mediterranean coastline (French-run water plant launched in Israel, 2005). This plan will effectively make freshwater available to scarce regions allowing Israel to profit and strengthen political ties with these affected countries. The Ashkelon plant is the first in a series of these plants and is expected to produce 750 Million Cubic Meters of water by 2020 (roughly the national domestic average used today). Desalination techniques are developing quickly and Israel has taken strides in developing and improving the

technology in order to service the ever-growing water needs of its people and capitalize on its low cost production in order to sell water to other countries in the region. While there are obstacles to exporting these technologies in the region, they will be addressed later in the Key Success Factors section.

4.2 Water Treatment

Water reclamation has been an ideal way for Israel to deal with its growing population and agricultural demands without compromising the amount of water used by households and for agriculture. Israel has the highest level of water reclamation in the world. It reuses 75% of its water with Spain in second place at only 12% (Israel- More Water for More People, 2009) (see Table # 1below). This high level of efficiency is in response to the pressing need of new water resources.

Table #.1 water reuse rates

Israel	Spain	Australia	Italy	Greece	Central Europe and USA
75%	12%	9%	8%	5%	1%

Water The Israel Experience. (2009). Retrieved June 13, 2009, from israelnewtech.gov.il: http://www.israelnewtech.gov.il/_Uploads/dbsAttachedFiles/Presentation.pdf

The above table shows the level of efficiency Israel has been operating at in order to reuse its water supply compared to other developed nations. Based on the comparative levels of the other countries, there is a vast opportunity to import water treatment that would effectively increase water supply, improve environmental conditions and create cleaner drinking water. Based on the percentages many of the largest economies have

done little to develop and implement water treatment technologies into their water infrastructures. Israel has a unique position as it is geographically located in the Middle East, making water a precious commodity, yet it has a capitalistic economy that gives it a natural alliance with other capitalistic countries. Israel has the available technologies and knowledge while also having the economy that will facilitate the exportation of its products.

4.2.1 Major Treatment Infrastructure

The Mekorot Water Company provides Israel with 90% of its drinking water and 80% of all it water supplies, leading the way in water technologies (Water The Israel Experience, 2009). The company is responsible for treating 40% of Israel's wastewater, which, translates to 200 Million Cubic meters of water per year. Mekorot is able to reclaim 75% of the secondary effluents. As noted earlier the reclaimed water is as pure as the freshwater however, it is only used for agriculture, as other uses have not been approved by the government. Mekorot operates six wastewater plants that are the initial phase in treating the water supply. Following biological treatment, the effluents are directed to one of nine effluent reclamation plants which disinfect the effluent before it is supplied for irrigation (Activities > Desalination , 2009).

As earlier mentioned, The Dan Region Treatment and Reclamation Plant at Shafdan (south of Tel Aviv) has been in operation for 30 years and is one of the largest and most complex plants in the world. The plant purifies 130 million cubic meters of water a year, which supplies 2.3 million people of the greater Tel Aviv region. Another treatment and reclamation plant in Israel is the Greater Haifa project at the Kishon

complex north of the city. The plant serves a population of 450 000 and uses similar technology and management processes as the Tel Aviv plant.

4.2.2 Water Treatment Technology Development

Emerging technologies in the water industry have been developed by a multitude of start-up companies. 27% of Israeli water start-up companies are in the field of water purification and improvement which demonstrates not only the need for these types of technologies but also the opportunities available (Israel's Water Economy - Thinking of future generations, 2002). Some of the leading companies in this sector of the water industry have gained global recognition and are geared to continue providing cutting-edge technology. Some examples include

- Amiad Filtration Systems developed self cleaning technology that assures a continuous flow of filtered water. Owned by Kibbutz Amiad in Israel's Upper Galilee, Amiad recently had a successful IPO on London's Alternative investment Market (AIM). The company focuses on developing technology used for. Agricultural and landscape irrigation, Aquaculture, Industrial water processing, Industrial wastewater treatment, Municipal water treatment (drinking and waste treatment) and Prefiltration to protect costly media and reverse-osmosis systems
- Arkal Filtration Systems is a market leader in the filtration of water containing high levels of biological materials. The company has seen great success around the world and holds a 25% share of the global micro-irrigation markets in agriculture and landscaping. The company covers a wide scope in the water filtration industry – from initial concept, design and engineering to supply, installation and commissioning of

water filtration and treatment systems for agricultural, industrial, commercial and municipal market segments (Israel's Water Economy - Thinking of future generations, 2002).

The list of companies is by no means exhaustive but instead shows the diversity and robustness of the water industry in Israel and some of the different actors involved. There has been great success in many of Israel's Water initiatives and it continues to be successful with the emergence of new companies and new technologies. However there are still challenges that Israel faces mainly with Industrial and Municipal wastewater.

4.2.3 Challenges in Water Reclamation

Industrial wastewater that is released into the environment presents a double challenge because much of the material in the water is highly toxic and is detrimental to the environment. Further-more industry specific wastewater technologies must be customized in order to provide the proper treatment that complies with increasingly stringent regulations (Israel's Water Economy - Thinking of future generations, 2002). The potential impact this has on businesses is substantial as in-house reclamation facilities can vastly improve business efficiency by optimizing production and minimizing costs. The second challenge is in water intensive industries such as pulp and paper, food processing, and textiles, which are often dependent on wastewater treatment in order to increase production. If the wastewater treatment system is insufficient, then production is limited and therefore poses economic consequences.

Municipal wastewater treatment is becoming the accepted norm for developed countries however there are still potential strategic problems. First, the rapid

urbanization, caused by Soviet Immigration, of many municipalities has caused unexpectedly high levels of wastewater to be treated. Furthermore there is increasingly more stringent regulations on wastewater treatment which coupled with the influx of urban dwellers have caused a strain in wastewater treatment. Many plants were not initially designed architecturally, environmentally or strategically in order to deal with these problems however despite the challenges Israel has been able to advance treatment plants and water reclamation initiatives. The evolving changes allow Israeli businesses and government policies to adjust in order to address the new challenges thereby making the industry more adaptable and productive. With many countries facing infrastructure inadequacies and growing populations, there will be a need for adaptive technologies and management processes. Israel has addressed many of the problems that other countries are only now starting to experience such as China whose water transport system is becoming outdated because water demand is increasing due to a growing manufacturing industry which requires high levels of water consumption.

4.3 Water Demand Management

Israel's location in a semi-arid region has made it of paramount importance to be able to manage water supply through efficient allocation strategies and innovative reclamation technologies. Until recently, Israel has devoted roughly two thirds of its water to agricultural purposes.

