

Linking Water Research and Policy

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I. INTRODUCTION

Given the precarious situation of the water sector in the Arab region, the region should have become, in theory, a water “Silicon Valley”, generating cutting-edge water science, innovative solutions, and new pathways to address the region’s water challenges. Today, this is not the case. Despite some progress, the regional overall knowledge index (including water sciences) remains one of the lowest in the world (World Bank, 2008a). As a result, demand for water research is not yet a systematic component of the water policy cycle even among government agencies that provide funding to research organizations. Underfunded, understaffed, and poorly performing research organizations continue to dominate the regional water research landscape with a few bright spots (Taylor et al., 2008). The weak condition of the region’s water departments at national universities and research centers is compelling some Arab governments to seek the expertise of consultants from outside the region to fulfill the demand for strategic water resources management plans. The high demand for key water policy documents by policy-makers combined with the weak state of water research centers make the debate on linking water research to policy a top priority. Research and innovation are critical to setting the stage for effective water policies that ensure sustainability, efficiency, and equity in access and use of the scarce water resources available to Arab states.

In line with this, in his opening remarks of a Board of Governors’ meeting of the Arab Water Council in the city of Alexandria in June 2007, Sadeq Al Mahdi, the former Prime Minister of Sudan, made a very simple but eloquent statement: “Unless good science is a key demand of the policy-makers in order to choose between policy options, all efforts to reform the water sector in the Arab region will be like flowers in the desert, wasting their perfume.”

Our research has demonstrated that there is little effort to link science to policy in the Arab region particularly in the water sector. The linkage between science and policy can have a significant contribution in improving both water governance “as a process” of decision-making and power sharing and in water management “as a result of that process” (Laamrani et al., 2008). This is evidenced by Carden (2009) in his book devoted



fully to this topic reflecting on linking knowledge to policy based on 23 country case studies across the globe including some from the Arab region: “Research can contribute to better governance in at least three ways: by encouraging open inquiry and debate, by empowering people with the knowledge to hold governments accountable, and by enlarging the array of policy options and solutions available to the policy process.”

The *raison d’être* of research organizations is simply to generate new knowledge that societies can utilize to address socio-economic development challenges. In this sense, the Arab region has excellent individual technical competences in the water sector. The current gap is more about the institutionalization of science and innovation. The Arab region lacks a critical mass of world-class researchers that is needed to build water research organizations. Therefore, the ability to sustainably produce cutting-edge science to influence policy-making is weak. What it needed to address these shortfalls is what this chapter aims to examine. The intention is to shed some light on how research and policy in the Arab region can mutually guide and feed each other in order to work “in series” instead of working “in parallel”. We intend to challenge some taken-for-granted assumptions about research and policy that might not hold true at least in the context of some Arab countries based on recent work pioneered by the Water Demand Initiative for the Middle East and North Africa WaDImena.

II. RESEARCH AND DEVELOPMENT IN ARAB COUNTRIES: WHERE DO WE STAND?

Water research and scientific innovation in the region is part of a deficient research system. Indeed compared to other regions and countries of the world, excluding Africa (not including South Africa), the Arab region is on the bottom of the world scale in science and technology as reported by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Institute of Statistics (UNESCO, 2001). As shown in Table 1, Arab states rank low relative to all regions of the world in the global share of research and development (R&D) expenditure, in gross domestic expenditure in research and development (GERD) as a percentage of the gross domestic product (GDP), in the number of researchers per million inhabitants, and in R&D expenditure per researcher. The contribution of Arab states to the world production of science and technology publications, patents, and exports of high-technology products was too insignificant to be detected or reported. In contrast, very high shares of these indicators are scored by countries

from North America, Europe, and Asia which is clearly reflected in their high level of socio-economic development.

