The need for Virtual Water Credits and Trading System

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ABSTRACT

Understanding, sensitizing and accounting Virtual Water Trade (the embedded water flow) between locations, nations and geographies is necessary to contain future water wars. Virtual water need not be limited to agricultural output, but can also be applied to all other products and services. Across nations, all organizations, farmers and consumers should be accounted for the Virtual Water Units consumed. There is a need for an international Virtual Water protocol defined similarly to the current Carbon Credits model and managed by an independent body. This paper discusses the need for Virtual Water Credits, an International Trading System for Virtual Water Trade between countries, roles and responsibilities of all key stakeholders.

Key words | Virtual Water Credits, Virtual Water Trading Protocol, Virtual Water Trading System

INTRODUCTION

The core development of the nation depends on how well water resources are utilized and managed as they determine long-term social and economic progress. Water resources impact food, energy security, sanitation, human development and the environment, etc. A World Bank analysis suggests that by 2030, the world may face a 40% global shortfall between demand and supply of water resources. By 2050, feeding the planet's predicted 9 billion population may require 50% more water. More than 2 billion of the world's population live in countries with absolute water scarcity and this number is expected to rise to 4.6 billion by 2080 (World Bank 2014). Quite good research has been conducted in water management space, but still rising population, urbanization, abrupt shifts in economic growth of various countries and climate change make this specific area of research nascent and dynamic. Within water management research, ‘water footprint’ and ‘virtual water’ concepts are important from a world water management perspective as they not only refer to domestic consumption, but also refer to water movement between countries. Hoekstra & Chapagain (2007) argue that water footprint refers to the water required to sustain a population whereas virtual water refers to the volume of water required to produce a commodity or service. Water footprint is a super-set which describes the needs of the nation or individual whereas virtual water deals with specific products or services. Virtual water is important for trade and international peace. Hoekstra & Hung (2003) argue that trade in real water between water-rich and water-poor countries may not be practical due to associated costs but trade in water-intensive products (virtual water trade) is possible. Starr (1991) stresses the importance of future water wars between such countries and how a ‘creative response to water cooperation could forge a new path to peace’. Warner (2003) opines that water scarcity might lead to water wars and social conflict and argues that ‘the shift from a supply-driven to demand-driven water economy is bound to create adjustment tensions’. This paper discusses the need for ‘Virtual Water Credits and International Virtual Water Trading System’ with respective to virtual water movement between nations, international policy on virtual water trading for bringing peace and harmony, virtual water sensitization programs among citizens in terms of how they are accountable and responsible for the goods or services they use, the price they are paying for the same and how they impact water harmony in the long term. This paper does not discuss the methods and technicalities for calculating virtual water but assumes that an international policy definition can be worked out amicably.
between member countries under the jurisdiction of an independent Virtual Water Body or the United Nations.

VIRTUAL WATER TRADING AND ITS IMPORTANCE

Allan (1993) introduced the concept of virtual water and argued that agriculture consumes the majority of water resources (sometimes it can go up to 60–90% of national water-use budget). Hoekstra & Chapagain (2007) argue that livestock products have a higher virtual water content than crop products as animals consume feed crops, drinking water and service water before they produce good output. Hoekstra (2003) argues that virtual water trade between nations can be positioned as an alternative to real and inter-basin water transfers. The global volume of virtual water trade is estimated to be 940 Gm³ per year. The countries with the largest net virtual water export are the USA, Canada, Australia, Argentina, and Thailand. The countries with the largest net virtual water import are Sri Lanka, Japan, Italy, the Republic of Korea, and the Netherlands (Chapagain & Hoekstra 2003). Tamea et al. (2014) identifies various drivers which control virtual water flows between countries. Among them, population, gross domestic product, and geographical distance are core drivers in determining virtual water fluxes. Carr et al. (2012) analyzes the influence of socio-economic drivers as being in reducing inequalities associated with global distribution of water and people. Renault (2003) argues that if a country imports 1 million tons of wheat, then it enlarges its water resource by 1 billion m³. However, it should not be at the cost of over-exploitation of water resources in water-rich countries which may again face major environmental issues. These considerations increase the importance of virtual water trade. Water usage efficiency is a major root cause of many of the water problems faced today and virtual water trade plays a major role. Gualtieri (2008) argues that judicial implementation of virtual water trade may increase water use efficiency both from national and international perspectives and may solve some social and political problems. Allan (1993) argues that ‘at present, users of water have no incentive to use water efficiently and governments have no incentive to realize efficient returns to water as there are no institutions or mechanisms which effectively enable its value to be recognized in transactions of distribution and use by either individuals or by the state’. Wichelns (2003) argues that government gains in terms of implementing national goals like agriculture, employment, food security, poverty reduction, etc. while implementing policies linked to virtual water trade. International water accounting is necessary. It not only creates a culture of efficient usage, but also attempts to facilitate world peace. Chapagain & Hoekstra (2008) argue that one-sixth of the water problems in the world can be traced back to production of the various exports, hence the need for the study of national and regional water policies in the context of international virtual water flows. Allan (2003) clarifies and makes the comparison that although there are no transactions made through shadow prices (in economics) and yet the concept remains valuable in spite of its theoretical role, similarly virtual water creates an analytical perspective in terms of how nations and economies bring water security. Most of the virtual water exports and imports (agro-specific) are part of the WTO framework, which promotes sustainable water use but under the guidelines of international trade rules. Vaidya (2011) introduces water as a tradable commodity and promotes ‘water credits’ along the lines of ‘Carbon Credits’.

