BEYOND THE WATERSHED: AVOIDING THE DANGERS OF HYDRO-CENTRICITY AND INFORMING WATER POLICY

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ABSTRACT
The purpose of the paper will be to demonstrate that there are a number of economic processes that have the capacity to ameliorate local water scarcity. Arid and semi-arid regions and economies worldwide encountered water scarcity in the past thirty years. Many more will encounter water scarcity in the next three decades. The analysis will review briefly three ameliorating processes - first, the global role of virtual water in water scarce regions, secondly, the impact of socio-economic development on water management options and thirdly, the cultural specificity of water demand management policies. All three processes have the characteristics of being economically invisible and politically silent in the easily politicised management of water. Their impacts, however, are determining with respect to solving local water deficits.

It will be shown that the water, food and trade nexus is not easy to model because of the dynamics of the political economies in the North and the South. Water sector policy-making is subject to evolving discourses, which can easily de-emphasise the underlying environmental and economic fundamentals. The paper will conclude that invisible and silent virtual water will provide the food water for water scarce regions such as Palestine and Israel. Its invisibility and silence will, however, have the effect of attenuating the pace of water policy reform with respect to water use efficiency and the consideration of the environmental services provided by water. A range of demographic, economic, social and political theory will be used to frame the discussion.

KEYWORDS: water policy, problemshed solutions, hydro-centricity, soil water, virtual water, socio-economic development

INTRODUCTION

The purpose of the chapter will be to demonstrate that there are a number of economic processes that have the capacity to ameliorate local water scarcity. These economic processes partly take place in the same spatial domain as the processes observed by water scientists. Some of the most important socio-economic ameliorating processes have, however, been shown to operate outside the boundaries of the river basin and the groundwater basin. (Allan 2004, Brichieri-Colombi 2004)

Recent experience in the Middle East has been especially important in demonstrating that water scarce regions can access water via global trading systems. To have the secure capacity to operate in this global trading domain those managing water scarce economies have had to adopt new approaches to combining their environmental resources – land and water – with their human, social, manufactured and financial capitals. The extent to which the factors of production have been more effectively combined determines the security of the economy.

Strategic water resource security has been achieved in the Middle East as effectively through the reform of an economy as by investing in and reforming the water sector in the second half of the twentieth century. (Allan 2001) In the twenty-first century the import of water intensive commodities will be the main strategy with which to address the 'big water' challenge. Both types of reform are necessary but the water scarce are wise to recognise the potentially dominant role of socio-economic transformation over reforms and efficiency gains in the water sector alone.

SOME DEFINITIONS AND SOME EVIDENT AND NON-EVIDENT PROCESSES

We need a few definitions. Big water and small water. Big water is the water needed to produce the for an economy. 90% of the water consumed by society is needed to raise its food and underpin food producing livelihoods. Small water is the 10%of total water needed to provide society's drinking water, domestic water services and to underpin non-agricultural livelihoods. Big water differs from small water in the huge difference in the volumes used and consumed and potentially re-usable. Crop production consumes high proportions of the high volumes of water deployed. Domestic and industrial uses can potentially return most of the water deployed for their processes for treatment and re-use.

Figure 1 here

Figure 1 is helpful in conceptualizing a number of essential ideas that could usefully be adopted by the water science community as well as by the diverse epistemic group associated with making and advising on water policy. The first idea is that of *big water and small water*. The big water is the 90 per cent of *freshwater and soil water* needed to produce the food needs of human populations. Small water is the 10 per cent of freshwater – *it can only be freshwater* - needed to provide drinking, domestic and municipal water as well as the water needed for non-agricultural livelihoods.

Secondly, Figure 1 is useful in conceptualisng the role of soil water. Two political economies with similar populations – Egypt and the United Kingdom – located in very different environments, can be compared. The diagram indicates the significance of their respective water endowments. Egypt has to use almost all its average annual availability of between 55 and 60 billion cubic metres of freshwater in the Nile river. The figure includes re-use. It has negligible soil water. Egypt accesses virtual water to meet its rising water deficit. The UK uses about 15 billion cubic metres of surface and ground waters. Soil water is not negligible in the UK water budget. About 25 billion cubic metres of soil water [an un-researched number] and accesses virtual water to meet its food-water deficit. In both cases the virtual water calculus is a net figure in that both economies export food commodities as well as importing them.