4.3.1 Water Resources Management and Optimization

Israel's impressive achievements in water conservation are a culmination of research, necessity, and government policy and management operations. The expertise

developed covers a wide scope and deal with a constantly changing environment, economy and political landscape. Israel has a diverse landscape and terrain that ranges from arid and wet to urban and rural. All of its water sources have been discovered through extensive research and excavation, including surface and groundwater. Management practices have been refined and applied to regional and national programs, from the national water carrier project in the earlier years to the more recent focus on desalination and reclamation projects in Ashkelon and Eilat. Within this comprehensive scope of water management, Israel focuses on data collection and analyses, engineering innovation, and economic feasibility of projects.

4.3.2 Managing Regional and seasonal Inequalities

There are vast rain inequalities in Israel. Israel's North receives 600mm of annual rainfall while the northern Negev receives 200mm and the southern Negev barely receives any rain at all. This poses a major problem to the Israeli economy, especially for the agriculture industry. Israel was able to combat this problem by developing the National Water Carrier. As noted earlier, the carrier was one of the most extensive man-made water routes and for over 40 years it has transported more than 13 Billion cubic meters of water from North to South (Kantor, 2009).

Seasonal inequalities are also prevalent in Israel, with the rain season occurring from December to March and no rainfall between May and October. This results in the need to conserve water supplies effectively in order to meet demands during dry spells. Thus Mekorot focuses on water storage between the winter and summer months. By carefully monitoring the level of the Sea of Galilee and the underground coastal aquifer,

which supplies an additional third of Israel's water, Israel is able to provide water to regions even during drought periods. Additional reservoirs have been built in recent years in order to help store the excess precipitation that occurs in the winter months. The Jewish National Fund (JNF) has helped provide reservoirs that now amount to roughly 200 in Israel. In 2008, the static amount of water that reservoirs filled was 150 million cubic meters however, the turnover amounted to 270 Million cubic meters (Gafni, 2008). The reservoirs act as a strategic operation in order to increase water supplies. The storage of water effectively increases water supply because it is not dumped back into the environment. Since the water is contaminated, the environmental benefits are increased because the water becomes treated and reused along with stored rainwater. Since much of the effluent water, which is collected from rainfall and run-off from used water sources, is rich in fertilizer it can be reused for agriculture thereby being more efficient by reusing water and fertilizer. The benefits of the reservoirs also extend to the improvement of innovative ways of treating secondary effluents. By having central locations that store the water, operational technologies can be set up with R&D facilities and further improve the quality and use of the stored water

Most of the Middle East region experiences similar seasonal droughts as Israel. However, because of their authoritarian regimes and restrictive business practices water management has not been as effective as it has been in Israel. Managing water supplies and data collection are essential, especially in this region, where current water sources are becoming more strained. While water shortages and inequalities are not limited to the Middle Eastern region, this would be Israel's closest market. Israel has been working

closely with Turkey to improve its management strategy yet there remains a wider untapped market in the region, given that political relations can be stabilized

4.3.3 Water Planning and management

In order to meet demand of water for a growing population while increasing standard of living, planning is fundamental to the process. Mekorot has been pivotal in managing water supplies and allocating resources in Israel. The company operates 3000 installations throughout the country for water purification, desalination and rain enhancement (Water Resources Management in an Arid Environment: The Case for Israel, 2006). Mekorot's state-of-the-art infrastructure comprises 630 pumping stations, over 1,200 wells, more than 3,050 pumps, over 10,500 kilometres of large-diameter pipes, 570 concrete and steel reservoirs, 95 large earth reservoirs and related equipment.

The Tahal Group, Israel's largest engineering consultancy and project management firm, has aided Mekorot in order to maintain its extensive and complex infrastructure. Established in 1952 by the Israeli government and privatized in the 1990's, Tahal's initial brief was to provide engineering solutions to deal with Israel's water scarcity. Since then the company, through its subsidiary, Water Planning for Israel has been integral to satisfying Israel's water demands (About Tahal, 2009).

Centralizing the process by having a national water company allows Israel to collect and manage data and resources easier. Interestingly, other Israeli companies are encouraged to develop technologies because of the free market environment of the country. In turn water tech companies are able to partner with Mekorot and improve their technologies while profiting from their innovations. This is important because due to the

complexity of the landscape and entire infrastrcuture, having more resources available help improve the water planning process. Israel's water industry structure is unique in that it is centralized yet collaborative allowing the government to make more calculated decisions while also encouraging entrepreneurial activity. Exporting this dynamic to other countries can help them improve their water supply and manemgement. An example would be America where water is ultimately run by the free market making it harder for the government to make strategic decisions. This could lead to business decisions which conflict with national interests. However adapting astructure similar to Israel's might make for a system better suited for water allocation and planning.

4.3.4 Computer Use for Water Management

The use of computers has helped optimize water use. Mekorot installations use sophisticated, computerized remote control systems, which help, improve water efficiency and reduce labor, expended energy and water loss. For example, in 1999 Mekorot implemented the "Unicenter TNG which covers real-time management of the entire IT infrastructure and water distribution system, including every server, desktop, network, database and application" (GLOBAL SOFTWARE MARKET: Computer Associates' Unicenter TNG To Manage Israel's National Water System, 1999)". This added technology is one of the ever-evolving changes that have undergone in order to continue managing Israel's water supply.

4.3.5 Flow Enhancement

An important part of water management is the infrastructure in which it operates. Having reliable and efficient pipes, valves and filters that route and purify the water makes water easier to deliver, quantify and effectively distribute and conserve. In urban areas, water loss from underground water infrastructure can account for up to 60% of a city's water consumption which results in lost profits and more importantly failure to meet water demands (Water The Israel Experience, 2009). It is estimated however that Israeli technologies can reduce water loss to 10%, giving countries essential tools and strategies to conserve their water through innovative and effective management practices (Newtech). Israel's population has been increasing, yet water use per capita has stayed the same despite the economic development. Furthermore, agricultural technologies have improved which has lead to real agricultural production per unit of water to increase six fold since 1948 meaning that more products are grown with less water (Arlosoroff, 2004). Israel's achievements in water management have also included:

- Internet-based systems for wireless, automatic meter reading data networks
- On-line, real-time water management systems that automatically shut down if a deviation Is detected
- High-durable material with a life expectancy that is three times longer than traditional Materials
- Integrating electronic pressure controllers with hardware, software and hydraulics (Reclamation and Purification Boost Israel's Water Resources, 2009).

Water resource management is a culmination of the many different areas of the water sector. Through an ongoing process of consolidating and improving technologies,

operations, reclamation and measurement, Israel has been able to consistently fulfil water demand for its population.

