A STRATEGIC DECISION-MAKERS GUIDE TO VIRTUAL WATER

By
Anthony R. Turton
African Water Issues Research Unit (AWIRU)
Centre for International Political Studies (CIPS)
Pretoria University
E-mail: awiru@postino.up.ac.za
URL: http://www.up.ac.za/academic/libarts/awiru

> "The water wars that the popular media would have believe to be inevitable, will not be fought on the battlefield between opposing armies, but on the trading floors of the world grain markets between *Virtual Water* warriors in the form of commodity traders".

Introduction

The first region in the world to be confronted by a *water deficit* to the extent that economic growth is being hampered and social stability is being threatened, is the Middle East and North Africa (MENA) (Allan, 2000:127). In this sense, a region is being defined as crossing state borders. While many countries have severe water deficits within their own borders, this will not be regarded as being a regional issue for the purposes of this guide. The second region in the world that is being confronted by the debilitating effects of *water deficit* is Southern Africa. We are therefore in a more favorable position than the MENA region, because we can learn from those experiences and become sufficiently *reflexive* to manage the problem proactively. **The purpose of this guide is to highlight the key issues that a strategic level decision-maker will be confronted with when considering *Virtual Water* as a national *coping strategy*.** For the purposes of this guide, all concepts will be identified by the use of *italics*, simply to make the document more user-friendly.

Underlying Assumptions

In order to fully understand the relative advantages and disadvantages of a *Virtual Water*-based *coping strategy*, it is necessary to first focus attention on some of the key underlying assumptions of which five are strategically significant.

Firstly, **the notion of a nation-state with geographic integrity and decision-making sovereignty is taken as a given**. While some commentators argue that a nation-state is the root of the problem (because it introduces the notion of sovereignty into the overall equation), the author is of the opinion that nation-states are an undeniable reality. So to argue for their abolition is largely unhelpful to the real world decision-maker. For the purposes of this guide, the existence of sovereign nation-states will thus be taken for granted. This implies that within each nation-state there is a group of decision-makers that have the responsibility of maximizing national security by increasing the likelihood of economic prosperity and social stability.

Secondly, **the watershed or river basin is the unit of management**. This is so deeply entrenched within the literature of Integrated Water Resources Management (IWRM) as to be regarded as a fundamental part of water resources planning. While the ramifications of this can be debated at length, the existence of river basins as fundamental units of management are taken for granted in this guide.

Thirdly, **river basins are natural creations**, having taken millions of years to develop. Nation-states, it can be argued, are largely unnatural in the sense that they have been imposed by human beings onto a natural world, and thereby introduce a fundamental variable into the overall equation. In short, the existence of state borders within river basins introduces the *problematique* of sovereignty. Central to the concept of IWRM, is the need to integrate, manage and allocate in terms of some form of rationality, so sovereignty can be regarded as being a stumbling block. Alternatively, it can be argued that state sovereignty is challenged by the imposition of an IWRM approach within an international river basin. This guide will not go into these ramifications, and will merely accept the fact that river basins can cross state borders, thereby assuming some form of cooperation to exist between riparian states.

Fourthly, ***water scarcity* is a localized phenomenon, manifesting largely within a given watershed or river basin**. The significance of this is profound for strategic decision-making, because it allows for a conceptual difference to be developed between *water scarcity* at a local level, and the quest for a remedy at the regional or global level. What this means is that globally, there is a relative *water surplus*, while simultaneously one can find acute *water deficit* at localized levels. **Central to this is the key concept of a watershed versus a *problemshed*.**

Fifthly, it is necessary to understand that **national political economies are subordinate to regional political economies**, which in turn are subordinate to the global political economy (Turton, 2000a:144). This is the fundamental rationale of a *Virtual Water coping strategy*.