Although the quantifying of virtual water differs from place to place, season to season, production method, etc., it is important to develop a uniform method with a common consensus, acceptable to all regions both nationally and internationally. Hoekstra & Chapagain (2007) argue that virtual water flows between nations can be calculated by multiplying commodity trade flows by their associated virtual water content. The Personal Computer Trade Analysis System affiliated to the International Trade Center, in collaboration with UNCTAD/WTO, covers 5 years of import and export data for 230 countries broken down into 5,800 Standard International Trade Classification products (ITC 2014). Zimmer & Renault (2005) address a few methodological issues in calculating virtual waters and one of the conclusions made was that virtual water trade in the year 2000 accounted for one-fourth of the global virtual water budget. As the population is growing, there is a strong probability that global virtual water budget will grow. Yang et al. (2005) argue that in next 30 years, due to population growth, many populous, poor and developing countries are going to drop below water threshold levels
and cereal imports may not be affordable for these countries. The increasing of virtual water imports by a particular nation signifies two things: (1) decreasing water resources and (2) the preserving of one’s own water resources and the burdening of other nations. The former reason becomes a catalyst to build towards world peace but the latter becomes a promoter of water wars. Earth has been divided geographically in terms of countries but naturally Earth’s oceans are connected (one ocean but different named parts). The division is manmade. The Sun provides uniform radiation at its origin but how much the Earth receives depends on Earth’s position during its rotational movement and other atmospheric conditions. This whole process is natural. Nations across the world should realize that water is common property. Horlemann & Neubert (2007) believe that virtual water strategy should be part of Integrated Water Resource Management which brings solutions acceptable to various stakeholders. Water on the sea is evaporating, condensing and precipitating. Evaporation happens in one part of world, condensation in the journey and precipitation in an other part of the world. This is cyclic. This argument is useful for creating consensus among countries and treating water as common property.

Virtual water trading is different from carbon trading; however, the analogy of carbon trading brings some perspective to the building of a model for virtual water trade between companies producing products and services. Carbon trading involves individual companies trading polluting rights under the ambit of a regulatory system as cap and trade. The less polluting companies sell their unused polluting rights to more polluting companies without exceeding a baseline level of pollution, thus incentivizing the less polluting companies (Investopedia 2014). Similarly, there is need for virtual water trading between companies producing goods and services which use water directly or indirectly. Virtual water trading should have much more importance than carbon trading. Almost all the products manufactured or services rendered on the Earth use water. Whether the product or service is consumed internally at country level or exported, it is carrying virtual water status. Water being the common property of the Earth, every individual is accountable for virtual water. It is individuals’ responsibility to know and pay the price for the total virtual water consumed. Although the product manufacturer or service provider charges the consumer the cost associated with water in the product price, today that is not an explicit cost. It is implicit in nature. The user becomes sensitized when the associated water usage cost is explicit and visible on the product bill or displayed explicitly. This explicit display of water cost may lead to a conscious change in the user and judicious buying or selling. Today this orientation is completely missing in the consumer market. A sale is determined by factors like utility, design, cost and other market demands, but water usage is not an explicit consideration. This model brings that level of change. The individual has to realize that water is becoming more and more precious. Haddadin (2003) argues that poor people manage food better and leave less food waste. High income diets are richer in animal products (greater water requirement). Countries and companies have huge responsibility to preserve water, reducing the usage of water regardless of water availability and water footprint situation. This has to be accounted both at national and international level. It requires lot of processes to be set, automation of the entire process flow and tracking at every product/service buy/sale level. Mori (2003) argues that principles, rules, norms and decision-making systems must be properly designed otherwise it is going to lead more conflict situations. Strategic decision-making systems are necessary for managing global virtual water trading. The message is to promote responsible product or service sellers and incentivize sensible product or service buyers.