4.3.6 Water Program Partnership with India

Israel is already working with different countries in helping them imporve their water management programs. In 2007 they held a conference with India. The Bombay Chamber of Commerce and Industry, in association with the Consulate General of Israel, Mumbai, and the Maharashtra Water Resources Regulatory Authority, organized a conference titled 'Water Management and Technology - the Israeli experience' in order to deal with India's water scarcity (Ramakrishnan, 2007). According to the article " 'Successful implementation of technologies like drip irrigation and rain water harvesting can irrigate up to 50 per cent of India's uncultivable land. The country also needs to reframe its national water policy, through which technologies like drip irrigation can be introduced nationwide', said K C Mehra, deputy chairman & managing director, Forbes Gokak Limited. Presently, India has only 12 lakh hectares [Equal to 12 Million square kilometres] under drip and sprinkler irrigation system, while there are 690 lakh hectares that can still implement it". India is said to waste nearly 50% of its water supply because of lack of storage facilities while they only produce 0.15% of their water through the desalination process. Israel has been able to leverage its water experience by developing relationships and partnerships with different governments in order to address their needs thereby giving it more credibility and improving its economy.

4.4 Water Security

The security of water resources and infrastructures are of utmost importance. Without the proper security measure implemented, water supplies are exposed to such threats as terrorism, biological toxins and complex system malfunctions. Threats to a country's water supply can disrupt an entire region by creating panic and fear. In 2001, Israel found excessive amounts of Ammonia in its water system and within two hours of the reported incident 2 million people were cut off from water as the matter was being dealt with (Gary Winstona, 2004). While Israeli experts were able to respond to the crisis immediately and exposure to contaminated water was prevented, the incident still resulted in panic buying of water in Israel's stores. The effects of a situation like this can affect the psyche of a population and can have grave consequences to the economy. Natural disasters can also severely affect the quality of water and disrupt resources. Hurricane Katrina in New Orleans severely damaged water supplies, which beyond inconvenience and national shame caused casualties. Israel's exposures to political, environmental and unanticipated dangers have helped build a prosperous and valuable water security industry.

In order to provide secure water supplies free form outside threats Israel has developed national partnerships between Mekorot, the Israel Export and International Cooperation Institute and private consultants. They focus on packaged solutions comprising risk analysis including identifying gaps in water security; management, policies and planning; and drills and implementation of lessons. While this operational strategy has improved security, one of the major sources of Israel's relative success has been in Water Security Research.

4.4.1 Water Security Research

Some of Israel's largest and most reputable U\universities have been involved in R&D surrounding water security. Most notably Tel Aviv University, the Technion, Israel Institute of Technology, the Hebrew University of Jerusalem and Ben Gurion University of the Negev . One of the most celebrated international projects according to the Newtech website- is "The Technion's Grand Water Research Institute is conducting an interdisciplinary research funded by NATO, which integrates mathematical models for the placement of monitoring stations that can identify and neutralize chemical and biological contaminants, such as anthrax. Mekorot has further provided a beta-site through its WaTec initiative for start-up projects focusing on water technology solutions.

Israeli strategy is to first offer homeland security that physically protects water sources such as fences and alarms. Then, sensors and bio-sensors help detect contamination and unwanted particles entering the water supply. Third, if preventative measures fail than companies and governments are trained in crisis management procedures, which are coupled with strategic decision making in order to minimize casualties and economic volatility. Part of water security is dealing with the public response in order to mitigate fear and unwanted backlash. Israel's strategy is centered on tackling the problem before it makes it to the public.

There is large opportunity for Israel to enter the world market with its experience in water security. In 2000, a well in Walkerton, Ontario was contaminated with manure and a chlorinator failed to work resulting in 7 deaths and 2300 contaminations. Adding to the devastating human impact Canada spent $64.5 Million as direct aftermath of the

incident with an additional $520 Million to ensure it does not happen again. Investing in water security programs prior to an unforeseen accident can save the government and water suppliers millions of dollars. Dealing with water security issues is a problem that affects every country. The need for water security is not limited to developing countries but is rather pervasive in the Western world as well, as depicted in the Walkerton case. Israel‘s history of enduring threats has left it with innovative ways of dealing with security issues.

4.5 Drip Irrigation

One of Israel’s biggest successes in its water economy has been the development of drip irrigation. Unlike sprinkler irrigation, drip irrigation minimizes the amount of water needed through advanced engineering techniques, which allow just the right amount of water to reach the root of the plant deriving more products from less water. Israel has achieved 70-80% efficiency in agriculture through drip irrigation compared to more traditional forms of irrigation, which produce only 40% water efficiency. The level of efficiency is benchmarked to what engineers consider optimal use for agricultural water. This means that more primitive forms of irrigation methods use more water to produce the same amount of crop thereby creating more wastewater and less efficiency. Sixty percent of Israel’s agriculture industry uses drip irrigation as its main source of farming where other countries are only just starting to incorporate this more productive form of agriculture (Sandler, 2005).

Drip irrigation minimizes evaporation, reduces the need for fertilizer and chemicals, prevents salination of plants and reduces weed growth. In effect, drip

irrigation helps save money on chemicals and water and improves the quality of the environment by minimizing chemical use. As mentioned earlier, Israeli firms control nearly half of the $1.5 Billion global market with plenty of room to continue its growth (Sandler, 2005). Despite its efficiency and relatively low cost considering the benefits, Drip Irrigation has been adopted slowly. In the U.S., only 6% of the water used in farming is drip irrigated. Drip irrigation combined with the use of wastewater is very effective for farming techniques, helping farmers save money while also preserving natural waters supplies.

The need for drip irrigation has garnered attention from all across the world. It is geared to increase exponentially when countries begin to experience serious water shortages. Joint programs in the U.S. have been established in partnership with the Israeli government in order to improve agricultural processes and efficacy. Particularly, The Texas-Israel Exchange Fund, an innovative project sponsored by the Israeli government and the Texas Department of Agriculture under a larger national program called the Israel-U.S. Binational Agricultural Research and Development Fund; helps maximize water use in dry areas such as Texas. Netafim also operates a manufacturing facility in Fresno, California and sells $200 Million worth of water supplies per year used for drip irrigation in the U.S. According to the same article there are “Several other Israeli research programs, including the Water Research Institute at the Technion-Israel Institute of Technology, are working to maximize the mileage farmers the world over can receive from each gallon of water at their disposal”.

Recently Netafim launched the Netafim Irrigation University in Pune for providing training in the area of drip irrigation and fertigation to the Indian farmers and field professionals. “In India we have implemented this system of training in 2003 and so far thousands of farmers all over India have already been trained by us. We are now formalizing it as Netafim Irrigation University, as we feel that drip irrigation in India is expanding at the fastest pace compared to any other country worldwide and there is a dire need of trained professionals for effective implementation of drip irrigation systems in the country.” Netafim India offers the complete irrigation and agronomical support to the farmers (Israeli Drip Irrigation Firm To Set Up University In India, 2005). India’s depleting water sources has made country a regular partner with Israeli companies. The political and business relationships continue to grow as technologies and management practices are exported there.