Definitions

In order to achieve meaningful debate on the topic, it is necessary to first have conceptual clarity. This will enable all participants in the debate to compare apples with apples. The following definitions are offered as a point of departure, and should not be seen as being holy cows that cannot be sacrificed. In fact, their purpose is to stimulate debate in such a way as to develop the concepts further to the extent that real world strategic level decision-makers can fully comprehend the relative merits and pitfalls of *Virtual Water*.

Coping Strategy: A *coping strategy* is the output of the decision-making elite, usually in the form of some coherent policy or set of strategies such as water demand management, that seeks to manage the *water scarcity* in some form or another (Turton & Ohlsson, 1999). A *coping strategy* is the synthesis of a logical series of options that decision-makers consider, thereby converting those options into a clearly defined policy choice with which to confront the problems of rising levels of *water scarcity* in a given state or regional setting. A *coping strategy* contains a logic of its own that is based on political rationality, which in turn may not coincide with an outsider's perception of rationality.

First order resource: A *first order resource* is a natural resource such as water, which can be either abundant or scarce within a given spatial entity.

Problemshed: This is a conceptual unit in which the remedy for a problem can be found. In other words, conventional wisdom would have us believe that watersheds are the unit of management, but it is also at this level that *water deficit* exists. By introducing a new conceptual unit and calling it the *problemshed*, it allows strategic decision-makers to source an element of a viable *coping strategy* from outside the watershed, usually in the global political economy of cereal trading, otherwise known as the *problemshed*.

Reflexive: A policy is said to be *reflexive* when a given social grouping becomes concerned by the undesirable and unintended consequences of its actions, such as environmental degradation caused by industrialization, and actively seek to limit these consequences by developing coherent coping strategies, policies and regimes to effect these desires (Turton, 2000b). A condition of reflexivity is said to exist when a social entity starts to recognize the implications of sustainability within the overall context of economic and social development.

Second order resource: A *second order resource* is defined by Ohlsson (1999:161) as the level of social adaptive capacity within a given social entity with which to confront and effectively manage increasing levels of *first order resource* (water) scarcity (Turton, 2000b).

Sectoral Water Efficiency: The *Sectoral Water Efficiency* (*SWE*) is the ratio of water consumed within a given economic sector (expressed as a percentage of total national water consumption) in relation to contribution of the same economic sector to overall GDP (expressed as a percentage of total GDP). (*Sectoral Water Efficiency* = Sectoral Water Consumption as % : Sectoral Contribution to GDP as %) (Turton, 1998:7).

Sanctioned Discourse: The *sanctioned discourse* is the prevailing or dominant discourse that has been legitimized by the discursive elite within the water sector at any one moment in time. It represents what may be said, who may say it and how it may be interpreted, thereby leading to the creation of a dominant belief system or paradigm (Turton, 2000b).

Virtual Water: This is a concept that was developed by Prof. Tony Allan, which refers to the volume of water needed to produce a commodity or service. For example, it typically takes 1 000 tonnes of water to produce one tonne of wheat. This represents the *Virtual Water* value of wheat. As such, it is easier, and less ecologically destructive, to import one tonne of wheat than to pipe in 1,000 tonnes of water (Turton, 2000a:145). *Virtual*

Water is also present in hydroelectric power and constitutes the volume of water needed to produce a given unit of hydroelectricity (Turton, 1998:7-8).

Water Deficit: This refers to the prevailing condition that exists when the consumption of freshwater within a given social entity exceeds the level of sustainable supply (Turton, 2000b).

Water Scarcity: This is the condition that exists when the demographically-induced demand for water exceeds the prevailing level of local supply, meaning that supply-sided augmentation becomes necessary (Turton & Meissner, 2000).

Population - Food - Trade Nexus

Before one can fully understand the implications of *Virtual Water*, one needs first to understand the role of water in society within the context of a developing state or region. The so-called population-food-trade nexus really lies at the very heart of the subject. In this regard, there are five strategically important issues that need to be understood.