THE MENA REGION EXPERIMENT

For the past three decades the MENA region has undergone an experiment, which has proved the argument set out so far. When the region entered it water deficit phase as a result of demographic pressures in the early 1970s the idea that water problems could be solved outside the water sector was inadmissible. Most insiders in the region are still at the beginning of the new millennium unwilling to recognise the non-water sector factors that have brought about food and water security.

Arid and semi-arid regions and economies worldwide encountered water scarcity in the past thirty years. Semi-arid regions such as the Middle East and North Africa [MENA] have an important place in the history of water management in the last quarter of the twentieth century. The responses they have made to water scarcity, and more importantly why they have not made some other rational responses in accord with underlying economic fundamentals, provide important lessons.

These lessons highlight the role of politics in water resource policy-making. Scarcity leads to politicization at the levels of the farm, the community, the nation and the riparian. The nature of politicized water relations is explained by power relations, historic circumstances and the extent to which water scarcity can be ameliorated by evident and non-evident transactions.

The normal human reaction to scarcity is to reduce the scarcity by finding and mobilizing more of the resource within the sovereign territory of the scarce economy. Resource scarcity is commonplace. Most economies are short of a number of strategic natural resources such as oil and minerals. They address such scarcity by importing the scarce resource.

Water is different from other natural resources in that its value per unit is small. At the same time the volumes of water needed to substitute for the local scarcity are very bulky. Importing water in the volumes needed is deterringly expensive, unless the water flows naturally in surface or sub-surface systems and is secured by favorable international customary conventions.

In the 1970s the MENA region as a whole moved out of the phase when it could address its rising water needs by mobilizing more water. The economies of the Gulf as well as those of Jordan, Israel, and Libya had gone into deficit in the 1950s and the 1960s. The timing of the MENA journey into water deficit has proved to be fortuitous for the region. The MENA experiment in handling its strategic water resource deficit occurred at a point in history when the global system was engaged in another experiment. This experiment was the post-1950 subsidized revolution in crop production in North

America and Europe. The goal was to secure the farming sectors of these two industrialized regions.

As with most experiments based on subsidies the impacts have been perverse. For the MENA region they have brought the immediate benefits and possible longer term problems. The benefits are political stability and economic security, through the consumption of imported water intensive strategic staples. These commodities were put on the world market at half cost by the US and some European exporters. The longer term problem associated with the reduction of economic and political stress enabled by the import of cheap strategic commodities is that this trade has hidden the underlying fundamentals from consumers, water policy-makers and especially from government leaders. Water sector reforms to re-allocate and manage water resources would have been essential in the absence the global solution provided by the industrialized North. In the emollient world of cheap food staples the MENA those managing the importing economies could assume that water policy reforms with associated high political prices were not urgent.

The reason that food production and water have been emphasized thus far is because water for food is the dominant use of water. About 90 per cent of the water needed by an individual is devoted to food production. The remaining ten per cent is needed for drinking, domestic use and the support of non-agricultural livelihoods.

The three departures from conventional approaches to water allocation and management essential to the message of this chapter are the following. The first generally ignored feature, though hydrologically and economically fundamental, is ‘soil water’. The second is ‘virtual water’. Virtual water is a new concept to the water sector. But the term is merely an example of Ricardo’s powerful, two century old, notion of comparative advantage. Wichelns (2004) has added a purist economics definition insisting that virtual water is an example of absolute advantage because it does not have embedded in it optimal production and trading strategies. He recognizes that ‘the virtual water metaphor addresses resource endowments, but it does not address production technologies or opportunity costs. Hence, the metaphor is not analogous to the concept of comparative advantage. The metaphor can be helpful in motivating public officials to consider policies that will encourage improvements in the use of scarce resources, but comparative advantages must be evaluated to determine optimal production and trading strategies.'

Prior to human consumptive water-use the natural water resources supported only biological and hydrological systems. All the consumptive use of water by human populations has to be taken from the diverse environmental water resources available to a political economy. Available water includes surface waters, groundwater, soil water and atmospheric water. Surface waters, groundwater and soil water are the waters that the human population use for their economic, social and amenity purposes. Surface waters and groundwaters are taken into account by water scientists and water policy-makers insofar as they can be quantified. Soil water is generally ignored. 'Things do not always appear as they are'.