As the world is looking into adopting more advanced methods of water management, Israel continues to improve its drip irrigation in order to sustain its current leadership in the industry. Sub-Surface irrigation, which delivers water directly to plants' roots further minimizing water evaporation by up to 20%, will help the agriculture industry by even further minimizing pesticide use and water wastage. To further the improvement across farming techniques, the distribution of fertilizers through drip irrigation systems called fertigation delivers fertilizers more efficiently to the roots (Water The Israel Experience, 2009). Technology moving toward a new generation of drippers for hydroponics allows for the growing of greenhouse plants without the soil. These emerging technologies will help Israel strengthen its leadership through innovation, giving the country a first-mover advantage.

Venturing into new markets will help Israel improve its position in the global water economy. Since it has continued to develop new technologies for domestic use, the next step involves expanding its business and developing ventures in new countries. Having offices in water pressed countries such as India and large economies like the U.S. will make it cheaper for Israel to export their technology. The fact that these countries are already turning to Israel to improve their systems shows that they do not have the resources at home or that the available resources are too costly. This means that Israel can leverage its position to strengthen it's current relationships as well as marker it's industry to other parts of the world who face similar water needs as India and U.S. especially when it comes to agriculture and drip irrigation.

5: Key Success Factors

The Key Success Factors (KSF's) help identify and lend insight into what Israel needs to do and to continue to do in order to be successful in the water industry. The KSF's are grouped into two categories: Internal KSFs, which suggest what Israel needs to do, and external KSFs that outline external factors which will increase the global demand for water. Demand for Israel's technologies and management techniques are the fundamental KSF, however in order to facilitate this there needs to exist certain conditions.

- **Venture into international partnerships**: To increase awareness of technological developments. Developing global partnerships will help improve Israel's export initiatives and give it access to information on foreign markets thereby helping it devise a more calculated entrance strategy.
- **Continued R&D initiatives:** Will help Israel remain innovative. With innovations come new opportunities, which are difficult to do without extensive Research and Development. Universities are the first step toward technological developments. R&D collaboration between Universities, government and private companies will encourage new ideas and make it easier to bring new products to the market place.
- **Attracting international investors:** While Israel devotes many capital resources to its water technology sector there remain gaps that can be bridged with investment from international investors. Furthermore, international investors will

have vested interests and will extend their resources and knowledge in order to help Israeli companies succeed. Specifically venture capitalists who are highly involved in the projects that they invest in will serve as invaluable strategic alliances for Israeli companies.

- **Cost of water continues to rise:** Creates a need for water technologies and demand management techniques. With rising costs, countries, businesses and municipalities will have more incentive to be less wasteful and more efficient with their water supply. This KSF will most likely pertain to the exportation of water demand management and drip irrigation as they help optimize water use and create a cost-effective way of using water.
- **Water resource depletion:** The advent of global warming and excess water use should continue to strain water resources. This will increase global demand for water technologies and will serve as an opportunity for Israel to lend its expertise in providing new and innovative ways for creating and preserving water supplies.
- **Improve political relations with Middle Eastern countries:** Israel's geographic location and regional climates serves as a large market. The entire Middle East is stressed for water while the population continues to grow. Without the proper diplomacy initiatives, Israel will miss a large market. Improving relations with its Arab neighbours will help Israel further their water industry because of the geographical proximity and similarity in culture.
- **Strict government water regulations:** Israel already operates under tight government controls. If other countries adapt these policies, they will have a need

for better water purification technologies, which are currently being utilised in Israel.

- **Leverage NASDAQ Success:** Israel has the second most non-American companies listed on the NASDAQ, next to Canada. By continuing to list water-tech companies, Israel can gain access to more capital and increase exposure of its developments.
- **Marketing Initiatives:** Israel needs to develop marketing strategies that showcase their water industry. Especially in areas where they are leaders, like drip irrigation, they need to be able to market their technologies and describe their benefits. This can be done through conferences, seminars and trade shows.
- **Awareness of water scarcity:** To create demand for ways of conserving and reusing water supplies. Without awareness of the need to improve current global water utilisation there will not be demand for better more efficient methods.
- **Water Conferences:** Creates a platform for different actors in the water industry to come together and share resources and form partnerships resulting in potential technological breakthroughs and water use improvements. Water Conferences are listed as both an internal and external KSF because Israel can organize them at home and attend foreign ones.