Firstly, population growth is the fundamental driver of *water scarcity*. **In fact, *water scarcity* is not the problem - it is merely a manifestation of a far more fundamental problem - rapid and unchecked population growth.** This is a contentious statement and is liable to be contested, but this remains the fundamental underlying principle behind all *water scarcity* related problems in the developing world. The reason why this statement is likely to be contested, gives rise to another basic hydropolitical concept that needs to be understood - the *sanctioned discourse*. In the context of many developing countries, the conventional wisdom is that all development-related problems are caused by historically relevant issues over which the current government has little or no control. Typical amongst these issues is the historic experience of colonialism or the discourse of dependency or under-development. The reason for this is simple. By blaming all problems on something that is beyond the direct control of government, that same government cannot be held accountable for the results of their policies. This *sanctioned discourse* is powerful and is usually left unchallenged by advisors because it is not healthy for their future career prospects. In this regard, many advisors are in the business of perpetuating their own future usefulness by not rocking the boat. The author does not belong to this school of thought for reasons that are motivated in this guide. For this reason, the *sanctioned discourse* needs to be challenged because left as it is, the remedy for the problem of *water scarcity* will always be sought in the wrong place or by means of an inappropriate strategy and will therefore fail. So for this reason, the author notes the irrefutable connection between population, food and trade and uses this as the underlying rationale for *Virtual Water* strategies.

Secondly, **this population-related *sanctioned discourse* has two distinct manifestations that need to be understood**. For reasons of simplicity, **let us call these two manifestations the visible and invisible fractions of water consumption patterns**. The visible water fraction is easy to understand because it is the one that is most readily perceived by the layperson. This can best be illustrated by means of a graph showing the direct correlation between population growth and water demand in a given spatial entity. Figure 1 shows the direct correlation between population growth and water demand for the city of Windhoek. From this it is clear that a close correlation exists between population growth (whether from endogenous causes such as increased fertility rates, or from exogenous causes such as population migration) within a given spatial entity and water consumption.

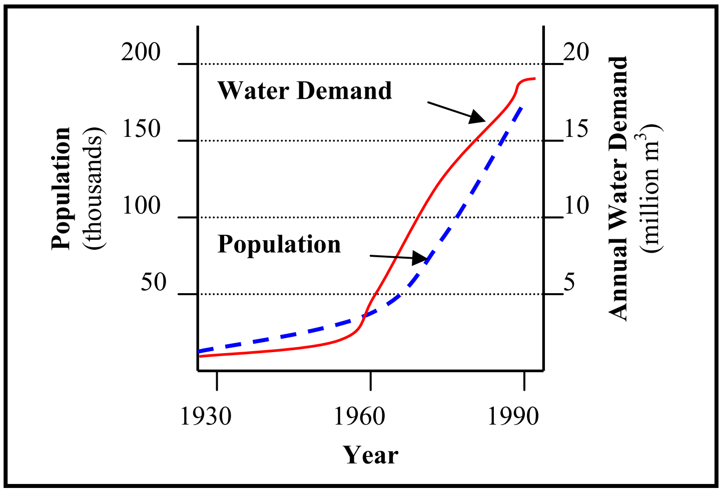

Figure 1. Growth of Windhoek's population and water demand (after Jacobson *et al.,* 1995:57). This can be thought of as being the visible fraction of water demand.

This is typical of the problem being faced by urban water supply schemes so the literature is rich with examples. While this is clearly an important aspect of water resource management, it does not tell the full story and as such can be misleading to strategic decision-makers. This is where the invisible water fraction becomes relevant. Ohlsson (1999:180) provides an insight into the problem by showing a breakdown of water needs for one human being expressed in liters of water per day. In terms of this analysis, one human being can survive on 2-5 liters per day for drinking purposes; between 25-100 liters per day are needed for domestic use such as sanitation services, washing of clothes and cooking utensils, etc; and between 1,000 - 6,000 liters per day are used for food and biomass production. From this it is evident that the volumes of water that a local authority would need to supply - the so-called visible fraction of water consumption - is in the order of 27-105 liters per person per day. This pales into absolute insignificance when compared to the invisible fraction of water consumption for that same person, which according to Ohlsson (1999:180) ranges between 1,000 - 6,000 liters per day (depending on where that person lives and what type of diet is taken as being normal). Stated differently, **at the lowest end of the scale, the invisible water fraction (for food) is 37 times greater than the visible fraction. At the highest end of the same scale, the invisible fraction of water in the form of food is a staggering 57 times greater than the visible fraction.** This nuance is largely ignored in the literature.