The poor position of Arab states in their contribution to science and technology (S&T) has unfortunately continued to appear in all of UNESCO's science reports with minor fluctuations from the indicators shown in Table 1. As an example, Badran (2005) provided a comprehensive report that reviewed the state of science in Arab states. The author stated that the region today exhibits poor performance in science and technology due to political turmoil, low quality education, and inadequate R&D infrastructure. He concluded that the Arab region has failed to deliver the high-quality scientists it needs to build economic self-reliance and capacity for innovation in the region. The indicators quoted for water for the year 2000 in this report showed comparable poor figures to those compiled in table 1 (1996/1997): There is no change in GERD as a % of GDP; the number of researchers per million inhabitants has decreased to 124; and the expenditure per researcher has only increased to US\$48,000 as

TABLE 1

THE STATE OF SCIENCE AND TECHNOLOGY RESEARCH SYSTEMS IN ARAB STATES COMPARED TO OTHER REGIONS OF THE WORLD

Region/ Country	Share of world R&D expenditure in 1996/97 (%)	GERD as a % of GDP	Researchers per million inhabitants	R&D expenditure per researcher (10 ³ US\$)	World production of S&T publication (%)	Patent world share (%)	
						EPD	USPTO
USA	36.2	2.6	3698	203	36.6	35.2	51.5
Europe	28.8	1.7	2476	89	37.5	46.3	19.2
Asia	27.8	1.3	537	85	15.2	15.5	27.5
Latin America and Caribbean	3.1	0.5	715	48	1.8	0.2	0.2
Africa (excluding Arab states)	0.5	0.3	113	49	0.7	0.2	0.1
South Africa	0.4	0.7	1031	49	-	-	-
Arab states	0.4	0.2	356	24	-	-	-
World average	100	1.6	946	105	-	100	100

Key:

R&D: Research and Development

GERD: Gross Domestic Expenditure in R&D

GDP: Gross Domestic Product

Source: Adapted from UNESCO (2001)

S&T: Science and Technology

EPD: European Patent office

USPTO: United States Patent and Trademarks Office

BOX 1: LIMITED HUMAN AND FINANCIAL RESOURCES LEAD TO LIMITED IMPACT

A study by Taylor et al., (2008) revealed that water research organizations in the Middle East and North Africa (MENA) region are hampered by the following constraints:

- The unavailability of a critical mass of competent researchers in the region.
- The management and leadership of research organizations are ineffective.
- The linkages between research and policy communities are not established.
- Career opportunities in the region for researchers may not be compelling enough to retain them.
- Limited connectivity to international research communities hampers professional growth, learning, and exposure to new ideas, all of which are vital to the success of careers in research.
- Many organizations in the region lack an internal research agenda that is “owned” by the organization itself. Many research organizations feel obliged to follow donors’ agendas, which are not necessarily aligned with community or national needs. Consequently, researchers may feel “sub-contracted” to pursue the agenda of others, leading to frustration and a sense of disempowerment.
- Organizations whose primary goal is to influence policy will often resort to recruiting well-connected and reputable researchers in order to increase policy-makers’ confidence in their research. However, reputation in the Arab region seems to be closely associated with seniority rather than performance in terms of relevant, high quality research. The importance of seniority appears to make it difficult for young researchers to attract funding or support for their own research ideas (Taylor et al., 2008).

compared to US\$238,000 in USA. The report confirmed the same low levels for 2000 in all other indicators and gave more quantitative details about these indicators in different Arab countries. For example, Saudi Arabia showed good progress in registered patents (67) for the period 1995-1999, compared to all other countries in the region. However, the Republic of Korea and Israel registered 9984 and 3076 patents, respectively, in the same period. Furthermore, member countries of the Gulf Cooperation Council (GCC) indicated higher users of Internet in 2003 as a percentage of population, compared to other countries in the region. The report also indicated poor performance by the countries of the region in two other indicators: translation and

publication of scientific papers, and number of cited articles in reputable journals. For example, the number of frequently cited scientific papers per million inhabitants amounted to 0.02 in Egypt, 0.07 in Saudi Arabia, 0.01 in Algeria, and 0.53 in Kuwait compared with 43 in the USA and 80 in Switzerland.