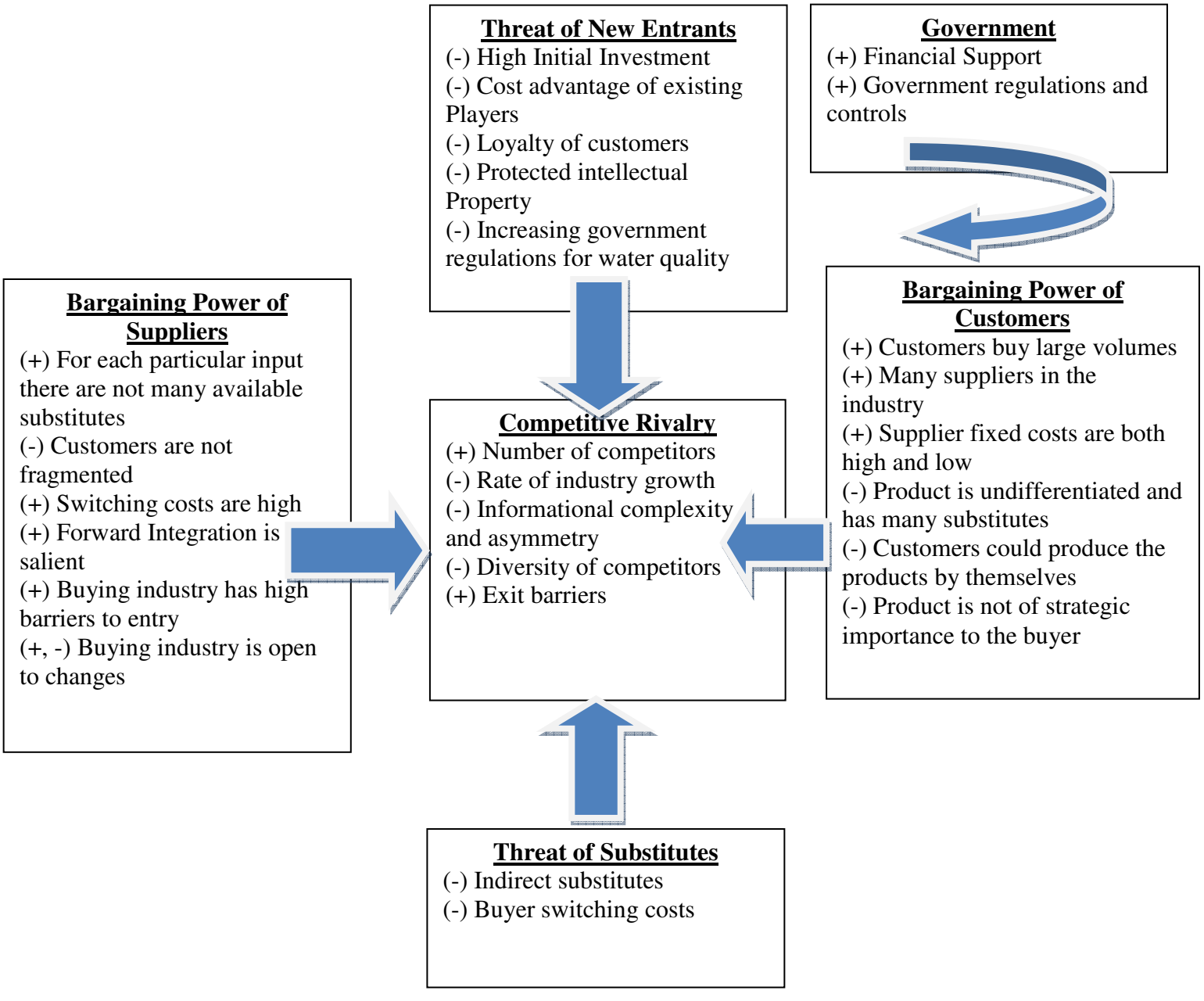
Table 1: Key Success Factors

Key Success Factors
Internal Forces • Venture into international partnerships • Continued R&D initiatives • Attracting international investors • Improve political relations with Middle Eastern countries • Leverage NASDAQ success • Marketing Initiatives • Water Conferences
External Forces • Cost of water continues to rise • Water resource depletion • Strict government water regulations • Awareness of water scarcity • Water conferences

6: 5 Force Analysis

In order to understand the opportunity available to the Israeli Water industry Porter's 5-force analysis plus government will be used to explore export opportunities.

Figure 1: Porter's 5-Force Water Industry Analysis



6.1 Bargaining Power of Suppliers

The world water market is made of many suppliers that range from infrastructure development to drip irrigation technologies. The many suppliers operate on different levels meaning they end up being complimentary to each other rather than substitutes. This is because the water industry encompasses many smaller niche industries.

(+) For each particular input there not many available substitutes. Especially within the technology sector of the industry, they require standard inputs in order to ensure that it works properly. This increases the bargaining power of the supplier because the buyer needs a specific technology or management technique in order to solve their problem.

(-) Customers for suppliers in the water industry are generally not fragmented. The key to the industry is sharing available knowledge and resources, which are established through relationships and partnerships. This in turn creates a customer base, which is deeply involved and at times collaborative with the suppliers. The customers are not really fragmented because many contacts are extended from level of the water industry to another. India is increasing drip irrigation methods as well as water management process. Since both products are being utilized in India, the buyers are likely to have access to each other. This is a common scenario across the whole of the industry.

(+) For the entire industry, switching costs are high because of the technology used. Understanding and implementing the technology requires a steep learning curve, which would make it costly for customers to switch to different suppliers. Furthermore, the Industry is highly dependant on relationships and partnerships making the actors in

the industry less inclined to switch suppliers. Instead, they will be more likely to try to solve whatever bottlenecks arise instead of switching suppliers.

(+) **Forward integration is salient in Israel's water industry**. Specifically with the national water company, Mekorot, there are many divisions, which are integrated in order to bring products to the market. Beyond Mekorot are water hubs that bring Israeli companies together in order to make products cheaper and more accessible. The Ashkelon desalination plant has the stake of various companies that contributed their technology and expertise making the plant the producer of cheapest desalinated water in the world. This essentially has allowed them to reach economies of scale by providing a new water source (Salt Water) at a relatively low price.

(+) The buying industry has high barriers to entry. Most of the buyers are local governments and businesses that use the technologies, management practices and infrastructure improvements to supply water to their local populations. Furthermore, implementing new processes such as drip irrigation and desalination have higher up-front costs, which may inhibit acquisition of these products and services.

(+, -)The buyer industry has only recently become open to changes and improvements in the water industry. The reason for this is that the costs to revamp traditional agriculture methods and water infrastructure design are costly. With the increasing need of water resources, buyers should be more amendable to accepting efficient methods of water use.

Overall, the bargaining power of suppliers is high. There are many actors in the industry however many of the successes are leveraged on relationships and connections

making it harder for buyers to switch. Furthermore, the water industry is growing and it is fundamental in overcoming pressing concerns for depleting water resources.

Identified Key Success Factors:

1. **Developing breakthrough technologies:** will give Israel's water industry a competitive advantage and give the suppliers more bargaining power in the global industry.
2. **Partnerships:** Help maintain economies of scale in order to keep costs down and profit margins up.
3. **Effective marketing:** Will demonstrate the value of improving water management techniques and create exposure and more willingness of buyers to adapt these products and services.

6.2 Bargaining Power of Customers

The customers in the water industry generally refers to governments who are purchasing new water systems to improve water efficiency and companies who need to either improve agriculture methods with such technology as drip irrigation or private companies who sell water to local municipalities. Different countries are governed by different water laws, which determines who controls the supply and distribution of the resource. This section will attempt to analyse the bargaining power of customers comprehensively while also applying a framework on how Israel can capitalise.

(+) Customers buy large volumes. This generally holds true across the entire industry. Changing water infrastructure is a lengthy process, which requires extensive resources and management practices. Whether it be water transport systems or desalination plants, buyers are likely to buy large quantities. In turn, the customer must commit to invest time and capital in these changes giving them more bargaining power over suppliers.

(+) There are many suppliers in the industry. This acts as an advantage to the customers. There are many suppliers for many products in the water industry. Customers are free to explore their options however in the overall Industry there are leaders, which make certain suppliers more coveted. Israel for example, is a leader in drip irrigation, and has more experience in this water technology making it a more likely supplier.

(+) Supplier fixed costs are both high and low. For the technology sector of the water industry, fixed costs are relatively high because of R&D investment. In order to continue to improve water techniques there needs to be sizeable investment in R&D. Aside from the technology there are high fixed costs associated with water consulting management practices as well as infrastructure suppliers. Manufacturing plants that supply pipes and tubes have high overhead costs such as lease space, energy costs and labour. This results in a pressing need to recoup fixed costs giving buyers more bargaining power.

(-) Product is undifferentiated and has many substitutes. Under the current strains for more efficient water use, there are not many substitutes. Buyers can leave their current infrastructure, as is however, in the long term this will be detrimental because of the fast depletion of water resources. Instead of adapting new technologies, customers

could potentially excavate for new water resources but this is unlikely to be an effective substitute. The world's water sources have been strained in searching for new water supplies.