This can be understood by means of a simpler illustration. Let us take the basic water requirement (BWR) at 50 liters per person per day. Let us then accept that a healthy diet consists of 3,000 calories of food per person per day. **We know that on average, it takes around one liter of water to produce one calorie of food. This translates to 3,000 liters of water per person per day for the invisible fraction of water for food production, which is a staggering 60 times greater than the visible fraction of water consumption.** This is very important to grasp, because most of the water demand statistics tend to focus on the visible fraction, simply because this is the figure that engineers need to work with in order to develop basic water supply schemes. The water for food (invisible fraction) is largely ignored in this form of analysis. **Therefore in order to ensure an adequate supply of food and water for one person for a year, a whopping 1,113 tonnes of water is needed of which a mere one sixtieth (18 tonnes) is related to the visible fraction.** Translated into equivalent water transfer projects, assuming a population growth of 1 million people, all of which are to be fed a balanced diet that is derived from irrigated agriculture alone, it would take either 73 new North-South Carrier Projects (in Botswana), or 54 new Okavango Pipeline Projects (in Namibia) or 2 new Phase 1a's of the Lesotho Highlands Water Project (in South Africa) to sustain this population growth if *Virtual Water* trade is not used (Turton, 2000d).

Thirdly, we need to take yet another fundamental fact into consideration. This is related to the *Sectoral Water Efficiency* (*SWE*) of agriculture versus industry. Ohlsson (1999:178-9) notes that a reasonably acceptable global benchmark figure for agricultural water consumption is 65-70% of the total water abstractions in a given country. This will obviously vary from country to country, largely as the result of agricultural dependence. In developing countries this can be higher. An acceptable international benchmark for industrial water abstraction is in the order of 20-25% of the total water abstraction in any given country. Of this a small fraction (9%) is consumptive use, with the rest being recaptured via treatment and recycling technologies and therefore made available for other economic processes or activities. The world benchmark for household water abstraction is only 5-10% of the total water abstraction in any given country. So, in terms of pure abstraction alone, **agriculture is by far the largest user of water in any given economy.**

The relevance of this situation becomes clear when one looks at the other portion of the *SWE* equation. Typically agriculture uses the largest portion of water in a given political economy, yet it only contributes a small component to the Gross Domestic Product (GDP) of a country. Industry, on the other hand, uses less water and contributes a significantly larger fraction of the overall GDP. Thus, **in general terms, the agricultural *SWE* is low whereas the industrial *SWE* tends to be high. In fact water that is diverted away from agricultural use into the industrial and urban domestic sectors, can produce 70 times more economic value for given volume of water** (Ohlsson, 1999:170).

Figure 2 shows some selected *SWE* statistics for four SADC member states during 1995. Both Botswana and South Africa are particularly illustrative of this point in both economic sectors. We can therefore conclude that as countries develop, they tend to move away from agricultural-based economies to more industrial-based economies with a resultant change in economic efficiencies related to water.