VIRTUAL WATER TRADING SYSTEM

Water resource management is the most important function of any nation. A Virtual Water Trading System built on trivalue principles (social, economic and environmental dimensions) is going to provide good governance and strategic advantages to the member countries. This type of system solves the problem of gaps between international regimes on trade and multilateral environmental agreements (Mori 2003). There are lots of parameters that influence the determination of virtual water. Fracasso (2014) argues that geographical distance, economic mass, trade barriers, water pressure, etc. are the usual determinants of virtual
water trade flows. Warner (2003) argues that once agricultural subsidies decline, the West stops agricultural exports, the WTO outlaws it, and immediately food prices rise. It impacts poor countries which are fully dependent on subsidized trade. Global trade has to be a level playing field. When grain farmers are outcompeted by global imports (subsidized virtual water imports), they tend to shift to other water-intensive cash and export crops such as cotton which negates the advantage of virtual water imports and decreases the water savings. To overcome these issues, a Virtual Water Trading System should be proposed similar to carbon trading and its purpose should be beyond the need.

The need for a Virtual Water Trading Protocol

The concept of Carbon Credits in the context of greenhouse gas emissions trading is galvanizing the containment of emissions effects. The Kyoto Protocol, United Nations Framework Convention on Climate Change, provides a visionary model for achieving quantified emission limitation and reduction commitments by various participant countries (United Nations 1998). The spirit of the Kyoto Protocol demands a similar protocol for virtual water trading between nations, virtual water trading caps and reduction commitments by member countries (Mori 2003).

The proposed Virtual Water Trading Protocol should promote sustainable economic development across countries while keeping long-term environmental effects. The protocol should spread the peace message and contain future water wars. Dangerous water shortages, contamination and dwindling shared water might spawn future water wars. In specific cases, water retrieval is becoming costly and causes environmental degradation. Starr (1993) emphasizes the example of the Gulf States and how they are using natural gas byproducts to distill water, though waters in the neighboring countries flow freely into the ocean. The study further lays importance on water, communication, and transportation, which are fundamental to economic survival, with energy as the common denominator. A Protocol should be designed keeping these four parameters connected. Any deviation leads to environmental degradation or economic insecurity. The Protocol should lay importance on food security in terms of alternative food research in place of current water-intensive food grains. The proposal should introduce Virtual Water Credits, which can be traded in the international market. Nations across the world should own Virtual Water Credit caps in terms of how much they can both export and import. In turn, they can distribute these caps internally across the organizations which produce or manufacture the products and services. This process not only helps in utilizing the water judiciously, but also leads to conscious delivering of water-efficient research, systems, machinery, and goods. The Protocol should also emphasize the need for incentivizing water harvesting or conservation schemes similar to offsetting emissions by planting a number of trees in the case of Carbon Credits. Subsidies should be provided for high water-efficiency systems. Operators are motivated by these subsidies rather than by taxing the products or services. The Tax solution may reduce operator profits but it may not impact psychologically the usage of water and efficient systems. A virtual water credit becomes a motivating instrument. Virtual water allowance can be defined with common consensus similar to the allowance of a certified emission reduction which is equivalent to one metric tonne of CO₂ emissions. Virtual water prices can be quoted by commonly accepted currency. Virtual water trading exchanges can be established similar to the Chicago Climate Exchange or European Climate Exchange.
Given the due importance, virtual water becomes one of the important commodity markets. Individuals and societies are motivated to develop projects for which they can earn Virtual Water Credits. The approval mechanism can be defined in the Protocol. These credits can be sold to organizations which need them. Policy should require organizations to showcase current virtual water imports or exports in their balance sheet along with their liabilities and assets. In fact, there is a need for research linking and comparing virtual water imports/exports and carbon emissions.

