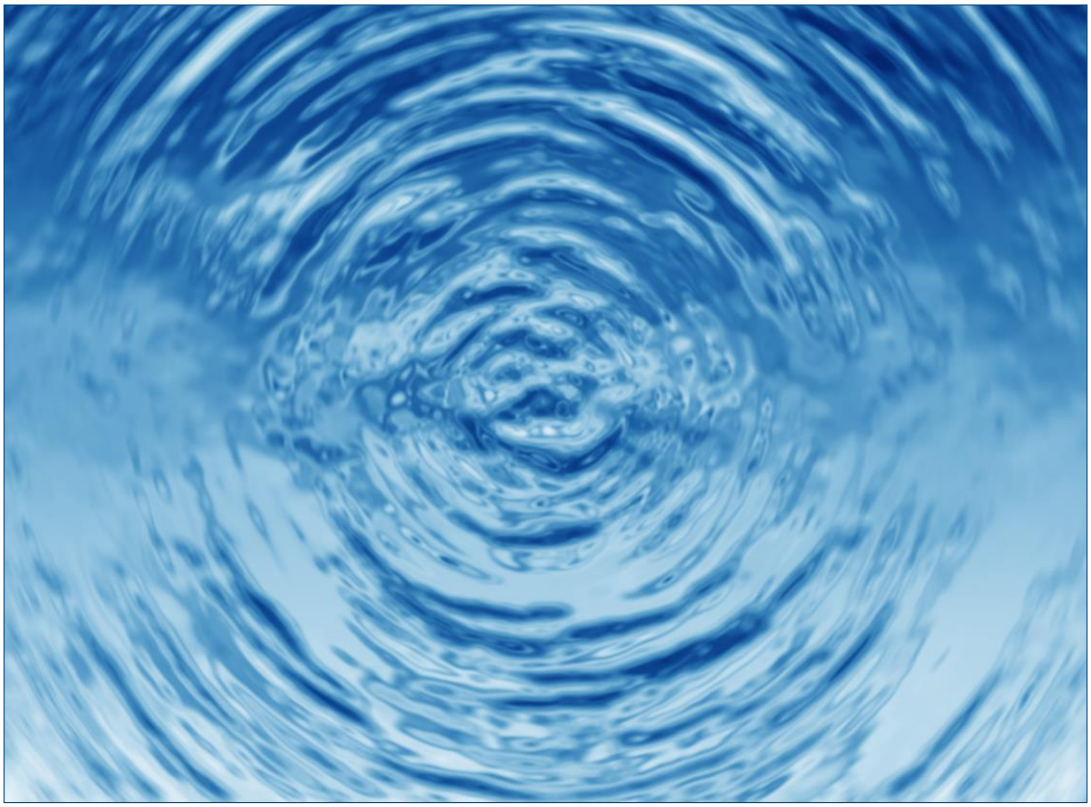
Wilton Park



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Report

Sharing innovation to address water challenges in the Levant

Sunday 11 – Wednesday 14 September 2016 | WP1489

In association with:

BRITISH COUNCIL

UK Science & Innovation Network

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This Wilton Park conference addressed the problem of water stress in the Levant, specifically in Jordan, Israel, and Palestine.

The conference was attended by academics, scientists, NGO representatives, and policy officials from these three countries and the wider MENA region as well as from the United Kingdom, Europe, and America.

Key points

The Levant faces absolute water scarcity;

Israel has pioneered a way forward in water management technologies such as desalination and waste water recycling. Scientific innovation means that Israel has no water shortage, unlike its neighbours.;

The usefulness of technological innovation must be placed in context – it is politics and management that is determining; the science can rarely be separated from the political in the MENA region.;

Engagement with local communities is vital to long-term water management success;

While scientific innovation does not lead to peace, co-operation on small-scale water projects can create 'islands of co-operation" contributing to peace building efforts in the region.