(-) Customers could produce the products themselves. The agriculture industry and governments are not likely to produce these technologies themselves. Both operate within a specialized area and do not have the resources needed to produce the products themselves. In the case of the governments, they operate on in order to fulfil social needs and do not invest as heavily in R&D as private companies would. Although farmers might have some of the knowledge to produce a selective amount of the technologies, they remain inhibited by the fact that it is easier for them to purchase the technology and focus on farming and selling crops rather than developing new agricultural technologies.

(-) Product is not of strategic importance to buyer. The buyer has low bargaining power as the water industry is growing at a high rate because of its strategic importance. The water industry serves the customer on different levels. The primary one is that useable water is limited and there is a need to preserve current sources while creating new ones seen in desalination technology. Another is that the growing water industry is more sustainable causing less environmental damage. With the increasing trend in sustainable initiatives, and need for useable water, the water industry is of highly strategic value to its customers.

Overall, the bargaining power of the buyer is low to medium. There is an undeniable shift to improve water efficiency and with that comes the pressing need to adapt new technologies and water demand processes.

Identified Key Success Factors:

1. **Create products that improve efficiency:** There needs to be an inherent value that serves the needs of the buyer. Without a value proposition that is difficult to substitute, the water industry will suffer.

6.3 Threat of New Entrants

The water industry is globally pervasive and its scope is wide covering many technologies and products. The threat of new entrants affects some parts of the water industry more than it does others,

(-) High Initial investments. High start-up costs are prevalent in the water industry. Since lot of the success is dependant on technological advances companies must invest large sums of money into R&D. Furthermore developing the necessary connections to enter the industry also involve a large devotion of resources. The cost to companies makes the entrance into the industry a relatively low threat. Using different resources, Israel has invested a lot of capital into its water industry, which has helped it be successful.

(-) Cost advantage of existing players. Many companies have established themselves in the industry and command a large advantage because of their expertise and resources committed to their products. An example is Netafim who invented drip irrigation and currently control half of the global market.

(-) Loyalty of customers. This serves as an advantage to Israel because they have already garnered international attention and forged valuable relationships in India and China. This makes it more difficult for companies to enter the market because of the level

of customer loyalty. Given that the nature of the industry is highly collaborative, both buyer and seller need to have loyalty to each other.

(-) Protected intellectual property. Much of the industry is dependant on innovative technologies. Patents help maintain the integrity of the industry and are used to protect competitive advantages. Much of the global water industry is protected by patents, which essentially inhibit new entrants from penetrating the market place.

(-) **Increasing government regulations for water quality.** Many governments are calling for tighter regulations on water quality. This is in response to threats such as global warming and the need to improve water supplies, especially in the developing world. In order to enter foreign markets water companies will increasingly need to comply with government regulations that call for high standards of operation for products and services. Since Israel already operates under tight government controls, Israeli companies will be at an advantage in entering foreign markets.

Overall, the threat to new entrants is relatively low. The need to build relationships, Invest in R&D and abide by government regulations makes it difficult to enter the market successfully.

Identified Key Success Factors

1. **Learn about foreign government regulations:** This will help the Israeli Water industry to expand into other markets. Knowing and understanding government controls will create an advantage in the global water industry.
2. **Protect Competitive advantage:** Patenting all new technologies is essential in protecting competitive advantages. The Israeli Water industry

must protect its innovation and knowledge in managing and improving water supplies.

3. **Expand business relationships by leveraging current ones :** Continuing to build a wider customer base will make it more difficult for companies to enter the market thereby creating more opportunities for profit.

6.4 Threat of Substitutes

Substitutes are similar in function and can readily replace an industry's product. As defined earlier the water industry comprises all the actors that are involved in treating, transporting, preserving and securing water resources. As of now, there are no immediate substitutes for water making rendering it a low threat for the entire industry.

(-) Indirect substitutes – There are currently no direct substitutes for water. There are however limited indirect substitutes in the water industry. One substitute might be companies that specialize in water exploration. The discovery of new freshwater water sources could potentially replace technology that specialises in water reclamation. The hypothetical new water sources will still need to be transported which will require the services of actors in the water industry. New water sources might inhibit the reuse of water and stifle the water industry's growth although this outcome is unlikely. In short, the only substitute for the current water industry is to leave water infrastructure as is and to continue to deplete natural water resources.

(-) Buyer switching costs. Switching costs are most applicable to the industrial sector. Manufacturers could conceivably find alternative ways of production without using less water. This however will require high switching costs. Assuming that

manufacturers switch their operational processes to use less or no water than they will still need to pay for their new technologies and learn the process in which their businesses operate.

Ultimately, the threat of substitutes is low because there are no direct substitutes and any of the indirect substitutes rely on some level on the water industry.

Identified Key Success Factors

1. **Global awareness of lack of water substitutes:** Stressing the danger of diminishing water resources across all sectors: industrial, household, agriculture. This can be achieved through marketing campaigns, public service announcements and conferences.

6.5 Competitive Rivalry

Competitive rivalry refers to the level of competition amongst current actors in the industry. Rivalry can often make an industry less desirable as many businesses chasing the same competitors will effectively lower profit margins. Rivalry can however act as a catalyst to technological advancement. In order for businesses to gain a competitive advantage, they will need to either innovate and be product differentiators or restructure operations and compete on cost.

(+) Number of competitors. The global water industry has many competitors. The need for water management is pervasive across the globe. The industry is not limited to any one region. Certain technologies can be more clustered such as drip irrigation in

Israel however there are essentially many companies that also develop similar if not the same technologies. The water industry has many competitors within each sector. For the most part rivalry is high because demand is growing and many large corporations are creating subsidiaries that specialize in water demand management.

(-) Rate of industry growth . The water industry is one of the fastest growing sectors and is expected to grow between 7-8% for the next 10 years. The rate of growth will undoubtedly decrease rivalry. With the growing need for resources and outdated infrastructures, demand will continue to increase and the opportunity for many companies to profit will decrease rivalry.

(-) Informational complexity and asymmetry. Information availability and asymmetry of knowledge make rivalry less prevalent. Many actors in water economy specialize and continue to develop resources in one area in the water economy. Israel is unique in this case because many resources are shared across the entire industry giving companies access to each other creating an industry conducive to innovation and improvement.

(-) Diversity of competitors. The water industry is made of different actors and is segmented into many functions. Transport systems, drip irrigation, water security software and desalination technology are just some of the diverse players in the water industry. The depth and vastness of the industry keeps rivalry relatively low because each actor is vying for a different segment in the water industry. Furthermore, the diversity of the industry creates opportunities for collaboration. A major water management revamp will require many of the actors to co-ordinate together to improve a current system. In

India, major changes in water management are taking place ranging from infrastructure overhauls to improved reclamation strategies.

(+) Exit Barriers. Many of the companies in the water industry specialize. This means that they devote many capital resources into R&D and infrastructure development. This consequently makes exit barriers are relatively high.