While significant progress in different regions is taking place with regard to the performance of research organizations in different sectors where water resources are used, such as in agricultural research, limited progress in general is witnessed in the Arab world (World Bank, 2008b). A 2008 conference organized by UNESCO, the Arab League Educational, Cultural, and Scientific Organization (ALECSO), and the Arab League of States noted the slow pace of change in the role and capacity of R&D to change realities in the Arab region with water research not being an exception. In his report to the meeting, Saleh (2008) stated that national science and technology policies were lacking, coordination among research organizations was absent, and research data were unavailable.

III. WATER RESEARCH INSTITUTIONS: LIMITED ASSETS, LIMITED PERFORMANCE

In most Arab countries, water science and research organizations are functioning as adjuncts to agricultural research, civil engineering schools, and infrastructure research organizations, and rarely operate as standalone entities. The main mandate for many of them is for higher education with a research agenda left to the will and personal interests of the teaching staff. The low priority given to water research organizations is not commensurate with water’s critical role in securing livelihoods, public health, and development.

A typology of assets and constraints of national water research organizations is elaborated by Taylor et al., (2008) in Box 1. The authors pinpointed a set of key constraints affecting the performance of research organizations and their ability to influence policy formulation, implementation, and evaluation.

The Arab region has to engage strategically in

building a new generation of water researchers. There is an urgent need today for water researchers who are well-trained as engineers and scientists with proven records of performance, but who also possess a very good understanding of the policy environment. Universities and engineering schools in the region could adopt dual degree programs combining doctoral studies in an engineering discipline and a professional graduate study program in public policy. Moreover, research managers need to have sufficient exposure to the business model of “science parks and incubators” emerging in countries like Egypt, Jordan, Morocco, and Tunisia.

Aside from the competence and capacity of researchers and scientists, the capacity of water research organizations to retain talents (see Box 2) and funding mechanisms are key challenges. Core funding often comes from government agencies. But public funding is constrained and often drops off over time. This makes any forward planning typically short term, ad hoc, and uncertain. Unless research is considered central in setting water policy, water challenges are not likely to be addressed soon.

Water research organizations that are able to attract external funding typically perform better. Individuals and organizations that are able to compete for international funding opportunities continue to attract funds that allow them to conduct research that otherwise would not have been possible. Some of this research has generated findings that can be used to influence policy-making with support from donor organizations. For example, international organizations have contributed significantly to making water demand management a central component of water reforms, according to the study on the political economy of water demand management.

However, Taylor et al. (2008) have indicated that some researchers interviewed expressed reservations about the real impact of international funding on public policy considering that the agenda is not set based on national needs but rather on donors’ mandates and requirements.

High quality water research requires a national science and research agenda, political backing, outstanding research managers with a record of proven leadership, sustainable funding mechanisms,

career development incentives to attract and retain young and senior talents, and improved linkages between research and policy communities.

IV. GOVERNMENT DEMAND FOR RESEARCH

According to Carden (2009), a key element in linking research to policy is the government’s demand and systematic utilization for research findings in formulating policy in any sector. This statement is consistent with findings of the survey by Taylor et al. (2008) conducted in Algeria, Egypt, Jordan, Lebanon, Morocco, Palestine, Sudan, Tunisia, and Yemen with case studies in four countries (Egypt, Jordan, Lebanon, and Morocco) and encompassing 70 research organizations.