There is an urgent need for scientific technology and innovation to help respond to the emergency water needs of refugees and displaced persons in the MENA region with particular reference to the impact of refugees on water use in Jordan. The current political circumstances in the region were seen as an underlying major blockage to scientific innovation.

Executive summary

This Wilton Park conference addressed the problem of water stress in the Levant, specifically in Jordan, Israel, and Palestine. The objective was to encourage innovative scientific co-operation and dialogue to bring about durable and appropriate efforts to manage the water crisis in this part of the Middle East.

This conference was attended by academics, scientists, NGO representatives, and policy officials from Jordan, Israel, and Palestine, as well as from the United Kingdom, Europe, and America and the MENA region. It was an effective forum for the sharing of scientific ideas and the communication of progress. Technological, political, financial, and societal

innovations in water management, regulation, and funding were considered.

Background

1. The total renewable freshwater resources (TRWR) in Israel equate to 220 cubic metres per capita, while in Palestine and Jordan there are 179 and 123 cubic metres per capita respectively (World Bank, 2014).
2. In Jordan, the population increased from 6.7 million in 2010 to an estimated 9.5 million in 2015 according to a National Census in November of that year, an increase of over 40%. This increase is largely due to the growing refugee population, which accounted for 2.9 million of the total in 2015, largely (but by no means exclusively) as a result of the Syrian refugee crisis (Jordanian Department of Statistics, 2016). The TRWR has dropped to 90 cubic metres per capita.
3. Symptomatic of poor water resource management is the drying up of the Dead Sea. In the 1960s, the River Jordan carried 1.5 billion cubic metres annually from the Sea of Galilee to the Dead Sea, but today the flow has fallen to just 100 million cubic metres, most of which is brackish water and sewage. The Dead Sea has lost 30% of surface area in 20 years, and its level is falling by one metre every year.
4. 90% of the River Jordan's annual flow has been diverted by agriculture and around 250 million cubic metres is withdrawn annually directly from the Dead Sea for the Potash industry, which is again an input to agriculture.
    - Note: The Israeli Dead Sea Works' annual net pumping rate from the Dead Sea in 2010 was 168 million cubic metres. The average rate is 150 to 160 million cubic metres per year. The combined net rate for the Dead Sea Works and the Arab Potash Company is 250 to 280 million cubic metres per annum. (World Bank, 2013).
5. The main sources of freshwater in the region are:
    - Rainfall;
    - Aquifers;
    - The River Jordan and tributaries.
6. Desalination technologies have treated seawater from the Mediterranean and in future the Red Sea will also be desalinated to increase the supply of water. In Israel, extensive wastewater recycling has also been installed.
7. Virtual water is the water embedded in the process of producing foodstuffs or industrial goods. The importing of such virtual water allows countries to overcome shortages in their natural water endowments. This has been a crucial part of Israeli decoupling (decoupling is the act of separating economic growth and water use from local water resource constraints).
8. The key challenges to water resource management in the region are:
    - Increased water and food demand as a consequence of population increase;
    - Variation in annual rainfall;
    - Moderating agricultural water use to sustainable levels;
    - Reducing the pollution of freshwater resources;
    - Improving water infrastructures in places where they are inadequate;
    - Absolute water scarcity.
    - The overall geo- political reality, especially in the Israeli- Palestinian context. This includes the current situation in the Gaza strip, deadlock in the MEPP, security

concerns and the block on freedom of movement. etc.

9. Further innovation and research can help the Levant to meet these challenges. But it should be recognised that the water allocation and management experiment of the past half century in Israel is unique. It has demonstrated that a strong and diverse economy has the capacity, with effective governance and investment in a suite of technical measures, to deliver a version of sustainable food and water security.