SOIL WATER

Soil water is not accounted in national water budgets. [The Shiklamanov (2000) research group is an honourable exception.in that soil water appears in all its datasets.] Nor does soil water figure in an integrated way in the the statistics of the international agencies. (FAO 2003, FAO Aquastat, World Bank/WRI 2003) Although Renault at FAO has contributed usefully to the development of the valuation of virtual water. (Renault 2003) UNESCO has responded to the useful prominence recently given to the concept of virtual water by a number of water research groups. (Hoekstra and Hung 2002, Hoekstra 2003, Oki 2003, Renault 2003)

[Note: This discussion will not emphasise the water services provided by the water in the natural environment. The absence of such discussion does not mean that such water services are regarded as unimportant. There is not space here to address the topic adequately.]

VIRTUAL WATER

Virtual water has been conceptualized and defined elsewhere. (Allan 2003) The concept has also been critiqued and debated. (Merret 2002 and 2004) The argument that virtual water should have a place in reviews of global and regional water resources and in strategizing water policies in summary, runs. The water sector and the freshwater within its rivers and groundwaters are not a sufficiently comprehensive basis for quantifying, analyzing and optimizing the allocation and management of water resources.

To review water resources and water transferring processes comprehensively it is necessary see water allocation and management as a global issue and a global challenge. In the global hydro-economic system solving the problems of water scarce regions, non-hydrological systems, such as trade, are as important as the water and water flows within watersheds captured by hydrology. The proportion of the water re-distribution problem successfully addressed by virtual water processes is already impressive and has the potential to be of even greater significance. Hoekstra and Hung (2003:25) estimate that 695 billion cubic metres of freshwater and soil water entered international trade in virtual form out of the 5400 billion cubic metres water used to produce crops in the 1995-1999 period.

Livestock products are particularly water intensive. A study of the virtual water content of the 1995-1999 trade in livestock products (Chapagain and Hoekstra 2003) calculated the figure to 336 billion cubic metres per year. Most livestock products are raised on soil water. But a proportion of such products are produced from irrigated fodder. By adding the annual global virtual water figures for crop production - 695 billion cubic meters - to the 336 billion cubic metres for livestock products, we get a total global figure of 1031 billion cubic metres. There is some double accounting in this number but the calculation nevertheless does confirm the very important part played by virtual water, mainly derived from soil water, that enables sustainable water resources management across the globe.

All the volumes of water discussed above are situated in rising long term trends, although there is a current temporary levelling off in the trade in major grains. The levelling off is the result of improved efficiency as measured by returns to water in both the Northern and the Southern economies. (Dyson 1996)

Meanwhile estimates of current global freshwater use in irrigated farming suggest that the total mobilized is about 1430 billion cubic metres per year – that is 26 per cent of the total water used in crop production. (Rosegrant and Cai 2002) The same authors suggest that by 2025 the use of irrigation water could rise to 1480 billion cubic metres per year. Clearly the virtual water solution, associated with 13 per cent of global water used in crop production is significant as a problem solving process. The trade in livestock products adds to this global percentage. Virtual water is especially significant in addressing those problems, which local technological solutions cannot address in water scarce regions. Just as important as its volume as a proportion of total water use in crop production and its capacity to solve otherwise un-addressable problems in water scarce regions, is its flexibility. This quality of flexibility will be discussed below.

SOCIO-ECONOMIC DEVELOPMENT: A THIRD INVISIBLE SOLUTION FOR THE WATER SCARCE

The roles of soil water and of virtual water trading processes have, until recently, been unrecognized. The concepts remain very much part of a minority outsider discourse even in the international epistemic science and policy communities associated with water allocation and management.

The third non-evident process that spectacularly ameliorates water deficits is socio-economic development. The achievement of more *jobs per drop* rather than more *crop per drop* has been key to the successful amelioration of water scarcity except in sub-Saharan Africa. This ameliorative process is not even on the agenda of most water scientists and water policy-makers in the South.