The survey has found that government demand for research appears to be extremely limited at present. Where there is government interest, it is most likely to be represented through the actions of specific individuals. Researchers and managers of research organizations need to find strategies and mechanisms to develop personal relationships with these individuals, who tend to privilege the few. Building institutional relationships between research organizations and policy-making bodies is therefore difficult to initiate and sustain. Gate keeping relationships encourage individuals to guard their contacts, their resources, and even their findings with an aim to share them at international events in order to attract prestige

BOX 2: TALENTS ARE NOT ONLY RARE BUT DIFFICULT TO RETAIN UNDER POOR INCENTIVES AND “DISABLING” WORKING ENVIRONMENTS

In his speech at the Second General Assembly of the Arab Water Council in Cairo in December 2009, the Egyptian Minister of Water Resources and Irrigation made a revealing statement about the real problems facing his Ministry today. He stated that the number one challenge the Ministry has to deal with today is not the lack of funding; it is the movement of talented experts (both senior and junior) outside the Ministry seeking job opportunities in the private sector and international and regional organizations. “Young talents cannot resist attractive packages and a conducive working environment that we simply cannot afford to provide in the Ministry.”

DEVELOPMENT OF HUMAN AND INSTITUTIONAL CAPACITIES IN THE ARAB WATER SECTOR ARAB WATER ACADEMY: A REGIONAL CENTRE OF EXCELLENCE

Asma El Kasmi

The Arab region has a long and distinguished history of hydraulic innovation. In recent decades, leaders have increased access to potable water and sanitation and expanded storage and irrigation networks. Despite these important steps, poor water outcomes remain common in the region. Over-extraction of groundwater has left aquifers depleted and reduced the availability of reliable, lower-cost water resources. Spending on water infrastructure is not always well-directed to the most economically beneficial investments and performance levels of urban water supply and irrigation infrastructures are often low, with water losses of up to 50%.

Where water resources are not managed effectively, there are serious economic, environmental, and social consequences. Fiscal burden and budgetary pressures are increased and negative environmental impacts are accentuated, in addition to adverse public health outcomes, increased poverty, and risk of conflict and local tension.

Put simply, inadequate water management costs the Arab region too much to ignore. From an economic perspective, the facts are compelling: over-extraction of groundwater is undermining national assets at rates equivalent to 1 to 2 percent of GDP every year, environmental problems resulting from poor water management can cost between 0.5 and 2.5 percent of annual GDP, and illness and death related to inappropriate wastewater collection and treatment costs can exceed 2% of GDP in some cases.

The 21st century brings yet greater problems for water management in the Arab world. Rising populations, dynamic economic growth, and anticipated negative effects of climate change will further increase pressure on the region's water. Without changes in policy, technology, and behavior, increased water scarcity will reduce agricultural production and threaten regional food security. To further complicate this untenable situation, around 70% of the region's water flows cross international borders and need to be managed fairly and efficiently for all concerned if inter-community antagonisms are to be avoided. Facing and addressing these combined challenges require that high priority be given to investing in the development of human capital and institutional capacities.

It is well-established today that there is a need for more

focus on integrated management of water resources rather than water supply augmentation and service provision. This change in paradigm calls for a radical redefinition of the learning and capacity building programs. The Arab region can be proud to have invested in the training of excellent hydraulic engineers who have ably contributed to building numerous water infrastructure projects, serving cities and irrigation schemes, and helping control flooding. However, water problems are increasingly shifting to institutional and policy issues with a critical impact on both the quality of management and the governance of water. Sharing and managing this scarce resource in the region, while ensuring social equity as well as financial and environmental sustainability, demands skills that go beyond traditional engineering training to include economics, politics, ecology, diplomacy, and democracy.

Moreover, in order for the region to effectively meet the new generation of water challenges, there is a recognized need to focus on strengthening the knowledge and skills of the water sector's decision-makers and professionals.

The Arab Water Academy (AWA) was created to fill the gap in executive education and leadership development. As a unique regional initiative for human and institutional capacity development, the mission of the Academy is to go beyond conventional education and training and act as an "agent for change". Change is inspired by the shift from the hydraulic mission to a mission relating more to water for sustainability and growth.

The Academy is established as a regional centre of excellence with the mission to:

- Equip participants with new skills, ideas, and tools to develop water resource management strategies and policies based on integrated thinking across sectors; and
- Support participants as they work to improve enabling environments, institutional frameworks, policies, and organizational capacity in their countries.