Challenges to water resource management in the region

Demographic growth

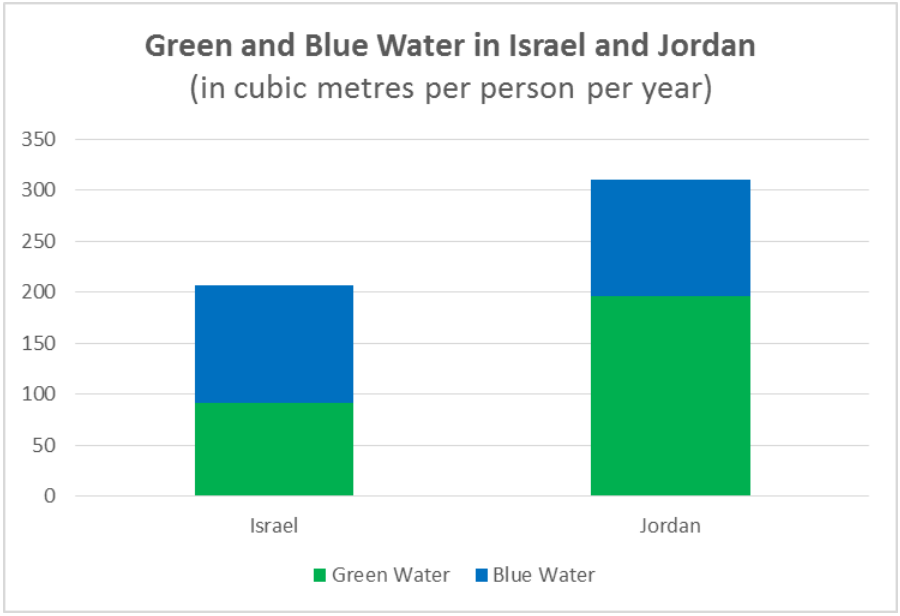
10. Since the 1950s, the population of the Middle East has quadrupled. This growth has made the region increasingly reliant on the global trade in virtual water for its water and food security. Rising populations everywhere will also place greater pressure on the network of virtual water trade, and those coping with water scarcity in regions such as the Levant should recognise that their water and food security depends on global demographics. For example, although UN-DESA estimates that China's population will fall by 400 million by the end of the century, the rise of the African population to an estimated 4.3 billion by 2100 is the number to note (UN-DESA 2015). A rising population in the Middle East in this context creates a growing imperative to acknowledge politically the vital role of virtual water in offsetting the risks of water scarcity.

Changing rainfall patterns

11. Climate change science has focused resources and funding on changing temperatures, but future rainfall patterns continue to prove difficult to predict. There is evidence that the Levant and Eastern Mediterranean is a region that can anticipate a decline in average rainfall.

12. Rainfall is essential to water resources and water use in the Levant. Aside from its obvious role as the feedstock of the River Jordan via tributaries, certain amounts of rainfall become embedded in the soil until evapotranspiration. This embedded soil water is called "green water", and it accounts for a significant proportion of the freshwater resources of the region; yet it is rarely considered or quantified. (Blue water is freshwater found in rivers and aquifers. See Figure 1).

Figure 1: Green and Blue Water in Israel and Jordan



Source: Based on Gerten et al 2011

13. Blue water used for agriculture has a high opportunity cost, whereas green water can only be used to produce food and/or sustain ecosystems.
14. Research should be conducted to investigate the potential for green water to ease further the burden of agricultural demands on blue water.
15. The worsening water resources of the Levant are significant. But they are not as significant as the unpredictability of future rainfall in the food baskets of the world that export food to water deficit regions such as the Eastern Mediterranean.