The rivalry between existing competitors is not a major threat in the water industry. The diversity and breadth of the industry allows each actor to specialize. Furthermore, the industry is growing rapidly which means that the industry has enough demand to support the growing number of competitors.

Identified Key Success Factors

1. **Continue to develop and innovative new products:** Israeli companies will be able to further differentiate themselves and create a niche if technological breakthroughs are realized.
2. **Collaborate as complementary products:** The water industry encompasses many smaller industries. If these smaller industries such as infrastructure and water reclamation partner they can promote each other as complementary products and increase profits across the entire industry.

6.6 Government

With any major industry, the government is highly involved and influential. Through taxes, regulations and partnerships, the government has the power to dictate the

success of an industry. The scope of control spans across all government agencies: federal, provincial and local. The water industry spreads across the globe, making many governments intertwined in the industry. A plus (+) in this section indicates that the force is strong and that industry actors must consider government impact in shaping the industry

(+) Financial Support. Since many water companies are formed to solve the problems of their local water supplies, much of their development is dependant on government financial support. Once these governments help start-up these projects and the businesses become sustainable they are able to enter the export market. This benefits the water companies because they can devote more in-house resources to R&D rather than focusing on raising capital. Netafim's drip irrigation technology received initial funding from the government and it is now an established world leader in drip irrigation. Government funding is strategic in the global water industry because it helps companies improve, develop and export their products.

(+) Government regulations and control. Each country is controlled by its own set of regulations that govern the water supply. Whether it is in regards to water quality or zoning permits, government regulations are strategic to the success of the water industry. If water suppliers and service providers fail to meet government regulations than they will be unable to profit from global demand. Formatting products and services to fit the requirements of international laws will help improve profitability. Israeli businesses have an advantage as the government enforces strict regulations on water quality.

Government controls also extend to diplomacy. If political relations are not diplomatic than the ability for two countries to engage in business activity is strained. Israel's political relations with most of the Muslim world are hostile making business initiatives between these countries difficult or non-existent.

If governments want to protect local businesses, they can also impose tariffs on imports. Since most businesses pass on their tax costs to the customers, they would be forced to sell their products for more expensive. This would result in less demand, especially if customers can get their products from local sources. While the water industry generally competes on product differentiation and innovative solutions, government taxes increased government taxes would cut into profit margins and make export initiatives less desirable.

Overall, the role of the government is influential and strategic in the global water industry. On almost every level of the industry, there are government regulations and investments that steer the profitability of the industry.

Identified Key Success Factors

1. **Understand international regulations:** This will ensure that Israeli companies are operating within the legislative framework of the countries in which they do business.
2. **Improve political relations:** Water companies can lobby the government to open business channels in Muslim countries. While the issue is complex, a resolution would be beneficial to Israeli companies opening up an entire new market.

3. **Forge government partnerships:** Conveying the value of partnerships between governments and the water industry will help secure funding and other resources needed to be successful. Like Watec or Mekorot, governments can provide a platform needed to exchange ideas and resources.

7: National Water Programs and Partnerships

7.1 NewTech Israel

Israel has developed programs, which brings people from the water industry together in order to share their expertise. One of the big national initiatives was the development of Novel Efficient Water Technologies (NEWTech) (Dan Yaron, 2002) which acts as a portal to the entire water industry together (Kantor, 2009). Recognizing that Israel has the potential to be a global leader in the growing global water technology sector, The Israeli government invested heavily into the project. By creating a central system where actors in the water sector can interact and share information, Israel has been able to expand its expertise in the industry.

7.2 Watec

WATEC Israel 2009 is an international professional exhibition that offers a meeting place for manufacturers, researches, investors, academics, purchasers and decision makers representing both local and international economies. The original initiative was exclusively developed for Israel however with the increasing need for water supplies and management training the conference became international. It displayed Israeli ingenuity and created a platform where the water industry could meet and help improve global water supplies. Taken from the Watec-Israel website the following is a list of some of the accomplishments of the conference, which support Israel's goal in becoming a leader in the water industry. The list demonstrates the influence that Watec has on the entire world

through the diversity and number of parties in attendance: 2,000 foreign water and environment industry experts and decision makers from 81 different countries participated in WATEC 07

- Ninety-four percent of the exhibitors affirmed WATEC 07 as a very successful event (4.28 out of 5) and stated they have made new contacts with potential clients during the event. Most exhibitors opined the visitors as very professional and industry involved.
- 1,650 business meetings were scheduled during last WATEC
- 1,900 participated in the Professional Conferences led by 130 worldwide keynote speakers

7.3 University Involvement and R&D contributions

Due to Israel's dearth of water supplies, many universities have devoted their resources to R&D to deal with the enduring threat of water scarcity. Israel commits the most money out of any country as a percentage of its GDP, allocating 4.8% of its GDP to R&D, according to IMD world competitiveness yearbook 2007. Israel exports billions of dollars of technology through which it gets plenty of support from Academia. . The Department of Soil and Water Sciences in the Hebrew University's Faculty of Agriculture in Rehovot has committed research ideas in order to help Israel's agricultural sector. Similarly, the Zuckerberg Institute for Water Research at the Ben Gurion University of the Negev's Jacob Blaustein Institute of Desert research in Sde Boker has been pivotal in dealing with Israel's Dessert landscape. The Stephen and Nancy Grand Water Research Institute at the Technion work closely with the Mekorot Water Company

sharing resources and technology in order to meet Israel's water needs and promote Israeli technology and expertise in water resource management (The Stephen and Nancy Grand Water Research Institute, 2009). Historically, start-up companies especially in the technology industry were established through research and patents developed in some of Israel's leading academic institutions. Volcani Center which is an arm of the Ministry of Agriculture's Agricultural Research Organization is made of 200 PhD scientists and 300 engineers and technicians. The center is dedicated to researching new ways in order to help preserve Israel's water supplies while making the land more fertile. Many programs throughout Israel are in place in order to promote entrepreneurship and innovation combining University research with start-up business acumen. The collaborative process helps Israel continue to develop its water resources and expand its knowledge to other countries and companies.

8: Venture Capitalists and Investments

The success of Israel's Water Industry cannot be solely attributed to the extensive research, innovative spirit and historical needs of the country. In order to bring the developments into fruition there needs to be funding that can support these ongoing projects. Aside from heavy government assistance through both government wings and the Mekorot Water Company Israel boasts a pool of Venture Capitalists and private investors devoted to developing Israel's water market through funding and business consulting. **.** There is a growing market and part of Israel's success depends on the willingness of investors to devote capital to these projects.