While each country of the Arab region faces its own distinctive water management challenges, a common set of opportunities exists to help achieve integrated water management in the region. The Arab Water Academy focuses on three areas: (1) informed and



visionary leadership to champion strategies for change, (2) management in possession of the latest knowledge and skills, and (3) public awareness of the issues and engagement in finding solutions to water challenges.

The AWA programs and services include:

- Leaders' forum, where concepts and ideas are discussed to shape future water policies;
- Executive education to boost knowledge and skills;
- Knowledge communities to share ideas and inspiration; and
- Expert advice to provide practical solutions to pressing problems.

The AWA functions as a regional knowledge hub where the most relevant new thinking from the Arab region and around the world is deposited. This knowledge is provided using cutting-edge learning methods.

The executive education programs of the Academy target senior professionals and policy makers from the public and private sectors. They are designed to bring new perspectives on demand management, institutional reform, cost recovery, integration of the water sector with non-water sector organizations, private sector participation, and environmental sustainability.

The learning programs of AWA for 2010-2011 include

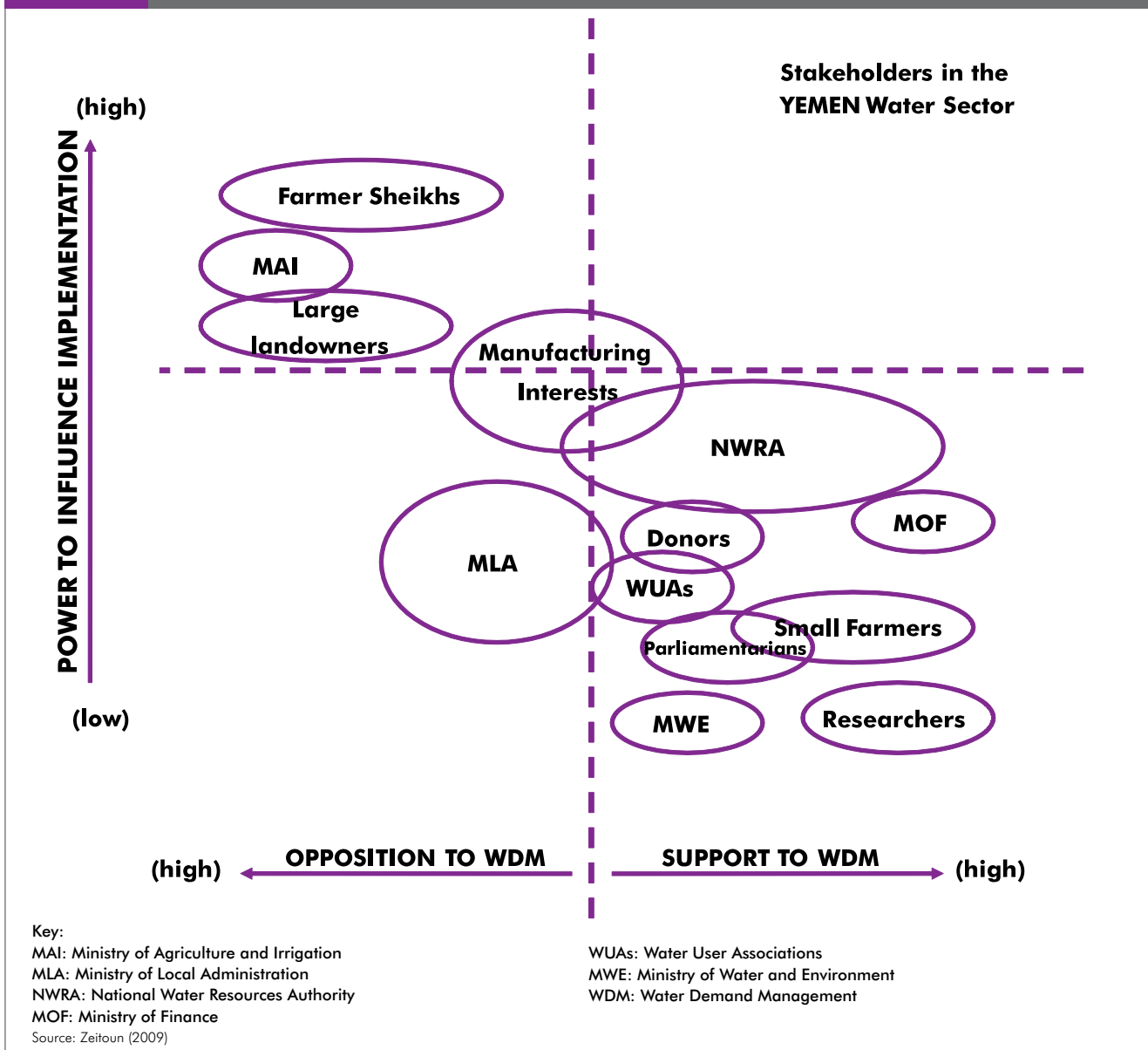
Water Governance and Leadership Development, Designing and Implementing Successful Utility Reform, Private Sector Participation in Water, Water Diplomacy: Sharing the Benefits, and a Non-Conventional Water Resources Traveling Workshop in Abu Dhabi and Australia.