Agricultural water use

16. Agricultural use accounts for 80-90% of freshwater withdrawals in Jordan and the Occupied Territories. By contrast, by 2010 the sector accounted for just 50% of total water consumption in Israel. Most of the water used for agriculture in Israel is recycled sewage water.
17. It was noted that the agricultural sector contributes just 4% to Israeli GDP, but is associated with the employment of 20% of the work force. Agriculture continues to be an integral part of the national fabric despite successful decoupling. Hence, the agricultural water burden can be reduced without abolishing agriculture. The difference between Arab and Israeli agricultural water use can be explained by four factors: green water, wastewater recycling, effective innovation, and crop choice and irrigation-water innovation:
    - Green water: When green water resources are taken into account, over 90% of Israel's total water use is devoted to agriculture;
    - Wastewater recycling: 88% of municipal wastewater is recycled, and 2/3 of irrigation water used is reclaimed sewage;
    - Efficiency innovation: Drip feed irrigation technology has been introduced, concentrating water around the roots of crops, and sealing it to minimise evaporation;
    - Crop choice and irrigation-water innovation: The development and selection of salt-resistant crops has allowed brackish water to be used for irrigation in some parts of Israel.
18. Agricultural water use is dominated by choice at the community level. Farmers are responsible for managing the vast majority of water resources, and it was emphasised that they should be included in policy discussions, such as at future conferences at Wilton Park. It is essential that innovation and changes in water-use practice are introduced in ways that are sustainable not only for freshwater resources but also for the livelihoods of farmers.
19. A number of projects and NGOs are focused on water-use management at the community level, particularly in Jordan and Palestine. It was emphasised that innovation is needed not only in technology but also in modes of thinking. Some examples of community-focused projects in Jordan are as follows:
    - A project to assess the needs of farmers found that the cost of energy to power groundwater pumps is a primary concern. The project installed solar panels, reducing the community's electricity costs by 32%;
    - A project to change habits and thinking about local water use and management introduced training sessions into local schools, and gradually built up their contacts and reputation to engage directly with municipal authorities and ministry officials. Willingness to co-operate with Israel on effective water resource

management is a key element of what this project is trying to achieve;

- A project to introduce an innovation in combining fish rearing and crop growth (to pool water and nutrient resources) is being trialled in a local community in Jordan.

Pollution of freshwater resources

20. Pollution is a major challenge to good water management in the Levant. Pharmaceuticals, nitrates from fertiliser, and untreated sewage are all seeping into groundwater aquifers and the River Jordan.
21. It is estimated that just 3% of the freshwater resources available as groundwater beneath Gaza is unspoilt by pollution.
22. Tackling pollution is considered to be an area of major potential for co-operation between the states and territories in the Levant.
23. In Israel between 1999 and 2014, 20% of wells were closed because of pollution, mainly as a result of nitrate pollution from fertilisers. Innovative projects have been implemented to clean water with fish, and also to introduce widespread water quality monitoring and remediation.
24. Projects have been started in collaboration between states in the Levant, but these have faltered because of a failure of political will. For example:
    - A 100 million USD sewage treatment facility was built in northern Gaza, close to the border with Israel; however, it was not made operational because of political reasons. . The plant requires 3MWh of electricity to operate, but spare capacity has not been made available. Thus, raw sewage continues to pollute Gaza's aquifer system and the Mediterranean. Recently, the Israeli desalination plant in Ashkelon closed because of this pollution: the shared environmental interest of Israel and Palestine has thus been disregarded because of political conflict.

The need to improve infrastructure

25. The leakage of water in urban water services is a major problem. It has been estimated that 76 billion litres is lost to leakage annually (Mercy Corps, 2014). There has been effective investment in Jordan to reduce leakage in Jordanian cities, but more investment is urgently needed.
26. Basic water infrastructure management is crucial to sustainable water management, and requires simple maintenance and investment. This, however, is complicated by poor funding mechanisms (see later section on Funding) and the difficulties of giving water and sewage services a high policy priority.
27. Ineffective water infrastructures highlight gender imbalances and place an unequal burden on women as fetchers and carriers of water. Women are significant users and managers of water, and projects and governments should ensure that they have the opportunity to be involved in decision making, not just consultation.