### Table 1 | Roles and responsibilities between stakeholders

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Functions</th>
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</table>
| **Virtual Water Management Commission** | - Independent body working under United Nations  
- Define policies and protocols  
- Arbiter between nations in case of conflicts  
- Owns the VW (Virtual Water) information management system and related data  
- Manage Virtual Water Credits (similar to Carbon Credits) between nations and organizations in the context of imports and exports |
| **Country**                  | - Each country owns the VW (Virtual Water) information management system and data specific to its country  
- Organizations manufacturing products or providing services report their yearly Virtual Water Credits/Units consumed to their respective country-specific committee |
| **Organization**             | - Each product or service consumes certain units of Virtual Water. These units are voluntarily displayed on the product and reported as part of the service provided  
- Organizations are requested to submit their yearly Virtual Water Units consumed/Credits to their country-specific committee  
- Keep separate price tag for Virtual Water and display it along with original price tag. This level of pricing information sensitizes consumers and makes them accountable |
| **Farmer**                   | - The farmer reports farm output produced and approximate Virtual Water Units consumed. Strategies need to develop when the farmer/consumer sells/buys farm outputs without accounting for the Virtual Water Units consumed. The best motivation mechanism would be to incentivize farmers/farm consumers such that the farmer discloses farm-output Virtual Waters and the consumer buys the product which contains Virtual Water data |
| **Consumer**                 | - Each consumer should have a right to see their Virtual Water Units consumed and pay a corresponding price or receive incentives  
- Consumers are also supposed to pay the price/get discounts for the farm-output Virtual Water requirement separately along with the product price. This makes consumers sensitive about water usage and help in preservation strategies |

### Table 2 | Illustration of typical distribution of Virtual Water Credits between product/services companies

<table>
<thead>
<tr>
<th>Sr no.</th>
<th>Country</th>
<th>Cap on Virtual Water Credits (Units)</th>
<th>Product/service organization name</th>
<th>Share of the Credits for a particular organization in %</th>
<th>Product/service name by particular organization</th>
<th>Product share in % (decided by organization)</th>
<th>Consumer view of product/service price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Coun #1</td>
<td>100</td>
<td>Coun #1POrg#1</td>
<td>0.6%</td>
<td>Pd #1</td>
<td>20%</td>
<td>Total Price $20 Virtual Water Cess $2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pd #2</td>
<td>30%</td>
<td>Total Price $40 Virtual Water Cess $3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sr #1</td>
<td>10%</td>
<td>Total Price $340 Virtual Water Cess $20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sr #2</td>
<td>23%</td>
<td>Total Price $400 Virtual Water Cess $40</td>
</tr>
</tbody>
</table>

Similarly all member countries are accounted with respective Virtual Water Credits
emissions. Heuristically, there will be some correlation which may direct policy definition differently.

The proposed Virtual Water Trading System

Figure 1 depicts various stakeholders of a Virtual Water Trading System.

Table 1 details roles and responsibilities of Virtual Water Trading System stakeholders.

Tables 2 and 3 illustrate a typical exchange of Virtual Water Credits and how they can be managed at the micro-level between countries and organizations and how consumers pay for the Virtual Water Units. Technically this illustration might require much more deliberation between countries and within countries (between organizations), but this illustration gives a perspective on the whole concept and positions the sense of water consciousness (WC).

CONCLUSION

A Virtual Water Trade helps in saving domestic water by importing goods and services from water-rich countries. However, unless this form of trade is properly planned, reported and accounted, it may lead to dangerous water wars situations. Virtual Water Credits should be defined at country and organization levels and may be at product or service level and produce goods or services accordingly. The true sense of globalization of water is to make the world accountable for water. An independent Virtual Water Committee should be formed to make this global project run successfully. Virtual Water Price tagging helps in creating WC among consumers. Products or services should be produced not based on supply and demand of individual products or services, but based on Water Consciousness and availability level. A Virtual Water Trading Protocol should become one of the major drivers for world peace and harmony.

REFERENCES


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