During its first year of existence, AWA has undertaken successful steps towards establishing itself as a regional centre of excellence. The academy is a groundbreaking institution for regional capacity development and has provided high-quality executive education programs to over one hundred professionals from 18 Arab countries. Over 80% of the participants in AWA's main programs were top decisions makers and senior professionals.

By introducing a new momentum for developing the region's knowledge base and advancing its economies, the AWA provides a unique stimulating platform for the Arab world to become a leader in 21st century water management.

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FIGURE 1 MAPPING POWER VERSUS INTERESTS OF KEY PAYERS IN WATER POLICY IN YEMEN



and funding. This seems to reduce opportunities for research organizations to make a contribution to positive change at the national or even regional level (Taylor et al., 2008).

V. SCIENTIFIC KNOWLEDGE ALONE IS NOT SUFFICIENT TO ENABLE SUSTAINABLE DEVELOPMENT

How knowledge and politics interact shapes the development of policies for the sustainable management of water resources.

Institutions, interests, and individuals also play a role in promoting or constraining sustainable development. Although the generation of scientific understanding is an exercise in rational thinking and objective analysis, the behavior of stakeholders in many regions of the Arab world is far more driven by existing power asymmetries.

Based on the synthesis work done by Zeitoun (2009), the diagram in Figure 1 demonstrates the power positions of different water stakeholders in Yemen in relation to their stance to reform. Indeed, the most striking element in the graph

is that researchers, who are very supportive of water demand management (WDM) as a way to ensure sustainability of groundwater resources, have limited power to dictate policy formulation and implementation. Stakeholders who stand to benefit from the status quo are opposed to water demand management and will use their more powerful position to prevent reform policies from taking shape or at least from being implemented. Policy-makers are aware of the various alternatives for action, but the political cost of rational action for sustainable water policies is what policy-makers cannot often afford.

The inability of water managers and professionals to adopt practices that reverse unsustainable practices, such as the depletion of water aquifers, is worth reflecting on. The political economy studies conducted in Jordan and Yemen and qualitatively in Morocco by WaDiMena have revealed some preliminary conclusions. Implementing a policy change that threatens deeply-rooted practices and entrenched interests in hierarchical contexts, as in the case of Yemen and Jordan requires a good understanding of the power relations that sustain them. The various forms of power relations between stakeholders in the water sector of both countries are found to fall into either 'hard' or 'soft' forms, but primarily the latter. 'Soft' forms of power include bargaining power and the power to frame issues in such a way that they may not be contested (Zeitoun, 2009).