Absolute water scarcity

28. As already mentioned, the Levant is in a situation of absolute water scarcity: the amount of renewable freshwater available for use across the economy per head of population is extremely low. This can affect economic growth, livelihoods, and social stability if economies are weak and incomes low.
29. Innovations to address this problem to date have primarily occurred in Israel. They have focused both on reducing the demand on blue freshwater resources and increasing the supply of freshwater.

30. Innovations to reduce freshwater demand have concentrated mainly on agricultural water use (see earlier section on Agricultural Water Use).

31. Innovations to increase the supply of freshwater in the Levant have involved several technologies and projects. For example:

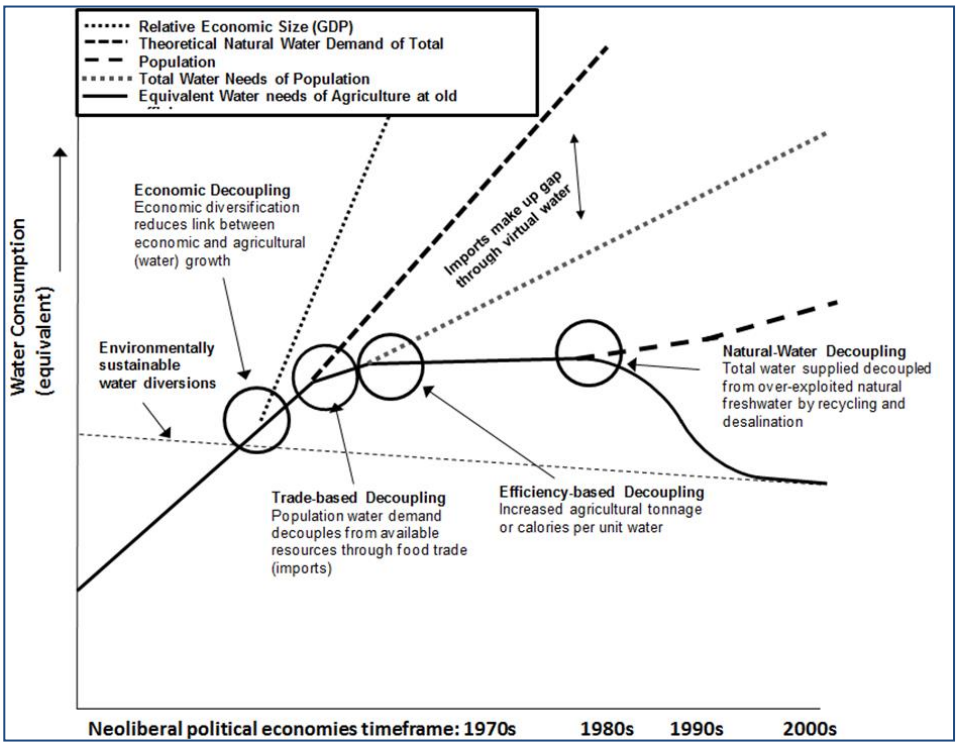
    - In Israel, water treatment facilities to recycle wastewater have allowed 88% of municipal wastewater to be reused, increasing the supply of water without placing an additional burden on naturally occurring freshwater resources. There are plans to increase this to 95%;
    - In Israel, there are 39 desalination plants along the country's 32km of Mediterranean coast. By 2020, desalination will provide 100% of Israel's drinking water;
    - In Jordan, a 100 million USD desalination plant is being built in Aqaba, which will produce 80 million cubic metres of desalinated water per annum, with 40 million cubic metres being bought by Israel at cost and the rest remaining in Jordan. This is part of a larger, 1 billion USD, "Red Sea – Dead Sea Project", which will see the excess brine from desalination transported to and discharged in the Dead Sea to arrest its decline. There are significant environmental concerns about the second part of this project, and it can be questioned whether it is simply a politically feasible solution to avoid the more challenging issue of the proper management of the River Jordan basin area;
    - In Jordan, the Disi Water Conveyance Project was inaugurated by King Abdullah in 2013 to transport 100 million cubic metres per year from the Disi aquifer, in the south of the country, to Amman. This 1.1 billion USD project taps the non-renewable aquifer which is shared with Saudi Arabia. On 30th April 2015, the kingdoms of Jordan and Saudi Arabia signed a co-operation agreement for the "Management and Utilisation of the Ground Waters in the Al-Sag /Al-Disi Layer". This is one of the few global agreements to deal specifically with shared groundwater resources.