Figure 2. Comparative *SWE* Statistics for Selected SADC Member States during 1995 (after Turton, 1998)			
Botswana	Agricultural Industrial	48:5 20:46	High Medium
Namibia	Agricultural Industrial	68:14 3:26	Medium Medium
South Africa	Agricultural Industrial	72:6 11:30	Medium Medium
Zimbabwe	Agricultural Industrial	79:14 7:30	Low Medium

Fourthly, having noted that an industrialized economy tends to be more water efficient, another critical aspect also becomes relevant to this guide. **This different *SWE* characteristic allows the notion of economic gearing to be brought to bear on the problem of *water deficit*. This in turn implies a better water use pattern, and in particular, the ability to generate foreign currency with which to finance *Virtual Water* imports**. Therefore, within any *Virtual Water* paradigm, *SWE*s become critically important to understand. A deeper analysis of *SWE*s also reveals that they are exceedingly complex, because issues such as employment capacity within each sector also become relevant, along with the very fabric of society. There are far-reaching social implications for developing an economy away from a purely agricultural base to a more industrialized one. A discussion of these issues is beyond the scope of this guide however. {The reader is referred to Turton & Ohlsson (1999) for a deeper analysis of the social stability aspects of inter-sectoral allocative efficiency versus intra-sectoral allocative efficiency}.

Fifthly, **the latter issue of social stability gives us a clue as to the existence at strategic levels of yet another critically important aspect, namely the social ability to adapt to changing levels of *water deficit*.** The best way to understand the implications of this nuance is to dwell for a few moments on another new concept. Let us accept that a natural resource such as water can be available within a given political economy in a range of volumes from abundance to scarcity. For purposes of coherent conceptual development, let us call this a *first order resource*. Most of the literature that discusses *water scarcity*, and in particular the literature that deals with scarcity-induced conflict such as water wars, uses first order levels of analysis (see Turton, 2000c:41-44 for more details). This is misleading however, as empirical evidence suggests that *water scarcity* tends to result more in cooperation than conflict. This in turn gives rise to the important concept of a *second order resource*, or the ability of a given social entity to adapt to changing levels of *water deficit* over time. **Current research suggests that *second order resources* are in fact the defining ones when it comes to effectively managing *water deficit* in developing countries** (Ohlsson, 1999; Ohlsson & Turton, 1999; Turton, 2000b; Ashton & Haasbroek, 2000).

Strategic Issues

Having noted the above, what is it that the decision-maker who is functioning at the strategic level needs to know about *Virtual Water*? Arguably, there are seven key issues that need to be understood.

Firstly, **by broadening the water management paradigm from the watershed or river basin level of analysis, to the *problemshed* level of analysis, an increased range of options become available** to the strategic-level decision-maker. It is this fact alone, that has mitigated against the confidently prophesied water wars in the Middle East (Allan, 1998).

Secondly, **by reaching into the *problemshed* for a solution, vast quantities of *Virtual Water* become available at reasonable (usually subsidized) prices, with the added advantage of being environmentally sustainable**. The current global grain surplus sees *Virtual Water* that has been harvested from the soil profiles of water abundant countries, often at highly subsidized rates, becoming a viable means of balancing local-level *water deficits*. During times of drought, countries often resort to importing grain or foodstuffs. This time-tested remedy has always been available to governments in water stressed regions. The only difference between this normal *coping strategy*, and a *Virtual Water*-based solution, is the fact that the former is a once off act, whereas the latter is a deliberate policy choice.

Thirdly, **there is a definite conceptual difference between a country that uses *Virtual Water* as a rational *coping strategy* and a country that relies on food aid for survival**. Japan, for example, does not grow all of its own food, but Japan is certainly not aid-dependent. Botswana and South Africa are shifting away from a policy of national-self-sufficiency in food to one of food security instead. The difference between a country that has a rational *coping strategy* based on *Virtual Water* and an aid-dependent country is therefore the ability to pay. This makes the notion of *SWE* highly significant, and in particular, the increased economic leverage that an industrial-based economy offers over a predominantly agriculturally-based economy.