Therefore, sustainable water policy outcomes in the Arab region depend on processes and institutions that give all stakeholders the right to contestation and permit them to have a role in the formulation of policies regardless of existing power asymmetries. This requires political dialog among all stakeholders. Technical and scientific knowledge, if perceived to be credible and relevant by stakeholders, can provide a common ground on which contesting groups can mediate their differences. Knowledge can also provide an articulate voice to marginalized stakeholders and a means of leveling the playing field.

Another notable example that illustrates the marginal role assigned to technical knowledge is the policy of irrigated agriculture using non-renewable water resources in desert areas in many Arab countries. Scientific understanding of groundwater science has anticipated that

this would be an unsustainable strategy. Yet, the drive to attain food security and the power of agricultural lobbies prevailed. The over-exploitation of groundwater for desert irrigation started in the eighties and continued for 3 decades, although water subsidies have been reduced recently in a gradual policy reversal.

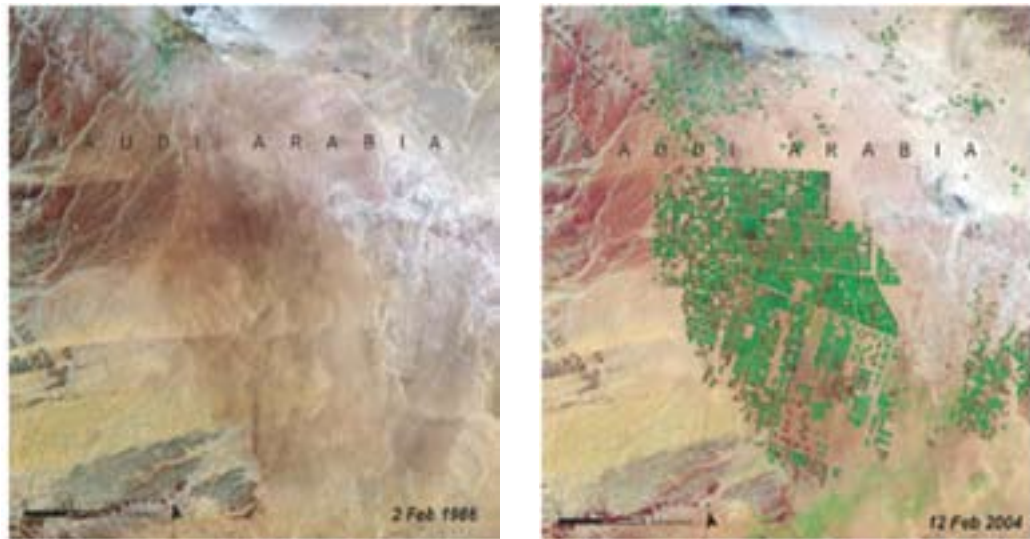
Al-Zubari (2005) remarked that "Over the past three decades, economic policies and generous subsidies in most of the GCC countries supported the expansion of irrigated agriculture in an effort to achieve food security. Irrigation water is often used inefficiently without considering the economic opportunity cost for potable as well as urban and industrial purposes. Agriculture contributes less than two per cent to Gross Domestic Product (GDP) in GCC countries but it over-exploits groundwater resources, most of which are fossil groundwater, resulting in their depletion and quality deterioration due to seawater intrusion and the up-flow of saltwater. No clear "exit strategy" exists to address the question of what happens when the water is gone." Figure 2 demonstrates dramatic changes in the desert landscape in Saudi Arabia as a result of this policy.

The example we borrow from Saudi Arabia is just one of many. The deterioration of groundwater resources in Sana'a and Taiz basins in Yemen as well as in the Saiss Plateau and Souss Mass in Morocco all illustrate the lack of timely impact of science on policy and show that the cost of these delays might be "irreversible and irreparable".