Case study: the Israeli example

32. Israel provides the leading example of economic decoupling from the constraints of absolute water scarcity. The process by which this has been undertaken has been described extensively by Gilmont (2014), and Figure 2 below illustrates water use, freshwater extraction, and economic growth over time. There have been several stages to successful decoupling in the Israeli experience:

    - Stage 1: Economic decoupling: Economic diversification reduced reliance on water-intensive agriculture;
    - Stage 2: Trade-based decoupling: Involving the importation of virtual water in foodstuffs (as discussed in Allan (1998)), allowing a reduced domestic dependency on agricultural irrigation;
    - Stage 3: Efficiency-based decoupling: Including greater efficiency in the agricultural sector, allowing it to reduce its water needs still further;
    - Stage 4: Natural water decoupling: The water supply was increased without drawing more freshwater. Used water was recycled, and desalinated water was introduced.

Figure 2: Decoupling in the Israeli Example



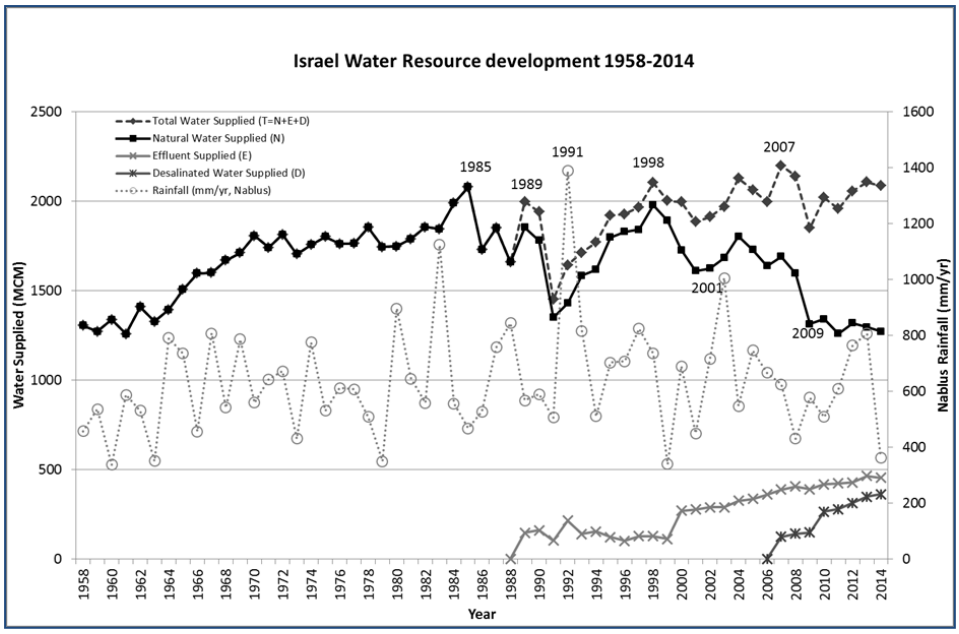
Source: Gilmont (2016)

33. Figure 2 shows how economies shift from meeting their water needs from their own resources to dependence on: 1) a TRADE-BASED version of water security; 2) EFFICIENCY-BASED DECOUPLING; and finally 3) NATURAL-WATER DECOUPLING from the overexploited natural water. Getting levels of water consumption down to an environmentally sustainable level can take 50 years.