Fourthly, **a rational *coping strategy* that is based on the merits of *Virtual Water* implies a fundamental re-think of the policy of national self-sufficiency in foodstuffs**. In fact, a *Virtual Water* paradigm is based on a policy of food security instead, with a strong and diversified economy with which *Virtual Water* imports can be paid for in a sustainable manner. This does not imply that a new form of post-colonial political or economic dependence is being accepted. It does imply however, that a balance needs to be struck between the relative merits (and demerits) of national self-sufficiency versus food security. For example, South Africa as a diversified political economy was forced to adopt a national self-sufficiency policy as the result of apartheid-induced sanctions. This implied massive mobilization of water for irrigation purposes, to the extent that environmental sustainability became a key issue. In post-apartheid South Africa, a more rational policy of food security can be considered instead, and it can be argued that although South Africa is highly water stressed, it is only water scarce if a policy of national self-sufficiency is the norm. This normalization of *Virtual Water* trade patterns is clearly evident in recent research (Turton *et al.,* 2000:Graph 9e). The same argument can be made for Botswana, and possibly also for Namibia and Zimbabwe. ***Virtual Water* is therefore environmentally friendly, and as such ought to be supported by environmental NGOs and special interest groups as a fundamental component of sustainable development in *water deficit* regions of the world**.

Fifthly, ***Virtual Water* is politically silent** (Allan, 2000:127&129). It is therefore never expected to become front-page news in any country that uses it as a *coping strategy*. In fact, research shows that where it is used, the political decision-makers concerned can keep up the necessary lie that *water deficit* is not a problem for economic growth and social stability. In this regard, it offers politicians a viable option in water stressed regions of the world and as such it has incalculable advantages.

Sixthly, ***Virtual Water* is not a universal panacea of all water-related problems** however. This fact needs to be appreciated as well. While *water deficit* can be balanced at the strategic level of a given country, it will not necessarily relate to food security at the household level of society. For that to happen, a whole host of other issues need to be considered, not least of which is the ability of the state to provide for all members of society, which in turn impacts on legitimacy and political stability.

Finally, ***Virtual Water* can become a powerful tool for balancing the water budget at a regional level**. This is particularly useful within the context of SADC, where development is spatially uneven and where water distribution patterns do not match economic development patterns. As such, by considering a *Virtual Water* paradigm as a fundamental driver of intra-regional trade and development, SADC can fast-track agricultural and economic development in a more equitable and sustainable way. It seems absurd for *water deficit* countries like South Africa and Botswana (Namibia and Zimbabwe can also be considered under this category) to balance their water budgets from outside the SADC region, while economically stagnant but water rich countries like the Democratic Republic of the Congo (DRC), Zambia and Angola remain marginalized. They can become the regional *Virtual Water* reservoirs instead, in the form of the breadbaskets of the SADC region. Why not use the *Virtual Water* rationale to allow the water deficits to be balanced, while keeping the hard currency within the SADC region for kick-starting those stagnant economies? For this to occur, political will, far-sighted planning and crosscutting multisectoral policy-making needs to be stimulated wherever possible. And above all else, a prevailing condition of positive peace will have to be established.

Conclusion

Virtual Water is a fascinating concept that is now being developed and refined for use by decision-makers at the strategic level of society. Recourse to trade in times of scarcity has been an age-old mechanism by which society has managed to cope with acute *water deficit*. This mechanism is now being considered as a component of a longer-term strategy. As such, **the trade in *Virtual Water* has shown itself elsewhere to be**

economically viable, and politically silent. A fine line exists between viable trade in *Virtual Water* and food aid dependence however. As such a balance needs to be struck between economic development and foreign trade. Similarly, post-colonial dependency is also politically risky. Therefore, a balance needs to be struck between a policy of national self-sufficiency and food security. All policies are doomed to fail however, if the underlying driver of *water deficit* is ignored. As such, *water deficit* is not really the problem. It is merely the manifestation of a greater and more complex problem - uncontrolled population growth. The latter is too politically risky to attack head on, so it is protected by a powerful *sanctioned discourse* that constructs knowledge in such a fashion as to downplay the population factor. *Virtual Water* trade allows this essential lie to be maintained until such time that it can be effectively managed. *Virtual Water* is therefore a strategic issue that needs to be debated at the highest level within SADC.

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