VI. HOW IS SCIENCE LINKED TO POLICY?

Among water scientists, some often see their mandate as being limited to generating scientific knowledge, leaving the task of making the link between knowledge and policy to other professionals. Therefore, the problem at hand goes beyond generating cutting edge knowledge to developing the capacity to utilize knowledge in a timely manner by policy communities. Because systematic mechanisms for linking knowledge to policy are not well established yet in the Arab world, Carden (2009) has suggested, based on an analysis of 23 case studies, to create organizations with capabilities to be knowledge brokers.

FIGURE 2 CHANGES IN DESERT LANDSCAPE AS A RESULT OF IRRIGATED AGRICULTURE IN SAUDI ARABIA



Source: UNEP/GRID-Sioux Falls

Inter-ministerial committees on water, which act more as task forces assigned with specific and time-bound tasks, can play the role of knowledge brokers. However, according to Luzi (2010), the inter-ministerial committees are either not functional or leave little trace due to unclear mandates, lack of permanent supporting structures, and ineffective feedback mechanisms.

Permanent bodies such as the Royal Water Committee of Jordan or the Higher Council for Water and Climate in Morocco could also act as effective knowledge brokers. In other countries this could be part of a multi-task think tank such as the Egyptian Cabinet's Information and Decision Support Center (IDSC).

A unique set-up is the National Water Research Centre of Egypt. This is a consortium of specialized institutes created in 1975 as the research arm of the Ministry of Water Resources and Irrigation. The findings of research projects conducted by the different institutes are used systematically by different departments at the Ministry. Although this is an ideal mechanism to link water research to policy, some structural deficiencies have been reported (IPTRID, 2007).

VII. CONCLUSION

- In the Arab world today, water research

is not yet a systematic component of the water policy cycle. The Arab region is facing a double challenge in regard to linking water science to public policy. First, the capacity to generate cutting-edge scientific research is lacking. Second, systematic institutional linkages to utilize knowledge in policy-making are not yet well-developed. Hence, the ability to formulate and implement effective water policies is severely constrained;

- The interaction of knowledge and politics within an institutional setting provides a good framework for initiating and advancing water policies. However, the water policy environment in Arab states is far more influenced by the politics of entrenched interests and asymmetric power relations than by a knowledge-based discourse. Institutional mechanisms that give voice to all water stakeholders are not well developed yet;
- Research organizations in Arab countries are hampered by the lack of national science and technology policies and the absence of coordination. Research agendas sometimes reflect the requirements of international funding organizations rather than echo local community needs and national goals;
- Water research organizations in Arab



states lack human and financial assets and do not have the capacity to offer young researchers promising and supportive professional careers. Researchers have limited connectivity to international research communities.

VIII. RECOMMENDATIONS

- Arab governments should give priority to developing the capacity to generate credible and relevant water research. This requires a national science policy, a locally-accountable research agenda, political commitment, outstanding research management and leadership, sustainable funding mechanisms, and career development incentives to attract and retain young and senior talents;
- Linkages between research and policy communities need to be significantly improved. This would enhance the capacity of governments to utilize knowledge to serve their policy-making needs;
- Water think tanks and water centers of excellence should be established to play an intermediary role in bringing water science to policy;
- Institutional mechanisms and processes need to be established to level the playing field and give voice to all social actors who are affected by water policies. These mechanisms can provide a forum for all stakeholders to engage in political dialog and utilize knowledge in negotiating their differences;
- Universities and water research centers involved in academic endeavours in the Arab world are encouraged to offer innovative graduate-level programs combining engineering education and professional public policy graduate studies;
- Governments should encourage scholars and young water experts to develop an understanding of the policy cycle, where it exists, and to generate scientific knowledge that is perceived by policy-makers to be credible and relevant to their needs;
- Decision-makers should shield strategic decisions in water research and policy from influence by international aid agendas, while keeping high level of scientific cooperation with world class research centers;
- Water research organizations need strong political commitments and mandates to firmly place research at the center of water policy and locate water policy at the heart of overall development policy, rather than the other way around;

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