34. The first three stages of decoupling are related to reducing the water needs of the agricultural sector. The process of agricultural water decoupling is very political. There was an attempt to reduce agricultural water use in Israel between 1985 and 1991, but this was aborted as a result of political pressure and drought. A second attempt began in 1995 and has been sustained. Large reductions in freshwater extraction have resulted – this was before the introduction of significant desalination programmes.

35. The Israeli case study is unique in its successful decoupling of freshwater withdrawal from water use and economic growth. This outcome has required innovation in policy, management, and technology.

Figure 3: Israeli Water Resource Development 1958-2014



Source: Gilmont (2016)

36. It is important to be circumspect in drawing lessons for Jordan and Palestine from this case study. Water management and water resources in Israel are highly centralised, streamlining decision-making, whereas Jordan's water management is far more locally controlled in practice. Nonetheless, lessons that can be transferred highlight the primary importance of the political sphere and water management in the agricultural sector.

Funding

37. The availability of finance is crucial to the success of any project, and to the maintenance and improvement of any infrastructure. Innovations, projects, and maintenance in the water sector are no different, and are reliant on funds from three sources, dubbed by the World Bank as "the three 't's", all of which introduce problems for good water management and innovation:

    - **Tariffs**: In practice, tariffs are kept low due to political and social pressure. Thus, water networks are typically underfunded and struggle to cover costs or invest in innovation;
    - **Taxes**: These are again often limited by political and economic constraints;
    - **Transfers**: International transfers (aid and loans) often invest in sanitation, and are seeking clear proof that their investment is giving good results. This can impact on the type of project or innovation that receives funding, sometimes limiting the potential for longer-term or more subtle projects to get off the ground.

38. Centralisation in the Israeli experience has allowed tariffs and taxes to lead. A highly developed and competitive private sector has also allowed funding to be leveraged from markets.

39. In Jordan, international transfers (aid and loans) are central to innovation, and to project and management funding. It was suggested that this rentierism is an impediment to economic diversification in Jordan.

40. Funding for universities is a critical issue for innovation in the water sector. Scientific research and innovation is a culture, but is one that does not always find full and active support from political decision-makers in the Arab Middle East. Some participants

suggested that free thinking, innovation, and co-operation across borders are not encouraged by Arab governments or societies.. Israel produces 1% of science globally, while the entire Arab world also produces just 1%.

41. A lack of university funding from Arab governments means that Arab universities rely on international and Israeli research projects and grants. Yet, political and social pressures limit Arab researchers from pursuing opportunities with Israeli institutions, and West Bank universities have formally refused to co-operate with Israeli universities since 2010.

42. Innovations in water management are limited by their take-up by industry. Greater co-operation is required between academics, industry, farmers, politicians, and regulators, to ensure that the right innovations are introduced to resolve real problems in a sustainable way, and to ensure that funding is flexible enough to allow this.

43. The UK Department for Business, Energy and Industrial Strategy (BEIS), the UK Science and Innovation Network and the British Council - are committed to support collaborative water research projects in the MENA region through the STREAM programme, currently run for its second year.

Strategies for peace

44. It is sometimes suggested that low-politics co-operation in water management, for example, leads to high-politics peace.

45. The international project Blue Peace works to build “circles of co-operation” between Israel, Palestine, and Jordan in technical water management, in the hope that this will contribute to high-politics peace.

46. Participants heard that trans boundary co-operation does not lead to peace and that without governments there is no peace process. Participants challenged the reality of casting scientists as peacemakers while recognising the importance of small steps of scientific co-operation and sharing innovation. Scientific innovation does not lead to peace, Neither does academic collaboration. This however doe not negate the value of small steps of co-operation and the role of civil society in promoting peace from the bottom up.

47. Although co-operation is important to the resolution of joint problems (such as groundwater pollution in Gaza), it does not in itself lead to good relations outside of the narrow sphere of co-operation. High politics determine good relations, not low politics. Questions of identity and rights are fundamental. For example, no amount of water co-operation between Israel and the West Bank will lead to good high-level relations or a durable peace as long as the current geo-political circumstances remain. Any number of low-level gains can be reversed in a moment of politics. Whether it is possible to deliver a tri partite water agreement before the resolution of the political situation was a questions participants raised. The impossibility of separating science and politics was discussed with the view expressed that ignoring politics is itself political.