Socio-economic development associated with the strengthening and diversification of economies has achieved impressive levels of allocative efficiency in association with virtual water related processes. The very desirable allocative efficiencies achieved in the water sector in the past half century have, however, been incidental benefits resulting from the socio-economic development. These water efficiencies gained were not part of water policies. They were *hidden-hand* (after Adam Smith) processes. The hidden hand enabled the perversely hydrocentrically (Brichieri 2003) inclined water sector professionals and policy-makers to achieve sustainable economic outcomes.

Job creation in industry, services and the public sector silently and invisibly reallocated water at a scale beleaguered politicians dream of. Job creation associated economic diversification has proved to be a mighty demand management tool. In addition job creation outside agriculture has generated incomes and revenues with which political economies have been able to access virtual water in the global system. Economic transformation achieved in the East Asian economies, and in for example Israel (Allan 2001:249), demonstrate how economies can achieve water security through economic diversification.

Virtual water transactions and diversified job creation have enabled five decades of relatively conflict free global co-evolutionary transition from water abundance to water scarcity. For the past 25 years potential regional water scarcity has been managed within sustainable regional and global water management regimes through the very effective *threefold synergy* of soil water access, virtual water processes and socio-economic development.
[Definitions of conflict are not within the scope of the paper. The author would be very pleased to elaborate.]

THE TIMELY AVAILABILITY OF THE FLEXIBLE THREEFOLD SYNERGY: SOIL WATER, VIRTUAL WATER AND DEVELOPMENT

The worsening water scarcity experienced in some regions of the world in the second half of the twentieth century was happily encountered at a fortuitous moment in world economic history. The first good fortune of the water scarce was the availability of a comprehensive global trading system in food. This is not to say that the food trade is new. The system has been operating effectively for millennia. Rome in antiquity was fed by grain and other commodities raised in North Africa. Apparently comparative advantage is not static – as Wichelns (2004) argues in each case it is related to the production systems and the opportunity costs that obtain. By the late twentieth century economies such as Egypt, the main North African food exporter in antiquity, were importing more than half their food. Two thousand years ago Egyptian agricultural exports to Italy were substantial. Semi-arid economies facing water scarcity encountered their scarcites at a moment in history when, fortuitously, the world's temperate regions had become highly industrialized and were producing substantial crop surpluses throughout the second half of the twentieth century.

A second fortuitous, and invisible, non water sector, process assisting the water scarce since the middle of the twentieth century has been the economically perverse agricultural policies of the European Union and in the United States. Their production and export subsidies on wheat for example, ensured that half-cost grain was available on the world market. The pivotal global grain importers, the Middle East and North Africa economies and Japan, were both well able to purchase imports. They have been significantly advantaged by the EU/US subsidies. Together they accounted for about 150 billion cubic metres of virtual water imports in crops – out of the total annual global volume of 630 billion cubic metres – transacted in the global system in the last five years of the twentieth century. These major importers accounted for 23 per cent of the total. The author is at the same time aware of the negative economic impacts of low world prices for grain on those economies, especially those in sub-Saharan Africa, which enjoy no potential comparative advantage except in crop production. There is no space to analyse this issue here.

Variable water demands: the threefold synergy is also flexible and responsive

Virtual water is, therefore, part of a mighty *threefold synergy* – soil water, virtual water and socio-economic development – that enables communities, nations and river basins to access sufficient water to meet their variable water needs. A further very important feature of the mighty threefold synergy is its unmatched flexibility. Since the 1970s it has enabled the extension of a form of supply management miracle across the globe. The synergy has been capable of meeting varying regional and emergency food/water demands. Variable demand is normally associated with drought. The threefold synergy can successfully augment demand management policies that in themselves cannot achieve local sustainable water allocation.

The threefold synergy has proved its capacity to respond to systemic trends associated with increased demands associated with regional demographic dynamics – for example in the Middle East. The system has coped with the closure of the Middle East and North African water systems and the resulting increased demands for food imports. It has also coped with the variable demands coming from the former Soviet Union and the Russian Federation. The biggest variable demands have come from China. These demands have occurred despite China's own extraordinary increases in production since 1961. The variable demands for grain imports from China have also been accommodated. That there is a mix of local and international solutions is revealed in the decline in volumes of grain entering international trade in the last five years of the twentieth century. Despite the progressive increases in the world's population the volumes of grain traded have been declining since the late 1990s.