Israel is ranked 2nd in the world for Venture Capitalist funding next to the U.S. Six venture capital funds in the water and clean tech sectors were able to raise $300 Million in capital for Israeli start-ups and later stage development companies (Water The Israel Experience, 2009). Aside from the available capital within Israel from clean-tech venture capitalists, Israel has been recognized for its outstanding water technology by garnering investments from other countries. Recently a conference held in Toronto called "Israel's Water Technology: Solutions for a Thirsty Planet" was sponsored by the Government of Israel's economic mission to Canada. The conference was established in order for Israel to help raise more money for water technology. Booky Oren, formerly the CEO of Mekorot, is the CEO of the Arison Israel Water Initiative, a private holding company that invests in water equipment and related technologies. Canada's outdated water infrastructure can be overhauled with the help of Israeli firms. In order to do that

money needs to be invested In the Israeli water industry. In 2008, Canada invested $100 Million in Israeli firms focusing on water technology.

Water technology oriented incubators were established in order to provide a business commercialization framework for Israeli scientists and entrepreneurs in order to bring their technological advancements to the market place. The biggest incubator is the Kinarot Jordan valley Technological Incubator. The program is exclusively dedicated to water technology and is the biggest investor of seed capital for water technologies worldwide (Overview, 2009). Founded in 1993 in order to deal with the influx of educated Soviet migrants and provide them with work, Kinarot was sold to the Canadian investment company Stern Group for $25 Million in 2006. The company has extensive business experience, with their stand-alone companies' annual revenues ranging from $15Million - $200 Million. The company is backed by an advisory board made up of leading academics and industry leaders and has strategic partnerships with Mekorot (Israel National Water Corporation), Water and Energy Technology (WET) Incubator in California and the L.A. City Water and Energy Department, the largest water utility in the States (Overview, 2009).

9: Global Water Need

The world is experiencing severe shortages of water. Arid regions have been forced to change their infrastructure in order to support their local populations. With global warming and depleting resources, water is set to go from an expendable free service to a valuable commodity. Because of contaminated water sources, World demand for chemical and non-chemical water treatments is projected to increase 6.4% per year to nearly $40 billion in 2011 according to the Fredonia Group. The need for water technologies and management strategies will be particularly prevalent in emerging market countries such as China and India where growth in the water industry is already seeing levels of nearly 60% (Morris, 2009)**.**

In order to feed the growing population of the world there needs to be more efficient ways of bringing water to a starving global population. The UN-backed World Commission on Water estimated in 2000 that an additional $100Billion a year would be needed to tackle water scarcity worldwide. This is a much larger amount than the estimated $20Billion needed for preventative measures aimed at fighting HIV and Aids, according to the Commission.

Water scarcity is the result of simultaneous global trends, which are detrimental to the water supply. The first is the occurrence of urbanization whereby there is mass migration into city centers. In 1950, there were only 86 cities with a population of over a million, but this figure had risen to 387 by 2000. This makes it essential for water

transport systems to be able to provide this growing urban population with the required water supplies. Along with the soaring urbanization is the increase in demand for food. The world population is growing and demand for food is expected to be 55% more in 2030 than it was in 1998 according to the Food and Agriculture Organization (FAO). To put things into perspective it takes roughly 1000L to produce 1KG of bread with optimal water use. The increasing need for food will seriously deplete water resources creating urgency for water technologies, which provide optimal productivity for water supplies (Wild, 2007)

To add to the global need of water is the inefficiencies of the currently outdated infrastructures. Most of the water infrastructures are built to last 60-80 years and many are approaching or have passed their lifeline. The U.S. environmental protection agency EPA identified the need for maintenance of the water infrastructure citing if spending remains at the same levels for the next 20 years the U.S. government will lose roughly $540 Billion. In London 800 Million Litres of what is lost per day because of the severe leakages while in countries like Spain and France 30% of water is lost before it even makes it to the consumer (Wild, 2007). The problem of lost water through inadequate infrastructure is a growing concern that will eventually need to be addressed regardless of the front-end costs. In 2006, Israel exported $243 Million in valves and meters, while filters and pipes accounted for $108 million, together making up 39% of Israel's water industry exports for the year (Water The Israel Experience, 2009).

10: Conclusion: Opportunity for Israel

The global water market is valued at $400-$500 Billion, the fifth largest market in the world, trailing only Energy, IT, Cellular Telephony and Pharmaceuticals. The industry is growing at a relatively fast rate of 7-8% a year compared to the energy industry's growth of 1 percent annually. The global demand coupled with Israel's expertise and experience gives it an advantage in becoming one of the global leaders in the water market. Already dominating the drip irrigation market, netting $900 Million, and boasting the world's largest reverse osmosis desalination plant which produces the cheapest desalinated water, Israel has garnered support from emerging economic powerhouses such as China and India while also developing collaborative programs with the U.S. and Canada (Sandler, 2005). Through government programs such as Watec, The national company Mekorot, University partnership and clean tech investments Israel will be able to continue to bring innovative technologies and management processes to the global market place. The inevitable transition of water from a perceivably abundant resource to a scarce commodity will effectively create more business opportunities while also helping improve the environment.

There are still barriers and room for improvement in order for the country to secure its position. Firstly and possibly the most important goal of the entire water industry is to create awareness for improved water management and the consequences of water scarcity. There are countries that are not yet pressed to preserve their water resources, such as Canada and Switzerland, who have relatively easy access to fresh

water resources, making them less inclined to adopt these new technologies. Specifically, drip irrigation technology is underutilized worldwide and despite its success in countries where it is implemented it has yet to replace current less efficient methods of irrigation. Israel needs to create more partnerships with governments and businesses showing them the economic and social effects that drip irrigation has in the long run despite the initial upfront costs. Without global awareness campaigns, Israel leaves the opportunity for other countries to replicate its technologies and overcome it s first-mover advantage. Creating partnerships and public campaigns with local governments will help create demand for these technologies.

Continuing to attract investors will be another major source in Israel's pursuit of gaining share in the water industry. Similar to the conference held in Toronto, Israeli companies need to continue courting new investors. Despite the "green tech" capital already available in the country, Israel can push more aggressively for foreign investors to not only fund the projects but also contract the investors' business skills, which would help market these technologies in other countries. Foreign venture capitalist investment would increase international interest in Israeli technology and create awareness of the pressing need for more efficient water management strategies and technologies. Venture capitalists continuing to develop partnerships through water programs would help strengthen Israel's presence in the water industry. Mekorot recently had 250 proposals for joint ventures and has begun work with 30 who have passed the screening process. Branching out and extending business networks similar to Mekorot's, whether through public or private companies, will help expand Israeli water exports.

The groundwork for Israel to thrive in the water industry has been established. Government legislation, venture capital, university joint programs and entrepreneurial activities have brought the Israeli water industry forward. The success of Israel's water industry is founded on the need to create awareness, exposure and necessity for global water resources. By further developing international partnerships with governments and businesses, Israel has the potential to be a global leader and primary supplier of water technologies and management techniques helping curb the environmental effects that current water strategies produce while also strengthening Israel's, and the worlds, economy.

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