48. There are nonetheless many important avenues for co-operation, which can create “islands of co-operation”:

    - Groundwater pollution in Gaza;
    - Water management in the Jordan Valley;
    - Sharing of technology;
    - Building energy-water-nexus mutual dependency.

49. The Middle East experiences 300 days of sunshine per year and Jordan has the extensive land available for renewable energy. If political will allows, and technological infrastructure is put in place, it should be possible to trade Israeli water for Jordanian energy, the latter being used to produce the former in desalination plants. This, of

course, is a far larger political step than simply technical water management.

50. As Jordan becomes more technologically and scientifically advanced, growing Palestinian-Jordanian collaboration will reduce Palestine's reliance on Israel. This will promote regional stability and Jordanian economic development.

Sharing innovation

51. Innovations in technology, politics, practice, and funding are critical to generating a system of sustainable water management. Sharing these innovations is necessary for building political, institutional, and human capacity to improve water management in the Levant, but sharing innovation can be difficult:

    - Professional interaction between Israel, Palestine, and Jordan is politically fraught. The issue of trust was raised repeatedly.
    - Enabling technological innovation to be implemented depends on the relationship between academics and industry, as well as with farmers and other users;
    - Even innovations from third party states, such as the United Kingdom, can be difficult to communicate and implement on the ground. In Jordan, innovations that have not emerged from Jordanian science are unlikely to be adopted, and UK visa restrictions have made it difficult (if not impossible) to employ Jordanian PhD students on research projects. This limits the uptake of UK innovation in Jordan.

52. Sharing innovation in the Levant relies on good networks, and permissive politics and regulatory frameworks.

53. Women are often left out of the sharing innovation cycle- bypassed in decision making on water, both as technical specialists and in the decision making in legislation and strategies on water and its management.

Conclusion

54. Political and management contexts (including at the local level) are determining to the success of projects and the sustainability of water use. Technological innovations are important, but should be considered in this context. A renewed vision to promote scientific innovation is needed.

55. Technological progress has dominated water management discourse, to the detriment of human capacity-building. Funding and attention needs to be refocused towards changing attitudes, habits, politics, and building capacity, to ensure sustainable water use management.

56. It is essential that farmers and the private sector are fully involved in water management decision-making as such a high proportion of water is used in agriculture.

57. Wilton Park encourages participants to consider follow-up actions to ensure that this conference leads to real and positive progress. Forging new networks is a valuable outcome in itself, but additionally this conference proposes exploration of the following next steps:

    - An international incubator centre: To enable start-ups and joint ventures to develop and test innovations, making it easier to attract funding and industry attention;
    - Projects engaging local communities: To change modes of thinking – both in terms of water use and co-operation with regional and international partners;
    - Engaging young researchers: To build networks and capacity, positions for research students from across borders should be created. The German-Israeli Foundation provides an excellent model for this. Co-operation between Israeli and Palestinian wastewater engineers should particularly be encouraged as should the development of thought leadership clubs in this field;

- Research into an early warning system: To monitor wastewater pollution infiltrating the drinking water system and particularly to encourage research on removing pharmaceutical products;
- Funding for water management policy innovation in the Arab world**:** Israel's success is not just due to technology but to a holistic policy approach;
- A future conference**:** To engage farmers and the private sector in addition to researchers and officials. This could be hosted at the World Science Forum, which will be held in Jordan in 2017.
- A future conference on how scientific technology and innovation could help respond to the emergency water needs of refugees and displaced persons in the MENA region with particular reference to the impact of refugees on water use in Jordan.

58. No step in the right direction is too small. Small steps, such as engaging a village community or training individual researchers, are not trivial.

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