THE THREEFOLD SYNERGY AND THE ENVIRONMENT

Finally, through reducing the pressure on water resources in water scarce regions the threefold synergy has alleviated, or at least it has had the potential to alleviate, progressively higher demands on the freshwater and the soil water in the environment. The availability of the threefold synergy has enabled demands on local surface and ground waters to level off and in some cases to be reduced. This is especially the case in Northern semi-arid economies - for example in Israel. Water has been returned to the environment in Northern semi-arid economies to reinstate, to some extent, the environmental services provided by natural hydrological systems. (Allan 2001:146-148) In the South the availability of virtual water has not yet had the same impact. [Again this is a topic which deserves attention but it is not the focus of the paper.]

The shift towards precautionary and green water policies is not a response to the economic processes that made it possible. The advocacy of the green movement has been very important factor in environmentally sensitive water policy-reform in the North. In this Northern discourse the new resource managing circumstances afforded by the threefold synergy has enabled pressure on the water in the environment to be alleviated in Northern political economies.

The green social movement is poorly developed, however, in most Southern political economies. In Southern semi-arid economies the apparent amelioration of scarcity by the threefold synergy can play a negative, rather than a positive role in strategising the allocation of water vis-à-vis the environment. Old practices and policies can be left in place because to reform them would only be achieved at unacceptably high political prices. Paying such prices can be avoided in the apparent water security provided by the invisible threefold synergy. Water abstraction practices associated with the livelihoods of poor farmers with no alternative job options tend to remain in place, including those, which damage the water environment. (Allan and Olmsted 2003)

CONCLUSION: THE THREEFOLD SYNERGY AND WATER POLICY IN THE MENA REGION

An understanding of the politics and local history of water policy-making processes is a much better starting point for a water policy reform campaign. This is not a new idea. Marx pointed out the determining role of politics. The historically evolved 'abstract' domain of politics overwhelms the information coming from science and sub-optimal markets in what Marx termed the 'concrete' economic domain. (Fine and Saad-Filho 2003) The concrete provides possible conceptual foundations for the (political economy) superstructure, where those with power make allocative decisions. The evidence is, however, that the concrete is only very selectively included in policy-making discourses. Scientists do not draw up policy-making agendas. Nor are they normally much involved in developing politically controversial allocative policy. They can help to raise awareness of how things are. But they normally have to struggle mightily to bring about significant shifts in perception.

One of the reasons that water science and water professionals have limited purchase on policy-making is because there are economic processes outside the water sector and its watersheds, which solve water scarcity problems. The analytical tools of hydrologists, environmental scientists, and hydraulic engineers are not effective in these 'problemsheds' beyond the watersheds of the water sector.

After two or more decades of reorienting their own approaches to managing water scientists and professionals are still undecided about how to cope with the politics of water policy-making. For centuries, even millennia, water professionals solved the water problems of the societies managed by political elites. They did this without much consideration for the value of environmental services of water or of the economic value of the water inputs to society and agriculture. Recognizing these two issues as new fundamentals was challenging. Conveying their unavoidable importance to water users with few or no alternative livelihood options, and to water policy makers wanting to avoid paying high political prices associated with re-allocative reforms, took the discourse into realms of very painful uncertainty.

Water professionals had little experience of a world where problem solving was social and political rather than technical. In another policy domain, Teller the nuclear physicist knew how to influence politics. ‘He knew that it was more like magic than logic, and in spinning his spells, he was both dishonest, wasteful, and at times dangerous. He never saw this as evil or immoral. He once corrected Oppenheimer's famous comments that "scientists have known sin". As far as Teller was concerned "scientists have known power" and what it demands.' (Goodchild 2004)

Water scientists and water professionals are still unsure whether they should know power, and remain uncomfortable telling new truths to power. Activists from the green movement have been much more successful in shifting the debate and water policies than the science community and water professionals. The activists are regarded by the water professionals and scientists as ‘dishonest’, ‘spinners of spells’ and ‘at times dangerous’. But they have influenced the discourse and associated policy reform.

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